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Chapter 3: Thematic conference papers

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Chapter 3

Thematic conference papers

This chapter includes the documents prepared for the conference by the session conveners and case study representatives. Each session of the conference includes an overview paper providing an introduction to the tool or the region, as well as two or more case study papers.

1. Economic instruments as tools for water management in the transition towards a green economy

Green growth means fostering economic growth and development while ensuring that natural assets continue to provide the resources and environmental services on which our well-being relies. To do this it must catalyze investment and innovation which will underpin sustained growth and give rise to new economic opportunities.

A return to "business as usual" would be unwise and ultimately unsustainable, involving risks that could impose human costs and constraints on economic growth and development. It could result in increased water scarcity, resource bottlenecks, air and water pollution, climate change and biodiversity loss which would be irreversible; thus the need for strategies to achieve greener growth.

OECD (2011a)

Water is an essential element in a progressive strategy of economic development. The lack of access to sufficient quantities of adequate quality water can significantly hinder growth and human development but improved water management can generate huge benefits for health, agriculture and industrial production providing an opportunity for economic growth, poor eradication and social fairness (OECD, 2011b).

But economic progress can only be sustained if population and welfare trends are decoupled from an increasing use of natural resources. The outlook for water security is not optimistic. The projections of current trends implies a 55% increase in water use between 2000 and 2050, with half of the world population living in river basins under severe water stress by 2050. Over the next 50-100 years, impacts of climate change are projected to lead to severe water shortages in semi-arid regions, and more frequent and severe floods and droughts worldwide. Moreover, water quality degradation is on the rise, resulting both from an increase in contaminants as well as from the degraded ability of water ecosystems to treat them.

Challenges and opportunities

Green development has the potential to address economic, social and environmental challenges and open up new sources of growth through the following channels:

- Promoting greater efficiency in the use of water, enabling an increase the production of goods and services without further detrimental impacts on water sources, and restoration of the water environment without harming the prospect of production and consumption.

- Promoting improvements in the allocation of increasingly scarce water resources to the most beneficial uses in the economy and also in the natural environment, enabling the

generation of welfare gains both from production and consumption of goods and services in the economy and from improved environmental services.

- Fostering knowledge advances and technical development to identify new ways of addressing environmental problems.
- Creation of new markets by stimulating demand for green technologies, goods, and services as well as creating new job opportunities.
- Boosting investor confidence through greater predictability and stability around how governments plan to address major environmental issues.
- Managing water scarcity by rebalancing the equilibrium between natural and human made capital. Preserving natural capital may, for example, be preferable than costly capital investments in desalination to cope with scarcity or in expensive water treatment plants to solve pollution problems.
- Preventing imbalances in natural systems which raise the risk of more profound, abrupt, highly damaging, and potentially irreversible, impacts – as has happened to some fish stocks and as could happen with uncertain water supplies.
- Matching green growth policies and poverty reduction strategies. These include, for example, providing people access to more efficient infrastructure (e.g. in water and transport), reducing health risks associated with environmental degradation, and introducing efficient technologies that can reduce costs and increase productivity, while easing environmental pressure. Given the centrality of natural assets in low-income countries, green growth policies can reduce vulnerability to environmental risks and increase the livelihood security of the poor.

Green growth strategies need to address the following challenges:

- Water is under-priced or not priced at all. In the best of the cases water prices are lower than those required to maintain the financial cost of providing the services and do not cover the capital costs associated with building the water providing facilities or its maintenance and replacement in the long run. Water prices are then far from reflecting the real opportunity cost of provisioning in terms of giving the same water to other alternative and eventually more productive uses (the resource cost) and the degradation of natural capital (or the environmental cost).
- Path dependency and dominance of existing technologies and systems can make it very difficult for some new technologies to compete, establish a place in the market and scale up, which is why temporary support may be needed in certain cases. Innovation support instruments must be carefully designed to foster the emergence and uptake of efficient technologies while minimising the risk of technology lock-in, lack of competition or crowding out of private investment.
- Misguided government policies, market constraints and distortions all lead to or arise from market failures, which mean there is often a gap between private returns from economic activity and the overall benefits that accrue to society. Green growth economic instruments aim to close that gap and raise returns to 'green' investment and innovation. They also aim to minimise the distributional consequences of change for the least

advantaged groups of society and manage any negative economic impacts on firms while retaining incentives for improved economic performance.

- Barriers to trade and investment can place a serious break on the development and diffusion of green technologies globally. Reducing these barriers while providing effective protection and enforcement of intellectual property rights (IPRs) are essential to encourage the development and diffusion of technologies and the facilitation of foreign direct investment and licensing.
- In developing economies there will be opportunities for leap-frogging to new forms of infrastructure development. Leveraging public and private financing – e.g. through public-private partnerships, a mixture of tariffs and taxes, facilitating investment by major institutional partners through reforming regulatory barriers and sound long-term policy signals, and development assistance – will be necessary given the large-scale investments required in most countries.

Ultimately, what matters for the success of a green growth strategy is a well-defined framework for action and a consistent set of economic and environmental policy criteria. A high degree of co-ordination among ministries and levels of government as well as stakeholders outside government will be required to identify a policy mix suitable to local conditions. In many cases, developing appropriate institutional capacity will be an essential condition for integrating green growth into core economic strategies and other government policies, and for ensuring a leading role for finance, economic and environment agencies.

Approaches

Economic Instruments (EIs) have an essential role to play in providing the proper incentives to guarantee that human decisions concerned with water are coherent and make a real contribution to green growth. As part of a green growth strategy, EIs are means to encourage greener behaviour by all water users, to mobilise investments in capital and technology towards greener activities and to provide adequate incentives and support to green innovation.

While national circumstances will differ, putting a price on pollution or on the over-exploitation of water sources – through mechanisms such as prices or tradable permit systems – should be a central element of the policy mix. For example, by reducing demand and rewarding good behaviour, pricing mechanisms help reduce the cost of achieving a given objective and provide incentives for further efficiency gains and innovation. In addition, increased use of environmental and water scarcity taxes can play a role in green fiscal reforms offering an attractive alternative to higher taxes on labour or capital income or deep cuts in public expenditure and public debt.

Not every situation lends itself to market instruments. In certain cases, well-designed regulation, active technology-support policies and voluntary approaches may be more appropriate or an important complement to market instruments. In addition, the responsiveness of businesses and consumers to price signals can, in many situations, be strengthened through information-based measures that highlight the consequences of environmental damage caused by specific activities and the availability of cleaner alternatives.

Barriers are also important and EIs can only be successful if accompanied by a provision of the institutional changes required and a strategy to overcome the many barriers that putting

a price to water might face. In other words, changing the payoffs in the economy is only part of the solution. Societies become dependent on institutions and technologies with which they are familiar. Social and economic inertia can be so strong that even quite large changes in pay-offs will not change behaviour. A strong capability to innovate is essential to establish the capacity for breakthroughs and new patterns of production and consumption.

An economic policy instrument for water management is, by definition, an incentive or a set of incentives designed to produce a desired change in individual (and co-operative) decisions in those activities in which water services are used in the economy. They are means to the collective ends of water management.

Water is a basic input in many production processes. It is also essential for human life and for the preservation of water-related ecosystems and the biophysical flows of services they provide. Not surprisingly the specific decisions that can be targeted by EIs in water policy are pervasive and cover a wide array of situations. Among the decisions and expected targets of EIs for sustainable water management, the following can be mentioned:

- A quantifiable reduction in the quantity of water services demanded by a defined set of users in some economic activities at certain particular places. This is, for example, the case of incentives to reduce water demand for irrigation, household consumption or manufacturing.

- An increase in the efficiency with which these water services are produced. This refers to EIs designed to abate the pressures on water bodies stemming from the need to satisfy a given demand of water provision services. These tend to include incentives to promote more effective irrigation systems, investment for improving water distribution networks or replacing assets, better water transport systems, use of recycled water in manufacturing processes, etc. Within the same category some other EIs can be found with the potential to reduce the negative impact of providing the economy with waste disposal and treatment services. They include, for example, incentives for investing in more efficient effluent treatment plants, reducing pollution loads, etc.

- A substitution of water supply sources in order to reduce pressures on water bodies associated with the provision of a given set of water services both to production and consumption activities. This is, for example, the case of incentives which promote the substitution of alternative resources (such as recycled or desalinated water) for freshwater or shift water supply from some traditional sources to others with lower negative impacts.

- A reduction in the impact on the structure and functional activity of water (providing) ecosystems produced by specific economic activities. This may be the case of incentives to promote agricultural practices that increase soil conservation, reduce deforestation, minimise floodplain occupation, etc.

- A reduction in risk exposure to extreme events such as droughts and floods as in the case of incentives to deter land settlements in hazard zones or to promote water stress-resistant crops in drought-prone areas.

There are many different alternative EIs that depending on the economic and institutional framework can be designed and implemented in the transition to a green economy. The

following table presents a general classification of the challenges presented above and the set of EIs that can be mobilised to help in its solution.

Table 1. Economic instruments for addressing green growth constraints

Green growth constraints	Policy options
Inadequate infrastructure	• Taxes • Tariffs • Transfers • Public-Private Partnerships
Low human and social capital and poor institutional quality	• Taxes • Subsidy reform/removal
Incomplete property rights, subsidies	• Review and reform or remove
Regulatory uncertainty	• Set targets • Create independent governance systems
Information externalities and split incentives	• Labelling • Voluntary approaches • Subsidies • Technology and performance standards
Environmental externalities	• Taxes • Tradable permits • Subsidies
Low returns on R&D	• R&D subsidies and tax incentives • Focus on general-purpose technologies
Network effects	• Strengthen competition in network industries • Subsidies or loan guarantees for new network projects
Barriers to competition	• Reform regulation • Reduce government monopoly

Source: OECD (2011) Tools for delivering green growth

Lessons from implementation

The challenge for any green growth strategy is making individual decisions coherent with the societal objectives of fostering growth, eradicating poverty and enhancing social justice while protecting water providing ecosystems. This suggests the use of incentives to promote the desired kinds of behaviour through market based mechanisms and pricing instruments. Nevertheless all EIs has advantages and disadvantages depending on the particular problem at hand, and the economic, social and institutional framework within which they are implemented.

For example, in general markets for water rights are less information demanding, more adaptable to changing circumstances and provide farmers with more stable income than water tariffs. But markets have also steep learning curves and potentially high start-up administrative and transaction costs. For this reason, water markets are more difficult to implement when compared with taxes that can be easily created within the existing institutional framework. But water prices, especially for irrigation water and for pollution loads require high monitoring and enforcement costs. Water tariffs and taxes have the potential to increase revenues to finance collective investments in protecting natural capital, fostering innovation or even the transition towards a fiscal green system, while water markets only affect revenues and expenses of those involved in water trading. The right choice of economic instrument is therefore highly context-dependent and will be determined through the water management decision-making process.

Green growth strategies will inevitably result in the call for subsidising green sectors and environmental activities. This is the case for investments in infrastructures to guarantee water security and to facilitate the reallocation of water resources across space and among different economic activities. Subsidies may be appropriate in some circumstances, for example when enforcement or alternative instruments are difficult, economies of scale or market size effects are high and when the subsidy programme can be designed in relatively simple way, for a limited period and with minimal side effects. Nevertheless, in contrast to prices and market based mechanisms, subsidies need to be considered only as transitional instruments in order to foster a desired change for example to substitute current water using techniques and speed up technology diffusion, to compensate potential losers in the job market, or to mobilise the amount of resources required by infrastructures when coordination, network and scale economies are important.

The ideal EI would be that which can effectively generate behaviour change towards more efficient water use, which is stringent enough to encourage innovation, is stable enough to give security to investors, is compatible with legal and institutional frameworks, is politically acceptable, and is implementable at a low monitoring and enforcement cost. Real examples are far from this ideal and the selection implies many tradeoffs that would need to be considered in the collective decision making process.

In choosing the economic incentive to be implemented in any case, attention must be given to the whole implementation process. Introducing EIs in the water management arena entails a long and adaptive social learning process. Starting small and scaling up is more advisable than implementing a fully fledged incentive system from the beginning. The same can be said with respect to overcoming the main barriers that impede the application of EIs. For example, small increases in water tariffs when accompanied by the use of extra revenues

to improve the quality and coverage of water services can contribute to a successful strategy for overcoming the still significant cultural and political barriers to pricing water.

The role of EIs needs to be understood in the context of water development. EIs play an important role in overcoming the barriers for building up the infrastructures for water development when there are significant economies of scale involved, coordination problems among water rich and water scarce regions or uncertainties about the long-term benefits of heavy capital investments. For example, in South Africa water storage, transport and distribution infrastructures are considered the main means to achieve water security and cope with the uneven distribution of water across the territory. Properly managed water infrastructures are expected to provide the flexibility required to allocate water to its most productive use and to adapt water supply and demand. New EIs to manage water demand and promote the reallocation of water use rights, including prices and markets, are being considered as part of a new water development strategy. Marginal pricing and full cost recovery are concepts which are easier to accept in countries where the main objectives of water development are water security and efficiency (as in Australia or Israel) rather than social justice, poverty reduction or supporting the transition of the economy (as happens in South Africa). The prospect for EIs needs to be understood in the context of the country's water development.

In Israel, a combination of increasing block tariffs, excess water use fines, production levies, tariffs to finance artificial recharge, subsidies for well rehabilitation, long term commitments for purchasing water produced by new sources and a close to full cost recovery water price system has proved to be a successful policy reform for addressing severe water scarcity and providing adaptive mechanisms for coping with drought. Water prices and their role can only be understood in the context of an IWRM system and in the context of the different role that water has played in economic development. In Israel, this has shifted from an initial stage where the dominant objective was food and water security to the present when environmental sustainability is a paramount concern.

Consistent policy actions can result in the successful implementation of different EIs making for example water trading the best alternative in some places (as in the Murray-Darling basin in Australia) and command and control and prices in others (as in the case of Israel). The framework conditions and the political process are more important than the instrument itself in explaining the success or failure of each case. This might also explain that why EIs may deliver benefits for the green economy even when their implementation fails. For example, in the case of the over-consumption tax in Israel (which ultimately failed), the initiative helped raise public awareness and discussion of water challenges which can assist in the search for better social responses.

The Murray-Darling basin in Australia illustrates that persistent government policy action to define property rights of water and to combine incentives, markets and regulations are a means to enhance water security, sustain economic progress and improve the environment. Water markets are but one important ingredient in the whole water management system. The success of EIs is also dependent on advances in political leadership, water governance and effective stakeholder involvement, all of which are important not only for convincing those who may benefit from water markets but also for managing potential conflicts. In this respect, good quality, transparent information may support social dialogue and the involvement of those who are threatened by the change process.

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Israel: water pricing and command and control for water demand management in cities and agriculture

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Type of tool: economic instruments, technology
Issue: cities, agriculture
Location: Israel, Western Asia

Challenges and drivers for green growth in the Israeli water sector

Green growth and water

We live in an era where it has been recognised that economic growth and development can be sustained only when we ensure that natural and environmental assets continue to provide resources and ecosystem services. Economic development and growth require investments and innovation, which in turn, open new economic opportunities. Technological innovation and the use of inputs (natural resources, human capital, capital etc.) enable production and contribute to economic growth. However, input scarcity may slow down economic growth unless technological progress can compensate for input scarcity. Such technologies may produce a substitute for the scarce input or enable a more efficient use of that input. For example, water scarcity constraint can be alleviated using technologies that produce desalinated water (sea water reverse osmosis technology), treat/recycle water (sewage treatment technologies) and use water efficiently (drip irrigation). When technological change occurs in such environments, it undoubtedly becomes a key to ensuring co-existence of economic growth and environmental improvements. This paper presents the Israeli case of promoting green growth: while dealing with water scarcity and environmentally-water-related threats, Israel also applies advanced administrative and economic tools and incentives that intend to rehabilitate natural resources and push forward innovative technologies.

Drivers of innovation in water and wastewater

Water scarcity and environmentally-water-related threats enforced Israeli policymakers to introduce advanced regulations, standards, administrative tools and economic incentives to the water sector in order to manage the sector efficiently. That, in turn, promoted the need for research and development of water and wastewater technologies – some of which financed by public funds and some by the private sector.

The unique experience of Israel can be attributed to several factors. Israel is a semi-arid area with an uneven distribution of its water resources and had already decided in its early days of its establishment to develop regions that were also remote from water sources. Blooming the desert was perhaps one of the initial driving forces for the Israeli economy and for which the water sector has responded with the building of the National Water Carrier from north to south. Border security settlements, food security and agricultural development put further pressure on water resources. The response was further development of physical infrastructure and efficient drip irrigation technologies. Increasing population growth and a large inflow of immigration have created an additional burden on the already overexploited and environmental degraded resources, thus requiring reallocation of renewable water from the agricultural sector to the urban sector for drinking purposes. The need to supply water from alternative sources to the agricultural sector has pushed forward innovation in sewage

treatment technologies that produced recycled water suitable for irrigation. Over the years, regulation and standards related to the quality of treated sewage have also contributed to advancing sewage treatment technologies.

Water scarcity also created markets for water saving technologies for domestic uses and for municipal uses. Economic incentives designed for reducing water demand in the urban and agricultural sectors based on increasing block tariffs resulted in the development of innovative water management devices such as water meters that are read remotely and more accurately (including measuring small drops so leakages would be fixed), pressure optimisers devices, computerised irrigation systems, etc. In recent years, increasing standards of living, consecutive years of droughts and peace agreement obligations have put further stress on water resources, pushing the economy to adapt to water production using sea-water reverse osmosis desalination technologies that were developed in Israel over the last few decades.

Contaminated drinking wells and aquifers are also a major factor in developing innovative purification/filters/membranes technologies. Economic incentives for rehabilitation of such water sources are today in place, pushing technology implementation but also innovation as investors are searching to minimise the operation cost of such activities. Finally, highly educated human capital supported by excellent universities and research centres have enabled the industry to use well-trained human power for developing innovative water and waste water technologies.

New challenges: restructuring national and municipal water organisations, rethinking production scales, realising financial sources

In recent years, the rationale motivating the water sector in Israel underwent major changes, embedding economic incentives and environmental and health considerations, striving to become more efficient and responsible for future generations and therefore enhancing innovation of water and wastewater technologies. The changes result from deficiencies in past management of the water sector. The changes indicate a very dynamic and advanced sector that deals with substantial risks and large climatic uncertainty by implementing new technologies of water production and water treatment and advanced supply and demand management tools.

Going big, meant restructuring the way the old Water Commission worked and turning it to a National Water and Sewage Authority with an inter-ministerial Water Authority Commission.

It necessitated dramatic political-structural-economic changes in the way Israel serves its urban customers which resulted in the establishment of 56 Municipal Water Corporations. It meant involving the private sector in PPP, including intervention of international companies and large foreign investments in state of the art desalination plants. It meant major changes in the way Israel realises the potential of waste water. Finally, it meant that water scarcity must be reflected in water prices. Prices increased substantially to reflect cost recovery leading the water sector to become eventually an independent, closed economy sector.

Policy towards water security

Dynamic policy: evolving issues

Policy towards water security has been very dynamic since the establishment of the state. It is irrelevant to report on one specific 'golden' policy that can be applied in a generic way elsewhere. Water policy is always relevant to location, time, culture, politics, social needs, etc.

Water policy has to be adjusted according to the stage of development of each State. Various needs and changing pressures raised different types of concern. Evolving issues, such as vast immigration in the 90's, water agreements with the HK of Jordan and the PA, water pollution, climatic impact, etc forced Israel to rethink its policy continuously. Water was and still is a major engine for economic growth for Israel. In order to secure water sources – natural, produced and treated – Israel has diverted vast financial resources over the years. In recent years, the financial burden has been shifted to consumers that pay higher water tariffs that reflect cost recovery. But tariffs also reflect cost of environmental and natural assets that have been deteriorated in recent years and require large investments for rehabilitation (polluted wells, aquifers and streams). Natural resources that provide ecosystem services such as lakes, streams, wetlands are also in increasing demand as GDP per capita has grown and leisure time increased. Sufficient level of water must be kept for nature in order to maintain and enhance various ecosystem services (biodiversity, recreation, drainage, flood control, aesthetic, property value, etc).

It is possible to indicate several issues that pushed forward the water economy in Israel. At first, survival and security were at the forefront of the agenda whereas today environmental considerations are an integral part of development. Chronologically, issues that have affected policies are as follows:

- Water and food security – development of water sources for agriculture, settling borders and developing remote areas. Today, after years of droughts, degraded water quality in aquifers, water is needed for existence and for keeping agreement with neighbours.

- From an infant economy to advanced industry – as a new emerging country with infant industry and much need for food security at the time, water was highly subsidised in order to allow for economic growth. Reliable supply along with sufficient quantities where the two major issues. Only in recent decades, as anthropogenic activities have affected water resources, water pollution has become a major issue and provision of clean water is demanded. With increasing demand for water and diminishing availability of natural resources on one side and with growing economic strength, ability to pay and innovative technologies on the other side, subsidies have declined and prices reflect cost recovery.

- Social and ideological values – Israel enabled non-urban way of living for various strategic, social and ideological reasons. Customers living in areas remote from water sources did not pay marginal cost and tariffs were highly subsidised. Obviously, such an approach is not consistent with economic theory where subsidies cause inefficiencies. Another important issue was equity. All end users pay same price regardless of distance

from water source. Again, water allocation is not based on the economic principle where water goes to the highest economic use.

- Health – today with higher pressure on water resources due to large, dense populations that reside along the coastal line and their activities cause pollution that effects water resources – the public may be subject to health risks. The standards of drinking water quality and the standards of waste water treatment (water is been reused for irrigation or diverted to stream) must be high and carefully monitored for health reasons. Health consideration effected water policy is Israel (e.g. standards, wells' protection zones, etc).

- Environment – two major issues are: open space and water treatment. The need to keep open space helps in advocating to maintain land use for agriculture. That in turn, kept the need for water allocation for farmers. The issues of water treatment can be divided to two main issues: (i) rehabilitation and treatment of polluted wells and aquifers; (ii) treatment of waste water – for reuse for irrigation and as a means to prevent pollution in streams where previously untreated waste water was discharged. Preventing stream pollution promotes enhancement of ecological assets and their services.

- Tourism – tourism is a source of economic growth. Provision of water supply must reliable and safe.

Supply and demand policies

While Israel during its years of establishment gave importance to water security, agriculture, and settlement along borders, it is clear that water policy was oriented towards the needs of the agricultural sector and those of remote areas beyond urban needs. Engineering and resource exploitation were major means to meet these needs. Through the years, Israel has developed its water management based on principles of supply and demand management.

The following summarises briefly the principles of the supply and demand management:

Supply management:

- Engineering and hydrological based – increase storage capacity, connect remote areas, develop water resources, divert saline water from fresh water sources

- Technologically based – water treatment: desalination of seawater and brackish water, waste water treatment to be reused for irrigation

- Environmentally based – allocate fresh water to the environment in order to maintain ecological assets and services, divert waste water to streams only after treatment, divert saline water, manage resource exploitation

- Efficiency and economically (cost) based – minimise water loss by repairing leakages, managing water pressure, etc.

Demand management:

- Education, awareness, water saving campaigns – encourage behavioural change

- Increasing block tariffs – incentives to consume less
- Fines – pay fines for consumption above allotted quotas (farmers and industry), pay over-use fee during drought period (residential, imposed for limited time)
- Aquifer production levies – pay for water production to reflect water scarcity rent

Financial policy

The water sector in Israel operates as a closed economy. It relies on water tariffs for its financial needs. Water tariffs reflect cost recovery and scarcity of resources. Government backs the sector with long-term commitments for purchasing water from desalinated plants in case water production in plants would not be required in heavy rainy seasons. Government also granted and backed the establishment of Municipal Water Corporations. It is likely that government budget would still be needed for unique projects where decision makers would prefer not to increase water tariffs in order to subsidise unique projects that may be unjustifiable economically but still legitimate at a national strategic level (e.g. expansion of water availability in remote areas such as Arava).

National policy for promoting the water industry, green jobs and export

Since 2005, the government has been promoting a national water technology programme. The goal was to take advantage of the concentration of water technologies in Israel, continue developing and exporting them. This represents true Green Growth in action. Not only do the technologies developed allow for more efficient management of the water (supply and demand) but they also produce many waste water treatment technologies and processes benefiting the environment directly. Also, material, methodologies and technologies for treating polluted wells are been developed, increasing efforts to keep natural water resources clean and available for use. Green jobs have been created in the water industry and green export has developed to about $2 billion in 2010. Connection with other non-water technologies such as the ICT sector has been promoted. Also, many non-technologically based solutions such as economic and statistical models have been developed (pressure management, statistical models for leakage detection, etc).

The program provides: grants for start-ups, infrastructure for water technology incubators, connection between academia and industry, academic site for experiments, beta site in the water sector, education, training, conferences, and international fairs.

Economic and administrative instruments for green growth

Several economic and administrative instruments are being used in Israel in order to achieve efficient management of water resources and of consumption. Among them are:

- Environmental taxes – aquifer levies for water production, sewage treatment fees (not part of the water tariff)
- Water quotas and increasing block tariff – for agricultural and domestic users (industry has quotas and flat tariff)
- Exchange of water rights (scarcity signal) – farmers could exchange fresh water rights for irrigation with recycled water and pay lower prices for actual use

- "Feed in tariff" – payment mechanism for artificial recharge in aquifer (storm water catchment, treated water)
- Government grants for well rehabilitation and water reclamation plants
- Government grants for eco-innovation – national water technology programme

Evaluation: economic, social and environmental benefits

To summarise briefly, among Israel's notable achievements are: the establishment (2005) of one of the world largest reverse osmosis sea-water desalination plant with a capacity of 120 million cubic meter per year (mcm/yr) along with additional plants (2007) with a capacity of 30 mcm/yr – both of which increased production capacity to a total of additional 45mcm/yr. The Government aims to augment sea-water desalination capacity to 750 mcm/yr by 2020.

Additional achievements are: structural changes related to the creation of the Governmental Water and Sewage Authority (GWSA), creation of 56 Municipal Water Corporations, treatment of sewage and recycling of treated effluents for agricultural purposes, thereby freeing up potable water for other uses, raising the quality standards of drinking water and of treated sewage, changes in the structure and the rates of water pricing in all sectors to reflect marginal cost in order to improve efficiency in use, an innovative residential water saving campaign which transfers the implementation risk to the private sector, and implementation of public-private projects through international bids for new infrastructures and technologies.

Finally, green growth has also enabled job creation and the involvement of the private sector:

- Job creation – water saving awareness campaign, distribution of water saving devices for the tap, upgrading WTP's, eco-innovation industry, traditional water industry jobs
- PPP including foreign investment – desalination plants

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Economic instruments in establishing water security in Australia's Murray Darling Basin

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Type of tool: economic instruments
Issue: agriculture, cities, watersheds
Location: Murray Darling Basin, Australia

Challenges and objectives

The OECD green growth strategy argues water security, defined as ensuring access to adequate quantities of water, of acceptable quality, for human consumption, productive and environmental uses, through effective application of demand and supply policies, can act as an engine for sustainable growth. This case study outlines the role of three economic instruments in this process in Australia's Murray Darling Basin (MDB).

Water is a valuable resource, critical – indeed essential – to economic development. Australia's challenge, one shared by many countries around the world, has been to put in place framework conditions such that water can contribute to economic growth more fully than has been the case in the past, in the context of sustaining environmental outcomes.

Australia's approach to water policy in the MDB in particular is to recognise that water use, be it for human consumption, production or to provide ecosystem services, is a valuable and scarce input that needs to be priced properly and managed actively to be used effectively. In a global context, Australia accounts for only a very small proportion of the world's water resources. And if the FAO data of water availability per capita were used, one would think Australia is well endowed with water resources. And in a sense that is true, but the catch is that most of it is in the tropical north of the country, a long way from the bulk of the population and mid-latitude irrigated farming country. Only around 6% of runoff occurs in the MDB, which accounts for around 40% of Australia's agricultural production.

The key objective under Australia's broad blueprint for water management is a nationally compatible, market, regulatory and planning based system for managing surface and groundwater resources for rural and urban use that optimises economic, social and environmental outcomes. Sustainable water use needs to recognise the importance of the environment *per se*, and its role generating future economic output and services.

This case study examines three economic instruments that are being used to achieve this objective.

Approach one: water markets and water trading

The first instrument I will focus on is the use of water markets and specifically water trading. Water trading is a key feature of water management in the MDB, but not all water rights are traded.

In 2009-10, water markets in the MDB accounted for over 90 per cent of both the entitlement trade and the trade in seasonal allocations (or trade in actual water) nationally. Trading of entitlements in the MDB (around 1800 GL) was equivalent to around 10 per cent

of the stock of entitlements, while trade in allocation water (around 2300 GL) was equivalent to around 40 per cent of the water used in 2009-10. This compares with water entitlement trade of under 100 GL in 2003-04 and trade in allocation water of around 980 GL. The intensity of trading varies across the MDB, with much higher rates of trading in some trading zones than in others – it is most intense in what is known as the 'southern connected system'. Hydrologically, and therefore economically, the main market comprises what is called the southern connected system, and is made up of around half of the 23 river Basins. The overall trade in entitlements was valued at around AUD $2.6 billion, while the trade in allocation water was over $360 million (much lower than in 2008-09 because of the wetter season and greater availability of water in storages (NWC, 2011; MDBA, 2011a,).

Both the markets for allocation water and for water entitlements have grown substantially in recent years, as shown in Charts 1 and 2 below for the southern MDB (Source: NWC, 2011).

Chart 1: Volumes of allocation water traded in the southern MDB

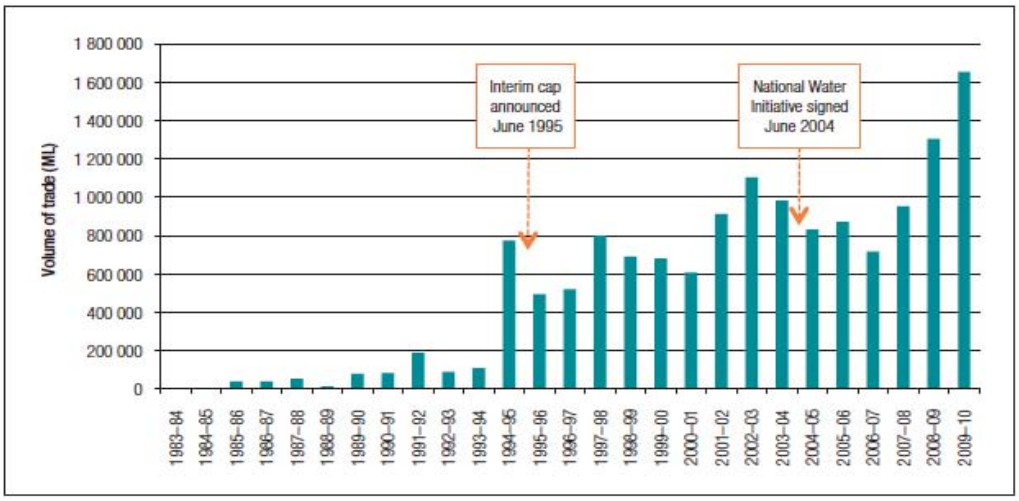
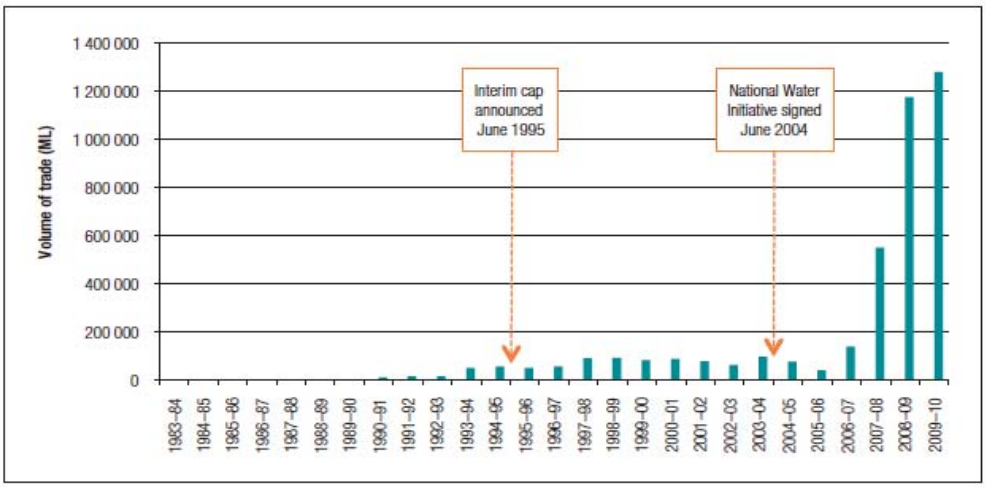


Chart 2: Volume of Entitlements traded in the southern MDB



There are a number of reasons for this growth:

- In the allocation water market, changes to rules on carryover – allowing more to be carried over from one year to the next – provided an incentive to purchase forward to reduce risks around water availability in the following year. Transaction costs also fell progressively. Necessity was probably an additional driver, reflecting the extended and deep drought, but only time will tell how much impact that had.

- In the case of the entitlement market, the Water Act 2007 – a piece of national legislation – gave the impetus to removing some of the key remaining constraints to trade by making separation of land and water a reality in key MDB states. This separation is not yet national: Western Australia, for example, lags behind the progress achieved within MDB notwithstanding commitments to the approach. There are some areas where markets will not make any sense (for example, the so called wild rivers in northern Australia, where use of water for agriculture, industry or communities is a tiny proportion of available water).

Water markets that allow efficient water trading of both water entitlements (the right to use a certain share of available water) and water allocations (the actual water that each year accrues or is allocated to an entitlement, and can be used by the entitlement owner – be they irrigator, urban commercial business or environmental water manager) have made a demonstrably positive impact on economic growth. A 2010 study of water trading in the southern MDB indicated that it increased economic activity by some $370 million in 2008-09, and that economic activity increased in each of the three states where the trading occurred. This study suggests that all major industries – dairying, rice and horticulture – benefited from water trading (NWC, 2011). Previous studies over the past decade all agree on the basic conclusion, that water trading in properly developed markets boosts economic activity and growth.

Of course such markets just do not appear out of nowhere. They reflect the legal and social history of the country or river basin in question. Water markets in the MDB are based on:

- Secure, well-defined property rights for water access entitlements that in essence are just like other real property, i.e. they are transparent, can be mortgaged, and are tradable. This is important for all users – be they farmers, commercial interests or environmental water managers managing water for the environment. These entitlements are fully separated from land, and generally provide access to a share of the consumptive pool each year (that is, the relevant authorities announce allocations as the water year progresses, which are a percentage of a nominal quantity).

- Policy actions that have largely eliminated barriers that impede market activity – in Australia's MDB the market framework reflects a key role played by the 2007 Water Act and by virtue of that legislation, a key role by the competition regulator, and introduction of market and charge rules that address issues which had hitherto stymied market growth. Some barriers to trade (such as the Victorian application of the 4 per cent rule) do remain but the worst of these should be eradicated over the next few years. Transparent access to trading information across the MDB is still work in progress, through the development of a national water market system

(Australian Government, 2011a; Bureau of Meteorology, 2011a; Bureau of Meteorology, 2011b; ACCC, 2010).

Well-developed markets allow market participants to actively manage their water assets and inputs into production, in the same way as they manage other assets and inputs into production. Prices formed in transparent allocation markets will reflect short term scarcity of actual water, while prices for water access entitlements will reflect market views on reliability of products and the relative demand for those products over the foreseeable future.

For example:

- If it is more profitable to sell the water and not grow a crop, potentially keeping other crops such as perennials alive, that can occur.
- If it is more efficient to sell the allocation water and buy fodder to feed dairy cows, rather than growing the fodder on-farm with irrigation, that can occur (water can thus be substituted in some cases).
- Water assets with different reliability characteristics can be put together in a portfolio that can reduce risk, compared with the original product held by the farmer.
- Water assets can become an explicit part of active balance sheet management.

These sorts of actions allow available water to shift to areas of highest return and it enables risk to be reduced. As water in all forms becomes priced in the market it comes to reflect scarcity, thus encouraging water saving innovation.

Markets can be a key tool in sustaining ecosystem services, and provide a transparent way to cost (as distinct from valuing) ecosystem services. They provide a tool that can be used by environmental water managers to make decisions on use of their water portfolio.

One of the biggest developments in recent years has been the setting up of a national Environmental Water Holder, where water entitlements can be held and water accruing to those entitlements used to generate a healthy environment, from a national rather than a state based perspective (which from time to time may be different), adding significantly to the security of water available to the environment.

One of the next steps in water market development is to examine the benefits of setting up a market for capacity sharing of delivery rights. This reflects congestion for delivery of water in peak growing seasons; a market for water delivery will assist in extracting further value out of this scarce resource.

Water trading and the environment

While a cap on overall use was put in place in 1996 ostensibly to halt further deterioration in the environment and ecosystem functions, little action was taken on restoring a sustainable balance between the needs of the environment and other users in the MDB until 2004 when '*The Living Murray*' programme was introduced. It sought to purchase (largely through investments in works and measures) 500 GL of water entitlements for the environment

(MDBA, 2010). Significant results have been achieved, but it was more expensive than direct purchase would have been, and the benefits harder to verify until after the fact.

Economic concepts can also be used to underscore the potential benefits from water trading between irrigators and the environment. 'To achieve maximum social gain, the distribution of water between the environment and irrigators should be set so that the marginal value of water for the environment and marginal value of water to irrigation are equal (Horne, A et al, 2010).

Water purchases by government can be directly from willing sellers. Indeed this is at the heart of a $3 billion water entitlement purchase programme commenced in 2008 by the national government, and over half has already been spent. Water can be purchased at market prices, meaning that existing entitlement holders who choose to sell can be appropriately compensated in a clear and transparent way, and ensures taxpayer funds can be properly accounted for. There has been no shortage of willing sellers. Indeed, prices paid in tenders over the past year have declined, reflecting the state of the market in general (Department of Sustainability, Environment, Water, Population and Communities, 2011a). By purchasing entitlements with the same rights and obligations as irrigators, there can be no question that the environment is not paying its way, and the cost of restoring and maintaining the environment can be made more transparent.

This approach allows large adjustments in the balance of water available to the environment compared with other uses, as envisaged in the MDB Basin Plan processes, can be achieved at least cost and provides significant relative flexibility compared to infrastructure investments.

Environmental water managers can sell water back into the market in years that it is surplus to requirements, potentially generating revenue to purchase water in years when the manager's allocation is less than requirements.

By establishing the Commonwealth Environmental Water Holder (CEWH) as a statutory position in 2007, the national government can ensure Basin-wide environmental interests are looked after, and ensure that water actually gets used as promised. Transparency is at the centre of these arrangements, and the CEWH is required to provide an annual report setting out activity and performance. To repeat the point made above, with water a scarce commodity, with competing uses, it provides governments and society transparent access to the cost of providing ecosystem services. 'Planned' or rules based environmental water, or water set aside for the environment after diversions for agriculture, hitherto has been far from transparently managed, although there is no intrinsic reason why this should be so.

Approach two: government subsidies

The second instrument I will focus on is the use of government subsidies to increase the efficiency of water use, and to promote water security. Programmes with strong public good components may well justify government subsidies.

Three such programmes, which have been progressively implemented over the past 4 years, cover:

- funding of better water information through the Bureau of Meteorology (BOM);

- funding of cutting edge research (CSIRO water availability studies and the Water Information Research and Development Alliance between CSIRO and the BOM); and
- increasing consistency, timeliness and transparency of market information, (including through the National Water Market programme being developed by the Commonwealth and the Australian states and territories).

These programmes are gradually increasing the transparency and availability of market information, enabling better decision-making and risk management, hence enhancing water security.

Governments have also sought to increase the efficiency of the irrigation sector through a suite of programmes that offer varying incentives to change. One such programme rolled out by the national government has supported the funding of irrigation modernisation planning, aimed at getting irrigators to assess the viability of their districts out into the future, in a climate change environment. Questions that have needed answering include: Is it worth upgrading capital investments in the irrigation district? Should particular channels be closed? Irrigators can make decisions against a market background for their water assets.

Some irrigation modernisation studies came to the conclusion that significant parts of existing irrigation networks (in some cases 30 per cent) had no future, and should be closed. A $650 million open tender based government investment programme in NSW is to provide incentives to achieve this and to fund other proposals to improve efficiency in the Macquarie River valley (Department of Sustainability, Environment, Water, Population and Communities (2011). Results thus far are apparently encouraging – with tracts of irrigation channels in Trangie, Tenandra and Marthaguy in NSW being rationalised, and water recovered for environment (held by the Commonwealth Environmental Water Holder) at what appears to be relatively low cost multiples – the cost above the market price for water is the price for securing significant on the ground regional reform.

The case for investments of this sort (other programmes are also operating) rests on their impact on building strong community support for genuine, lasting change. It must be based on cost effectiveness, and net value to the community at large. Many projects to do not pass the test, and governments need to be very clear about expectations. Sometimes that is not the case.

State priority projects

The national government has sought proposals from state governments that might merit national government funding, flowing out of a MDB institutional reform package in 2008. Over AUD $3 billion was originally earmarked for these projects (Australian Government, 2011b). Project proponents were required to develop assessable business cases and much effort was put into testing the viability of projects.

From publicly available information, many projects that were raised by state governments and irrigators alike do not appear to meet the viability test, and there is a persistent (and persisting) attitude at a state level that these funds should simply be handed over without a stringent testing process and without guarantees that lasting reforms would be realised. The original proposed $1 billion investment in Northern Victoria Irrigation Renewal Project (NVIRP) was committed before any serious investigation had been undertaken, and at best only offered modest returns of environmental water at very expensive multiples. In a sense it

was a political commitment of funding to ensure passage of an overall reform programme. Expenditure of this type is fraught with danger, as it encourages rent seeking and decision-making that is not focused on generating long-term sustainability and net benefits to the society. (Following an extended period of negotiation, a contract was signed in October 2011 for a commitment of $953 million for NVIRP stage 2, for a water return to the Commonwealth of 102GL. Separately, a second 102 GL of water savings will be purchased at an additional cost of $219 million.)

There are examples of very good infrastructure projects where government assistance has the potential to produce significant overall public benefits. For example, the NSW government proposed to require all irrigators to upgrade meters to a given standard. The final detailed business case and pilot work indicated substantial benefits from the project, particularly ensuring that irrigators extracted only their allocated water (NSW Office of Water, 2011). Making whole systems subject to consistent metering increases transparency and confidence of all parties in the value of entitlements and access to water.

Equally, there are many projects that have been proposed that do not meet a basic cost benefit test. Making sound investment decisions is critical: governments need to be prepared to invest only in projects that make sound economic sense, rather than make funding available on a 'my share' basis. As a ground rule, investing in infrastructure network projects, or other investments need to have a clear rationale, and a clear understanding of benefits and costs. It will be critical to invest in areas that deliver results rather than provide funding to 'wish list' projects of dubious quality. Water savings are likely to be second best compared with market purchases, as their source will often be determined by the location of the project, not environmental need. Interest groups and the states will continue to make claims for 'their' share of these reforms. This will not always coincide with optimising national outcomes for the MDB as a whole.

Overall (and at the risk of repetition), injection of government funding into water infrastructure, particularly if it can cost effectively result in additional water for the environment as a part of a rebalancing programme, can accelerate the pace of reform, and ensure the support of key sectors. However, poor investments in large projects can lock inefficiencies into the asset network for long periods. These assets will need to be maintained over time, and often this cost burden is shifted back onto the agricultural sector. Insufficient attention being paid to benefit cost analysis can result in poor public investment of scarce resources, and governments and communities not achieving the level of water security and sustainability that was originally sought.

Approach three: legislation and regulations

The third set of economic instruments I focus on cover legislation and regulations.

The 2004 National Water Initiative – an intergovernmental agreement that the Commonwealth and state governments have agreed to pursue – remains the central framework document for water management in Australia. However, in parts it has been strengthened by national legislation, which includes a new institution (the Murray Darling Basin Authority (MDBA)) and additional roles to two existing independent institutions, the BOM and the Australian Competition and Consumer Commission (ACCC).

Getting the MDB back onto a sustainable footing and keeping it there is at the heart of the *Water Act 2007,* which seeks to accelerate the pace of reform. It has been bolstered by a 2008 intergovernmental agreement between MDB states and territory. The *Water Act* seeks to facilitate achieving the objectives of the national water initiative, inter alia, by providing for water planning at a basin level in the MDB, to be undertaken by an independent, expert-based body with a whole-of-Basin focus.

- The activities of the former Murray Darling Basin Commission (MDBC) are now undertaken by the Murray Darling Basin Authority (MDBA) on the basis of a corporate plan, not via the convoluted decision making of the past. This provides the states and the Commonwealth with an initial decision-making role, but then allows the MDBA to get on with implementation.

- The MDBA is also responsible for preparing the Basin Plan. This basin-wide planning document will for the first time set enforceable sustainable diversion limits for every catchment and aquifer in the Basin. The Basin Plan will also include an Environmental Watering Plan, designed to put the environment back on a sustainable footing.

There are two steps in arriving at sustainable diversion limits. First, there is a need to ascertain what the current sustainable diversion limit is and then, second, to understand how future climate might affect this limit. These limits are to be based on 'best available science'. The legislation requires that the MDBA manage the resource at a basin level, 'optimising environmental, economic and social outcomes'.

These sustainable diversion limits have yet to be determined, but from the work done thus far it is clear that the major step in the short to medium term is to get the MDB back onto a sustainable footing, on the basis of the climate we already have. That is a large step in its own right in some catchments, likely involving reductions in water use by industry and agriculture of at least one quarter. The CSIRO water availability studies that have been undertaken have underscored the need for an adaptive management framework in water planning to adjust the rights of all users (irrigators and farmers, urban users and the environment) in a transparent way. Models need to be open, transparent and verifiable, entitlement frameworks clearly defined and the market well functioning important to make best use of the resource in the Australian context.

(The MDBA is currently undertaking extensive consultation with governments, research agencies and affected communities as they go about preparing the proposed Basin Plan. The process has been delayed several times, and is now well over a year behind the original schedule. The latest advice is that proposed plan will be released in late 2011 for comment before being 'made' by the responsible Minister sometime in 2012.)

A key factor underpinning recent growth in entitlement trade in the MDB was the strengthened role of the national competition regulator, the ACCC under the *Water Act 2007*. The ACCC was given the responsibility to develop new water market, charge and trading rules that would reduce or eliminate all major remaining impediments to trade.

- The market rules on transformation and termination fees now allow irrigators to transform their water right into a title that can be freely traded, without needing the approval of an irrigation infrastructure operator, and ensure termination fees do not

create barriers to trade. This overcomes perceived problems relating to stranded assets and control of water assets by other than the ultimate owner even after separation from land (Australian Government, 2009).

- Charge rules relate to fees levied by infrastructure operators for water storage and delivery services and state agencies for the provision of water planning and management services. The rules put in place now prevent these charges from being levied to hinder trade, including interstate trade, and making rules that might favour certain types of users. (ACCC, 2011).

- The new trading rules, yet to be determined (and which will be the responsibility of the MDBA), will address remaining artificial trade barriers. (ACCC, 2010).

The new role given to the BOM also deserves mention. The enhanced emphasis on transparent and reliable water information (in part illustrated by the development of a national water account (BOM, 2011b) will assist market participants address heightened risk and uncertainty. Research being conducted with the CSIRO, to develop new research tools to address user needs over coming decades will facilitate adaptation to climate change and promotion of green growth (BOM, 2011a).

All of the above (and other additional elements that will further contribute to strengthening the water management framework, such as increased compliance to reduce water theft) will need to be implemented in conjunction and cooperatively with state and territory governments. But there is little doubt that the higher national profile federal legislative provides should assist in better using the nation's scarce water resources to achieve green growth outcomes. Overall, the new legislation and regulations that flow from it are making a substantial contribution to a freer, more transparent market, and hence a positive contribution to efficiency and consequent economic growth and environmental sustainability.

Lessons learnt from implementation

Water reform is both iterative and adaptive. Australian experience suggests concerted, sustained action is required over long periods of time. Ongoing political commitment is required to 'finish the job'. This requires government, communities and business to work together. Finishing the task of putting in place the regulatory framework, completing development of information systems and above all 'making the Basin Plan', the overarching regulatory framework for managing the MDB, are all essential for strong effective water markets, for environmental sustainability and water security in coming decades, as climate change or increased climate variability heightens the risk of doing business. Further development of existing water markets will help to secure a sustainable future.

Each of the economic instruments discussed in this paper can contribute to a more effective use of water resources, and better, more sustainable economic and environmental outcomes. Used together the economic instruments can be mutually reinforcing. There is no inevitability about ongoing decline in environmental outcomes as economic growth proceeds. Indeed, looking after the environment will assist in sustaining long-term economic outcomes.

The Australian experience shows that there are substantial benefits for both economic and environmental outcomes from developing strong, transparent water markets, treating water transparently for what it is – a scarce resource. Having a price set for both water entitlements (the long run value for the water asset) and for water in the allocation market (the price reflecting scarcity in a particular year) will help society understand the nature of scarcity and the implicit value of the cost of tradeoffs between the environment and agriculture. Valuation of ecosystem services (an issue not discussed in this paper) is critical to making correct long-run tradeoffs, and is an issue Australia is only now starting to put in the necessary investments. Good information is necessary to undertake this task, and it is only in the past few years that adequate resources are being applied to this task. In many economies this is not the case. Without adequate information, it is almost impossible to make good policy of any sort.

All reform models need to be country specific, though the key elements of framework may well be the same. The Australian 'toolkit' follows closely the TEEB model, but the emphasis placed on each element will differ from country to country (see TEEB, 2009).

Key lessons from the Australian experience in the MDB are:

1. Moving from water management built around an engineering model to a framework with a market-based overlay takes time and persistence.

2. Significant benefits have accrued to rural and regional Australia from introduction of a market based approach, notwithstanding initial reticence. More flexible and adaptable systems have increased innovation and sustainability, and result in higher output in nearly all circumstances, but particularly in years of extreme water shortage.

3. Markets and prices alone will not solve everything and are not suited to all circumstances. A strong clear system of entitlements, and a transparent effective regulatory and compliance framework buttressed by sound, transparent information is important. A holistic (legislative) framework helps to achieve this outcome.

4. Australia's case illustrates how clear separation of land from water allows scarcity to express itself in the market.

5. Strong due diligence is necessary when governments consider subsidising investments to promote efficiencies in water use: it is critical to ensure all investments have a positive benefit cost ratio.

6. In a market based world, environmental managers can actively manage available 'environmental' water. It is important to achieve environmental objectives as efficiently as possible. Water markets allow (perhaps force) managers to think much more strategically about what is trying to be achieved. Used properly it can increase accountability and transparency of environmental objectives.

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Water development in South Africa

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Type of tool: economic instruments
Issue: cities, industry, watersheds
Location: South Africa

> *"The objective of managing the quantity, quality and reliability of the Nation's water resources is to achieve optimum, long-term, environmentally sustainable social and economic benefit for society from their use".*
>
> Principle 7 of the National Water Policy

Challenges and objectives

South Africa's water resources are, in global terms, scarce and extremely limited: average rainfall (450 mm per year) is well below the world average (of about 860 mm), evaporation is comparatively high, no truly large or navigable rivers exist, the combined runoff (of 49 billion cubic metres per year) is less than half of that of the Zambezi River, the closest large river to South Africa. In addition South Africa is also poorly endowed with groundwater and the natural availability of water across the country is highly uneven with more than 60% of the river flow arising from only 20% of the land. Four of South Africa's main rivers are shared with other countries, which together drain about 60% of the country's land area and contribute about 40% of its total surface runoff (river flow).

Most urban and industrial development took place in locations remote from large watercourses, dictated either by the occurrence of mineral riches or influenced by the political dispensation of the past. Some irrigation were also established during times that water was still relatively abundant and little incentive existed for seeking the most beneficial application thereof. As a result, in several river basins the requirements for water already far exceeds its natural availability, and widely-spread and often large-scale transfers of water across catchments have therefore, been implemented.

South Africa depends mainly on surface water resources for most of its urban, industrial and irrigation requirements. The use of water is dominated by irrigation, amounting to over 60% of the total water use in the country, the bulk of which is used consumptively. Water requirements for urban and domestic use account for nearly 30%, with the remainder being used for mining, bulk industries and as cooling water for power generation. Afforestation, which intercepts large quantities of water before it reaches the streams or rivers, is more dominant in the wetter parts of the country.

Water quality has deteriorated in the rivers or river reaches receiving large quantities of effluent. Some rivers with relatively high salinity (brackish) water occur in the dryer parts of the country. Major sources of pollution of surface waters are agricultural drainage and runoff, urban runoff and effluent return flows, industries, mining and rural settlements with insufficient sanitation services. The most important of these currently are insufficiently treated urban effluent and acid mine drainage. Pollution of groundwater mainly results from mining activities and human settlements. Water is also extensively re-used in South Africa, adding nearly 20% to the yield available from the surface water resources.

The water sector (and implicitly also water security) comprises a wide diversity of interests, physical components, authorities, stakeholders, inter-dependencies, externalities and other factors. The situation with respect to water security in South Africa is quite diverse, ranging from high levels of services and security in most of the large metropolitan areas, to severe and immediate risks in less developed and rural areas. The more important aspects with relation to economic growth and environmental sustainability are:

- The larger surface water systems that supply water to the main urban, industrial and mining centres are well managed at a high level of sophistication.[1] However, delays have been experienced with respect to the implementation of some large new water resource developments, which are partly attributable to a lack of sufficient institutional capacity.[2] These delays, if not contained, could have some negative impacts on the potential for economic growth.

- Water quality in many of the country's surface streams has been severely compromised by the inadequate treatment and control of effluent discharges and urban/agricultural runoff. This poses serious environmental, health and economic risks in many places. The situation is largely attributable to a lack of institutional capacity for the monitoring and enforcement of standards, as well an insufficient technical capacity for the operation and maintenance of treatment facilities.

- The general efficiency of water use still leaves much scope for improvements, especially with respect to irrigated agriculture and losses from municipal distribution systems. This results in more water being used than actually needed, with resulting increases in the risk of failure to supply.

- The abstraction of water for irrigation is poorly managed and controlled, largely as a result of insufficient institutional capacity. This has serious impacts on the ability to manage environmental flows and also negatively impacts on the overall efficiency of water resources management.

South Africa, because of its general aridity and high variability of rainfall in space and time, is especially vulnerable to changes in water availability. Indications from global circulation models (GCMs) are that greater variability in rainfall and climatic conditions may be expected. This includes the likelihood of an increase in the duration of dry spells in the interior and north eastern areas of the country, also more intense rainfall and the possibility of more frequent and severe flood events. The probable net effect would be greater variability in runoff and therefore of the usable portion of runoff, together with reduced recharge of groundwater. Specifically, there is growing consensus amongst the scientific community that rainfall over the south western part of the country can be expected to significantly decline and become highly variable over the coming decades.

South Africa has strong and enabling water legislation, well developed infrastructure, leading water resources technologies and management capability, and a sound track record. Given

[1] Many of the smaller surface water schemes and groundwater developments are poorly managed with resultant high risks of failure.

[2] The government tends to under spend available funds due to lack of institutional capacity.

the political commitment together with some strengthening of institutional and technical resources, it undoubtedly has the ability to ensure that sufficient water of appropriate quality will be available in future to sustain a strong and growing economy, high social standards and healthy ecosystems.

Response: improving the allocation of water resources

The National Water Act gives highest priority to water for the 'Reserve', which includes water for basic human needs and for the natural environment. Thereafter international obligations as agreed with neighbouring countries must be respected and honoured. Beyond this, water should be allocated by public authorities and by river basin to ensure that the greatest overall social and economic benefits are achieved. Consideration must not only be given to this primary aim, but also to potential disbenefits to society where water is made available to competing optional uses. This applies both to long-term allocations for water use as well as to short-term curtailments in supply during periods of drought and temporary shortage. Where surplus or unused water exists, prioritisation applies, provided that the water is not used wastefully.

The priorities are listed in the National Water Resource Strategy in descending order of importance, although the order may vary under particular circumstances:

1. Provision for the Reserve;
2. International agreements and obligations;
3. Water for social needs, such as poverty alleviation, primary domestic needs and uses that will contribute to maintaining a social stability and achieving greater racial and gender equity;
4. Water for uses that are strategically important to the national economy (such as power generation),
5. Water for general economic use, which includes commercial irrigation and forestry. In this category, allocation is best dictated by the economic efficiency of use. With the introduction of water trading, demand will automatically adjust over time to reflect the value of water in particular uses; and,
6. Uses of water not measureable in economic terms. This may include convenience uses and some private water uses for recreational purposes, which are likely to be of low priority.

Once these general principles have been established, the overall strategy to cope with water scarcity is to improve the overall efficiency with which water is allocated and used among the different places and activities. Water allocation can be improved between the different economic activities, the overall economic uses and the environment and, finally, between the different places in the territory including opening the displacement of agricultural production to neighbour countries. The potential gains of this strategy have been highlighted by various research projects assessing the value of water.

- Results confirm agriculture as both the main water user and the sector with a higher potential to save water for the environment and for other more productive uses. Nevertheless forward and backward linkages of agriculture as a supplier of raw materials and demanding of labour and inputs need to be properly accounted for.

- Sufficient provision was not made in the past for environmental water requirements and that in many cases water resources have been over allocated. Although the legal and institutional framework for addressing the situation is in place, it will remain a complex and extended process. The reservation of water for environmental purposes obviously reduces the potential availability of water for economic uses, with resultant socio-economic implications. Quantifying the environmental water requirements should therefore not be based on scientific assessment only, but needs to be augmented by assessments of the potential economic and social implications, and subjected to due public involvement.

- South Africa is well known for its extensive network of large scale schemes for the transfer of water from areas of surplus to areas of deficit; and to where the greatest benefits are to be achieved. Water resources over much of the country have been linked through inter-catchment transfers and are managed as large integrated systems, thereby reducing the potential risks of failure through the combined utilisation of resources and the balancing of climatic variability over large geographic areas (Basson and van Rooyen, 2001).

- A concept which could have far reaching mutual benefit for the southern African region, would be to move some of the water intensive and low water efficient production to countries with more favourable climate and soils. An order of 25 million hectares of high potential rain-fed cropping land could be available for this purpose (DWAF, 2010). In comparison, irrigated agriculture in South Africa covers the order of 1 million hectares. Such an initiative should fit well into the agenda of the Southern African Development Community (SADC) towards promoting greater trade and co-operation amongst these countries. It should also lead to the establishment/expansion of local agro-industries as well as other economic linkages, together with related infrastructure and other investments.

The National Water Resource Strategy requires that a range of possible solutions be investigated whenever there is a shortage of water or a need for additional water, taking account of the availability of surface and groundwater and the interactions between them, and the integration of water quantity and water quality issues. The main policy options to be considered include:

- Demand side measures to increase water availability and improve the efficiency of water use.

- Re-allocation of water, including the possibility of moving water from lower to higher benefit uses by trading water use authorisations.

- Supply side measures through the construction of new dams and related infrastructure, including inter-catchment transfers.

The significant impacts of all development options and other interventions need to be assessed. Social and environmental considerations need to be accorded the same attention as those of a technical, financial and economic nature; the aim being to ensure that the overall benefits arising from such actions will exceed the cost and that the benefits and costs will be

distributed equitably. Given the blend of tangible and intangible factors to be considered, public participation forms an important corner stone of the process to be followed.

There are two representative cases of how the growth in water requirements can be met in future:

- One is for an inland area around Johannesburg and the Gauteng Province, which is supplied with water from the Vaal River System, and represents more than half of the economic output of South Africa. For the Vaal River System, the target is to bring new interventions on line to meet the growth in water requirements after having first implemented water conservation and Water Demand Management (WC/WDM) measures. Evidence shows that further inter-catchment transfers still offer the lowest cost options for the augmentation of water resources serving the inland parts of South Africa (Note: The figures have been omitted). This does not imply however, that these would necessarily be the overall best options to be implemented. In particular, due consideration needs to be given to the possible re-allocation of water.

- A second case is the Cape Town area on the coast together with some surrounding developments. A totally different situation applies to the coastal Western Cape area (Note: The figures have been omitted). This area, being more remote from large rivers and not having the same benefits of scale of the Johannesburg/Gauteng area, is totally dependent on the development of modest inland resources (surface and ground water), the re-use of water and desalination of seawater. A rather pronounced drop in the availably of the water resources already developed is expected due to provisions for environmental water requirements (EWR), together with a provision for the possible impacts of climate change.[3]

Conclusions from both cases, together with similar findings for other parts of South Africa, are that water can be made available to meet the future needs in all the major urban and industrial centres in South Africa, although at steeply increasing costs in most cases. Comparisons of the unit reference values (URVs) to the economic value of water indicate that the unit cost of water from some new water resource developments will substantially exceed the economic value of some existing water uses; most notably irrigated agriculture.[4] The re-allocation of water could therefore offer a feasible alternative to some new resource developments and augmentation schemes. It is projected that water resources across the country will become even more inter-connected and inter-dependent in future (Note: The figures have been omitted).

What role for economic instruments?

Water is not freely tradable in South Africa; moreover water use licences or authorisations may be transferred on a temporary basis for one year in the case of water for irrigation, and permission may be granted for an extension of a further year. Permanent transfers may be

[3] Indications are that the Western Cape is likely to be the area in South Africa that may soonest and most severely be affected by climate change.

[4] Although the URVs and economic values are based on different financial and economic approaches and are not intended to be directly comparable, they at least provide a broad indication of the relative costs and economic values/benefits.

affected by one user offering to surrender all or part of an allocation to facilitate a licence application by another prospective user (DWAF, 2004). Transfers of this nature constitute trade in water use authorisations, and require new licence applications, which will be subject to all relevant requirements of the Act relating to applications for licences, including the need for a Reserve determination if one has not already been carried out. Permanent transfers become effective only when the new licence is granted. They may be authorised only by a responsible authority, which may attach different conditions to the new licence than were attached to the surrendered licence. One such condition may be that the new user must pay compensation to the original licence holder, which could be viewed as a form of market related trading. Both the temporary or permanent transfer of water use licences are only permissible when the original and transferred water use are from the same resource.

The price of water in South Africa largely remains an administered item. Prices are mostly seen as a partial cost recovery instrument rather than an incentive to encourage the more efficient use of water, water conservation or a shift from lower to higher value uses. Exceptions are the new stand-alone water resource developments for economic use, such as mining, where the full cost of water from such development is to be carried by the users.

The principle of striving to achieve the overall best utilisation of water which forms one of the corner stones of the National Water Resource Strategy for South Africa, should not be restricted to the geographic confines of the country, but should also be viewed in a regional and more broadly in a global context.

A number of major socio-economic constraints to the exploitation of this potential have been indentified, that would need to be addressed (DWAF, 2010). These include land tenure issues,[5] the high rural population spread presenting a challenge to commercialisation of agriculture, poor or lacking infrastructure and general services (e.g. training and research). As experience shows in other countries, measures would have to be taken to accompany structural adjustment of the South African agricultural sector. A proactive role of the respective governments is needed to bring such regional co-operation to fruition. It would inherently be a long-term initiative to allow time for the gradual introduction of the necessary social and economic adjustments to be made.

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[5] The majority of the high potential land in neighbouring countries is occupied by subsistence farmers on commonly owned land.

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Annex

Economic value of water

Various project related studies have been conducted in South Africa towards assessing the economic value of water. The main approach used was to determine sectoral water utilisation efficiencies by means of a "water multiplier' analysis, to obtain an indication of the relative importance of water in production by some of the water use sectors and sub-sectors of the economy (Basson *et al.*, 2010).

As a broad comparison, national multipliers were determined per million m^3 unit of water used, expressed as employment opportunities and Gross Domestic Product (GDP) supported. Distinction was made between high, mid and low level jobs, based on the skills levels required to produce the output (Table 1).

Table 1. Economic returns from water use, South Africa (per million m^3 water used)

Sector	High-level jobs	Mid-level jobs	Low-level jobs	GDP (ZAR million)[a]
Agriculture (general)[b]	10	30	210	13
Gold Mining	650	2 880	11 900	1 600
General manufacturing	6 800	27 000	28 000	6 700
Pulp and paper	25 000	79 000	81 000	23 000
Beverages	38 000	131 000	158 000	37 000
Glass products	233 000	716 000	836 000	250 000

a) Expressed in 2009 values
b) Least efficient (includes irrigation, rain-fed and livestock farming)
c) Most efficient
Source: Basson *et al.*, 2010

The results show agriculture as the most inefficient user of water. Gold mining and general manufacturing could serve as being representative of water use efficiencies in the mining and manufacturing sectors. It is important to note that the results are based on national statistics, and therefore reflect the average performance of the different sectors.

Wide variations around these averages are bound to occur, but they are unlikely to change the essence of the results, considering the very large difference between agriculture and the following sector in the ranking.

Similar outcomes were obtained with respect to a new water resource development in the Olifants River catchment (Table 2).

Table 2. Economic returns from water use, Olifants River catchment (per million m^3 water used)

Sector	Gross Value Added (GVA) (ZAR million)	Employment
Agriculture (irrigation)	20	200
Mining	370	3 300

Source: Basson *et al* (2010)

Similar results were obtained by comparing the utilisation efficiencies of water in different geographic areas. In this case the economic benefits of allocating the water to the Orange and Fish/Sundays River region, where the economic activity is dominated by irrigated agriculture, were compared with the benefits achievable by applying the same volumes of water to the diversified and industrialised economy of Gauteng, the central industrialised province. The results of the analysis indicated that allocating water for use in the industrialised areas rather than for irrigated agriculture, will, from an economic point of view, render the highest returns (Table 3).

Table 3. Economic returns from water use, Orange River and Gauteng areas (per million m^3 water used)

Factor	Irrigated Agriculture[a]	Diversified Industry[b]	Ratio[c]
Production (ZAR million)	2.1	510	1:240
Employment	24	1 940	1:80

a) Orange River area
b) Gauteng area
c) The ratio refers to diversified industry having 240 (or 80) times greater returns than irrigated agriculture.

Source: Basson *et al* (2010)

Inter catchment transfers

Based on the probalistic assessment of the likelihood and severity of drought in specific areas for example, water is transferred to areas that may be suffering from severe drought conditions, from areas where the prevailing conditions are less critical. A high level of sophistication has been reached in this regard, and substantial greater utility is thus obtained from South Africa's water resources than the sum of the component parts (Box 1).

Box 1. Gains from inter-catchment transfer

A prime example of the benefits of the systems approach for the management of inter-catchment transfers is offered by the Thukela-Vaal Transfer Scheme. In this case an average volume of 530 million m^3/a is transferred from the Thukela River Basin to the Vaal River Basin, at a transfer rate that may vary from zero to a maximum of 630 million m^3/a. By properly managing the storages and times of transfer, a resultant increase in yield in the Vaal River System of 736 million m^3/a is achieved, whilst the residual yield in the Thukela system is reduced by only 377 million m^3/a.

The total quantity of water physically transferred in South Africa from one catchment to another currently amounts to 3 500 million m^3/a. In comparison, the total surface water yield is approximately 110 000 million m^3/a.

Water curtailments during times of severe drought are also incrementally introduced based on probabilistic grounds, and selectively applied to different user groups and economic sectors, in order to minimise the economic and social impacts of such measures.

The same technical, environmental, social and economic considerations as are applicable to any other water resource development and use of water are applicable to inter-catchment transfers of water. Some specific considerations are:

- The allocation of water away from a catchment can only be justified if it results in an overall benefit from a national perspective.

- The inter-catchment transfer of water may have unique impacts on natural ecosystems that extend beyond those associated with in-catchment developments. Specific consideration needs to be given to the possible transfer of organisms/species and changes in habitat conditions. The potential risks and impacts with respect to the transfer of species are more pronounced with the transfer of water between river basins, than between catchments within the same river basin.

- The transfer of water for the express purpose of meeting environmental water requirements in the receiving catchment is not supported.

Given the relative scarcity of water in South Africa, most large scale water resource developments are inherently multipurpose schemes, which also facilitates the better utilisation of the benefits of scale. A recent example is the Olifants River Water Resource Development Project in the north-eastern part of the country.

The project is located in a valley adjacent to a very dry plateau where about 250 000 people live in scattered communities, with totally insufficient availability of water. To construct a single-purpose dam and water supply network for domestic purposes only, would have been exorbitantly expensive and unaffordable to the predominantly poor households on the plateau. By linking the domestic water supplies to some large scale water resource development for mining purposes, almost halved the unit cost of water from the scheme.

A further opportunity was then identified, with the visionary linking of a proposed 1 500 MW pumped storage hydro-electric scheme to the water resource development project, and using the pumped storage scheme to also lift water up the escarpment for domestic use.

The scheme, now under construction, will also serve to stabilise flow downstream for environmental purposes. Specific consideration was given to the potential impacts on the Kruger National Park, (South Africa's premier conservation area which is located further downstream) and also to how the yield from the Massinger Dam in Mozambique would be affected.

2. Green jobs policies and approaches for a fair and well managed transition

Carlos Carrion-Crespo, ILO

The notion of "green jobs" has become something of an emblem of a more sustainable economy and society, that aims to preserve the environment for both present and future generations and to be more equitable and inclusive of all people and all countries. Green jobs hold the promise that humankind will be able to face up to the following two defining challenges of the twenty-first century:

- *Averting dangerous and potentially unmanageable climate change and protecting the natural environment which supports life on earth*
- *Providing decent work and thus the prospect of well-being and dignity for all in the face of rapid population growth worldwide and the current exclusion of over a billion people from economic and social development.*

The above challenges are closely linked and cannot therefore be addressed separately. Green jobs are key to meeting both simultaneously.

Green Jobs Report (2008)

Annandale and Morrison-Saunders (2008) and UNEP (2008) have considered the following definition.

> *"A green job is one which makes minimum negative impacts on the environment relative to the status quo, thereby making enterprises and sectors more sustainable".*

Introduction

It is widely acknowledged that unsustainable use of resources, high levels of pollution and the deterioration of natural capital in general pose severe threats to today's economies and societies across national borders. They threaten the very basis of growth and development and endanger livelihood security for millions of people who are dependent on those resources or potentially affected by climate change. At the same time policy measures aimed at supporting a shift to more sustainable growth and development trajectories have far-reaching implications for employment and labour market dynamics in many countries and economic sectors.

There are four ways in which green economy measures may affect employment. First, they may result in the creation of new jobs, for example in manufacturing pollution-control devices and environmental consulting services. Second, they may result in the substitution of some types of jobs for other types, for example in renewable energy instead of fossil fuels. Third, they may result in the elimination of some jobs without direct replacement, such as when packaging materials are discouraged or banned and their production discontinued. Lastly, they may have an impact on the reorientation and re-skilling of existing jobs, such as in construction.

The International Labour Conference, the ILO's highest body, adopted the Global Jobs Pact in 2010. The Pact recommended "increasing investment in infrastructure, research and development, public services and 'green' production and services as important tools for creating jobs and stimulating sustained economic activity." The major policy challenge is to reconcile the gains of sustainable development with the claims for short-term answers to unemployment and poverty. The Global Jobs Pact seeks to stimulate and support social dialogue to discuss and agree on pathways for "just transition". This notion marries the economic, social and environmental dimensions of employment strategies towards a "green" economy.

Challenges

Workers and employers will be affected in different directions – positive and negative – by sustainable development policies. Policies to reduce unsustainable production patterns may contract employment and enterprises in some sectors, while policies to encourage technological change, are likely to expand employment opportunities.

In UNEP's Green Economy Report[6], a global model was developed which compared a green investment scenario (assuming investment sufficient for achieving the water MDG by 2015) to a business-as-usual scenario. Modelling revealed that overall employment and income is greater under the green investment scenario compared to the business-as-usual scenario. However, the number of people working in water-related employment is lower in the green economy scenario, as a result of the efficiency gains achieved in this sector. In this scenario, labour and other resources are freed for use in other sectors. Further, it is suggested that as water is used more efficiently more is available for industry and other sectors, therefore increasing employment in other areas.

Infrastructure and technological investments are a main means of restarting growth and creating jobs. Moreover, investment decisions taken today are going to determine global use of resources and emissions for tomorrow and a good number of years to come. Investments to stem or mitigate the causes of climate change and those needed for adapting to the impacts can be used for creating employment on a large scale. Examples include infrastructure works for sanitation, flood control, irrigation schemes to combat droughts, the improvement of water networks and fittings in buildings.

We must consider that not all water investments and technology changes promote sustainable development. For example, changes in technology can do so if the technology is accompanied with new skills development programmes. Neither is there a cut-and-dry distinction between green and non-green jobs; there are several shades of green, according to how they contribute to reduce harmful effects to the environment. For example, a job may contribute to the reduction of water loss but not to the sustainability of agricultural development. Or it may be green in many aspects, but be located in a conflict-ridden environment that will not lead to sustainable development of water resources.

The challenge is to show that efforts to green the workplace pay off in terms of higher productivity and greater competitiveness. In turn, investments and enterprise

[6] UNEP (2011) *Towards a Green Economy: Pathways to Sustainable Development and Poverty Alleviation.*

development for a greener economy induce the demand for new competencies and a different kind of entrepreneurship skills. The structural changes wrought by the transition to green technologies or improved use of water resources modify the skills needed in labour markets. New "green collar" occupations will emerge and new types of skills and competences will need to be incorporated into existing occupational profiles. Developing new training curricula and launching green entrepreneurship promotion campaigns, for example among youth, should be grounded on the needs for these new requirements in the labour markets.

The overarching policy challenge is how best to coordinate employment and skills development policies with environmental and sector policies for more sustainable development and green economies. The time-lag to do so constitutes a supply constraint that in turn, delays the action on sustainability.

Finally, the green economy concept should very clearly include the social dimension: education, health, social protection, gender equity and labour as the focus of policies and investments. Alternative adjustment measures should be assessed with the inclusion of the different social benefits accomplished. In terms of investments for the green economy, the needs of the most vulnerable should be considered.

Approaches for a fair and well managed transition

A fair and well-managed transition for workers and entrepreneurs through those rapid changes is required. Getting there requires, in turn, consultation and social dialogue, and active labour market policies, particularly relating to the needs of the most vulnerable. A critical component is governance at all levels.

Improving governance/institutional arrangements

The ILO's forthcoming *Manual: Guidance on Formulating Projects and Research Studies Concerning Labour Issues in Greening the Built Environment* suggests that the Greening Agency will need to explore the issue of institution-building in close collaboration with the local authority (or over a sub-region several local authorities) and relevant members organisations of the Greening Agency itself. Effective institutional arrangements should be brought into being in parallel with pilot projects that demonstrate the possibilities.

One recent example is the remunicipalisation of water supply in Paris, which will include a citizen's water control board that will enable users to evaluate water quality. Money previously used to pay dividends will be reinvested into the water services.

A similar scheme was implemented in Buenos Aires, Argentina, in which public management of water services was restored in 2001. Trade unions and government agreed to provide 10% worker participation in the government utility company. This partnership has led to better productivity and water provision.

Enhance Social Dialogue and collaboration

The importance of concerted efforts and joint actions to address such challenges is well recognised by governments, trade unions and employers organisations, and has been reiterated in several forums, including discussions during the ILO Working Party on the

Social Dimension of Globalisation in November 2007. As part of these efforts, the International Labour Organization, the United Nations Environment Programme, the International Trade Union Confederation and the International Organization of Employers came together in the Green Jobs initiative with the goal of promoting environmentally sustainable jobs in a climate-challenged world. The initiative seeks to enhance dialogue and strengthen collaborations, build the capacity of ILO constituents, fill knowledge gaps, facilitate a 'just' transition to environmentally sound economies, and support policies to achieve the sustainability of jobs and enterprises.

Create opportunities for productive employment and decent jobs for all

Social transfers alone cannot support long term development: we also need policies that create opportunities for productive employment and decent work for all. Relevant reports and country experiences show that a transition to a green economy can lead to net gains in employment and particularly benefit the poor, youth and women. For this paper, we adopt the ILO's definition of a job and for the purposes of the international Standard Classification of Occupations to mean "a set of tasks and duties performed or meant to be performed, by one person, including for an employer or in self employment".

Investing in skills

In both the North and South, the implementation of sustainable sanitation may generate substantial employment. To some extent this will be 'conventional' kinds of work at both design and implementation levels. However, the new approach generally will require a reorientation of attitudes and in some cases skills with knowledge of the health implications of what is being done. Relevant awareness-raising and training programmes will be necessary (see ILO's forthcoming *Manual: Guidance on Formulating Projects and Research Studies Concerning Labour Issues in Greening the Built Environment).*

Investment in skills development is vital to this sustainability. In the 21-country study "Skills for Green Jobs: A global view" (2010), the ILO found that skills shortages hinder the potential to unlock the employment potential of green growth. The report recommends that countries devise strategies based on well-informed policy decisions, social dialogue, and coordination among ministries and between employers and training providers. We must bear in mind that new technology creates new needs in this regard.

Improving management practices

Improving responsible management practices at and around the workplace can greatly contribute to cleaner, greener and safer practices, reducing emissions and preventing health care costs of occupationally related accidents and illness.

Social Dialogue for decent jobs

Green jobs must also provide workers a say in the decisions which will affect their lives and the development of necessary reforms. The ILO's *Declaration on Social Justice for a Fair Globalization (2008)* asserted that "Social dialogue and tripartism [are] the most appropriate methods for translating economic development into social progress, and social progress into economic development; [and] facilitating consensus building on relevant national and international policies that impact on employment and decent work strategies and programmes."

Social dialogue seeks to build consensus and prevent conflict. The ILO promotes social dialogue in water utilities through an action programme that builds the capacity of the workers, employers and government ministries, as well as funding baseline studies on the state of social dialogue in the utilities and facilitating the development of Action Plans to develop sustainable mechanisms for social dialogue.

A leading example is the Maynilad Water District, which has developed inclusive mechanisms for social dialogue that has enabled workers in the utility to help develop systems to reduce the loss of water, thereby increasing productivity. The ILO has also developed activities to increase the participation of indigenous communities in the design and construction of water supply infrastructure and in the management of water resources. The main impact of this programme has been an increase in hygiene and sanitation education in the communities, and their entrepreneurship to make the service more efficient.

Similarly, the Namibian government has developed a programme to establish conservancies within communal lands. This programme has sought to decentralise natural resource management through devolving user rights over wildlife within the conservancy boundaries to elected committees of local people. It has benefitted as many as 95,000 Namibians, and provided incentives to manage wildlife populations in a sustainable manner.

Participatory approaches and empowerment for managing change

Organisational change or reforms which are undertaken from the bottom to the top, by empowering workers and employers through consensus-building and participatory approaches, are more likely to change the culture of the organisation, not only the behaviour and the attitudes of its workers.

The Pepoo project in Kenya is a case in mind, which developed a single-use, hygienic toilet bag that can be knotted and buried. Once buried, it breaks down the contents into fertilizer. The program includes distribution and collection services which are expected to create 1000 jobs, which will focus on empowering women. Currently, the product is being sold mostly by women micro-entrepreneurs.

For example, improving water supply has been shown to reduce the burden of the water supply chain on women and children, allowing them to participate in agricultural activities and to attend school. One way to increase water supply was developed by the Working for Water programme in South Africa. This invasive species management programme employs members of the local communities to clear thirsty alien tree and plant species which preclude the free flow of water. At the same time, like the Panama initiative, it increases the participation of marginalised peoples in the water supply chain.

We can define organisational culture as: “the pattern of basic assumptions that a given group has invented, discovered or developed, in learning to cope with its problems of external adaptation and internal integration. These have worked well enough to be considered valid

and are therefore taught to new members as the correct way to perceive, think and feel in relation to these problems."[7]

Legge suggested a strategy to approach organisational cultures: Managing culture can be likened to 'riding a wave' – the best a surfer can do is understand the pattern of currents and winds that shape and direct the waves, then use these to stay afloat and steer the desired path. Clearly, this is not the same as changing the basic rhythms of the ocean.[8] Essentially, this means that lasting organisational change can happen if the organisation identifies the forces that move its employees to act; if employees are involved and consulted in identifying and resolving the problems of the organisations, the chances of instituting successful reforms increase.

Social protection

Green jobs must also offer workers adequate income, social protection and respect for their rights. Stable incomes and decent employment support sustainable development. The current economic crisis has shown the need for sound social protection policies to sustain livelihoods and lessen long-term economic and social scarring which result from market disruptions. These protections will contribute to sustainable water utilities through lower worker turnover, increased productivity, reduced corruption, and an increase in worker participation in environmental protection efforts.

[7] Schein, E. H. *Organizational Culture and Leadership* (Jossey-Bass, 1985), p. 18

[8] Legge, K. *Human Resource Management: Rhetoric and Realities* (Macmillan, London, 1995).

Maynilad Water District, Philippines

Roel Espiritu, Head of Labour Relations of Maynilad Water Services, Inc

Type of tool: green jobs
Issue: cities
Location: the Philippines, Asia

Challenges and objectives

Currently, Maynilad has a service area of 540 square kilometres with a population of 9.5 million, 89.2% of whom are customers of Maynilad or a total of 937,578 water service connections. Of these customers, 82% have access to 24-hour piped water services and 92% receive water at a pressure of 7 pounds per square inch (psi). The company produces 2,149 million litres of water per day (MLD) through its three treatment plants, 17 pumping stations and 35 distribution lines. The company also has 12 Business Areas, 35 Hydraulic Areas and 761 District Metered Areas. The company is currently manned with 2,123 full time employees.

Institutional challenges

The corporate history of Maynilad began with the successful privatisation of the Metropolitan Waterworks and Sewerage System (MWSS) in 1997; the oldest water system in Asia. This former state-owned corporation was in charge of providing water supply and sewerage disposal services in the greater Metro Manila area. With privatisation, MWSS handed over the operation of the water utility to two concessionaires; *Maynilad Water Services, Inc. (MWSI),* which was awarded the right to operate the waterworks and sewerage system in the 17 cities and municipalities in the West Zone areas of Metro Manila, home to then 7.3 million people; and *Manila Water Company, Inc. (MWCI),* to serve the East Zone area comprised of eight cities and municipalities with a then population of 4 million people. In this highly anticipated bidding that drew the attention of the global water community, the partnership of Benpres Holdings Corporation (Benpres) and Ondeo Water Services, Inc. (formerly Suez Lyonnaise de Eaux), was awarded by the government a 25-year exclusive concession to run the water and wastewater operations of Maynilad.

After a decade with many financial, legal, and regulatory disputes and after being reclaimed by the government due to bankruptcy, Maynilad went through a change of ownership. The consortium DMCI-MPIC Water Company Inc., formed by Metro Pacific Investments Corporation (MPIC) and DMCI Holdings, Inc. (DMCI), acquired 83.96% of the water company's shares. Lyonnaise Asia Water Limited (LAWL) held a 16% share. The MPIC-DMCI consortium took over the reins of managing Maynilad on 24 January 2007 and immediately started working on the financial and operational rehabilitation of the company. In August 2007, the consortium signed a prepayment and settlement agreement with Maynilad's creditors and MWSS. The new owners of Maynilad had paid off the company's outstanding debts, which would have reached 240 million by January 2008. An aggressive catch-up plan was also implemented to increase company revenue, improve water service operations, and drastically cut commercial losses.

The challenge of reducing non-revenue water

One of the top priority programmes of Maynilad is focused on ensuring business viability and sustainability by reducing chronic water losses or Non-Revenue Water (NRW). NRW is defined as the difference between the amount of water put into the distribution system and the amount of water billed to consumers. NRW, which is often defined in terms of percentages, is considered as the best over-all indicator of the quality of the water utility management; high levels of NRW lead to low levels of efficiency.

In 2007, the NRW of Maynilad reached 66% - a very high rate. This means that 1,500 million litres of water per day were wasted. To illustrate the enormity of this water loss; NRW at a volume of 1,500 MLD could flood a 16.95 KM road with 2.0 meters of water or could supply Ho Chi Minh City, Vietnam with water 1 ½ times. Furthermore, water of this quantity, if not lost, could supply an additional 1,250,000 households with potable water. When lost, this volume of treated water remains unaccounted for and does not translate to revenue for the company and adversely impacts water supply.

NRW may be categorised into physical or real loss; commercial or apparent loss and loss of water for operational purposes. High *physical losses or real losses* refer to the loss of actual water as a result of leakages in pipes, joints and fittings, overflow at the utility's reservoirs caused by poor operations and system maintenance. Significant *commercial losses or apparent losses*, on the other hand, refer to loss of revenue exemplified by unbilled water due to data or meter errors and system flushing and theft. Another cause of water loss is for *operational purposes*; for example due to the fact that the distribution lines of the company were inherited and date back to when the company was established and was poor maintenance of the network

The drivers of change and the barriers for addressing NRW

Management changes

Before the new management arrived, there was no programme that focused on combating the NRW problem, primarily because the threat and the impacts of NRW to the business were not fully understood. The management also did not support the elimination of the NRW problem. Under the directive of the new management, Maynilad has been more aggressive in its efforts to combat NRW.

Customer dissatisfaction

Customer dissatisfaction is another repercussion of intermittent water supply. If the customer demands are not satisfied, their willingness to pay for improved service decreases. The customers also suffer because of unnecessarily high tariffs to cover the cost of the NRW. In Maynilad's case, because it inherited 66% NRW, NRW is factored into the fixing of the tariff. The reduction in NRW benefits the customers. The tariff is computed based on targeted volumes which assume a certain NRW. If actual NRW is lower than the target, then volume is higher than forecasted. This means in the next rebasing the tariff should be adjusted downwards. The regulator, Metropolitan Waterworks and Sewerage System-Regulatory Office (MWSS-RO) can choose to only partly adjust the tariff.

How the barriers were overcome through a green jobs approach: Maynilad's approach to addressing NRW

Institutional will and new recruitment

The new owners of the management of Maynilad were determined to combat the high level of NRW in order to provide quality service to the customers, to increase the revenue and to comply with the MWSS-Regulatory Office requisite of reducing NRW to 40% by the year 2012. To achieve these goals, the company devised, implemented and invested in various measures, including the acquisition of modern equipment and technology to localise and detect leaks.

At the onset of 2008, a Central Non-Revenue Water (CNRW) Division was created to show the management's full support and commitment in managing the NRW. To ensure the proper implementation of the projects, manpower resources were also reinforced; new young engineers were hired and placed in this newly created division.

Investments

Another drastic measure taken by the new management was the massive investment in capital expenditure (CAPEX) projects to address NRW. The MPIC-DMCI management has earmarked 38 billion pesos for CAPEX for the years 2008 through 2012, primarily for the rehabilitation and/or replacement of old and deteriorated network and lines. In fact, 51% of the CAPEX budget is allotted for the management of NRW.

Establishment of network management improvements: District Metered Areas

The establishment of District Metered Areas (DMAs) is another measure implemented to manage NRW. Since Maynilad has a very vast distribution network with poor pipe conditions, the system could not easily be managed as a whole. Therefore, the system was broken down into smaller sub-systems. DMAs are small hydraulically discrete zones where water flowing can be precisely measured and compared with metered water use. This step localises and diagnoses the specific problems in each area and helps to determine the most efficient solutions.

Restructuring of departments

To further actualise an efficient management of NRW, the Metering Department was restructured and incorporated as one of the core departments of the CNRW Division. This reorganised department aims to re-evaluate meter performance, focus on correct sizing of meters, and meter replacement programmes with a quality service benchmarked on others. The department was staffed with new young engineers who will use new technologies and will be guided by meter experts.

Investments in new technologies to increase effectiveness and efficiency of management

The Central NRW Division is engaged in active leak control activities to detect and repair leaks, since they are the primary causes of physical losses. The company invested in modern and sophisticated technologies for *aggressive leak detection*. It called in the services of Pressure Pipe Inspection Company (PPIC) to train Maynilad engineers in the use of

Sahara®- a state-of-the-art technology, which accurately detects leaks, pockets of trapped gas, and structural defects in water main lines.

With the help of these technologies, *pipe inspection* can be undertaken without water service interruptions and the company can intensify its leak detection efforts without affecting water delivery services to its customers. Furthermore, accurate detection of leaks using the latest technologies allowed for an efficient execution of repair works, especially in main thoroughfares. This reduces traffic jams that contribute to already high carbon emissions in Metro Manila.

Pipe replacement is another step taken by Maynilad to reduce NRW. Maynilad's network is 80 years old and most of the pipes are fractured, corroded and too deep in the ground, so they already need to be replaced. However, total pipe replacement would be a very costly way of solving leakage problems. Therefore, the company has resorted to selective pipe replacement rather than total pipe replacement.

Furthermore, Maynilad also invested in equipment known as *pressure-reducing valves (PRVs)* which reduce and maintain pressure at a set level. With these PRVs, NRW personnel are able to manage leaks more efficiently.

Another function involved in NRW reduction is *Hydraulic Modelling*. Hydraulic Modelling is implemented in partnership with the Water Network. Hydraulic modelling enables the company to correctly predict how the system will function under certain conditions, without affecting the supply of water to customers. After a hydraulic model of Maynilad's network was built, actual flow and pressure data were checked in the field to calibrate the model and ensure its accuracy.

The reduction of NRW is a very data-driven project, so the company also focused on *data management*. To correctly manage NRW, data on DMA flow and pressure, leakage complaints, leak repair, and Geographic Information System (GIS) data of pipes and laterals were regularly collected. For this, Maynilad maintains a netbase programme, which is an automatic system integrating network data from different sources and also allows for multiple function analysis. The netbase programme plays a very important role in NRW management.

Training and new jobs

To reinforce the implementation of leak detection strategies, the company trained competent leak finders for leaks that are hardly visible and require special equipment to be detected. These leak finders use sensitive microphones to detect leak noises and pinpoint their locations. This is usually done at night when it is quieter. It is a race against time for the leak detection team, because the longer the leak duration; the higher the water losses. Due to the improvements in the leak detection strategies, the number of resolved leak-related issues has increased up to 99% by the last quarter of 2010. Furthermore, the resolution time was also reduced by more than half. In 2009, reported leaks were repaired in 15-39 days and now they are repaired in 10 days.

NRW reduction programme would not be successful without *continuous comprehensive trainings,* undertaken in partnership with the Corporate Human Capital and Organization Development (CHCOD) Division of the company.

Social Dialogue and partnering with the unions

There are two labour unions which co-existed when privatisation took place. These unions are recognised by the management and encouraged to take up any issue affecting the rights and welfare of their members. The management has consistently respected the employees' right to organise and to collectively bargain, among others. On the other hand, the unions, while remaining vigilant in protecting the rights and welfare of its members, have shown vital support for the management in delivering its commitment to the government, its customers and stakeholders.

The Maynilad Water and Sewerage Union-Philippine Transport and General Workers Union (MWSU-PTGWO) is the sole and exclusive bargaining agent of all rank-and-file employees in the agreed bargaining unit. Meanwhile, the Maynilad Water Supervisors' Association (MWSA) is the sole and exclusive bargaining agent of supervisory employees in the agreed bargaining unit.

Since 2007, when DMCI-MPIC Water Company, Inc. took over the reins of Maynilad, the management has effectively partnered with the unions in accomplishing its mission and goals while at the same time taking care of the welfare of the employees. A number of significant issues have been amicably settled between Maynilad and the unions through the responsible utilisation of the grievance machinery and labour management committee provisions of the CBA. Furthermore, the management, MWSU-PGTWO and MWSA are very active partners of the United Nations' International Labour Organization (ILO) in espousing social dialogue in the work place.

In compliance with statutes, our collective bargaining agreements contained two provisions that formalised social dialogue in Maynilad. The first one pertains to the Labour-Management Committee (LMC) and the second one covers Grievance Machinery. The former convenes to discuss and resolve work-related matters and problems affecting operations and the latter provides the procedure for adjusting grievances and disputes between the management and the unions. In practice, however, most the work-related problems, grievances and disputes are settled outside of these formal mechanisms. The leadership of the unions and Management's Labour Relations officials have adopted an open-door and informal attitude in addressing the concerns of employees. Management can at any time visit the union office and vice-versa. They have open and candid discussions on pressing daily issues as well as future concerns. Solutions are made by consensus and both sides trust each other to deliver on commitments. Only when both sides are determined that reaching an acceptable solution is not possible, the formal mechanism of LMC or the Grievance Machinery is set in motion. They document the disagreement and report this to the proper government agency, either for mediation or arbitration. In our experience, this process has abolished confrontation and animosity and contributed to respect and trust between the parties involved.

Examples of issues resolved by the management and the unions are:

1. Most of the leak detection work is executed during night-time when noise from vehicles is minimal. In this regard, the management and unions have partnered to ensure the safety and well-being of the employees. Maynilad coordinates through its Security Department with authorities in areas where leak detection operations are being conducted.

2. Maynilad also provided marked service vehicles and medical and legal services to employees in the event of accidents.
3. Employees are provided with the proper personal protective equipments.
4. Issues on compensation and benefits.

Additionally, as a direct result of the trust and confidence developed between the parties, our recent collective bargaining agreement with the rank and file union was forged in just one month after four formal negotiations. And our collective bargaining agreement with the supervisory union, while we needed the mediation of the government, was forged in just two months.

Our collective bargaining agreement with the rank and file union embodied the management and the unions' commitment to protect the environment. The pertinent provisions of our CBA read as follows:

Article XIV

Environment, Safety and Health Care

Section. 1 The Company as a whole the Company will create and maintain a work culture that will encourage all employees, contractors, suppliers and shareholders to support this commitment. Both the management and the union agree to:

a) Protect the environment by minimising and managing the impact of company operations on the environment, optimising the use of resources and increasing operation efficiencies;
b) Establish an environment management system to ensure that protection and sustainability is an integral part of the Company's business management;
c) Design and execute systematic programs that eliminate all hazardous acts and conditions to prevent work-related injuries, illness and accidents at the workplace. Both the management and the union shall pursue the establishment of high standard of safety and occupational health awareness, practice and discipline.

In keeping with this policy, the Company and the Union will comply with all the regulatory requirements and international standards on environment, health, and safety. This will be achieved through the use of appropriate technology and the best practice in the pursuit in the pursuit of growth and viability

The investment in water technology for resolving NRW is one of the fruits of the partnership and commitment of the management and the unions to protect the environment. Moreover, this commitment for the protection of the environment and occupational health safety led to the IMS (Quality Management (ISO 9001:2000),Environmental Management (ISO 14001:2004) Occupational Safety and Health Management (OHSAS 18001:2007)) certification of the following Maynilad facilities:

1. Dagatan-Dagatan Sewage and Septic Treatment Plant
2. Tondo Sewerage Treatment Plants
3. La Mesa Treatment Plant 1 – a conventional-type plant with a maximum design capacity of 1500 MLD

4. La Mesa Treatment Plant 2 – a plant of the pulsator-type that has a design capacity of 900 MLD with an allowable overload of 990 MLD.

Additionally, Maynilad is ISO 14064:2006 certified for the verification of its greenhouse gas or carbon footprint quantification and reporting initiative.

Lessons learnt from implementation

Since the new management started a head-on approach to addressing NRW, the level of NRW has been reduced from 66% in 2007 to 47.8% at present. These considerable efforts resulted in 33% more billed volume and 29% more total revenue. Maynilad's total revenues increased from P8.1 billion to P10.6 billion. The company's success is also attributed to strong support from the management, sufficient funding, manpower, equipment and world class advisors.

The existence of unions is not incompatible with the success of an enterprise. A strong partnership between the management, the unions and the employees through active and effective social dialogue contributed immensely to the success of the business. The respect and transparency between the management and the unions and the willingness to negotiate, discuss, and even compromise on many issues has resulted in industrial peace within the company. Therefore, energy and resources could be directed to attaining the company's mission: providing excellent services to its customers and value to the shareholders, and improving the employment conditions of the workers. Truly it can be said that "*Sa bagong Maynilad, gumadaloy ang ginhawa*!" (In the new Maynilad, comfort/good life is flowing-freely.).

The management and the unions are now teaching the unions of local water utilities about the success of their partnership and showcasing that successful privatisation, one that strongly respect the rights and welfare of the employees, is achievable.

Scaling up and relevance for developing and transition countries

CHCOD and CNRW have started a standardised NRW management training programme that aims to produce competitive and world-class NRW experts from Maynilad. In fact, the company has recently amended the primary purpose of its Article of Incorporation to allow it to be able to offer NRW expertise to other water utilities both in the Philippines and overseas. Furthermore, we expect that new green jobs will be created as a result of the expansion of our sewage treatment services.

Evaluation: economic, environmental and social benefits

Impact of NRW and management changes on employment and business productivity and efficiency

The CNRW started with just five personnel but at present, Central NRW is already manned with more than 258 full time employees. In general, since DMCI-MPIC Water Company, Inc. took over the ownership of Maynilad in 2007, the company has already generated and employed 87,000 people, including those hired by contractors and suppliers that rely on Maynilad as their major client.

High levels of NRW translate to high inefficiency of a water utility. The loss of treated water – in which the company has invested considerable amount of money – increases the treatment and distribution costs and decreases revenue. Also, more investment in capital expenditure programme is needed to meet the increasing demand. Furthermore, poor financial performance of a water utility company makes it difficult to invest more in expansion of its distribution network as financing institutions review the financial performance of its borrowers to determine the latter's ability to repay its loans.

In Maynilad's case, due to the effective reduction of NRW and determination to grow the business, financing institutions have shown confidence in Maynilad's ability to repay its obligations. In the first quarter of this year the company has secured a Php7B loan to partly fund its capital expenditure programmes for 2011 and 2012 to improve operational and network efficiency, to meet the company's service obligations and support growth. Moreover, in June of this year Maynilad has secured US$137.5 million loan from the World Bank which will be used to fund its wastewater treatment projects.

Social impact of NRW

When a water utility company experiences a high level of water losses, it cannot achieve its primary goal of satisfying the needs and demands of its customers. NRW caused by physical losses often lead to intermittent water supply and reduced supply hours and volume for the customers. Intermittent water supply also causes health risks as contaminated groundwater, or even sewage enters leaking pipes when there are supply interruptions or very low pressure periods.

Customer dissatisfaction is another repercussion of intermittent water supply. If the customer demands are not satisfied, their willingness to pay for improved service also decreases. The customers also suffer from unnecessarily high tariffs, because they have to bear the costs of the NRW.

Moreover, the amount of lost water lost could have supplied additional unserved customers or customers who do not have access to piped, clean and potable water yet. The reduction of physical losses of treated water can make more piped water available and increase the coverage of water utilities, especially in poor communities[9].

Participation is a basic principle in the policies of the management and the unions. The Preamble of our collective bargaining agreement states that:

> *"Maynilad's goals (including reduction of NRW) can be attained only through our (Management and Union) partnership, unity and discipline, recognising each other's right and responsibilities and the role each plays in increasing Maynilad's productivity, level of efficiency, and committing ourselves to service excellence, … in improving the quality of life of the Filipino…"*

A participatory approach has hastened the reduction of NRW as it has fostered a stronger relationship between the management and the employees by creating a sense of ownership. In fact, one of the anchors for determining the performance rewards for employees in 2011 is

[9] Asian Development Bank (2010) The Issues and Challenges of Reducing Non-Revenue Water

the reduction of NRW. Mid-year results showed that we are well on our way to achieving, if not surpassing, the target of 48% NRW.

Additionally, the company acknowledges the importance of a participatory approach in delivering its services and reducing NRW. In this regard, as part of Maynilad's corporate social responsibility, Maynilad has set up the Samahang Tubig Maynilad and Bayanihan Bayan Tubig programmes/projects. These programmes are designed to address the problems of water inaccessibility and irresponsible water use in Maynilad's concession. In the Samahang Tubig Maynilad project, residents of urban poor communities are organised and trained to enhance their capability of sustaining the water management programmes in their communities. On the other hand, in the Bayanihan Bayan Tubig project beneficiaries help themselves and one another by contributing time and physical labour to the programme. Under supervision of Maynilad engineers, the beneficiaries install the pipes that will bring water to their communities. This not only cuts the cost of the pipe installation project, but also fosters a stronger relationship within the community, while creating a sense of ownership of the project among the recipients.

Environmental impact of NRW

Addressing NRW does not only concern the company's stakeholders and its customers; it also avoids that water, a scarce and precious resource, from being wasted. The high level of NRW adversely affects climate change mitigation efforts. Climate change impacts were felt in 2010, when El Nino occurred in the Philippines. A high rate of NRW also implies a high consumption of energy by the company used in the treatment and distribution of water.

At 66% NRW in 2007, we had to produce 4,500 litres per day for each individual service connection. Now at 48% NRW, we only have to produce 2,500 litres per day. This represents a reduction of 44% in Maynilad's water demand. Additionally, every 1% reduction in NRW is equivalent to more than 20 million litres of water saved. Hence a reduction of 28% in NRW (from 66% in 2007 to 48% in 2011) is equivalent to 560 million litres of treated water saved and redistributed.

Programa de Inversiones Intensivas en Empleo (PIIE), Panamá

Julio Pérez, ILO

Tipo de herramienta: Empleo Verde
Localización: Panamá, América Latina

Retos y objetivos

La experiencia se desarrolla para el fortalecimiento de la equidad para reducir las brechas en los servicios públicos de agua segura y saneamiento mediante el empoderamiento ciudadano en áreas rurales e indígenas excluidas.

Objetivos:

- La salud de la población debe mejorar con el desarrollo de estrategias de promoción de la salud, prevención de enfermedades, ampliación de la cobertura y acceso a los servicios (ODM 1, 3, 4, 5, 6).
- La sostenibilidad ambiental (recursos hídricos, biodiversidad, desarrollo forestal, estabilización del cambio climático, prevención de desastres) se debe fortalecer con el apoyo de marcos normativos, estrategias nacionales y acciones locales (ODM 7).

Los motores del cambio

En este proyecto participan la UNICEF, la Organización Panamericana de la Salud (OPS/OMS), PNUD y la OIT, además de los Ministerios de Salud y Educación, ANAM, los Municipios, los Representantes de Corregimiento, las autoridades indígenas tradicionales y las organizaciones comunitarias. El Ministerio de Salud, por ejemplo, ha logrado visualizar no sólo los beneficios que implica la construcción de los sistemas de suministro de agua, sino también la participación de las mismas comunidades en el proceso de diseño y construcción. El establecimiento de instancias de coordinación nacional (instituciones y agencias) y local (en cada cuenca) entre los diferentes actores (Comités de Coordinación Local, Unidades de Coordinación distrital, Unidades de coordinación Técnica Regional) ha sido un elemento clave para la sostenibilidad de las iniciativas de ambos programas. La colaboración de las diversas instituciones facilitó la comprensión del concepto de programa conjunto articulado, lo cual fue bien valorado por los actores locales y facilitó el diálogo. Acá también es fundamental el perfil del Coordinador/a para ayudar a construir hilos conductores que unen el trabajo de las agencias y contrapartes.

Cómo se superaron las barreras: la aproximación del programa de inversiones intensivas en el empleo

Empoderamiento de los actores tradicionales

Se utilizaron marcos de referencia, por ejemplo memorandos de entendimiento o el documento marco del programa, para empoderar a los actores tradicionales y convertirlos en socios de los programas y no simplemente beneficiarios. La integración de los actores claves en el proceso de ejecución de los programas como socios y no meramente beneficiarios es fundamental para la apropiación nacional de las actividades mismas y los resultados esperados. Además, un documento formalizado y por escrito ayuda a manejar las

expectativas de los diferentes actores, sus responsabilidades, aportes para la ejecución del programa conjunto, etc., y fortalecen el rol de las autoridades tradicionales.

Se fomentó el desarrollo comunitario participativo, no solamente asistencialista. En el caso del programa conjunto de gobernanza económica, una importante lección aprendida fue el reconocimiento de que el concepto de "proyecto" para la cosmovisión Ngäbe Bugle lleva implícito el pago por servicio y no participación, por lo que recomendaron el concepto de "programa" porque lo comprenden como desarrollo comunitario. Por ende, en las zonas de intervención se utiliza Programa Conjunto, tal como está en el documento marco.

Diálogo con las comunidades

Se estableció un diálogo continuo con las comunidades mediante la presencia de los programas en los congresos indígenas generales, regionales y locales, brindando informes de avances de las actividades a las autoridades tradicionales y comunidades con el objetivo de sensibilizar y divulgar los programas en general, así como temas específicos de cambio climático y manejo de los recursos naturales, saneamiento de agua y gobernanza. Este dialogo y la lectura permanente de escenarios de cambio también ayudó a crear espacios de transición con autoridades tradicionales.

Ampliar la coordinación a otros aspectos de importancia local

Para aumentar la relevancia y probabilidades de continuidad de algunos mecanismos de coordinación local, se ha visto la necesidad de abarcar temas generales que van más allá de las actividades de los programas mismos. Los programas conjuntos, tanto en el nivel central como nivel regional/local, han creado una oportunidad para construir un puente de comunicación entre instituciones del estado que trabajan en temas similares, pero sin ninguna coordinación formal. Apoyan el trabajo de una coordinación interinstitucional "armónica". El Ministerio de Salud ha adoptado un enfoque integral en temas de Agua y Gobernanza y su relación con las necesidades de salud.

Desarrollo y fortalecimiento institucional

Además, el programa ha logrado reactivar las Juntas Administradoras de Agua Rural (JAARs), instancias poco activas antes de la llegada del Programa. La reactivación y fortalecimiento de estos grupos fortalece una gestión articulada en el nivel regional con base en las estructuras existentes.

Procesos participativos

La identificación de los actores locales y su posterior incorporación en procesos participativos ayudó a lograr los diferentes productos de los programas, como clave de la apropiación nacional y la sostenibilidad. Estos actores incluyeron las autoridades, organizaciones comunitarias, docentes, niños y juventud, empresas indígenas, médicos, instituciones académicas, etc. Por primera vez la empresa constructora reconoce la necesidad de tener por delante una trabajadora social frente al proyecto antes de "enterrar tuberías" (se entiende esto como la construcción o manejo e implementación completa de los acueductos rurales.

Acompañamiento técnico en apoyo al empoderamiento

OIT a través del Programa de Inversiones Intensivas en Empleo (PIIE) viene realizando el acompañamiento técnico a los Proyectos de Agua y Saneamiento de Nicaragua, Panamá y Paraguay, financiados por el Programa Conjunto PC-ODM de las Naciones Unidas. Este programa procura el mejoramiento de la salud mediante el empoderamiento de la población beneficiaria para lograr ampliar la cobertura y el acceso a servicios de agua y saneamiento; fortalecimiento de la sostenibilidad del recurso hídrico mediante acciones locales e institucionales.

En tal sentido, la OIT ha desarrollado la pericia de los usuarios en las diversas fases del proyecto y específicamente sobre el tema de gestión comunitaria del agua, Panamá tiene una experiencia exitosa de gestión de servicios de agua con enfoque inclusivo e intercultural con comunidades Ngoblé. Producto de dicho proceso las mujeres indígenas integran estos comités, administrando eficientemente los recursos que se recaudan por los servicios generando inclusive un margen de ahorro para el mantenimiento de los sistemas.

Talleres de capacitación y desarrollo de materiales

- Talleres de capacitación para hogares, in situ, sobre la importancia y manejo del agua potable, saneamiento y disposición de residuos sólidos para los cuatro distritos seleccionados, con enfoque multicultural y de género.
- Talleres de capacitación para las organizaciones comunitarias, como las Juntas Administradoras de Acueductos Rurales (JAAR), empleando herramientas participativas como la Planificación Integrada de Acceso Rural (PIAR) para lograr la priorización participativa de intervenciones en el sector.
- Adecuación de la metodología de instrucción mediante la actualización y/o producción de manuales y materiales informativos multilingües sobre educación sanitaria y gestión de agua y saneamiento.
- Talleres de capacitación para las JAAR sobre procesos participativos de planificación y toma de decisiones para la generación de recursos a través de actividades productivas sostenibles.
- Capacitación técnica del personal del MINSA y autoridades locales para acompañar a las comunidades en la gestión, supervisión, seguimiento y evaluación del programa. (OPS/OMS, UNICEF, PNUD)

Realización de procesos participativos y empoderamiento

- Realización de diagnósticos rápidos participativos sobre la situación de agua, saneamiento y manejo de residuos sólidos en los distritos del programa realizados.
- Elaboración de planes participativos municipales para el desarrollo de infraestructura de agua, saneamiento y disposición de residuos sólidos, por distritos.
- Desarrollo de mecanismos para la participación de los pobladores en el desarrollo de las obras. (UNICEF, OPS/OMS, PNUD).
- Creación de un programa comunitario de vigilancia y protección de fuentes de agua con enfoque de género y juventud. (UNICEF, OPS/OMS, PNUD).

Desarrollo de soluciones apropiadas en cooperación

Desarrollo, a través de los gobiernos locales y autoridades tradicionales, de acueductos y equipamiento para soluciones sanitarias, incluyendo rellenos sanitarios manuales aplicando tecnologías apropiadas a las condiciones físicas y socioculturales, y aceptadas por las comunidades en los distritos de Müna, Kankintú, Besiko y Kusapín, ubicados en la Comarca Ngöbe-Buglé. OPS/OMS (UNICEF).

Lecciones para el futuro y para otras experiencias

Esta experiencia fue presentada a inicios de este mes (1 y 2 de agosto) en el Seminario-Taller "Cooperación Sur-Sur sobre la gestión de agua y saneamiento en poblaciones indígenas y rurales dispersas, desde la perspectiva de género y enfoque intercultural" en el Chaco Paraguayo. En el evento participaron líderes indígenas mbya, guarani, nivaklée y ayoreo quienes escucharon de sus pares indígenas ngoblé el proceso desarrollado para el logro de una gestión del agua más equitativa.

La lideresa Vicenta Trotman, integrante de una de las Juntas de Agua y saneamiento de la Comarca Ngoblé, expuso acerca del proceso de sensibilización, capacitación y empoderamiento desarrollado a través del PC. Así mismo informó de como la mesa técnica está integrada por el médico tradicional y el médico del centro de salud; el cacique y el alcalde y todos se sienta en una mesa de diálogo para definir el alcance y mejorar el manejo de la gestión del agua.

Es importante tomar en cuenta y respetar los tiempos y procesos tradicionales de consulta y de diálogo. Hay que ajustar los planes de trabajo para incorporar estos tiempos para que no se mal interprete como "baja ejecución" o retrasos en la implementación de los programas. Al final estos "retrasos" iniciales se convierten en ganancia para la sostenibilidad. Una importante lección aprendida ha sido el respeto muto de la interculturalidad – hacia las comunidades y también de las comunidades hacia las agencias, las contrapartes y el PC mismo.

Evaluación económica y social

Hasta ahora hay 4 microempresas comunitarias formadas en construcción, diseño, con visión empresarial. El programa busca que obtengan personería jurídica y que sean estas empresas las que ejecuten las construcciones en los próximos proyectos. Toda la mano de obra es local y muchos emprendedores son contratados por la empresa. (Albañiles, artesanos, plomeros). La comunidad exigió la contratación de una trabajadora social de parte de la empresa. Además las empresas comunitarias, formadas en su mayoría por jóvenes, han sido capacitadas en Módulos en emprendimiento indígena de parte de los experimentados peruanos Rene Apaza y su esposa y se ha formado una red de Facilitadores indígenas en emprendimiento en Panamá.

3. Water cost recovery and financing to support the transition to a green economy

Diego Rodriguez and Julia Bucknall, World Bank

A green economy is one that results in improved human wellbeing and social equity, while significantly reducing environmental risks and ecological scarcities. (UNEP)

To function properly and sustainably, all parts of water resources management and the supply of water related services must be fully funded. This includes not merely the creation and maintenance of physical infrastructure, but also water resource management, environmental protection and pollution abatement measures, as well as the less visible functions such as policy development, research, monitoring, administration, legislation enforcement, provision of public information, and involvement of public stakeholders. (World Bank)

Financing the green economy

The water development agenda overlaps with that of the green economy in areas of pollution mitigation, wastewater treatment, energy efficiency in water and wastewater treatment, distribution and reuse, irrigation, hydropower, and management of natural water ecosystems (including wetlands). Many of these projects could target several objectives simultaneously and therefore, can generate an array of benefits. The financing of such initiatives is attractive. However, designing and implementing projects and programmes with multiple objectives (cross sectoral) is challenging and complex.

UNEP has made an assessment that under a green investment scenario the additional investment needed in the water sector would be US$ 191 billion per year until 2030 and US$ 311 billion per year until 2050 (mainly to supply water and sanitation services and meet MDGs and universal coverage). “The Africa Infrastructure Country Diagnostics” (AICD) estimates that US$ 22 billion per year (approximately 3.3% of Africa's GDP) is the amount required to attain the water and sanitation MDG targets. These estimates, which are based on minimum acceptable asset standards, include an annual capital expenditure of US$ 15 billion and operating expenditures of around US$ 7 million. These figures do not include the cost of investment in hydropower or irrigation.

Investment in water infrastructure, in both its physical and natural assets, can be a driver of growth and the key to poverty reduction (UNEP 2011). Although the recent global economic crisis set back investment in water in many countries (Winpenny et al. 2009), the impacts have been varied, and some governments have made determined efforts to compensate through counter-cyclical fiscal measures. Approximately 20% of the $2 trillion of economic stimulus packages announced since 2008 is estimated to have been in “green” investment in renewable energy, energy efficiency, more efficient use of materials, clean technology, waste mitigation, and sustainable use and restoration of ecosystems and biodiversity. Water is one of the beneficiaries of these programmes, although its full importance has not been recognised.

The challenges for financing water in the green economy

There are a number of identified barriers to investment that have limited the scale up of investments required to transition to a green economy. These include existing market failures such as access to finance, especially for small and medium enterprises (SMEs) and communities; political interests; limited credit availability and risk-aversion; lack of transparent and enforceable legal and regulatory frameworks (the enabling environment); knowledge externalities; information asymmetries; and policy-induced distortions.

The current financial climate has decreased the availability of liquid financial resources, affecting the supply of risk capital (e.g. equity) and financing for loans and concessional instruments. Many innovative instruments, developed with technical assistance and risk-sharing from donor agencies, are at risk. Low access to financial resources can have a serious effect on the already low level of investments and operation and maintenance faced in most developing countries resulting in deterioration in the infrastructure providing services, and a lack of infrastructure to cope with succession of droughts and floods worsened by climate change (Winpenny et al. 2009).

Achieving the MDGs requires large investments to increase access to safe and sustainable water services in many countries. Yet in itself increased investments in the water sector do not result in improved access to sustainable water services. When large flows of resources in the sector are managed by the government, the efficiency and effectiveness with which these resources are managed becomes a critical factor to ensure the sustainability of the services and the systems. If calls for increased spending on infrastructure are to translate into better services in the developing countries, then it is paramount that the efficiency of public resources and using it to better leverage private sources is improved.

Approaches to financing a greener economy

Closing the financing gap in the water sector and advancing towards implementing the principles of a green economy requires a range of instruments including higher user charges and environmental charges, higher collection rates, more efficient service provision resulting in lower costs, and more targeted subsidies.

The financing report of UNEP proposes a range of potential ways of financing these investments. This includes institutional investors such as pension funds and insurance companies, public financing (from taxation and government borrowing from capital markets), global development institutions (e.g. the IMF, World Bank and other multilateral institutions), and stable and resilient capital markets. It is likely to be a longer-term process in which the appropriate mix of instruments will change over time.

Generating finance for water infrastructure and services

The green economy agenda has serious implications for water infrastructure, adding more weight to the search for greater efficiency in the use of resources, and a reduction in waste and greenhouse gas emissions, all aimed at shifting investment and consumption towards patterns that reduce depletion of natural capital.

All countries, at every level of development, face heavy costs in creating a water infrastructure that is “fit for purpose”. According to a recent World Bank Study (2010b), progress towards fulfilling the Millennium Development Goals (MDGs) has been challenged

by the global financial crisis. The crisis will potentially magnify the already large investment needs. According to one of those projections for 2015, 100 million more people will lose access to safe drinking water. A rethinking in financing strategies is required as additional resources will need to be captured from improvement in the efficiency of public expenditures.

Approaches for financing water infrastructure and services

To raise the sums needed for water and sanitation infrastructure, a pragmatic and eclectic approach is required, including the reduction, mitigation and sharing of water financing risks, which are by now widely appreciated[10]. National and international public agencies are the predominant sources of finance for water infrastructure.

National governments may be constrained by their fiscal position, but some of them have greatly benefited from strong commodity prices and have used their fiscal resources to invest in infrastructure, including water.

External Official Development Assistance (ODA) is now on a rising trend. In 2007-8, DAC countries' bilateral annual aid commitments to water and sanitation rose to US$5.3 billion. Adding to that the concessional outflows of multilateral agencies, the total ODA for water and sanitation was $7.2 billion in that year[11] (compared with $5.6 bn. in 2006). ODA takes place predominantly in the form of grants. Public international development banks (World Bank, the regional development banks, European Investment Bank, offering loans on attractive terms, are well placed to regain market share for infrastructure finance and are gearing up for this purpose.[12]

The Asian and Middle Eastern sovereign wealth funds and publicly sponsored companies are an additional and increasingly important source of money for the development of natural resources and infrastructure[13].

Hedging against devaluation risk is not a practical proposition. The more sustainable long term solution is to generate more internal revenues from tariffs, and to rely as much as possible on local financial and capital markets.

A number of donors and IFIs offer risk sharing products to encourage the growth of local currency finance for water and other infrastructure.

The food crisis, driven by population growth, higher food production and a surge in energy prices leading to higher food prices, brought an estimated 44 million additional people below the poverty line and contributed to the economic woes of most developing nations. Food security is contingent upon a sustainable and efficient water management system. Preventing the food crisis from reaching alarming proportions requires improved water management and the expansion of water access for the worlds' poor. New investments in irrigation infrastructure and improved water management can minimise the impact of water scarcity and partially meet water demands for food production (Falkenmark and Molden 2008). More importantly, sustainable water uses need to be assured through more efficient irrigation technologies and effective water pricing models.

[10] Amongst many references, v. the *Camdessus Report* (2003) and OECD (2010)
[11] OECD/DAC June 2010. www.oecd.org/dac/stats/water.
[12] E.g. World Bank 2010a
[13] ICA 2007

Funding in response to climate change and growing water scarcity

Projections reveal that an annual cost of climate change adaptation in developing countries in the industrial and municipal raw water supply sector would be between $9.9– $10.9 billion (net), and $18.5–$19.3 billion (gross), while costs for riverine flood protection is projected at between $3.5–$5.9 billion (net), and $5.2–$7.0 billion (gross). A large and challenging agenda stretches ahead for water infrastructure to cope with greater variability and uncertainty caused by climate change and other change forces.

Approaches for financing responses to climate change and water scarcity

The investments required will pose high financing demands from governments, public agencies and international research institutes. Their efforts will need to be supplemented with those of private, non-governmental bodies of all kinds, who can add value though extra resources, different ways of working, new approaches and innovative products. Adaptation and mitigation projects implemented by public agencies can draw on:

- A range of development funds, including new adaptation funds created for this specific purpose, to which public agencies have access. There are currently over around a dozen funds available for adaptation for water, amongst other sectors. Particularly relevant is the funding provided by the Pilot Program for Climate Resilience (PPCR), sponsored by the World Bank and other major IFIs. "The pilot programs and projects implemented under the PPCR are country-led, build on National Adaptation \programs of Action (NAPAs) and other relevant country studies and strategies. They are strategically aligned with other donor-funded activities to provide financing for projects that will produce experience and knowledge useful to designing scale-up adaptation measures." (www.cif/ppcr.org).
- For sub-sovereign agencies who cannot tap into development funds, commercial financial sources are critical.
- Much of the adaptation/mitigation efforts will fall to private companies, farmers and households. A different kind of finance is required for adaptation carried out by commercial entities (including farmers) or other water users.
- Microfinance is particularly suitable for improving irrigation efficiency for small farmers.
- Certain forms of contract can also be funded by *quasi-equity*, in which rewards depend on the successful achievement of project aims, e.g. performance-related contracts for water leakage reduction.

Funding diversification and demand management

Diversifying the sources of water by increasing the use of technologies, such as desalination and reclaimed water and promoting self-supply by users (farmers, households and companies) can reduce and distribute risk by relying on different sources of water. Funding for these activities follow more of the traditional financing approaches.

Improvements in resource and eco-efficiency, especially in the manufacturing industry, offer huge potentials for improving competitiveness in local, regional and global markets, as well as achieving more sustainable solutions. Increasing resource efficiency can achieve

cost reductions and decrease the environmental impact of industrial activities from enhanced resource and energy use. These actions are increasingly necessary to deliver sustainable growth and jobs and to gain competitive advantage in response to increasing global competition for resource and environmental constraints.

Approaches for financing diversification and demand management

Desalination plants and some projects for the use of reclaimed water (entailing sizeable investment in wastewater treatment plants – WWTPs) lend themselves to stand-alone commercial ventures funded from equity and commercial finance, typically under a concession form of contract. The main challenge lies in the financial sustainability of these schemes and more efforts should be devoted to devising sustainable solutions.

Demand management needs a different approach to financing. Much of the cost of demand management falls on and is financed by consumers – households, farmers and industries –, though governments can help with subsidies and tax breaks (McKinsey & Co. 2009).

Funding governance, institutional reform, management and information

Adequately funded water governance is essential for reducing uncertainty and managing risks. Generating data for policymakers and managers (observations, analysis, modelling, scenario building) will help inform decision makers and hence reduce decision-making uncertainty. Effective governance in areas such as environmental controls, groundwater monitoring and abstraction licensing, and monitoring and policing of pollution can reduce the risk of overexploitation of water resources or of surface water pollution and irreversible contamination of aquifers. Many water governance problems arise at the transboundary level, which is fraught with potential risks and conflicts. Capacity building and management support for transboundary water institutions needs proper funding.

Investment in strengthening the information base and data collection of hydrological information will result in positive returns but it is an area currently underfunded. Furthermore, transboundary cooperation is influenced by political and sovereign issues that affect cooperation. The attribution of benefits to the different partner countries is difficult, hence sharing costs is problematic, and hampers setting realistic budgets and funding modalities.

Approaches to financing governance

Some of these governance functions can be self-financed through abstraction and pollution charges. Other sources would be from multilateral and bilateral agencies, local governments, usually in combination.

Supporting technology development and adaptation

Specific enabling technologies that have substantial potential have been identified in various sectors. However, many of these technologies are still very costly or are at an early stage of development. Furthermore, the transfer of technology is a complex issue that is constrained by regulatory factors, technical capacities and political interests. ICT should be in the list of the sectors that are likely to play a leading role in a green economy. At a global level there is a

need to increase environmental research and development (R&D) and encourage the international transfer of cleaner technologies.

Approaches to financing technology

- Governments should invest in ICT infrastructure, foster broadband deployment and try to accelerate the digital economy.
- Public funds should be made available for investment in technology adaptation and adoption.
- There is a need for different types of patent franchise and access mechanisms for developing countries.

Investing in environmental assets and pollution reduction

Investing in environmental assets and the management of those assets can help achieve national goals for relief from poverty, hunger, and disease. Investments in improved agricultural practices to reduce water pollution can boost coastal fishing industry. Wetlands protection can help meet needs of rural communities, while avoiding costs of expensive flood control infrastructure. Both the UN Millennium Project and Millennium Ecosystem Assessment (MA) highlight the interdependencies between economic development and environmental management for poverty reduction and general wellbeing. Due to a combination of poverty, vulnerability to drought and crop failure, lack of safe drinking water, and other environment-related ills, millions of people die each year. Over a billion people suffer from diseases due to the lack of clean water, resulting in losses in productivity that affects growth.

Approaches for investing in environmental assets and reducing pollution

- Public policies should give incentives for private sector decisions regarding investment, production and consumption patterns that reflect the social benefits of environmental sustainability and the costs of various forms of environmental protection.
- Payment for environmental services to protect upper watersheds and preserve ecosystems services downstream.
- Unitary tax over agrochemicals.
- Pollution fees as a mean to finance effluent collection systems and water treatment plants.
- Mark-ups over water prices to finance river restoration programmes or to create water protection funds.
- Trust funds formed with voluntary contributions from firms and individuals.
- Reductions of risk premiums over loans to finance water infrastructure by means of loan guaranties to help the projects tap debt markets in local currency.
- Performance based price rebates (provided water users demonstrate a sizeable reduction in pollution loads or water consumption).

Approaches for addressing the challenges of financing

Improving efficiency in public spending

Much can be done to reduce the financing gap in the sector, while at the same time ensuring that the funds that come from government are efficiently used. Sector authorities will have to prioritise their efforts, but also be aware that in the absence of full cost recovery for water service delivery, implicit trade-offs are made between current and future users, and current and future taxpayers. Public Expenditure Reviews are a promising tool to shed light on how public resources are utilised in the sector. Also, results-based financing could prove an essential mechanism to improving efficiencies in a resource-constrained, inefficient sector. Ensuring that institutional capacities are strengthened to implement some of the new methods and tools becomes a priority. The challenge of scaling up in countries with weak institutional capacities is enormous but a transformation is required in the sector to accelerate progress. Making these trade-offs more explicit might be an important tool to increase accountability and transparency in the sector. They may also provide an incentive to create support for the necessary changes that are still needed in large parts of the sector.

A proactive role of government in major infrastructures

A proactive role for government is necessary in the context of relatively higher start-up costs compared to the longer-term benefit stream, positive externalities, and the commercial risks related to green investments and new technologies. This is particularly relevant to achieving a competitive outcome. Utilised with care, some state or public intervention may have a positive effect, for instance in supporting agri-environmental measures, development of renewable energies for desalinisation or other necessary infrastructure.

Reducing costs

A major source that needs to be tapped to close the financing gap is reducing the cost of the service providers. The most common factor of operational inefficiencies in utilities that can have important environmental impacts is non-revenue water (NRW) losses. Measures to address NRW should aim at reducing losses due to metering inaccuracies and unauthorised consumption and leakages in the network and in the household. Such a strategy needs to be based on an understanding of the full scope of the problem. In addition to taking the critical step of understanding the baseline situation, building capacity including use of appropriate technologies are also fundamental to an effective reduction programme. More importantly, implementing a reduction programme requires consideration of NRW within the broader context of utility reform. Thus the NRW reduction programmes must ensure an alignment of all objectives of developing an efficient and effective utility that meets the needs of its customers.

Approaches to NRW reduction could involve the private sector which can assist with providing services such as new technology development, investment, and incentives for project performance. Options for private sector involvement range from delegated management under Public Private Partnership (PPP) contract, to outsourcing of NRW reduction activities, and technical assistance contracts (Kingdom et al. 2006).

A good example of a well designed performance based contract is the Manila Water Company in Philippines which received a concessionary contract from the Manila's Metropolitan Waterworks and Sewerage System (MWSS) in 1997 and successfully reduced NRW from 63% to about 15% by 2009. This was accomplished through the implementation of efficient NRW management programmes that combined technical and social interventions. Illegal connections and meter tampering were addressed through community dialogues and "Water for the Poor" programmes.

Source: Kingdom et al. (2006)

Technology selection

Technology selection also plays an important role in reducing the cost of services. Technology choice will affect initial investment costs and hence the capital costs of the service, but also the operation and maintenance cost of the service over time. Both of these costs need to be taken into account when selecting technologies as lower capital costs may not necessarily go hand in hand with low operation and maintenance costs. Also important is the need to standardise the use of technologies in a country. The wide dispersion of technologies poses costs in terms of availability of spare parts and the local knowledge to deal with the different technologies. Standardising technologies and setting minimum standards, such as hand pumps should be considered.

Pro-poor tariffs and financing of water utilities

Local governments and service providers can consider increasing the design and implementation of successful policy instruments such as Social Safety Nets (SSN). SSNs are part of a broader poverty reduction strategy and are used as social tools to help facilitate productivity, redistribute resources to the poorest and most vulnerable, and protect low-income households from the effects of economic shocks or inequities. SSNs tend to have a better targeting performance than consumption or connection subsidies and they are offered through cash or non-cash instruments. Cash instruments include programmes that provide transfers in cash such as income support programs, non-contributory pensions, and disability benefits. Non-cash programmes on the other hand include food transfers, training opportunities for beneficiaries, and subsidies. Public-works and micro credit are other forms of SSN instruments. Public works typically provide low skills employment opportunities (for example, construction or rehabilitation of much needed public infrastructures) to the poor willing to work for a low wage payment in cash or in-kind (Milazzo and Grosh 2008).

Lessons learnt from the application of Social Safety Nets and investments for poor communities

The World Bank has actively incorporated SSN components into its lending and analytical work activities. In its water lending operations, SSN interventions have ranged from conditional cash transfers to grants and training opportunities. For example in the Indonesia Third Water Supply and Sanitation for Low Income Communities project, the World Bank is supporting the Government of Indonesia's commitment to achieving the water MDGs, by providing community block grants to deliver water supply and sanitation infrastructure, community empowerment and local institutional development including incentive grants which would increase the number of low-income rural and peri-urban residents with access to improved water and sanitation facilities. The project is being implemented on a

programmatic basis to provide assistance to selected villages that meet the project's targeting and section criteria. Through this mode of delivery, project funds are directly allocated to the participating villages.

Quantity-based subsidies are, however, not the only type of subsidies that are being provided in the residential water sector. Many utilities offer connection subsidies, targeted by geographic or proxy means-test criteria. In addition, self-selection is used to target subsidies for lower-quality services such as public standpipes. These schemes perform somewhat better than quantity-based ones. The geographic schemes examined present an almost neutral distribution, while proxy means-testing and self-selection present relatively progressive distributions. Still, these schemes exclude a substantial proportion of poor people – due to low utility coverage for this group. In irrigation, subsidies are delivered either through area-based pricing or volumetric pricing. Area pricing tends to promote little conservation, whereas volumetric pricing helps to limit water use but has high transaction costs.

Results Based Financing

In Results Based Financing (RBF), resources are disbursed not against individual expenditures or contracts on the input side (as traditionally done), but against demonstrated and independently verified results that are largely within the control of the recipient.

Examples of RBF structures:

- Output-based Aid (OBA). Typically OBA involves payment of a subsidy to cover a funding gap to access basic services by the poor. OBA can also be used for more efficient delivery of services that exhibit positive externalities. Service delivery is contracted out by the entity providing the public funds to a service provider (a private enterprise, a public utility, NGO, community-based organisation), with payments tied to achievement of specified service performance or outputs. OBA subsidies can either buy down the capital cost of investments required to deliver the service or can cover the difference between an affordable user fee and a cost-recovery user fee, for example a consumption subsidy.

- Output-Based Disbursement (OBD). OBD involves payment of a subsidy to a service provider or a contractor for improvements in the efficiency of service-related assets, systems, or recurrent government activities.

- Performance-Based Financing for Health (PBFH). PBFH involves payments to a provider, payer (e.g. government entity) or consumer when measurable actions are taken or defined performance targets are achieved.

- Conditional Cash Transfers (CCT). CCT programmes provide cash payments to poor households that meet certain behavioural requirements, generally related to children's health care and education.

- Cash-on-delivery Aid (COD). Proposed by the Centre for Global Development, COD involves payments to the recipient government after measurable progress, only for as much as is verifiably achieved (e.g. a fixed amount for every student that takes a

standardised competency test in their last year of primary school, or for each additional child over an enrolment baseline who takes the standardised competency test).

- Advance Market Commitments (AMCs). AMCs are a range of mechanisms which aim to create sustainable markets by providing a guarantee of future revenues to service providers for a limited period of time. AMCs act by guaranteeing service providers a price on delivery of a pre-defined output and/or that they will be able to sell a minimum number of units for a limited period of time.

- Carbon Finance (CF). CF is an instrument for leveraging private and public investment into projects that reduce greenhouse gas emissions. It involves contracts to purchase emission reductions similar to a commercial transaction, paying for them annually or periodically once they have been verified by a third party auditor (World Bank 2010c).

RBF mechanisms such as OBA, OBD, AMCs, and some types of PBFH link service outputs with associated unit costs and disbursements reflect the actual cost of service. Other RBF mechanisms such as COD, PBFH, CCT, and CF, where the costs cannot easily be predetermined (e.g. school enrolment numbers), consider output delivery or achievement of specific milestones or measured outcomes as a condition for funding without the unit cost linkage.

Lessons from implementation of Results Based Financing of water projects

The application of RBFs in the water sector has been quite limited, but in recent years, these instruments have emerged as an important new way of financing basic services. Output-Based Aid (OBA) is one of the mechanisms that have been used in the water supply and sanitation sector in the last few years with promising results. Most of the financing has been channelled through the Global Partnership on Output-Based Aid (GPOBA), a partnership of donors and international organisations working to promote the concept of OBA. There are currently 22 projects with World Bank participation with approximately US$ 140 million allocated to subsidies: 15 water supply schemes, three sanitation schemes, and four providing both water and sanitation (Kumar and Mugabi 2010). Many of these projects are already showing promising results: in a span of less than a year 6,700 connections were made in Cameroon (project target at completion is 40,000); in India 77,000 connections in rural communities in Andhra Pradesh were completed. In most of the schemes a one-time subsidy is provided for access to service. Most cases financed so far involve piped-water schemes, with access defined as the delivery of a working connection to the network.

In an evaluation of the implementation of OBA projects in the water sector, Kumar and Mugabi (2010) draw some key elements for success necessary early in the process: i) market structure and experience with competitive processes to encourage efficiency; ii) regulatory or legal and contractual framework, including policies for setting and adjusting tariffs; iii) capacity of implementing agencies – for example, to handle transaction processes, monitoring and verification, and the flow of funds as well as an understanding of and willingness to work with performance-based arrangements, and iv) extent of experience with the private sector in service provision, where relevant.

The formulation of clearly defined incentives requires reporting systems that generate systematic and reliable information to benchmark and monitor the efficiency with which

resources are being used in terms of outputs and outcomes. Governments must understand the benefits of being able to clearly monitor and measure the impact of its investments.

Lessons learnt from specific cases

Lessons learnt from 'Output-based Aid: extending water and sanitation services to the poor in peri-urban Morocco':

- The use of performance-based subsidies helped refocus service provision on household demand, which increased accountability, strengthened partnerships between local authorities and operators, and made monitoring of service delivery a priority.

- The OBA approach proved an efficient and powerful tool to extend services to poor peri-urban areas in a cost-efficient and sustainable manner.

- Participation was strictly demand-driven. This created an incentive for the operators to carefully assess demand from targeted beneficiaries during preparation and work with local authorities and partners during implementation to raise awareness and promote the programme.

- Operators reached potential customers by sending dedicated teams to marketplaces or the centre of targeted neighbourhoods to record demand from beneficiaries who might not easily travel to one of the operator's agencies.

- The OBA approach was seen to play an important role in overcoming financing blockages, mobilising stakeholders, and making sure funding reached the targeted people.

- The quarterly inspections by an independent technical reviewer helped improve the operators' progress reporting requirements and implementation methods.

- The OBA is seen as strategically relevant to Morocco, given the lack of targeted subsidy mechanisms for poor households, especially in informal urban settings. Despite the maximum number of connections being made through the pilot project, the need for additional connection remains great. The operators continue to deliver connections under the same conditions, but without the subsidy; there is an immediate need for concrete action from the government to implement a programme which continues to address the persistent service deficit in low-income peri-urban settlements throughout Morocco.

- The Government of Morocco has expressed interest in replicating the OBA approach on a citywide or nationwide scale. The World Bank is now working with the government to plan a scale-up programme that could be adapted to address the needs of several large municipalities. Such a programme would also aim to strengthen coordination between institutions in charge of the different aspects of peri-urban utility service, and reform tariff and connection fee structures, so as to prevent an expansion of unserved peri-urban neighbourhoods.

Lessons learnt from 'Social contract formulas in rural areas: the India Naandi Foundation water treatment plants':

- An OBA approach has promoted participatory community involvement and capacity building in the villages for managing and delivering efficient services. A grassroots fee-for-service model coupled with a sense of community engagement and ownership will help ensure the long-term sustainability of the water supply schemes.

- Rural households are willing and able to pay for clean drinking water; however, in most cases this demand has to be created through community awareness campaigns. In this case, a cost recovery tariff was a new concept for the beneficiaries and willingness to pay had to be generated. This was made possible by the community awareness and social marketing campaigns carried out by the implementing agencies, and a high level of transparency and accountability ensured through the OBA approach.

- A win-win strategic partnership between the grant recipient and the technology provider/operator is critical to success. The partnership resulted in a win-win situation whereby WHI (the technology provider) benefited from increased demand generated by Naandi's safe-water education campaigns, and Naandi benefited from linking its traditional health education work to new and reliable clean water supplies. However, as operators increase their capacity in using the community approach, a direct contractual agreement between the Panchayat and the operator is likely to be more efficient.

- Small grant-financed pilot projects can stimulate discussion amongst government agencies on wider sector issues (e.g. appropriate water treatment technology for rural water supply, institutional arrangements for O&M, and improving accountability and transparency in service delivery). But project implementers must be flexible enough to respond quickly and appropriately to take advantage of opportunities.

- Paying on outputs effectively transfers procurement and financial management-related risks to service providers.

Lessons learnt from 'Pro-poor financing and tariffs in Medellin, Colombia':

- Know your target population well. Programmes addressed to the poor must be built on a thorough analysis of the target beneficiaries' conditions and their local particularities in order to structure flexible and custom-made options for social improvement. This requires interdisciplinary study of economic, social and psychology behaviour, as well as the rules, regulations and institutions that affect social behaviour.

- A successful programme in one particular context does not necessarily guarantee success when the practice is transferred to a similar context. As initiatives are designed to solve a specific situation, what can be transferred is not the practice itself but the building and conceptualising processes involved in its design and initiation.

- Do not think the target has been already met. Constant monitoring and evaluation is essential to identify changes or deviations from the expected outcomes or to introduce improvements leading to increased efficiency and effectiveness of measures.

- Investment in social capital in the community contributes to economic development and generates positive externalities.

- Credit is not the solution when it does not contribute to income generation or savings for consumers. Thus, credit options for delinquent accounts must be considered just as temporary measures in order to avoid consumers' dependency or poverty traps.

- Joint efforts generate high impact. Collaboration and cooperation between governments (both municipal and national), private and public entities is the best way to support the expansion of water and sanitation services and invest in social welfare, through joint commitment to the achievement of a common target. The responsibilities and roles of each actor should be identified.

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Social contract formulas in rural areas: the India Naandi Foundation water treatment plants

Cledan Mandri-Perrott, World Bank

Type of tool: cost recovery and sustainable financing of water services
Location: Andhra Pradesh State, India, Asia

Challenges

The provision of safe drinking water is a key development issue in India, where only 18 percent of rural households have access to clean water and 21 percent of communicable diseases are water-related. Andhra Pradesh is the fifth most populated state in India with 80 million people. Nearly 65 percent of its population has access to water; however, 17 million people (over 22 percent) routinely experience bacteriological contamination of water. Rural households in the coastal districts suffer frequent outbreaks of jaundice, diarrhea, and gastroenteritis. Some of the challenges in providing clean water in rural areas include geographic remoteness, poor maintenance of existing systems, and a paucity of public funds. Social factors also contribute to poor service levels in rural areas, notably the caste system and high rates of illiteracy. Providing safe drinking water to poor families in the coastal area of Andhra Pradesh is critical for the economic development of the region as well as for improving health and living conditions.

Drivers of change and objectives

In 2006 the Naandi Foundation was founded, an Indian non-governmental organisation which describes itself as "one of the largest and fastest growing social sector organisations in India working to make poverty history." Started by an extremely successful businessman, the foundation bases its approach to poverty on using public-private partnerships to create sustainable models for delivering critical services. Safe drinking water is a core programme. Naandi formed a relationship with Water Health India (WH India), a subsidiary of Water Health International (WHI), a disinfection technology provider, and approached Global Partnership on Output-Based Aid (GPOBA) to request funding to pilot rural village water schemes in coastal Andhra Pradesh that combine cost-effective water purification technology with a community-driven and performance-based approach.

The proposal was accepted by GPOBA and, in May 2007, Naandi and GPOBA signed a grant agreement for an output-based aid (OBA) project to improve rural water services in three coastal districts of Andhra Pradesh: Guntur, Krishna, and West Godavari. The Naandi Foundation manages the project and runs programmes to generate awareness about the need for clean water through health educators. These educators work with the community through women's self-help groups and schools, targeting women as they are the decision-makers for domestic water use. WHI installs and maintains the treatment plants, with the water meeting the quality standards specified by the Bureau of Indian Standards. Given the remoteness of the locations and the lack of technical support, the objective has always been to ensure sustainable delivery of services. Apart from setting up each plant, WHI hired and trained plant operators in each village. The water tariff pays for the ongoing operation and maintenance of the water plants.

The project aimed to establish Community Safe Water Schemes (CSWS) in 25 coastal villages that currently lack access to clean drinking water, benefiting around 12,500 poor households (earning less than $20 per month). It was estimated that each CSWS would benefit a minimum of 500 poor households. Each CSWS has a water treatment plant connected to a water distribution point from which users will purchase water in jerry cans. Although this project does not envisage domestic connections, it is a first step in providing safe and affordable drinking water in areas where typically the existing water source is of poor quality.

The approach: how the financing tool helped overcome barriers to providing safe drinking water for the rural poor

Public-private partnership

The community water project employs a community-based public-private partnership model involving the village *Panchayat* (local council), Naandi, and WHI, each with the following roles:

- The village *Panchayat* is required to provide land for the plant to be built on, a treatable water source for the plants, the community financial contribution, and electricity at a pre-agreed tariff for the CSWS.

- Naandi acts as project manager and secures pre-finance for the plant's construction through commercial borrowing. It mobilises the community to raise the necessary community financial contribution and collects water user fees. It trains Safe Water Promoters and Village Health Workers, and develops a communication and awareness campaign to change the behavioural practices of poor families regarding water. Naandi also undertakes monitoring and evaluations to measure outputs and the impact of the scheme.

- WHI is the project operator. It builds and installs the ultraviolet (UV) filter water purification plants and the basic infrastructure needed to operate them (i.e. pumping system, storage tank and shelter); hires and trains a plant operator for each of the 25 villages; and shares project implementation risks by providing Naandi with operational performance guarantees.

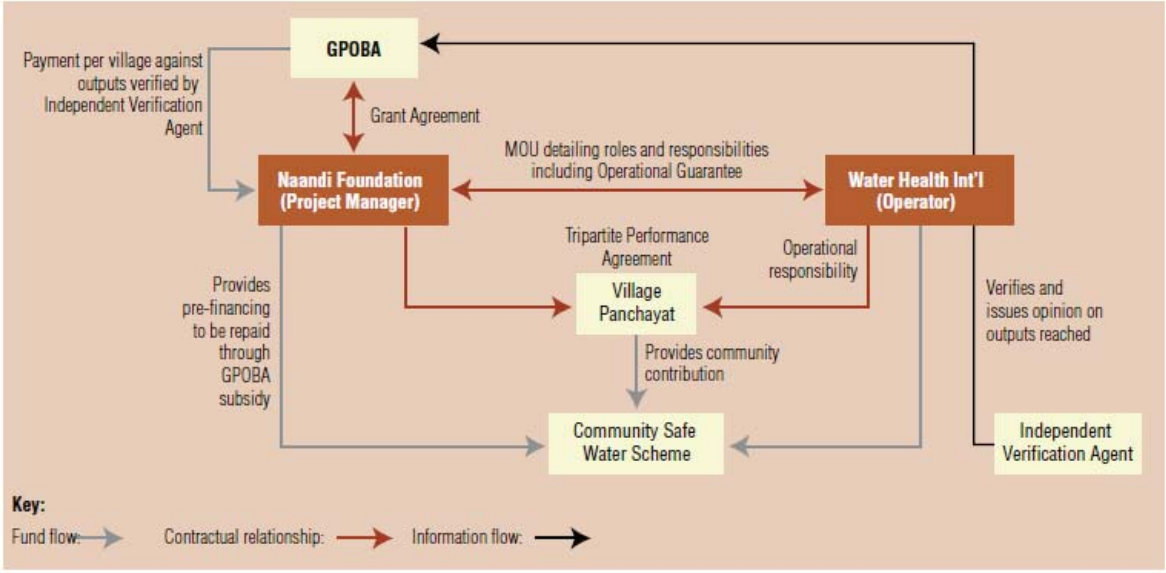

Figure 1. Project arrangements

Output-based aid approach

Enhancing the sustainability of the pilot water schemes through an output-based approach has been a key part of the project design. GPOBA subsidizes the cost of setting up the water treatment plants with ultraviolet (UV) purification technology 25 villages through a US$800,000 grant. This subsidy is performance-based and linked to the delivery of pre-agreed outputs which include three months of billed water services (see Table 1). The output-based approach requires that tariffs paid by users for consumption cover the costs of operation and maintenance, user-fee collection, and education and communication activities with key stakeholders and vulnerable groups such as young mothers, infants, and families living below the poverty line. Tariffs also cover loan repayment, thus helping to ensure the long-term sustainability of the services.

The GPOBA subsidy is paid to Naandi in instalments after independent verification of three pre-agreed outputs which Naandi pre-finances through commercial borrowing. Notably, a significant part of the subsidy is payable only after each CSWS proves it has provided reliable water services for at least three months after becoming operational. Together with an independent verification agent, the World Bank's Water and Sanitation Program (WSP) will conduct ex post reviews of the completeness, accuracy, and authenticity of the documentation provided for each village, and undertake ex post physical spot checks of the outputs. Payments by GPOBA are made only after these conditions have been met.

As the subsidy is mainly linked to service delivery (rather than constructs, as input-based schemes), if WHI does not perform, Naandi will not receive the subsidy from GPOBA and therefore will be unable to repay the loans it take acquired to pre-finance the schemes. Naandi relies upon the operational guarantee provided by WHI to protect itself against this risk.

Indicator	Output Item	Description of the Output	Means of Verification	%Disbursed
1	25 UV water purification plants/CSWSs installed	Construction and installation of the complete CSWS	Completion report for each plant available from the Independent Verification Agent	20
2	Registration of the households	Paid subscription fees	Minimum 500 Below Poverty Line households registered for paid usage of water; subscription fee available from such households	60
3	Three months of billed user free consumption	m^3 of water sold	Continued usage of paid water by a minimum of 500 households; billing records.	20

Table 1. Schedule of outputs and disbursements

Selecting eligible households

The project uses various techniques to target the poorest households. The three project districts were chosen because of their high poverty rate and lack of access to quality water services. Within this geographical area, villages were selected based on the presence of a water source that could be purified by ultraviolet technology, and the willingness and ability of the village to adopt a fee-for-service scheme. To target individual beneficiaries in the villages, the project uses the government's 'white ration card', a system that entitles low-income individuals to obtain basic commodities (e.g. rice, flour) at a reduced price. Other indicators considered include family size, construction of a house from low-cost material, limited or no possession of durable goods such as a TV, and time spent by women and children of a given household in fetching water. As project manager, Naandi does the targeting in close collaboration with the village *Panchayat*. The process is verified by the independent verification agent.

Sharing the investment costs

The total project cost is US$1.25 million. The cost per CSWS (US$50,000) covers investment, community awareness, and running costs. Tariffs are set at an affordable rate and cover the initial investment (net of subsidy) and operation and maintenance costs. Sustainability of the service is thus ensured through user fees which average US$0.03 for a consumption of 20 litres. Since the three project districts are contiguous, the cost per CSWS is almost the same across all the project villages.

The share of investment costs is shown in Table 2. The community contribution (which is at least 20 percent of the total capital cost) may come from user fees, and/or from local

government funds, and/or from donations from philanthropists and charitable organizations. The commercial loan sourced by Naandi is payable over a period of approximately seven years. During this period the assets remain with the community and Naandi, and WHI has full operational responsibility. After the loan is re-paid, the *Panchayat* may choose to renew the operation and maintenance agreement with Naandi and WHI. The life of the plant system is expected to be at least 15 years.

Source of funds	Per village (US$)	Total project (US$)	Share of total (%)
Community contribution	10,000	250,000	20
GPOBA subsidy	32,000	800,000	64
Long-term commercial loans	8,000	200,00	16
Total	50,000	1,250,000	100

Table 2. Share of overall investment

Evaluation

The project provided access to safe water through the construction and installation of 25 UV water purification plants in 25 villages in Guntur, Krishna and West Godavari districts. By grant closure, all water plants were fully operational and serving a total of 16,104 poor households (or 77,878 people), which is 29 percent higher than the original target of 12,500 households. Household surveys conducted after grant closure found that 98 percent of the households reached by the project still continue to use water from the new plants for drinking purposes (i.e. they have not reverted back to existing contaminated sources). This implies a high community awareness of the health risks of contaminated water, and evidence of the effectiveness of the awareness campaign which complemented the hardware component.

Evidence from household surveys also suggests that the project has led to health and economic outcomes (see Table 3), which can be reasonably and directly linked to the project outputs.

Before the project	After the project
• Average time spent collecting water was estimated at 61 minutes. • Incidence of water borne diseases in children and adults was 68 percent and 84 percent respectively. • On an average a family was spending around Rs.300-400 for treatment on	• Average time spent collecting water estimated at 20-22 minutes which shows that there was a time saving of around 40 minutes per trip of fetching of water. • Overall, the incidence of water borne diseases has dropped by 85 percent (figure collaborated by

these diseases for a single visit.	health workers in the village health centres). • Household savings on medical expenses alone was Rs 650-750 a year.

Table 3. Evidence of economic and health benefits from household surveys

Economic analysis

The project provided significant short and long-term benefits with many positive spillover social and economic impacts at the individual and community levels. Health and environmental benefits and cost saving from medical and health related expenses are the largest benefits of any water supply and sanitation project, but they are difficult to quantify in entirety.

A benefit-cost framework using a 'with' and 'without' project methodology has been used to calculate the Economic Rate of Return and the Net Present Value (NPV) of the project, ex post. The economic analysis covers a project life of 15 years. Cash flow is discounted at 12%, which is the estimated cost of capital. A conservative inflation rate of 6% per annum is assumed for cash flow analysis. Without project situation is what would have been prevailed without the project vis-a-vis factors such as population increase, continued exposure to contaminated water, and economic growth. The quantifiable economic benefits include: (i) water sold at flat tariff rate established by the operator which comprise of economic value of incremental water consumptions by households with access to safe water; (ii) health benefit of the project for the beneficiaries; and (iii) potential time cost saving for collecting water from distance. The economic value of cost of time saved is estimated using the opportunity cost of labour or the income foregone in other income generating activities; which is considered benefits to the households and the society.

The ex post economic analysis yield a positive and significant NPV of Rs.199 million (or US$4.4 million) and an overall Internal Rate of Return (IRR) of 71% (against IRR of 73% for ex ante economic analysis at appraisal). The economic benefit of the revenue generated from water sold alone at the established tariff rate is also significant with NPV of R.113.9 million (or US$2.5 million) and an Intern IRR of 38% (against 31% at appraisal). When the net benefits (over and above their willingness to pay) of time cost saved to fetch water are added, the IRR increases to 49% and with added net benefits from improved health, the overall IRR reaches to 71%.

Financial analysis

The ex ante financial analysis at appraisal revealed that project was financially sustainable from the operator's perspective. The ex post financial analysis reveals that the operators will be able to cover its operating costs and with a profit margin only starting year 2012. The reasons are: (i) of the 25 schemes constructed 23 are operated and maintained by the operator (2 are operated by the communities); (ii) of the 23 schemes in operations at the project closing in 2010, only 11 covered direct O&M costs and remaining sites did not generate enough revenue to cover operating costs; (iii) plant constructed were in operation only 8 hours a day; (iii) consumption in 9 sites was low due to bad taste of water; and (iv) in 3 sites community is small and therefore insufficient volume of water produced and

consumed. All these issues are being addressed, schemes are being upgraded to be operated more efficiently with better quality water, and operational hours of the schemes are being increased to cater increasing demand. With available data on revenue generation and O&M costs as of 2010, the measures being taken to improve consumption and revenue, as well as other relevant information, all 23 schemes are expected to generate enough revenue to cover the cost with a profit margin starting 2012 and in the 15 year of its useful life. The Financial Rate of Return (FRR) is estimated at 23% (against 64% at appraisal) when taking into account the subsidy from the grant; and it is estimated at 3.5% (against 6% at appraisal) without the subsidy.

Lessons learnt from implementation

The design and implementation of the project offers the following key lessons that might be useful in shaping future similar projects:

- *Rural households are willing and able to pay for clean drinking water.* This has been a consistent lesson emerging from many World Bank-supported rural water supply and sanitation projects in India. However, in most cases this demand has to be created through community awareness campaigns. In this project, paying a cost recovery tariff was a new concept for the beneficiaries, which for decades have been accustomed to expecting free service delivery from the government. The shift in payment behaviour was made possible by the community awareness and social marketing campaigns carried out by the implementing agencies, and a high level of transparency and accountability ensured through the OBA approach.

- *A win-win strategic partnership between the grant recipient and the technology provider/operator is critical to success.* The role of the Naandi Foundation as grant recipient, administering the project and interfacing with the implementing agency and the Panchayat through a tripartite agreement, has been instrumental for the success of the project. Naandi provided support in selecting communities and in targeting beneficiaries. Throughout the project Naandi conducted visits to beneficiary communities, trained and facilitated community-based health promoters, managed awareness campaigns and helped clarify issues relating to project implementation with the implementing agency. The partnership resulted in a win-win situation whereby WHI benefited from increased demand generated by Naandi's safe-water education campaigns, and Naandi benefited from linking its traditional health education work to new and reliable clean water supplies. However, as operators increase their capacity in using the community approach, the need for tripartite agreements between the operator, an NGO and the village Panchayat becomes less necessary. In such a case a direct contractual agreement between the Panchayat and the operator is likely to be more efficient.

- *Small grant-financed pilot projects can stimulate discussion on wider sector issues, but Bank teams must be flexible enough to respond quickly and appropriately.* This project partially contributed to stimulating a wider sector discussion on issues related to appropriate water treatment technology for rural water supply, institutional arrangements for O&M, and improving accountability and transparency in service delivery. However, the Bank team missed an opportunity to engage with the State government agencies (such as the Rural Water Supply and

Sanitation Division) regarding the potential benefits of the OBA approach in general and the potential for wider application.

- *Appropriate application of the Bank's fiduciary procedures to an output-based arrangement minimised the fiduciary risk to the Bank without encroaching on the implementers' freedom to use its own systems to deliver outputs.* The project has confirmed that paying on outputs effectively transfers procurement and financial management-related risks to service providers.

Scaling up

The GPOBA subsidy has made it easier for Naandi to borrow funds from commercial banks. The OBA approach is promoting participatory community involvement and building capacity in the villages for managing and delivering efficient services. The grassroots fee-for-service model coupled with a sense of community engagement and ownership will help ensure the long-term sustainability of the water supply schemes.

It is anticipated that the CSWS model can readily be applied to other villages in the State of Andhra Pradesh and ultimately in other parts of India. GPOBA, Naandi, and WHI believe that scaling up is possible, as the impacts of each pilot will motivate adjoining villages to engage in similar projects, accelerating demand and willingness to pay for clean water through user fees. Lessons from this project may also assist in the design of national programs aimed at achieving the Millennium Development Goals for water and sanitation.

WaterHealth International has entered into similar public-private partnerships in Ghana, the Philippines and India. Naandi is now introducing rural private operators into its schemes in central Vietnam with the aim of improving the financial and technical sustainability of its schemes.

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Output-based Aid: extending water and sanitation services to the poor in peri-urban Morocco

Xavier Chauvot de Beauchêne, World Bank

Type of tool: Output-Based Aid
Issue: cities
Location: Casablanca, Tangier and Meknes in Morocco, Northern Africa

Challenges

Morocco is a middle-income country and access to potable water and improved sanitation has seen significant improvements in the last decade, reaching 94 and 81 percent respectively in urban areas. However, infrastructure is lagging in slums and illegal settlements in urban and peri-urban areas, where the poor are deprived of access, particularly to the sewerage collection networks. In some cases, these settlements constitute a substantial portion of metropolitan areas. For example, in Casablanca, 1.2 million, or 30 per cent of the population, live in such illegal settlements.

The inhabitants of urban and peri-urban areas without access to adequate services must rely on contaminated water from shallow wells, water providers who charge relatively high unit price, or standpipes which may require women or children to queue for hours. The majority of households uses cesspits and poorly designed septic tanks, which risk further contamination of groundwater, and many of the poorest people have no form of sanitation at all. These deficiencies have serious and direct impacts on people's health, their ability to engage in economic activities, and children's school attendance. They also harm the finances of water utilities, which generally attain very low cost recovery from public standpipes.

Barriers

There are a number of barriers to extending water and sanitation services to the poor in these areas:

1. Unplanned growth of peri-urban areas has systematically excluded them from the service areas of water and sanitation operators.

2. Technical and administrative hurdles made it difficult for operators to intervene in illegal settlements, mostly because of a lack of basic access roads.

3. Operators have difficulty financing infrastructure for households perceived to be in the loss-making lowest brackets of existing water tariffs.

4. Connection fees are priced at marginal cost, topped with a 'first settlement fee,' thereby driving costs of access to unaffordable levels for many households, even when the option of payment by instalments is available through 'social connection' programmes.

Drivers of change

In response to these challenges, the National Initiative for Human Development (INDH) was launched in May 2005. One of the focuses of this initiative was on upgrading infrastructure, public utilities and social services in poor neighbourhoods, particularly in urban and peri-

urban areas. The initiative addressed a critical barrier by recognizing and addressing informal settlements which were previously considered illegal and therefore ineligible for services. This provided a strong momentum for municipalities and utilities to explore the best mechanism to expand access to basic infrastructure among the poorest. Local governments and operators were encouraged to reduce connection fees for their inhabitants to meet the needs of the poor. The lack of financing to develop connections for onsite upgrading of services remained a key challenge faced by the INDH.

The government and operators of water utilities in Casablanca, Meknes and Tangiers requested a grant from the Global Partnership on Output-Based Aid (GPOBA) – a World Bank-administered programme – to pilot an innovative Output-Based Aid (OBA) approach with the objective of expanding access to water and sanitation service among the poor living in peri-urban settlements with a recognized right to access services through the INDH programme. The tool employed in the project was the introduction of an OBA approach, which are performance-based subsidies to encourage service expansion, but disbursed on the basis of realized and independently verified outputs.

How the tool overcame barriers to extending service coverage

The project was launched in 2007 and implemented by the two private sector incumbents in Tangier and Casablanca, Amendis-Tanger and Lyonnaise des Eaux de Casablanca (LYDEC), and the Regie Autonome de Distribution d'Eau et d'Electricite de Meknes (RADEM), a public utility. The Government of Morocco also played an oversight and monitoring role. The pilots were funded through a US$7 million grant from GPOBA and aimed to connect 11,300 households (approximately 56,000 people) to piped water and sanitation services in poor peri-urban neighbourhoods in the three cities.

The utilities that serve Tangier, Meknes and Casablanca arranged pre-financing for expansion of water and sanitation facilities to pre-selected communities. Targeting was geographical and identified neighbourhoods in the INDH's shortlist of most disadvantaged urban and peri-urban communities. Water and sewerage connection networks were constructed on land belonging to the municipality and once the connections were made, an OBA subsidy would be disbursed to supplement reduced connection fees by households. The pre-agreed subsidy was designed to bridge the gap between capacity to pay and the real cost of connection. All households located in selected areas were eligible for a subsidized connection fee, in addition to the fee waivers granted for INDH areas and payment facilities offered by 'social connection' programmes.

The outputs for which the subsidies were disbursed were simultaneous network connections to water supply and sewerage services for individual households, or in the case of Meknes, the connection to either service. The subsidy was operator- and service-specific (see Table 1) and paid in local currency in two steps: 60 percent upon certification by an Independent Technical Reviewer of a working water and sewerage connection to an eligible household; and 40 percent upon verification by the Independent Technical Reviewer of at least six months of sustained service.

City	Operator	Subsidy levels per connection (MAD/US$ eq.)		Subsidy levels per connection (MAD/US$ eq.)	Minimum household monthly installment for connection fee*
		To water supply	To sanitation		
Casablanca	LYDEC	MAD 1,458 (US$170)	MAD 3,609 (US$421)	28%	MAD 60 (US$7)
Tangiers	Amendis	MAD 1,467 (US$171)	MAD 4,158 (US$485)	24%	MAD 100 (US$11.7)
Meknès urban areas (Ouislane, Meknès)	RADEM	MAD 1,422 (US$166)	MAD 7,821 (US$913)	53%	MAD 110 (US$12.8)
Meknès rural areas (Dkhissa, Ait Ouallal, etc.)	RADEM	MAD 5,319 (US$621)	Ineligible to OBA funding	74%	MAD 55 (US$6.4)

MAD-Moroccan dirhams (U.S> dollar equivalent in parentheses), exchange rate of as March 2009
*For households choosing to pay their connection fees in instalments over time.
Source: GPOBA/Infrastructure Développement Consultants
Table 1. Operator- and service-specific unit subsidy amounts per connection

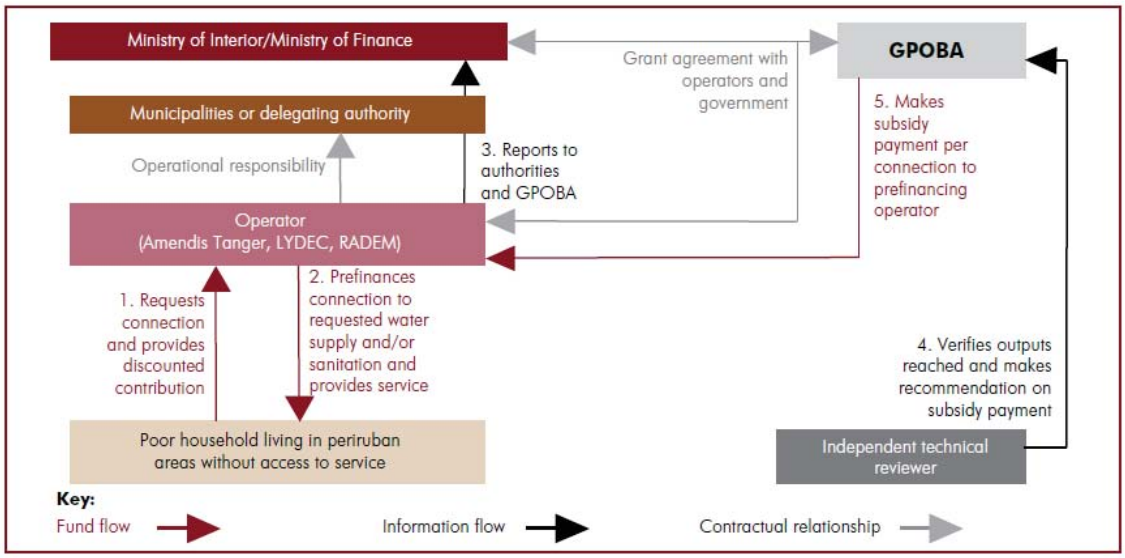

Figure 1. Project arrangements

The built-in incentives of the OBA approach are specifically designed to overcome traditional barriers of expanding services in marginal neighbourhoods, namely: inability to afford connection costs; operators' unsustainable financing for service expansion programmes to poor areas; complex technical and administrative obstacles to infrastructure development in

poor unzoned areas; and reluctance of national and local governments to fund subsidy programmes with no accountability or guarantee for results.

Evaluation and lessons learnt from implementation

The pilots experienced a slow start, with about 2,000 connections (15 percent of the programme's three year objective) in the first year, but connection rates accelerated significantly thereafter. Demand exceeded expectations. An independent midterm review of the pilots showed that the delay was due to implementation difficulties unrelated to the OBA approach: World Bank procurement procedures, upstream investment delays, and lack of clarity over land tenure. By 2011, the grant made available by GPOBA was fully committed and subsidies allocated. The pilot provided subsidized access to water supply to a total of 10,504 households and sanitation services to a total of 9,036 households, benefitting more than 52,500 people. Households that were simultaneously connected to water supply and sanitation services totalled 5,593 in Casablanca and 2,909 in Tangiers. In Meknes, 2002 households acquired access to water supply services and 534 to sanitation services. The collection rates achieved were equal or superior to the average in each operator's service area.

The project has resulted in important direct benefits to households in terms of time savings, reduced health costs and improved hygiene practices. Beneficiary households report high satisfaction with the service provided, and operators and government are also satisfied with the pilot.

Lesson learnt

- The use of performance-based subsidies helped refocus service provision on household demand, which has increased accountability, strengthened partnerships between local authorities and operators, and made monitoring of service delivery a priority.

- All parties agree that the OBA approach has proven an efficient and powerful tool to extend services to poor peri-urban areas in a cost-efficient and sustainable manner.

- Participation is strictly demand-driven. This creates an incentive for the operators to carefully assess demand from targeted beneficiaries during preparation and work with local authorities and partners during implementation to raise awareness and promote the programme.

- Operators developed proactive and dynamic approaches to integrate their new customers. E.g. they reached potential customers by sending dedicated teams to marketplaces or the centre of targeted neighbourhoods to record demand from beneficiaries who might not easily travel to one of the operator's agencies.

- The OBA approach was seen to play an important role in overcoming financing blockages, mobilizing stakeholders, and making sure funding reached the targeted people.

- The quarterly inspections by the Independent Technical Reviewer helped improve the operators' progress reporting requirements and implementation methods.

The World Bank will prepare an implementation completion and results report on the project in the coming months, to give a full account of results and disseminate final lessons.

Scaling up and relevance for developing and transition countries

The OBA approach is seen as strategically relevant to Morocco, given the lack of targeted subsidy mechanisms for poor households, especially in informal urban settings. Despite the maximum number of connections being made through the pilot project, the need for additional connection remains great. The operators continue to deliver connections under the same conditions, but without the subsidy; there is an immediate need for concrete action from the government to implement a programme which continues to address the persistent service deficit in low-income peri-urban settlements throughout Morocco.

The Government of Morocco has expressed interest in replicating the OBA approach on a citywide or nationwide scale. The World Bank is now working with the government to plan a scale-up programme that could be adapted to address the needs of several large municipalities. Such a programme would also aim to strengthen coordination between institutions in charge of the different aspects of peri-urban utility service, and reform tariff and connection fee structures, so as to prevent an expansion of unserved peri-urban neighbourhoods.

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Pro-poor financing and tariffs in Medellín, Colombia

Rubén D. Avendaño, Empresas Públicas de Medellín

Type of tool: cost recovery and sustainable financing of water services
Issue: cities
Location: Medellin, Colombia, Latin America

Challenges and objectives

Colombia, as is the case of many Latin-American countries, has implemented different economic reforms to improve the living standards of its population. In the utilities arena, some measures have been taken in terms of tariff structure and changes in the institutional framework. However, there exist economic, social and legal entry barriers for a significant proportion of people that remain without guarantees, living in an informal world where rights depend on income.

People living in poverty face innumerable access problems related to the lack of financial capacity to afford to a minimum water service allowance, and the inability to save enough money to pay for the consumption. This has been a crucial issue in the water sector in the developing world for years. In addition, experience shows that low or no income is not the only barrier inhibiting access to water services. Other conditions associated with poverty in these areas, such as social unrest, violence, unemployment and underemployment, urban displacement, and other related factors, threaten to undermine economic efforts to guarantee service access. In many cities in the developing world, as in Medellín, the poor peri-urban population not only live under 'border' economic conditions, entering and exiting to and from the formal world, but also under border social, legal, and institutional conditions. This interception of multiple geographical, economic and social stressors constitutes a major challenge to extending water services coverage to these areas. Moreover, this population is more vulnerable to external social and economic shocks (unemployment, sickness or death of members in close social networks, etc.)

Governments in association with utilities in the developing world have a responsibility to address these challenges in services provision. The experience of Empresas Públicas de Medellín (EPM) as water services provider for Medellín and the Aburrá Valley[14] in Colombia, consists of joining formal public policies of local and national government with EPM's corporate social responsibility policies to create shared value in the weakest segment of the population. A portfolio of initiatives has been specifically designed with the aim of guaranteeing universal access to public services, and to prevent this vulnerable population from falling into a poverty trap that impedes the possibility of connection and consumption. Based on an understanding of users both as households and as people that make part of a community, by considering their symbolic and social capital, EPM is addressing with success this challenge.

[14] The Aburrá Valley (in Spanish Valle de Aburrá), is the natural basin of the Medellín River and one of the most populous valleys of Colombia in its Andean Region with more than 3 million inhabitants. The Aburrá Valley is home to ten cities: Medellín, Barbosa, Bello, Caldas, Copacabana, Envigado, Girardota, Itagüí, La Estrella and Sabaneta.

About EPM

Empresas Públicas de Medellín is a Colombian company owned by the Municipality of Medellin. EPM is a utilities provider (water, electricity, gas, and telecommunications), and its main market is the metropolitan area of Medellin and the Department of Antioquia, comprising of 5.2 million people. It is the second largest water and sanitation utility in Colombia and currently its profits transferred to the municipality represent around the third part of the latter annual budget.

EPM is recognised nationally and internationally for its efficiency and quality operations. Some of the facts that demonstrate EPM's success are: good financial results, high quality standards of its services, high credit ratings[15] by national and foreign financial agents and the social acknowledgment[16] for its performance and commitment to improve the quality of life of the population it serves, especially the poor.

EPM projects are developed in accordance with strict financial, technical and legal principles, and all its procedures and controls for the acquisition of goods and services guarantee transparency in all contractual processes. Its management and directors are independent of any political influence. In addition, EPM's corporate governance model made of formal and informal mechanisms and its Corporate Social Responsibility Policy have become important drivers for the growth and sustainability of the company.

How have cost recovery and financing mechanisms helped overcome barriers?

Understanding that the access problem is critical in Medellin, EPM has designed and implemented a variety of solutions tailored to target people with different needs.

A key issue regarding how to overcome the barriers to the poor is the institutional capacity to understand the problem and to design and implement effective solutions. EPM has the institutional capacity for managing the entire process from problem identification to the implementation and evaluation of the programs. This process requires first of all, a clear understanding of the initial situation to enable the formulation of appropriate and comprehensive strategies. At EPM a conceptual framework is first developed, based on interdisciplinary studies and an in-depth analysis of the economic, social and psychological users' behaviour that is affected by rules, regulations and institutions. The next step is the planning of the intervention, identifying the roles and responsibilities of actors involved (national government, local government, ONG's, third parties, and EPM), followed by the design of mechanisms that better respond to the main objective – *service universalisation*. Finally, during and after implementation, the development and application of permanent monitoring and evaluation techniques is essential.

In the pursuit of its goals as public services provider, and in response to the challenges faced in its service area, EPM has designed the following strategies to increase access to water and

[15] Fitch Ratings: International rating for EPM's foreign currency debt BBB-. Bonds rating: AAA. (September 2010) Moody's rating Baa3. January 2011.

[16] The survey "Medellín cómo vamos", is a civil initiative created in 2006 to evaluate the quality of life changes in the city of Medellin. In 2010, EPM shows high satisfaction levels with the utilities services was of 4.5 over 5 points. For more information see www.medellincomovamos.org/

sanitation services, prevent services disconnection and to improve the quality of life of its customers:

Network Connection Financing Program (NCFP)

The NCFP is an EPM initiative designed to provide access to water services to low-income households in peri-urban areas of the Aburrá Valley. The program offers long-term credit facilities at low rates to people who have no access to credit. Beneficiaries of the program are then able to finance the construction or improvement of in-house and external water and sanitation infrastructure in order to gain access to public utilities. EPM offer this service based on household demand and credit is payable over ten years at DTF rate (average market interest rate for deposits). The credit component of the program is accompanied by infrastructure contracts that are awarded to formally organised community entities, helping to strengthen local technical and business capacity.

Financing and Re-financing Consumption (RFWC)

The purpose of this EPM initiative is to help households with low capacity to pay (strata 1,2 or 3[17]) and debts in their water, sanitation and energy bills, to access to low cost financing with minimum guarantees to prevent delinquent accounts and service disconnection. Before service suspension, clients have option of paying 80 percent of their debt within their current bill and the remaining 20 percent the following month without charges. Disconnected clients with over two months of bill debts are offered reconnection agreements and the financing of the debt for up to five years at DTF rate. In the case of clients that have been affected by displacement or natural disasters, the debt can be refinanced for up to ten years with no interest charged.

Prepaid Program (PP)

PP is an EPM initiative targeted at customers with delinquent accounts or that are at risk of having an illegal connection. The program allows reconnection of services (which are prepaid) and debt payment over 120 months charged at DTF interest. The customer purchases a PIN number from a local store and introduces the PIN in their meter at home to use the energy services purchased. Of the payment made through the PIN, 90 percent is for the purchase of energy and the remaining 10 percent contributes to repayment of the debt with EPM. Thus far, EPM has only implemented this program for energy services but offering a prepaid option for water services is being piloted.

Social Financing Program (SPF)

The Social Financing Program (SFP) / Grupo EPM card offers households in the Antioquia Region credit at competitive rates that vary according to the type of product or activity financed. Priority is given to strata 1 to 4 households which constitute 96 percent of cardholders. The credit is intended for use in financing home improvements and energy and

[17] Colombian socioeconomic classification system: Colombian legislation has established a household classification system with six socio-economic categories (strata 1 to 6) according to location, income level and public services provision. This classification determines people's taxes, public services tariffs, modalities of access to health service, among others. Strata 1, 2 and 3 are preferential to receive subsidies and benefits from the government due to their low socio-economic conditions.

water appliances, with the objective of improving efficiencies and the quality of life of customers. The credit is billed with the utilities and customers pay in monthly instalments incorporated into their utility bills.

Community Organisation Contracts

The objective of this social program of EPM is to contract community-based organisations and associations located in areas in the Aburrá Valley where EPM has projects on network expansion, operation and maintenance in water and sanitation services provision. EPM hires these organisations to build local infrastructure and the procurement requirements are specifically designed to enable them to enter contracts.

Water services provision peri-urban areas

This initiative is implemented by EPM in conjunction with the Municipality of Medellin and seeks to legalise and allow access to public water services for people in peri-urban areas in Medellin. The aim is to reduce risks derived from illegal or irregular use of public services and protect private and public goods. The charge is applied according to the average user's socioeconomic level without using individual meters. Although this is not ideal, it is one of the few coverage options for areas where regulations prohibit the provision of conventional public utilities.

Minimum Potable Water Consumption Amount for Life

The World Health Organization estimates that the average quantity of potable water needed per person to meet basic human needs is 2.5m^3 per month. 'Minimum Potable Water Consumption Amount for Life' is a Municipality of Medellin initiative launched in 2009 providing subsidies paid by the municipality to cover the cost of 2.5m^3 /month per person. Households targeted by the program are those in the rural or urban jurisdiction of Medellin that have been previously identified as potential beneficiaries of social programs due to unmet basic needs, as identified by the government. EPM applies the respective discount in the customers' bills. The program also includes information campaigns to promote the rational use of water.

National demand-side and supply-side subsidies

The national demand-side subsidies scheme offers users with low payment capacity (strata 1,2 and 3) subsidies financed by an overquote in the bill of users with the best payment capacity (strata 5 and 6), industrial and commercial users, and with municipality funds. The level of subsidy depends on the strata of the municipality: strata 1 receives a 50-60 percent subsidy on consumption; strata 2 receives a 30-40% subsidy on consumption; and strata 3 receives a 10-13% subsidy on consumption.

The national government also provides supply-side subsidies, investing in public services infrastructure so that public service enterprises can improve service delivery without passing on the additional cost to users.

Evaluation: economic, environmental and social benefits

Initiatives offered by EPM have resulted in significant improvements in the life conditions of the population it serves. Some verifiable impacts are:

Network Connection Financing Program

Economic: During 1999-2011, US$45 million was invested in water and sanitation services through the NCFP. The program has resulted in a total of US$5 million in interest rate savings for consumers compared to conventional financing. Indirect benefits of the program include the creation of 10,732 jobs in the water and sanitation services sector. The component on infrastructure contracts has resulted in 197 contracts with 214 community organisations in the Aburrá Valley.

Environmental: EPM has wastewater treatment plants that clean residual water before its flows into the Medellin River. As the river goes through the entire Aburrá Valley, the NCFP reduces environmental contamination by connecting users to the main sewage system.

Social: Direct impacts on water and sanitation provision during 1998-2010 include: 10,163 households connections to water services and 13,917 sewerage connections, benefitting 55,670 people. During 2008-2010, the aqueduct network was expanded by 50.7 km and the sewage network by 55.1 km. The program has also involved a total of 23,390 hours of community training and has contributed to poverty alleviation through job creation.

Financing and Re-financing Consumption

Economic: The RFWC financed 326,128 customers a total of US$95 million during 2008-2010 (constant 2008 prices). This has resulted in consumer savings of US$10.58 compared to the conventional financial system.

Social: Of the beneficiaries reached by the program, 92% are low-income households (strata 1, 2 and 3). The scheme has therefore addresses inequities and contributes to the improvement of quality of life of its beneficiaries.

Prepaid Program (PP)

As the PP initiative is only currently being trialled for water services, only the energy program has been fully evaluated, with the following results:

Economic: During 2008-2010, the program saw investments of US$9.3 million. Importantly, the program allows customers to consume public services according to their economic capacity without incurring any payment risk and preventing disconnection.

Environmental: The program includes education in rational energy use, which has resulted in a reduction in consumption of 60kW-h per family as compared to a representative sample of post paid families in 2010.

Social: A total of 70,930 network connections have been made in the last three years, benefitting 201,779 people (with 7% from strata 1, 2 and 3). The program will enable 88,000 disconnected clients to regain access to energy services by 2014. The program contributes to the improvement of quality of life and provides a mechanism to avoid illegal connection to public services.

Social Financing Program

Economic: US$28 million has been financed in three years through the SPF, representing savings of US$13 million for consumers. The program promotes credit channels for people

who otherwise would not be eligible for financial services, with low interest rates and repayment flexibility. The program stimulates local, regional and national economies.

Environment: The SFP has facilitated the adoption of a new generation of efficient appliances, contributing to significant energy, water and gas savings, with corresponding environmental benefits from reduced resource use.

Social: As of August 2011, the Grupo EPM Card has financed 63,000 households in 17 municipalities. The scheme has issued 39,276 cards in three years. Participants benefit from reductions in bills due to the use of more efficient appliances.

Community Organisation Contracts

Economic: During 2008-2010, 31 contracts with organisations in Aburrá Valley were made, totalling US$10 million. The initiative has generating 376 jobs in the water and sanitation services sector. This has enhanced the income of communities and contributed to the distribution of wealth, stimulating local, regional and national economies.

Environmental: The community organisation contracts include environmental protection clauses complemented with auditor procedures to verify compliance.

Social: The initiative has contributed to poverty reduction as a result of job generation; strengthened skills in management, operation and procurement; and successfully promoted community-based schemes.

Water services provision in peri-urban areas

Economic: During 2008-2010 US$126,000 was invested in water services provision for peri-urban areas.

Environmental: EPM has wastewater treatment plants that clean residual water before its flows into the Medellin River. As the river goes through the entire Aburrá Valley, the NCFP reduces environmental contamination by connecting users to the main sewage system.

Social: The peri-urban scheme contributes to the universalisation of public services, risk reduction and life quality improvement for peri-urban populations. A total of 67 meters have been connected during 2008-2010, benefitting 6,417 people. Customer education programs have been implemented to encourage sustainable and rational water use.

Minimum Potable Water Consumption Amount for Life

Economic: The Municipality of Medellin has invested a total of US$1.21 million in 2010. In that year, the total savings achieved were US$269,444, equivalent to a 12 percent in monthly savings per family which represents approximately US$5 – resources that vulnerable families can invest in meeting other needs.

Environmental: 92 percent of beneficiary households practice rational water consumption, with corresponding environmental benefits.

Social: The program provides a definite quantity of potable water at no cost to vulnerable families in Medellín. It has brought positive results and proven improvements in social conditions. In 2010, 26,079 households benefitted from the program and for 2011, this is

expected to rise by 72 percent (reaching 45,000 households). By guaranteeing vulnerable families' access to water, the municipality is improving economic, social and health conditions of Medellin's population. The incidence of illness is reduced as a result of the increased availability of potable water.

National demand-side and supply-side subsidies

Economic: During 2008-2010, US$140.53 million in water and sanitation subsidies were provided to lower income population (strata 1, 2, 3) of 17 municipalities (where EPM provides water services). This has reduced the cost of water and sanitation services for users. On the supply side, EPM has received US$19.82 million in public investment for water service provision, lowering the cost of water and sanitation services infrastructure.

Social: The initiative has benefitted 699,000 users (strata 1,2,3) in Aburrá Valley and addressed social inequities in the region.

Scaling up and relevance for developing and transition countries

To address the access problem, most developing countries have copied models from elsewhere in the pursuit of higher standards of living. But experience shows that due to varying social, economic, legal and cultural conditions between countries, models cannot simply be transferred with success guaranteed. It is therefore necessary to identify shared factors from which the transferability of an approach can be inferred.

After a long learning process of more than 50 years, EPM pro-poor initiatives have played an important role in the characterisation of the population it serves in terms of their life conditions and motivations (including neuropsychological factors that influence their decision making). In this respect, EPM is eager to share its experience about how its initiatives have been designed to meet the needs of its population and its permanent efforts to improve its operations.

Opportunities for the future

Recently (2011), EPM hired a consulting service to assess delinquent accounts and effectiveness of EPM tools in improving public services universalisation. The main conclusion of the study was that current initiatives offered by EPM to vulnerable users are achieving good results, but in order to help people living under border conditions (less than 5% of EPM target population) move up in the social scale, the following changes were recommended: i) restructuring existing initiatives and creating new and complementary tools (such as insurance mechanisms against shocks like death, illness or accident); ii) focalisation strategies leading to the development of differentiated options according to users' vulnerability levels (measured by poverty level and delinquent account risk); and, iii) collaboration in efforts with other actors concerned with situation of vulnerable populations. In addition to local and national governments who bring support on legislation and public policies, there are international organisations, NGOs and private entities that allocate resources and are interested in implementing programs to improve social welfare. Furthermore, more efforts must be made to link EPM actions to local and national policies for poverty reduction in order to concentrate focalisation strategies in the same population and improve effectiveness.

Lessons learnt from implementation

- Know your target population well. Programs targeted to the poor must be built on a thorough analysis of the target beneficiaries' conditions and their local particularities in order to structure flexible and custom-made options for social improvement. This requires interdisciplinary study of economic, social and psychology behaviour, as well as the rules, regulations and institutions that affect social behaviour.

- A successful program in one particular context does not necessarily guarantee success when the practice is transferred to a similar context. As initiatives are designed to solve a specific situation, what can be transferred is not the practice itself but the building and conceptualising processes involved in its design and initiation.

- Do not think the target has been already met. Constant monitoring and evaluation is essential to identify changes or deviations from the expected outcomes or to introduce improvements leading to increased efficiency and effectiveness of measures.

- Investment in social capital in the community contributes to economic development and generates positive externalities.

- Credit is not the solution when it does not contribute to income generation or savings for consumers. Thus, credit options for delinquent accounts must be considered just as temporary measures in order to avoid consumers' dependency or poverty traps.

- Joint efforts generate high impact. Collaboration and cooperation between governments (both municipal and national), private and public entities is the best way to support the expansion of water and sanitation services and invest in social welfare, through joint commitment to the achievement of a common target. The responsibilities and roles of each actor should be identified.

4. Investments and fiscal measures for the protection and improvement of biodiversity and ecosystem services

Thomas Chiramba, Silas Mogoi and Isabel Martinez (UNEP), Tim Jones (DJEnvironmental)

Challenges

UNEP's Water Investing in Natural Capital (2011) highlights the importance of investing and conserving biodiversity and ecosystem services. The report points that in terms of ecosystem health and function, global assessments of the health of the world's water river systems and aquifers suggests that the aggregate trend is one of decline (Millennium Ecosystem Assessment Report 2005; WWF's Living Planet Report 2010; the UN World Water Development Report 2010).

Examples of the decline included in the report are:

- Barriers have been laid across China's Taihu Lake to stop regular algal blooms reaching the water treatment plant that supplies water to over 2 million people (Guo 2007);
- From October 2002 until October 2010, the absence of flow has meant that dredges have been used to keep the mouth of the Australia's River Murray open to the sea;
- In Manila, the Philippines, groundwater extraction, primarily for industrial purposes, is lowering the water table at a rate of between 6 metres and12 metres per year (Tropp 2010);
- In 1997, China's Yellow River flowed all the way to the sea only for 35 days and for much of the year this river's last 400-plus miles were dry (Fu 2004).

Ecosystem services – for example the regulation of water quality and quantity – have enormous economic value, yet the linkage between degradation of ecosystem services, growing resource scarcity and the rising costs of providing those services artificially (e.g. through costly water treatment plants) have been widely neglected until relatively recently. Indeed it is only in the last decade or so, particularly since publication of a seminal journal article by Daily et. al (1997) that 'ecosystem services' is a phrase in regular usage.

Ecosystem services provided by watersheds

Smith *et al.* (2006) provide the following categorisation of the ecosystem services provided by a typical watershed:

1. *Provisioning services* – i.e. services focused on directly supplying food and non-food products from water flows: freshwater supply, crop and fruit production, livestock production, fish production, timber and building materials supply, medicines, hydroelectric power.

2. *Supporting services* – i.e. services provided to support habitats and ecosystem functioning: wildlife habitat (i.e. biodiversity conservation), flow regime required to

maintain downstream habitat and uses.

3. *Cultural and amenity services* – i.e. services related to recreation and human inspiration: aquatic recreation, landscape aesthetics, cultural heritage and identity, artistic and spiritual inspiration.

4. *Regulating services* – i.e. services related to regulating flows or reducing hazards related to water flows: regulation of hydrological flows (buffer runoff, soil water infiltration, groundwater recharge, maintenance of base flows), natural hazard mitigation (e.g. flood prevention, peak flow reduction, landslide reduction), soil protection and control of erosion and sedimentation, control of surface and groundwater quality.

The way in which management of the upstream part of a river basin or watershed influences the quantity, timing and quality of water available for downstream economic uses is among the easier ecosystem service linkages to convey (in principle at least) to non-specialist stakeholders.

The importance of maintaining intact vegetation cover – especially forest cover – in the upstream parts of river basins as a means of regulating infiltration, runoff, erosion and sedimentation, and the significance of healthy forest and freshwater ecosystems for maintaining biodiversity means that water managers and conservationists often have a common interest in the protection and/or enhancement, rehabilitation, or restoration of these ecosystems. This linkage is even more significant if the potential for additional 'wins' through the role of forests in limiting carbon emissions is taken into account (though the latter is largely beyond the scope of this session).

UNEP (2011) report considers that "*there is a new recognition of the positive synergy that emerges between healthy environments and healthy communities*". When astute investments in the restoration of ecosystems are made, internal rates of return in excess of 10 per cent are attainable.

Biome/ecosystem	Typical cost of restoration (high-cost scenario)	Estimated annual benefits from restoration (avg. cost scenario)	Net present value of benefits over 40 years	Internal rate of return	Benefit/cost ratio
		US$/ha	US$/ha	%	Ratio
Coastal	232,700	73,900	935,400	11%	4.4
Mangroves	2,880	4,290	86,900	40%	26.4
Inland wetlands	33,000	14,200	171,300	12%	5.4
Lake/rivers	4,000	3,800	69,700	27%	15.5

Table 1: Examples of the estimated costs and benefits of restoration projects in different biomes
Source: Adapted from TEEB (2009a)

Approaches

Restoration of degraded river systems

As documented by Le Quesne et al. (2010), some countries are now investing large amounts of money in the restoration of degraded river systems and the development of policies and administrative arrangements designed to prevent degradation of these systems.

Two examples of governments investing in river restoration

Korea

In July 2009, the Republic of Korea announced a Five-Year Plan for Green Growth in order to implement the National Strategy for Green Growth over the period 2009-2013. This includes a 22.2 trillion Korean won (US$ 17.3 billion) investment in a Four Major Rivers Restoration Project. The five key objectives of the project are as follows: (1) securing sufficient water resources against water scarcity, (2) implementing comprehensive flood control measures, (3) improving water quality whilst restoring the river-basin ecosystems, (4) developing the local regions around major rivers, and (5) developing the cultural and leisure space at rivers. Overall, it is expected that the project will create 340,000 jobs and generate an estimated 40 trillion won (US$ 31.1 billion) of positive economic effects as rivers are restored to health.

Australia

In January 2007, the Australian government announced a A$10 billion (US$10 billion) commitment to restore health to the seriously over-allocated Australia's Murray Darling basin and appoint an independent authority to prepare a new plan for the basin using the best available science. Some A$3.1 billion is being spent on the purchase of irrigation entitlements from irrigators and the transfer of these entitlements to a Commonwealth Environmental Water Holder, A$5.9 billion on the upgrade of infrastructure with half the water savings going to the environment and A$1 billion on the collection of the information necessary to plan properly.

Sources: Office of National River Restoration (under the Ministry of Land, Transport and Maritime Affairs) (2009); Korean Ministry of Environment and Korea Environment Institute (2009) and Murray Darling Basin Authority (2010).

Recognising and valuing the services provided by ecosystems

A central requirement for greening of economic growth is the proper recognition and valuing of the services provided by ecosystems, as highlighted in the Synthesis Reports of the Millennium Ecosystem Assessment. By finding means of incorporating these values into market-based mechanisms, not only can they be properly taken into account in conventional economic decision-making processes, but also market-based financial incentives can be established to support and maintain ecosystem services.

Payment for Ecosystem Services

One of the key ways that water managers and those interested in conserving biodiversity have come together is through the setting up of fiscal measures that provide incentives for the sustainable management of ecosystems. Such measures may take a range of different forms – they may, for example:

- be public or private
- involve cap-and-trade schemes
- involve direct or indirect payments
- involve downstream users explicitly paying for services supplied by upstream land/water managers
- be aimed at generating multiple economic, social and environmental benefits (rather than purely environmental benefits)

One of the most widely implemented approaches during the last five to ten years (although its use is still in relative infancy in many countries) is commonly referred to under the umbrella of 'Payment for Ecosystem Services' (PES), although some confusion surrounds the use of this term.

Indeed, Greiber (2009) states that:

"*PES sometimes appears to have become a 'catch phrase' which needs further clarification on what it actually embodies – virtually all financial and legal incentive mechanisms for promoting conservation and good environmental citizenship, or only specific ones. Depending on the concrete definition of a PES mechanism, its legislative and practical requirements will differ considerably*."

Greiber further concludes that:

"*What makes a PES a PES is that in any payment arrangement those who pay are aware that they are paying for an ecosystem service that is valuable to them or to their constituencies – and those who receive the payments engage in meaningful and measurable activities to secure the sustainable supply of the ecosystem services in question.*"

Some environmentalists have expressed fears that direct payments for ecosystem services may do more harm than good for the conservation of biodiversity (see Wunder, 2006 for a discussion of some of the key issues in this debate). A key constraint (see Wertz-Kanounnikoff, 2006) is that *payment* for ecosystem services presupposes that the services supplied by a particular ecosystem are understood in a real 'on the ground' (rather than purely theoretical context) and that means of valuing these economically are available. This is by no means always the case and while experience and know-how are expanding rapidly in all regions of the world, the necessary scientific/technical and socio-economic background studies required to prepare a successful PES scheme are inevitably costly and time-consuming.

In spite of such constraints, leading global conservation NGOs such as Conservation International, The Nature Conservancy, and WWF, are all actively implementing PES projects and PES is recognised as an important tool by the Conservation on Biological Diversity (CBD). Goal 4 of the CBD's Strategy for Resource Mobilization seeks to: *"Explore new and innovative financial mechanisms at all levels…"*. The first of six strategic objectives under this goal is *"To promote, where applicable, schemes for payment for ecosystem*

services, consistent and in harmony with the Convention and other relevant international obligations."

The TEEB/Bank of Natural Capital considers that PES "*offers a real opportunity to bring nature into our markets with a visible value*" and highlights PES as "*a key strategy for governments at international, national and local levels because [PES] rewards those who have the most immediate relationship with natural capital, but who usually lose out most in the trade and conversion of natural resources – namely the poor."* Alleviation of poverty as a driver of natural resource degradation is recognised by biodiversity conservationists and water managers alike as one of the most valuable potential contributions of effective PES schemes.

Lessons learnt from PES in practice

Different PES approaches have been reviewed including three from Africa, three from Asia and three from Latin America and the Caribbean (LAC). They cover a broad range of scenarios, from initial valuation of ecosystem services in the Sourou River Valley (Burkina Faso), to implementation of pilot PES schemes in Lam Dong Province (Vietnam), Lake Naivasha basin (Kenya) and the Maloti-Drakensberg region (South Africa), through efforts to solve specific water management challenges in Fukuoka City (Japan) and Pingwu County (China), to relatively mature PES programmes in Costa Rica, Ecuador and Mexico, which have already served as models for replication and scaling up elsewhere in the LAC region (see compendium table). .

Below is summary of some of the common themes and key points emerging from the case studies of PES as a whole.

1. *On the design*

Payment for Ecosystem Services (PES) schemes need to be carefully designed and targeted to:

- be appropriate for the relevant legislative and institutional/governance framework (this is clearly most important for public PES schemes – see Greiber 2009).
- have clear predefined objectives, targets and indicators of success (and failure);
- apply to specified geographical (or hydrographical) limits.

As such mechanisms are being newly applied in many countries or individual river basins/watersheds, pilot projects provide a valuable means of testing and adapting internationally or nationally proven approaches to local conditions.

2. *Set up baseline scenario and monitoring*

- It is vital to have a baseline scenario against which to measure changes in economic, social and environmental factors during implementation. This can easily be forgotten in the midst of complex negotiations to establish workable financial mechanisms.
- A programme of monitoring of economic, social and environmental factors needs to be designed in advance as an integral component of implementation.

3. Public awareness campaign

A programme of public awareness can be important in sensitising stakeholders to upstream–downstream environmental linkages and the economic significance of the ecosystem services management carried out by watershed owners/managers. This can enhance willingness to pay on the part of users, and willingness to adapt land/water management practices by service 'suppliers' – or at least willingness by both groups of stakeholders to engage in dialogue.

4. Start small and scale up

Experience shows that it may be better to 'start small' and to 'scale up' rather than to try to implement a fully fledged financial mechanism from the beginning. This can be done, for example, by targeting a specific land/water management practice – and the driver(s) underlying it – that influences a specific ecosystem service (e.g. deforestation driven by the need for fuel wood, causing increased runoff, erosion and sedimentation of water courses). Trying to address multiple management practices, drivers and ecosystem services simultaneously from the start is liable to overwhelm the programme managers as well as stakeholders.

5. Identify beneficiaries and suppliers of ecosystem services

It s important to identify 'beneficiaries' and 'suppliers' of ecosystem services and representatives of each group who are able and willing to participate in discussions/negotiations on behalf of others.

Stakeholders may include all or some of the following categories of 'actor', only some of whom are direct suppliers/sellers or users/buyers:

- government ministries/departments
- government agencies
- local authorities
- river basin management authorities
- public corporations
- private corporations
- individual consumers
- individual landowner/managers
- community groups
- water users' associations
- national or international NGOs
- development assistance agencies
- other external donors

6. The elements

Sustainable provision of ecosystem services can be achieved through changes in land-use practices and incentives to farmers that are both equitable and targeted at maintaining or enhancing livelihoods.

7. Continuous adaptation to deal with key challenges

PES is not a panacea. All of the case studies included in the documentation for this session confronted a range of challenges, requiring continual adaptation.

8. Tips for successful PES

Building trust:

- Building trust and a spirit of partnership or mutual 'buy-in' among stakeholders.

Financial mechanisms:

- Ensuring that any financial mechanism proposed is in line with the provisions of applicable policy and legislation (recognising that if not, further lengthy preparatory work may be needed to lobby for and secure the necessary changes).

- Counterpart/additional contributions may be leveraged by the successful operation of an investment scheme. This can dramatically increase the overall funding mobilised and – more importantly – the beneficial environmental impacts of that funding.

Financing/payment:

- Convincing downstream water users that they should contribute financially to protection, maintenance or restoration/rehabilitation of ecosystem services by upstream landowners/managers.

- Addressing the contention that downstream water users, who already pay fees or taxes for their water consumption, may be 'forced to pay twice' by any additional levy or charge for ecosystem services.

PES Charges and sustainability

- Setting the charges paid by water users at a level that is acceptable to the water users but which still generates sufficient income to finance planned investments in upstream environmental protection measures.

Equity and fairness

- Setting levels of payments to upstream land/water managers that are equitable and which are sufficient to act as an incentive in themselves to conserve natural resources (regardless of the stipulations of any contract or sanctions for non-compliance) rather than to continue exploiting them unsustainably.

Lessons learnt from selected PES cases

Case	Lessons learnt
Fund for the Protection of Water (Fondo para la Protección del Agua – FONAG)	Governments, NGOs (including international NGOs), development assistance agencies, the corporate sector and local communities can work effectively together on PES schemes if the benefits for all stakeholders are clear. Relatively modest expenditure can leverage much bigger overall investment through counterpart contributions. Restricting use of the fund to yields from interest and investments – NOT capital – means that the fund grew slowly but sustainably. Strong capacity building and communications/ awareness-raising components have been vital to FONAG's success.
PROCUENCAS Payment for Ecosystem Services scheme, Costa Rica	Upstream environmental services are linked to downstream beneficiaries through a direct and earmarked monthly financial charge to all city water end-users. The case is a good example of a small, independent PES scheme that has successfully addressed 'willingness-to-pay' (WTP) issues through clear articulation of the linkages between watershed conservation, quality (and cost) of water supply management and public health objectives.
Programme for Payment of Hydrological Environmental Services (Programa de Pago por Servicios. Ambientales-Hidrológicos – PSAH), Mexico	Scheme identified those benefiting from ecosystem services and found a mechanism through federal law for charging for 'natural capital'. Contracts with landowners were based on meeting conditions/ indicators that could actually be monitored (e.g. rates of deforestation via satellite photos) against a baseline scenario. Criteria used to set geographical priorities so that over-subscription of the scheme could be dealt with. In this case a points system was used to prioritise areas according to the value of environmental service, as well as the level of poverty and risk of deforestation.
Economic value of the Sourou valley, Burkina Faso – a preliminary evaluation	Apparent economic benefits accruing from a particular use (in this case agriculture) of a region's land and water resources may in fact be relatively insignificant if a comprehensive economic valuation of ecosystem services is conducted.

Payment for Environmental Services pilot project in Lake Naivasha basin, Kenya	Sustainable provision of ecosystem services can be achieved through changes in land-use practices and incentives to farmers that are both equitable and targeted at maintaining or enhancing livelihoods. Strong stakeholder partnership leads to more successful implementation. Necessary preconditions include: availability of baseline hydrological data; establishment of a strong business case; building of trust and commitment among stakeholders establishing a market mechanism – that stakeholders are easily able to engage with – for the selling and buying of ecosystem services. Appropriate and adequate capacity building of ecosystem service providers and beneficiaries strengthens implementation of PES projects.
Payment for Ecosystem Services (PES): Feasibility and Implementation in the Maloti-Drakensberg Transfrontier Project Area, South Africa	Improved management can shift destructive summer flows in periods of water abundance or excess, to the winter months when water is scarce and when value can be added. Management results in significant reductions in soil erosion, reducing the sedimentation of water infrastructure, improving productivity and increasing carbon sequestration. Watershed management may be one of the cheapest and socially equitable water augmentation options available to South Africa. Management costs vary – some catchments show that restoration and management is financially feasible with only baseflow enhancement being marketed, while other catchments require three services to be traded before management is financially feasible. Catchment management becomes increasingly feasible when more than one of the services is traded. Rural people can farm water, carbon sequestration and sediment yield reduction as complementary services to sound cattle farming.
Payment for Forest Environmental services (PFES): pilot implementation in Lam Dong Province, Vietnam	The identification and emergence of champions at all levels of the implementation process (national, provincial, district, and commune) was a key factor for success. The limited number of environmental services implemented under the pilot policy (water regulation, soil conservation, and landscape visual quality) reduced the risk of implementation failure. Despite the fact that extensive scientific/technical studies

	were carried out to value ecosystem services, the final payment structure also took into consideration the socioeconomic and socio-political context of the communities in question. Strictly adhering to the valuation studies, while scientifically robust, would not have guaranteed the uptake of the project and the backing of the community and payers. The development of the management mechanism was greatly assisted by local household participation in its design, implementation, and evaluation. The proper and equitable distribution of payments is contingent on the equitable and precise allocation of forest parcels to households. However, lacking a private land tenure system and integrated land-use planning system, the process of forest demarcation, allocation, filing, and approval in Lam Dong Province required significant time and money, at times impeding the proper and timely disbursement of payments to households. There was an issue of whether payments under PFES should be considered as being made from the state budget or whether they replaced the water-resource tax that hydropower plants had to pay. These and many other issues, connected to the innovative concept of PES, took time to resolve among various stakeholders. Establishing automated gauging stations in a relatively remote provincial river basin was a great challenge.
Conserving and managing forests as source of water for Fukuoka City, Japan	Good use of education and exchange programmes to foster interaction between beneficiaries and service providers.
Payment for Ecosystem Services and alternative livelihoods in rural China	The effectiveness of the scheme was increased by providing training and capital for villagers to pursue new (environmentally-friendly) sources of income

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FONAG – The Fund for the Protection of Water, Ecuador

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Type of tool: investments and fiscal measures for biodiversity protection
Issue: watersheds
Location: Ecuador, LAC

Introduction

The Fund for the Protection of Water (Fondo para la protección del Agua – FONAG) is a private trust fund established in 2000 for a period of 80 years and regulated under Ecuador's stock market law. In essence, the Fund is an example of payment for the environmental services provided by ecosystems (commonly referred to as Payment for Ecosystem Services or PES).

Challenge and objectives

FONAG works to ensure the provision of a *sufficient quantity* of water of *good quality* by supporting actions directed at protecting water resources, based on the principles of long-term natural sustainability.

FONAG focuses on the Upper Guayallabamba river basin, the Antisana river basin, the Oyacachi river basin and the Papallacta river basin which are crucial for maintaining the water supply to the Metropolitan District of Quito and its surrounding area. FONAG's area of operation covers some 5,025 km² and held 1.96 million inhabitants at the time of the 2001 census.

Oyacachi and Papallacta river basins

In order to avoid the degradation of these river basins, FONAG is supporting actions directed making the activities of local communities more sustainable but also more productive.

Antisana River Basin

Activities in the Antisana River basin are directed towards protecting the quality of water entering the Mica Quito Sur reservoir, part of the system that provides potable water to the city of Quito. The main problem in this basin is related to poor livestock management practices in surrounding properties, which cause water pollution, soil erosion and adversely impact nature conservation in the Antisana Ecological Reserve. Preparatory studies at an estimated cost of USD 22,000 are currently underway, with equal contributions by FONAG and TNC, and additional counterpart funding from the implementing institution.

The approach: how did PES help overcome barriers to dealing with the challenge?

Establishing a fund

A pilot project was set up in 1998, payments to FONAG began in January 2000 and financing of watershed protection projects was initiated in January 2002. The trust provides a stable, long-term financial mechanism, using revenues (interest and investments) derived from its equity to co-finance activities aimed at maintaining the hydrographic basins that supply the water needs of Quito Metropolitan District and its surrounding area of influence.

Establishing a clear mission, and vision

FONAG's Mission was established as: FONAG rehabilitates, cares for and protects water basins that supply water to the Metropolitan District of Quito and surrounding areas.

Vision: to be the mobilising agent that involves all actors in exercising their citizenship responsibly on behalf of nature, especially water resources.

A consensus and dialogue participatory approach

To lead processes and consensus through dialogue, proper decision-making, strengthening research and the appropriate use of technology to achieve integrated management of water resources in which active, responsible participation based on solidarity leads to sustainable water management.

FONAG implements programmes and projects that meet the institutional challenges of building a new 'water culture' (where the active and responsible participation of all stakeholders and actors creates a more just, shared and sustainable use of water resources with improved health and development outcomes) and achieving integrated water resource management.

Communities particularly targeted by FONAG programmes and projects include:

- Communities in the Cayambe-Coca Ecological Reserve (Oyacachi river basin)
- Communities in the Antisana Ecological Reserve (Papallacta river basin and La Mica Lagoon)
- Communities in the Cotopaxi National Park (Pita sub-basin of the Upper Guayallabamba)
- Communities in the Los Ilinizas Ecological Reserve (San Pedro sub-basin of the Guayallabamba)

The activities implemented by FONAG are the result of various consensus-based processes carried out among the participating institutions.

Collaborate with institutions

Through the Ecuadorian Centre for Agricultural Services (CESA), FONAG is seeking to conserve water resources, improve animal husbandry and agricultural practices, strengthen local resource management and provide access to financial services. All these components will be developed during an initial implementation phase lasting fifteen months, at an estimated cost of USD 78,000, with part-funding provided by FONAG and co-financing from The Nature Conservancy and CESA.

Among other practical actions, work is being done to genetically improve livestock herds living around the Oyacachi basins, through a campaign to vaccinate, identify and execute a programme to provide these herds with vitamins and rid them of parasites.

Implementing specific programmes and projects

These programmes and projects are carried out in FONAG's geographical area of operation (see below) with the participation of various community actors, local authorities, governmental bodies, non-governmental organisations, and educational institutions.

FONAG implements its programmes directly, conceiving them as a way of building processes that are capable of changing people's attitudes toward nature and encouraging responsible water management.

The *programmes* have a minimum time scale of 20 years and cover all six key areas of FONAG's activities:

- Water Management
- Site surveillance and monitoring
- Restoration of vegetation cover
- Environmental education
- Training in Integrated Water Resource Management (IWRM)
- Communication

The Water Management Programme has two parts: technical and social. The first aims to develop water management tools, while the second seeks to achieve better governance and administration of water resources. The technical work is being implemented by IUCN and the social component is led by the Fundación Futuro Latinoamerica with the support of the Tinker Foundation.

The *projects* are interventions undertaken by supporting institutions, communities, educational organisations and local governments. They are short-term, with a maximum duration of two years. There are currently 20 such projects covering all of the sub-basins within FONAG's area of operation. Of the institutional budget, 20% is assigned to these projects.

Financing and financial approach

The capital assets of the FONAG are composed of contributions from local businesses, private and international institutions.

Concerned with the conservation of water resources and committed to finding solutions for the problems resulting from inadequate management of these resources, the Metropolitan Water and Sewerage Company of Quito (EMAAP-Q) and the international environmental NGO The Nature Conservancy (TNC) entered into a contract establishing the Fund in January 2000. The Electric Power Company of Quito (EEQ) joined in May 2001; the private brewery company Cervecería Andina S.A. (now Cervecería Nacional S.A.) participated with effect from March 2003; Swiss Development Cooperation (SDC/COSUDE) from January 2005; and The Tesalia Springs Co. from April 2007.

Of FONAG's investments, 80% are allocated to developing and strengthening these programmes.

Specific projects are an integral part of FONAG's six programmes, which are led by like-minded institutions with co-financing provided by FONAG.

FONAG's financial development is illustrated in Figures 1 to 3 below. FONAG's success is based in large part on:

- A philosophy of modest but steady growth
- Limiting its financial support for programmes/projects to the revenue (interest and income on investments) derived from its equity capital
- Attraction of increasingly significant counterpart funding

By 2009 FONAG was making financial contributions of almost one million USD per year and leveraging counterpart funding to fund programmes and projects with total expenditure of nearly four times this amount.

Evaluation: economic, social and environmental benefits

FONAG is contributing to securing present and future water supplies for Quito. Through the fund, more than 65,000 ha of watersheds are now under improved management. Upstream farmers receive support for watershed protection programmes, as opposed to cash payments. More than 1800 people are estimated to have received increased economic benefits associated with watershed management and conservation.

Scaling up and lessons learnt from implementation

FONAG has served to inspire the development of similar schemes elsewhere in Latin America and beyond.

Lessons learnt

- Governments, NGOs (including international NGOs), development assistance agencies, the corporate sector and local communities can work effectively together on PES schemes if the benefits for all stakeholders are clear.
- Relatively modest expenditure can leverage much bigger overall investment through counterpart contributions.
- Restricting use of the fund to yields from interest and investments – NOT capital – means that the fund grew slowly but sustainably.
- Strong capacity building and communications/ awareness-raising components have been vital to FONAG's success.
- A stable, long-term financial mechanism provides the security, stability and sustainability needed for partners to feel confidence in participating in FONAG and enables FONAG to operate.

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Figure 1. FONAG equity yield 2000-2009 (USD)

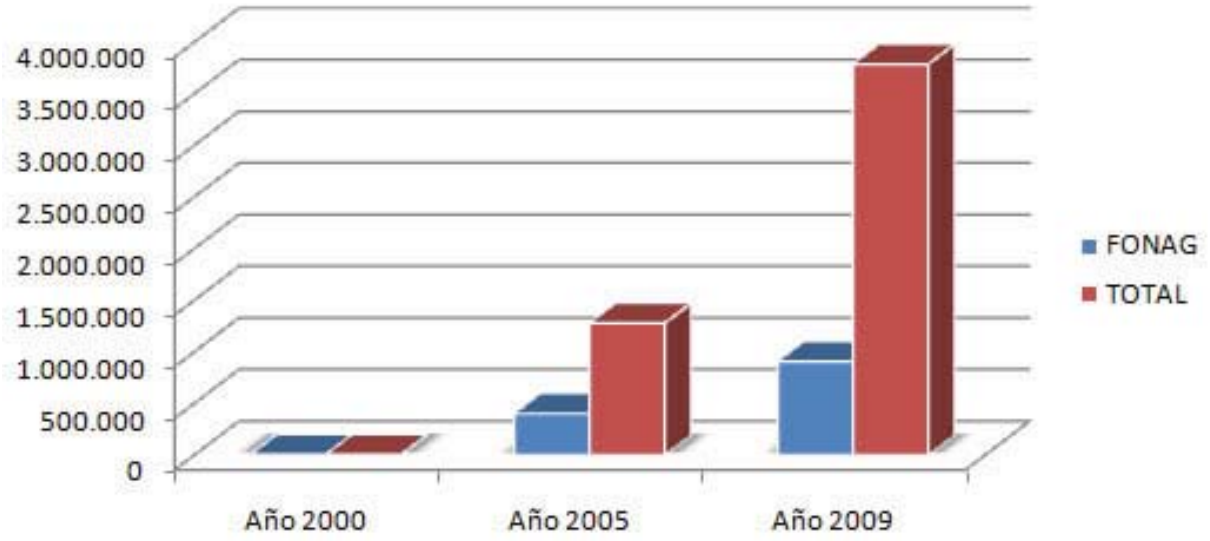
Year	Total equity	Revenue from equity (interest & investments)	Reserve fund	Total available	Yield (%)
2000	164.046	5.990	Not yet established	5990	3.65
2001	443.502	20.306	Not yet established	20306	4.58
2002	837.111	56.059	3.433	59492	7.11
2003	1.450.053	82.605	84.594	167199	11.53
2004	2.112.553	133.774	377.716	511490	24.21
2005	2.693.452	281.980	251.784	533764	19.82
2006	3.588.514	540.456	599.220	1139676	31.76
2007	4.193.784	467.123	96.434	563557	13.44
2008	5.162.206	1.014.447	26.480	1040927	20.16
2009	6.437.743	1.140.345		1140345	17.71

*A reserve was established in 2002 so that FONAG could be in a position to cover unforeseen but legitimate cost increases for projects already underway.

Figure 2. Programmes and projects funded (USD) – comparison of 2000, 2005 and 2009

Programmes & Projects	2000		2005		2009*	
FONAG Programmes	TOTAL	FONAG contribution	TOTAL	FONAG contribution	TOTAL	FONAG contribution
Water management	–	–	98,931	28,931	576,677	58,977
Site surveillance and monitoring	–	–	78,809	23,809	324,564	95,719
Restoration of vegetation cover	–	–	351,952	109,952	774,149	248,649
Environmental education	–	–	35,757	20,757	311,257	79,016
Training in IWRM	–	–	350,000		50,276	32,776
Communication	–	–	25,832	5,832	83,290	55,370
Programme support	–	–	36,091	16,091	1,082,266	49,728
FONAG Programmes subtotal	–	–	977,372	205,372	3,202,479	620,235
Community Projects	–	–	113,108	69,108	369,186	152,394
Operational management	690	690	136,560	76,560	119,026	52,318
FONAG administrative costs	5,078	5,078	51,770	51,770	97,350	83,350
Overall total	5,768	5,768	1,278,810	402,810	3,788,041	908,297

Figure 3. Steady growth in FONAG's investment in programmes and projects and the more rapid growth in counterpart funding leveraged (vertical axis, USD), comparing the situation in 2000, 2005 and 2009 (horizontal axis).



Payment for Environmental Services pilot project in Lake Naivasha basin, Kenya – a viable mechanism for watershed services that delivers sustainable natural resource management and improved livelihoods

Thomas Chiramba, Silas Mogoi and Isabel Martinez (UNEP), Tim Jones (DJEnvironmental)

Type of tool: investments and fiscal measures for biodiversity protection
Issue: watersheds
Location: Kenya, Africa

Challenge and objectives

Lake Naivasha is located in the Kenyan portion of the Great Rift Valley and has been recognised as a 'wetland of international importance' under the Ramsar Convention on Wetlands. The project is being implemented in the Malewa River basin (a sub-catchment of Lake Naivasha basin) situated in the Rift Valley and Central Provinces of Kenya. The project has consisted of three phases, beginning in 2006 with the project initiation phase (scoping and feasibility studies including hydrological survey, cost-benefit analyses, livelihood analysis, business case analysis, legal policy framework analysis). The implementation phases commenced in 2008, while the project has now entered its third and final phase – scaling up. The catchment of Lake Naivasha covers an area of approximately 3,400 km^2 and ranges in altitude from approximately 1,900 m to about 3,900 m above sea level. The project area covers the Turasha-Kinja and Wanjohi Rivers. Both are major tributaries of the River Malewa, which contributes 80% of the water that flows into Lake Naivasha.

Economic activities around Lake Naivasha include small-scale and large-scale agriculture, horticulture, ranching, tourism, fishing and geothermal power production, and pastoralism. Over 50 square kilometres of land around the lake is under intensive, commercial horticulture and flower farming. These activities provide livelihoods for over 500,000 people living within the basin.

Significant environmental threats emanate from poor land-use practices within the watershed, unregulated and excessive water abstraction for domestic and agricultural/horticultural use, weak policy enforcement, and population pressure on natural resources, water pollution and climate change. These have resulted in degradation of ecosystem services, economic losses, worsening poverty and reduction of biodiversity.

The approach: how did PES help overcome barriers to dealing with the challenge?

The goal was to develop a viable financial mechanism for payments for watershed services that delivers sustainable natural resource management and improved livelihoods and serves as a pilot and learning model for further expansion and replication.

Payment for Environmental Services (PES) is a market-based mechanism where land owners are rewarded by service beneficiaries. It is based on the premise that land owners undertake land use transformations that provide agreed ecosystem services. For these services, they are rewarded financially by the beneficiaries.

The role of intermediary institutions

WWF (WWF-Kenya) and CARE-Kenya are providing funding and coordination as intermediary institutions to develop Payment for Ecosystem Services – PES (the ecosystem service in this case being water) – as a market-based scheme for delivery of sustainable natural resource management and improved livelihoods.

Engaging partners

- Lake Naivasha Water Resource Users Association (downstream buyers)
- Lake Naivasha Growers Group (downstream buyers – the principal participant in the project among the buyers)
- Upper Turasha-Kinja Water Resource Users Associations (upstream sellers)
- Wanjohi Water Resource Users Associations (upstream sellers)
- Ministry of Agriculture
- Water Resources Management Authority
- Kenya Forest Services
- Provincial Administration

The partners therefore include ecosystem service 'sellers/providers' and 'buyers/users', as well as the principal national and local agencies involved in the regulation of these services.

Piloting and scale up

The project is designed to serve as a pilot and learning model for further expansion and replication.

Contractual benefit sharing

This linkage requires contractual agreements negotiated between the ecosystem stewards and ecosystem beneficiaries, making PES a unique benefit-sharing mechanism.

In this case, Lake Naivasha Water Resource Users Association (LANAWRUA – Lake Naivasha Growers Group currently being the major contributor to the Association) – on behalf of ecosystem service beneficiaries, notably the major floricultural/horticultural industry based around the lake – agreed to compensate small-scale landowners/farmers represented by the Upper Turasha-Kinja and Wanjohi Water Resource Users Associations (WRUAs) who forego some potential income to manage their land to provide good quality water to downstream users. The two WRUAs were provided with an initial financial incentive of USD 10,000, followed by a second payment of USD 10,000. The first incentive rewarded 470 farmers and second reward benefited 504 farmers.

Pilot site selection

Initial hydrological studies identified five degradation hot-spots. Two PES pilot sites were identified by considering a range of relevant factors for the Wanjohi and Turasha sub-basins.

Both pilot sites were regarded as highly degraded and of critical importance for biodiversity conservation. The Soil Water Assessment Tool (SWAT) model was applied to predict the impact of land-management practices on water over long periods of time. Other important elements of the selection process were livelihood assessment, cost-benefit analysis, marking and mapping of hot-spot farms (see below) and completion of an Environmental Impact Assessment. Potential buyers identified downstream were: Nakuru Rural Water and Sewerage Company, Naivasha Water and Sewerage Company, commercial horticultural growers (LNGG), Kengen geothermal electricity generation plant, Kenya Wildlife Service, the tourism industry in Naivasha and the Lake Naivasha Riparian Association.

Community sensitisation

Intensive awareness and sensitisation were conducted on-farm, in grass-roots meetings, seminars, workshops, field days, and public meetings (barazas) to enhance understanding and buy-in by the community and all stakeholders.

Hot-spot farm selection

Hot-spot farms were selected from target areas (i.e. areas of the two sub-basins where water quality/quantity problems had been identified) where initial sensitisation work on the concept, operation and benefits of PES had been conducted. From a technical viewpoint the farms selected as 'hot spot farms' were those on steep slopes where no soil/water conservation measures were already in place. To enhance buy-in from farmers, members of the Water Resource Users' Associations and opinion leaders guided the selection of target farms. All 565 farms in the selected pilot areas were mapped and marked.

Land management changes aimed at improving downstream water quality and quantity

- Rehabilitation and maintenance of riparian zones
- Establishment of grass strips/terraces to reduce runoff and erosion on steep slopes
- Reduced use of fertilizers and pesticides e.g. through integrated crop/pest management, use of new/improved crop varieties
- Agroforestry/tree planting – planting native trees and high-yielding fruit trees and cover crops for improved farm productivity, reduced runoff/erosion and increased biodiversity
- Training for livelihoods enhancement – training provided to farmers by Ministry of Agriculture and Horticultural Crops Development Authority on issues such as: (a) soil and water conservation techniques to boost farm productivity; (b) use of improved fodder storage techniques; and (c) use of new/higher-value crops such as improved potato varieties, tree tomatoes and apples.

Assessment and monitoring

Four river gauges were installed. On-farm monitoring and training in good agricultural practices aimed to ensure that the correct practices are being followed; on-farm follow up has been intensified on all farms.

Evaluation: economic, social and environmental benefits

- Land management changes. These were implemented at all participating sites.

- Water quality. Farmers along the target tributaries are reporting positive changes in water clarity though there is not yet empirical evidence for this (hydrological data collection is on-going).

- Livelihood improvement. Napier grass (*Pennisetum purpureum*), cock's foot (*Dactylis glomerata*) and Elmba Rhodes grass (*Chloris gayana*) used for conservation have increased fodder supply resulting in increased milk production and reduced pressure on forests from grazing. Planting of fruit trees and use of higher quality material for potato planting bring in additional income.

- Soil and water conservation. The structures introduced in the farms have dramatically reduced soil erosion and surface water run-off. Soil fertility has been enhanced by on-farm planting of appropriate trees.

- Forest cover. Apart from napier grass, the project focuses on planting trees on farm and along riparian areas. This has increased tree cover in the pilot areas with anticipated timber and non-timber products in future.

- Buyer's continued support. The project has continued to receive overwhelming support from Lake Naivasha Water Resources Users Association (mainly through LNGG).

Lessons learnt

- Sustainable provision of ecosystem services can be achieved through:
    - changes in land-use practices
    - incentives to farmers that are both equitable and targeted at maintaining or enhancing livelihoods
- Strong stakeholder partnership leads to more successful implementation
- Necessary preconditions include:
    - availability of baseline hydrological data
    - establishment of a strong business case
    - building of trust and commitment among stakeholders
    - establishing a market mechanism – that stakeholders are easily able to engage with – for the selling and buying of ecosystem services
- Appropriate and adequate capacity building of ecosystem service providers and beneficiaries strengthens implementation of PES projects

Present challenges and future plans

Present challenges

- Very high demand for change. The pilot farmers' on-farm benefits have triggered very high demand for change in the region. More than 300 additional farmers have joined the projects stretching the project resources.

- Unpredictable weather pattern. Climate change has disrupted the seasons resulting in adverse effects within the pilot area. Prolonged drought destroyed most of the conservation plants. This was followed by heavy rainfall and soil erosion.

- Degraded public lands. Non-point source sedimentation from degraded public land may threaten efforts to prove a business case for PES through water quality monitoring since such sedimentation may obscure the hydrological benefits arising from land-management improvements on the targeted hot-spot farms.

- Complex land ownership. There is much dynamic of land ownership in the pilot area due to inheritance, subdivision and use changes. These threaten the main pillar of the project, namely farm ownership.

- Low buy-in from buyers. Like other PES schemes around the world, especially those relating to watershed services, securing commitment from direct beneficiaries of those services is a challenge; especially in a situation where they are already paying a statutory water fee to the regulating body and therefore payment for PES appears as if it is a "double" payment.

Future plans

- Up-scale the scheme internally and externally. Significant long-term improvements at a sub-basin or whole-basin scale will only be achieved if all (or at least a large majority) of service providers are undertaking sustainable land- / water- use practices. This in turns implies the participation of a majority of water users to fund the provision of environmental services. Internally more sellers/ farmers will be engaged and already there is high demand from farmers who are not currently implementing the scheme. Externally, three other WRUAs will be considered for inclusion in the PES scheme following the results of feasibility studies.

- Engage more buyers and sellers. Consultative meetings will be organised to discuss with potential buyers their participation in the scheme. The selling point will be the opportunity to improve their business through investment in PES scheme, notably through reducing the cost of water treatment. It is anticipated that with improvement in quality, increased quantity will also be available to support business growth. Ecosystem service sellers will be mobilised through community sensitisation meetings involving the provincial administration. The selling point for them of PES will be the opportunity for improved livelihoods.

- Link to Reducing Emissions from Deforestation and Degradation (REDD). Through the PES scheme SMART approaches are/will be promoted to reduce emissions. For instance by promoting alternative renewable fuel sources (e.g. biogas, woodlots) and

energy-efficient stoves, these will reduce pressure on forest ecosystems. Payment for watershed services will be combined with a carbon finance scheme to generate multiple benefits.

- Institutionalise PES in the policy framework. Relevant policymakers will be engaged through dialogue and advocacy with the goal of PES schemes being integrated into natural resource management policies. The Water Resource Management Authority –WRMA is already engaged in the current project.

- Link the pilot farmers to markets. This will be done through facilitation of farmers to form producer and marketing groups. This will increase their bargaining power, market competitiveness, reduce transaction costs and therefore increase return on investment.

Conclusion

This case study demonstrates clearly how economic incentives for both ecosystem service buyers and sellers can be used to achieve significant land- and water-management improvements.

This is a pilot project, still at a relatively early stage of implementation and it is still too early to be able to quantify the gains in water quality/quantity or livelihood improvements achieved as a result of these management changes. However, the overall approach is one that can serve as a model for elsewhere in Africa and other developing country contexts, where conservation of soil, water and biodiversity must be seen to be delivering tangible livelihood benefits.

Rewards for watershed services in Sumberjaya, Indonesia

Delia Catacutan, World Agroforestry Centre

Type of tool: economic instruments in water management / investments in the protection and improvement of biodiversity
Issue: watershed management
Location: Sumberjaya, Lampung province, Indonesia, Southeast Asia

Introduction

Government's perception that uncontrolled deforestation and conversion to coffee farming on the slopes of Sumberjaya has led to increased soil erosion, threathening the operation of the newly constructed Way Besai hydropower dam and reducing water availability for irrigated paddy rice downstream has resulted in the eviction of thousands of farmers in the Sumberjaya forest between 1991 to 1996. On the contrary, studies by the World Agroforestry Centre (ICRAF) since 1998 in the area show that multi-strata coffee farms provide livelihoods to farmers and also control erosion in a way similar to that of natural forest. Therefore, coffee farming and forest protection should not be viewed as antagonistic practices. Multiple stakeholders have different knowledge and perceptions on forest and watershed functions which they use to justify their actions, but through negotiations, these differences have led to a new discovery of what stakeholders can do together to reduce conflict on the way the watershed should be managed. Rather than 'eviction', rewards schemes for watershed service provision was used to meet the multiple goals of coffee farmers, local government, district foresty, and the hydropower company.

Drivers of change

Since 2002, the World Agroforestry Centre (ICRAF) has been implementing the 'Rewards for Use of, and shared investment in Pro-poor Environmental Services' or RUPES project in Asia, covering China, Indonesia, Nepal, Vietnam, Philippines and India. RUPES is dedicated to developing practical environmental services schemes that can be adapted in different countries with different circumstances. It aims to integrate rewards for environmental services into development programs to alleviate rural poverty and protect the natural environment.

The environmental services (ES) discourse in Indonesia gained more attention after the RUPES Project organised a national ES seminar in February 2004. At the office of the Indonesian National Development Planning Agency (BAPPENAS), a seminar was conducted with participants from ES practitioners around the country. At the end of the seminar, the participants agreed to form a national level network, named 'COMMITTEES' to advance the thinking and application of ES rewards schemes to protect the environment and improve the welfare of poor farmers in upstream areas. Members of the COMMITTEES are currently working hand in hand with a number of partners to pass an ES policy in Indonesia.

At the field level, the Sumberjaya ES program is one amongst a number of pilot ES rewards schemes carried out by NGOs. Today, ES in Indonesia finds an increasingly significant place at the national discourse as evidenced by the increasing number of collaborative programs in both pilot and implementation levels involving various stakeholders including the government (especially the Ministry of Forestry), local NGOs, national and international research and development agencies.

About 40% of the 45,000 ha Sumberjaya watershed is protected forest. It has a history of conflict, including forced eviction which rooted distrust and tension between local people and various levels of government. From 1991 to 1996, thousands of farmers in the Sumberjaya forest were evicted by government based on their perception that coffee farming in the slopes has increased soil erosion, thereby putting the operations of the Way Besai hydropower dam at risk of sedimentation and low water levels. In 1998, ICRAF began its research to assess the impacts of multi-strata coffee farming on watershed functions, and found that this farming system provides good income for farmers and can control soil erosion in a way similar to that of natural forest.

In 2004, the RUPES project started facilitating local communities in understanding their important role in managing the watershed. Dialogues with local government officials, district foresters, local people and the Way Besai hydropower company were facilitated by RUPES staff. Using ICRAF's results from land use and hydrological studies, stakeholders understood that eviction and soil erosion should not be a consequence of multi-strata coffee farming – in that, watershed protection and coffee farming can be combined in a way that is not detrimental to the hydropower dam. Clearly, different stakeholders have different understanding about watershed functions, as well as different interests on watershed services and on the management of the watershed. Coffee farmers would want to continue cultivating the hillsides for their livelihood, whilst the Forestry Department and the Local Government wants control over the area and the hydropower company wants more water in the dam. The lack of secure land tenure by local people in the area was the basis for their eviction by the government, in favour of the hydropower dam. However, through the RUPES project, dialogues were facilitated to reconcile the differences in knowledge and expectations of multiple stakeholders; as a result, the stakeholders agreed to cooperate and use existing approaches or create new ways of rewarding local communities in their efforts to manage the watershed.

The approach to watershed management

The RUPES project is composed of three programs: the Community Forestry Program (HKm), *the* River Care Program, *and the* Soil Conservation Program. The HKm is implemented by the Local Forestry Department following the rules and regulations of the National Government's Community Forestry Program; whereas both the RiverCare and Soil Conservation Program are governed by Forum Committees—both receive technical advice and organizational capacity building to ensure that the contracts are complied.

1. Community Forestry Program (HKm)

To avoid eviction, the RUPES Project helped local communities gain access to the Indonesian Government's Community Forestry Program (HKm). The HKm Program provides farmers with conditional land tenure for forest protection. In exchange, farmers adopt environment-friendly farming practices and protect the remaining natural forest, thus ensuring that the land will continuously produce forest and watershed protection benefits. The RUPES project participated in dialogues with HKm administrators, making use of research results to argue that sustainable coffee farming could not be the main culprit of sedimentation in the river and the dam. With persistence and effective boundary spanning strategies, the HKm administrators eventually, approved the granting of conditional land tenure to coffee farmers in Sumberjaya. To date, the HKm Program has covered 70 percent of Sumberjaya's protection forests and involved nearly 6,400 farmers, protecting 13,000

hectares of forest land. The RUPES Project views the HKm as a non-monetary reward for farmers who provide environmental services. HKm represents a major success for farmers, who are no longer at risk of eviction.

A recent impact study of land tenure in Sumberjaya carried out by researches of the RUPES Project, Michigan State University, and the International Food Policy Research (IFPRI) found that community forestry permits:

- increased land tenure security;
- doubled the local land value;
- reduced corruption;
- increased income, mostly due to a reduction in bribes;
- increased equity, relative to local resources farmers have;
- promoted tree planting/agroforestry;
- promoted soil and water conservation; and
- gave farmers more reasons to protect the remaining natural forest.

2. River Care Program

The Way Besai hydroelectric company (PLTA) in Sumberjaya would need up to USD 1 million per year to remove the sediments from its reservoir. This is a huge amount of money that may not be necessary if they can keep sediments from reaching the reservoir in the first place. The RUPES Project set up a pilot project with one community and one sub-catchment area to develop a payment mechanism for reducing sediments through a "RiverCare" program. A Forum or Working team was formed at each sub-village consisting of hamlet administrators, community forestry administrators and mosque administrators. The Forum is used as a medium for capacity building, social networking and conflict resolution. The Forum Committee consists of the chief, secretary, treasurer, conservation service section, community development section, agriculture and economic section, and public work section.

In the program, RiverCare members work with RUPES facilitators and researchers to learn principles and practices related to soil and water conservation, as well as sediment monitoring and measurements. Facilitated by the RUPES project, a Conservation Agreement was developed by the RiverCare group and the Way Besai Hydropower Company. The Agreements include activities such as the following:

- Construction and maintenance of dams to retain sediments from forest, coffee garden, paddy field, foot paths;
- Diversion of waterway and construct limited ridging and sediment pits on coffee gardens to prevent erosion;
- Planting grass strips along potential landslide hotspots on coffee gardens;
- Installing water channels and PVC pipes to stabilise water flows.

'Conditionality' is the main principle in this initiative. The Way Besai Hydropower Company was committed to pay for water quality via sediment reduction in the dam, as long as the RiverCare group delivers the service. The terms of the Conservation Contract are outlined in the table below.

Payment schedule of operational cost	US$ 1,100 total Schedule of payment: 50 percent at inception 50 percent at two months contingent on performance
Payment as ES reward	Reducing sediment up to: • 30 percent—cash payment up to US$ 2,200 (Gunung Sari) or a micro hydropower plant with the capacity of 5000 watt with similar monetary value to Gunung Sari (Buluh Kapur); • 21 to 29 percent-- US$ 850 • 10 to 20 percent: US$ 550 • less than 10 percent: US$ 280
Duration and monitoring	One year with monitoring every three months; termination if 50% of the contracted activities are not completed by midterm monitoring.
Cancellation or non-compliance results in:	• Ineligibility for second payment installation • Purposively destructing public physical construction and properties • Friction and conflict among community members • Indication of corruption • *Force majeure* or natural disasters

3. Soil Conservation Program

Another reward scheme is through a soil and water conservation program. The scheme involves paying farmers for reducing erosion and sedimentation. The practices applied by farmers on their farms are terracing, sediment pit and strip weeding techniques.

The monitoring activity is conducted four times in a year. The first monitoring is done on the 3rd month after contract signing, followed by the 6th month, 9th month and at the end of the contract. The farmers receive cash payments in the amount of Indonesian Rupiah 1,600,000 ($160) per ha for a one year contract period.

Evaluation: economic, environmental and social benefits

Economic benefits

In all three programs, local people directly benefit from higher yields in the multi-strata coffee production system and cash payments from soil erosion control and sediment reduction. The payments may be small, but could represent an increment in household incomes.

Environmental benefits

All programs have a strong 'conditionality', which is essential in a contract-mediated ES reward scheme. The payments or rewards are conditional, subject to environmental performance in the area of forest protection, soil and water conservation and sediment reduction. The benefits to the environment are thus manifold. The HKm conditional land tenure scheme requires protection of remaining natural forest and adoption of sustainable coffee production techniques whereas the RiverCare and the Soil Conservation Programs involve soil and water conservation technologies to reduce on-and off-farm soil erosion and sedimentation in waterways.

Social/poverty alleviation benefits

Clearly, all programs have had positive social impacts. Because poverty is multi-dimensional, the conditional land tenure acquired by forest people was a step towards emancipation from poverty. Local people are no longer threatened from eviction, giving them a sense of protection and security for their livelihoods. On the other hand, members of the RiverCare program and farmers involved in the soil conservation program not only earn additional income from soil erosion control and sediment reduction activities, but also raise their profile and value from doing extra work for the community. More importantly, the local community gained respect from the Local Government, the Hydropower company, the forest department, and scientists for their contribution to wider society, and for having accepted the responsibility of being environmental stewards.

Lessons learnt from implementation

Why did the reward schemes work?

- Hotspot areas were identified through research, and expected environmental service outcomes are clearly linked to it. The cause-effect relation is thus clearly established.
- Stakeholders involved have good knowledge about the causes of soil erosion, the location of hotspots and how to tackle the problem.
- The contract has a clear conditionality – the rewards are linked to a specific service, which is sediment reduction and monitoring is done in a participatory way.
- The pilot program was oriented involving several steps such as identification of environmental problems, capturing local knowledge and understanding farmers' management options.

What did we learn?

- Good social mobilisation
- RES negotiation will succeed if the community appreciates its opportunity and their role and impacts as "ES seller".
- The communities should be involved in the scheme in a voluntary manner, and should understand their bargaining positions based on optimal threat and cooperation with others stakeholders.
- Community based institutions should have well-functioning structures in order to effectively support an operational RES mechanisms.
- Modifying the current policy criteria.
- It is important to consider the heterogeneity of biophysical characteristics (on soils, geology, etc.) and other landscape elements (footpaths, roads, landslides and river bank

collapse) in solving landscape problems. Policy responses should encompass various issues, tackle divergent sources of landscape problems, and address specific issues, rather than apply a 'single solution' fits all approach (e.g. reforestation).

Scaling up and relevance for developing/transition countries

The experiences of the three programs provide lessons to learn from, especially for forest contested areas in developing countries where poor people eke-out a living from small-scale cultivation and extraction of forest products. The experience in Sumberjaya suggests that reward schemes for delivery of environmental services are a better option than 'eviction' of forest people. On hindsight, misunderstanding of expectations from forest and watershed functions where eviction is used as an option could lead to serious damage. The experience is very relevant for governments who often have full control, but have limited capability to manage forests and watersheds. It shows that educating decision-makers and stakeholders with research-based information can lead to changes in attitudes and actions towards sustainable forest/watershed management. It also shows the business case for private-sector engagement in ES rewards schemes. Finally, the experience demonstrates that rather than coercion, provisioning environmental services can be secured through negotiated arrangements amongst the government, private sector, local people, and scientists with a shared understanding on the relations between land use and watershed functions as a first step.

The potential constraint for scaling up however, is the amount of research and information gathering needed to structure an ES reward scheme. Substantial data is needed to inform decisions and to agree on the conditions binding the ES contract. However, research collaboration can be developed by governments intending to initiate a PES program – they can also streamline relevant ministries and mainstream the PES concept in sectoral plans, and using common sense knowledge and available data, a PES program or policy can be designed at the national level.

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Payment for Forest Ecosystem Services (PFES): pilot implementation in Lam Dong Province, Vietnam

Thomas Chiramba, Silas Mogoi and Isabel Martinez (UNEP), Tim Jones (DJEnvironmental)

Type of tool: investments and fiscal measures for biodiversity protection
Issue: watersheds
Location: Lam Dong Province, south-east Vietnam, Asia

Introduction

Together with national and provincial partners, Winrock's Asia Regional Biodiversity Conservation Program (ARBCP), funded by USAID, developed a sustainable PES-based financing mechanism (entitled 'Payment for Forest Environmental Services – PFES – in Vietnam') explicitly designed to maintain biodiversity at a landscape level. The pilot approach supported natural resource management and conservation in ways that provided real economic opportunities to rural communities, using sustainable financing targeted at poverty reduction. PFES has provided local stakeholders with a significant role in managing those forest resources that contribute to their livelihoods, helping to ensure continuing local support for conservation. Hydropower and water supply companies are among the principal beneficiaries of the ecosystem services provided by forested areas and make the greatest financial contribution towards safeguarding those services. Funding has been provided by Asia Regional Biodiversity Conservation Program (ARBCP), funded by USAID's Regional Development Mission for Asia (RDMA) and coordinated by Winrock International.

The successful pilot project has led to a national scaling up of PFES (enshrined in a Prime Ministerial Decree) and to significant interest elsewhere in the South East Asia region in replicating the approach followed in Vietnam.

The implementing partners have been:

- Vietnam Ministry of Agriculture and Rural Development
- Lam Dong Province Peoples' Committee
- Lam Dong Province Department of Agriculture and Rural Development
- Lam Dong Province Department of Natural Resources and Environment

A Steering Committee was formed to oversee the development and implementation of a workplan, including the allocation of roles and responsibilities.

Challenges and objectives

Threats to biodiversity in South East Asia are largely driven by the imperative for economic development. One of the most pressing issues for conservation involves offsetting the costs to rural communities of protecting natural habitats rather than converting them to agriculture or other uses that provide immediate income generation. Biodiversity and watershed conservation services provided by forests are frequently undervalued and few markets exist where conservation benefits can be converted into tangible economic values that in turn influence human behaviour to promote conservation. As a result, economic

returns to be derived from protecting forests are not high enough to prevent their conversion to other uses, leading to biodiversity loss and degradation of water quality and quantity.

In Vietnam, as elsewhere in the region, insufficient funding for conservation serves as a major constraint to achieving biodiversity goals. Costs of managing protected areas are high, particularly those related to biological and enforcement monitoring. Management boards for protected areas rely on funding provided by Vietnam's central government. Few funding sources are available for conservation initiatives located outside protected areas, and reforestation programmes have not received enough funding to meet and maintain required results.

The approach: how did PES help overcome barriers to dealing with the challenge?

Planning

In 2006-2007, Lam Dong Province was supported by ARBCP to develop its first Biodiversity Conservation Action Plan (BCAP), establishing clearly defined landscape-level management objectives and targets for strategic biodiversity corridors to be achieved by 2020. The plan set out the framework for using funds generated by Payments for Ecosystem Services (PES) mechanisms to support and sustain the Province's priority conservation targets. The BCAP was the first in Vietnam to be fully coordinated with a province's socio-economic development plan.

Box 1 Provisions of the Payment for Forest Environmental Services pilot policy

Three categories of Forest Environmental Services (FES) were stipulated in the pilot policy:

- water regulation
- soil conservation
- visual quality of landscape

FES 'providers' were identified as local farmers, local farming households and local farming communities who had already been allocated forest land.

FES 'buyers' were identified as:

- publicly owned water and electricity utilities
- tourism operators

The pilot policy directed these buyers to pay for FES (water regulation and soil conservation, in the case of the public utilities) and landscape quality (in the case of tourism operators).

Based on preliminary studies conducted by Winrock, the pilot policy set payment levels at:

- 20 VND[1] per kilowatt-hour from commercial hydropower production businesses
- 40 VND per cubic metre from clean-water production businesses
- between 0.5% and 2% of annual revenue from tourism businesses.

Pilot phase

In 2007 ARBCP assisted the Vietnamese Ministry of Agriculture and Rural Development (MARD) to develop a pilot policy on Payment for Forest Environmental Services (PFES) in Vietnam – see Box 1. The pilot policy came into effect through a Prime-Ministerial Decision in April 2008 and implementation of pilot testing activities in two provinces (Lam Dong in the south of the country and Son La in the north) took place between January 2009 and December 2010 under the overall responsibility of MARD. ARBCP led implementation in Lam Dong Province, while activities in Son La Province were supported by the German bilateral cooperation agency GTZ (now GIZ).

Project implementation preparations

The preparations and process for implementing the pilot PFES policy in Lam Dong Province included scientific studies, national and local awareness raising efforts, and provincial capacity building and training activities. A national PFES Steering Committee was established and a two-year workplan was finalised by Lam Dong Province's Department of Agriculture and Rural Development (DARD).

The Dong Nai river basin (see map, Figure 1) was chosen as the river basin from which to select pilot sites because:

- It possessed the necessary conditions to directly support conservation and development objectives set out by the Government of Vietnam in the BCAP;
- The high demand for watershed services from Ho Chi Minh City and surrounding urban industrial parks gave PFES mechanisms in the Dong Nai basin the best chance of success; and
- The area's proximity to major tourism markets offered opportunities to turn demand for biodiversity conservation services into tangible economic incentives.

A spatial assessment was conducted to determine the level of economic threats in priority conservation areas of the Dong Nai river basin and two macroeconomic assessments were carried out to understand the rate and direction of likely changes under future development plans. Based on the information available, two focal areas – Da Teh and Da Nhim (see map, Figure 1) were identified as suitable pilot sites. Both sites adjoin National Parks and lie along a forested landscape corridor of strategic importance for national biodiversity conservation goals.

Box 2 Public awareness

Throughout the two-year implementation phase, the provincial authorities and the Forest Protection and Development Fund (FPDF), supported by ARBCP undertook a major public information campaign on PFES, including installation of poster panels in four districts, display of more than 200 small billboards at major tourist sites and some 40 large roadside billboards, and distribution of more than 14,000 brochures, as well as convening meetings and workshops for local stakeholders.

The FPDF also launched a VND 438 million multimedia publicity programme in September 2009, which disseminated information on PFES through television and radio in Lam Dong

Province.

In addition, MARD and ARBCP developed a 30-minute video on PFES implementation – including interviews and discussions with national, provincial, and local PFES implementers – that aired on national television and featured at inter-ministerial and other key national meetings.

It is estimated that more than one million residents in the Dong Nai river basin received information about PFES and biodiversity conservation through provincial and national media coverage. Transmissions were timed to ensure the widest possible viewing among farming communities.

Protection contracts

In April 2009, the Steering Committee and Lam Dong Province People's Committee, determined that Da Nhim commune would be the first pilot site to enter into forest-protection contracts.

ARBCP carried out an initial forest valuation study for the Da Nhim watershed to provide baseline estimates of the tangible economic value of two key environmental services provided by intact forests, namely water regulation and soil conservation. This valuation study was instrumental in securing the confidence of policymakers with regard to setting payment levels to environmental service 'providers'.

Two hydropower companies, two water-supply companies and various tourism businesses were identified as buyers of Forest Environmental Services (FES). As determined under the pilot policy, the hydropower companies were required to pay VND[18] 20 per kilowatt-hour into a specially established Lam Dong Forest Protection and Development Fund (FPDF). Water supply companies had to pay VND 40 per cubic metre, while tourism companies contributed 1% of their annual gross revenues.

Early in 2009 hydropower, water supply and tourism businesses signed Memorandums of Understanding committing payments of USD 3.4 million to protect more than 220,000 hectares of forests and the ecosystem services they provide. By the end of the pilot implementation phase in December 2010, a total of approximately VND 108 billion (over USD 5.5 million) had been paid into the PFDF, which is overseen by a governing board composed of national and provincial authorities and monitored by independent auditors.

The FPDF and Lam Dong Province concluded forest protection contracts with five small farming communities, involving 218 contracted households, for undertaking specific forest protection activities covering 4,795 ha of forest in and around Da Nhim commune, starting with a trial period of three months. Extensive preliminary studies had been undertaken to assess how to set PFES payments to service providers based on forest quality and threat levels, ultimately employing the concept of a 'K coefficient'[19]. However, pilot communities in

[18] In January 2009 (start of project implementation) 100 Vietnamese Dong (VND) was equivalent to just over half of one United States cent (USD 0.005).

[19] The national pilot policy on PFES provided guidance for applying a coefficient (the 'K coefficient') to determine the relative value of different forest areas based on an average of four factors: forest type,

Lam Dong Province elected to keep the payments consistent on a 'per hectare' basis, to assure equitable payments and thereby avoid possible conflicts. Payment levels were initially set at between VND 270,000 per hectare per year (/ha/yr) for Dai Ninh watershed and VND 290,000/ha/yr for Da Nhim watershed. These payments rose to VND 350,000/ha/yr and VND 400,000/ha/yr, respectively in 2010.

Payments

According to FPDF's report of January 2011, PFES payments were made to 22 Forest Management Boards and forestry businesses and to 9,870 households during the lifetime of the project. Contracted forest protection activities covered nearly 210,000 ha of forest. In 2009 the average household payment was VND 8.1 to 8.7 million (approximately USD 440 to 470), rising to VND 10.5 to 12.0 million (approximately USD 540 to 615) in 2010. These payments are around four times higher than forest protection payments received under former national government policies.

Monitoring

With support from ARBCP, Lam Dong Province established a watershed monitoring system in sub-catchments of the Da Nhim watershed. This action supports the scientific premise that effectively maintaining and managing forest cover will reduce soil erosion and enhance water regulation, and in turn reduce future production costs for hydropower and water supply companies.

Evaluation

A mid-term evaluation was conducted and submitted to the Prime Minister early in 2010. In general, it was noted that the pilot policy was being implemented successfully, with payments made by the payers and received by the communities providing the forest protection service.

The income of households involved in the implementation of the policy was shown to have increased significantly. PFES payments were becoming an important source of income for poor households, especially those of ethnic minorities. As a result, forests in the pilot areas were acknowledged to be better protected, with the incidence of violations and encroachment reduced significantly. According to the report, businesses benefiting from forest environmental services understood that PFES was an input investment that fosters sustainability of their own business operations.

Scaling up

On September 24, 2010, the successful implementation of the pilot PFES policy in Lam Dong Province during its two-year trial culminated in an announcement from the Prime Minister of Vietnam that a National PFES Decree had been approved. The PFES Decree transforms

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K_{LR} (protection category/special use/production); quality of forest, K_{CLR} (rich/moderate/poor/secondary); origin of forest, K_{NGR} (natural forest/planted forest); and human impact, K_{TD} (near road or residential areas,/remote forest area). The K coefficient = (K_{LR}+K_{CLR}+K_{NGR}+K_{TD}).

the way forests are viewed and managed in Vietnam, providing a measure of assurance that critical forests, and the ecosystems services they provide, will be protected into the future through the scaling up of PFES nationwide. This regionally and globally significant achievement serves as a model for other countries in South-east Asia struggling to find economically viable approaches to support biodiversity conservation.

Vietnam is now developing as a centre of excellence, from which other countries in the region could learn about implementing PES mechanisms. As one example of this, the Minister of Environment of Cambodia has requested support in the development of a similar PES policy in Cambodia.

Lessons learnt from implementation

Lessons learnt during implementation of the pilot PFES policy were manifold. They not only informed the shape and direction of the pilot project itself but will also assist the Government of Vietnam in effectively implementing the PFES Decree nationwide. Implementing such an innovative mechanism also involved many challenges. This section provides an outline of these, as well as lessons learned in overcoming the challenges.

- The identification and emergence of champions at all levels of the implementation process (national, provincial, district, and commune) was a key factor in the success of the pilot policy.

- The limited number of environmental services implemented under the pilot policy (water regulation, soil conservation, and landscape visual quality) reduced the risk of implementation failure and made the pilot policy easier to approve. The policy also concentrated the learning effort entirely on two pilot areas.

- While studies were undertaken to determine the K coefficient for PFES payments, Lam Dong Province elected to keep the PFES payments consistent across all areas on a per-hectare basis, regardless of forest quality and degree of threat. This occurred because the communities involved wanted an equal distribution of payment, and saw the K coefficient as a source of potential social discontent. Nevertheless, if these payments are to be effective in encouraging communities not only to keep forests intact but to improve their quality through sustainable land management practices, the K coefficient will have to be employed in due course.

- Despite the fact that extensive studies were done to value the ecosystem services (as well as to determine the K coefficient), the final payment structure also took into consideration the socioeconomic and socio-political context of the communities in question. Strictly adhering to the valuation studies, while scientifically robust, would not guarantee the uptake of the project and the backing of the community and payers.

- Lam Dong Province implemented a number of measures to raise public awareness of forest values and to impart information on the PFES pilot policy to related departments, authorities, companies, and communities. The most effective way to raise the awareness of the community and households was deemed to be through village and/or commune meetings and information from the Forest Management Boards (FMBs) during preparation of forest protection contracts. For the paying companies and institutions, the

flow of data and information through formal channels involving national and provincial authorities and the company/institution concerned was the most effective way to raise awareness.

- The development of the management mechanism was greatly assisted by local household participation in its design, implementation, and evaluation. Local stakeholders suggested that payments through the FMBs would be most effective because they could track the payments and have a forum to resolve disputes.

- The proper and equitable distribution of payments is contingent on the equitable and precise allocation of forest parcels to households. However, lacking a private land tenure system and integrated land-use planning system, the process of forest demarcation, allocation, filing, and approval in Lam Dong Province required significant time and money, at times impeding the proper and timely disbursement of payments to households.

- There was an issue of whether payments under PFES should be considered as being made from the state budget or whether they replaced the water-resource tax that hydropower plants had to pay. These and many other issues, connected to the innovative concept of PES, took time to resolve among various stakeholders. (During the pilot implementation companies paid both the water resource tax and PFES monies.)

- Establishing automated gauging stations in a relatively remote provincial river basin was a great challenge. The choice of either relying on manual measurements of water flow, discharge, and sediment or fully automated systems (or something in between) needs to be made after taking full consideration of the institutional and technical capacities of all the actors that will be involved in monitoring.

- To increase the robustness of the existing monitoring approach, including the four gauging stations, a comprehensive monitoring system based on a watershed analysis, a system of sediment fences to measure sediment yields at the sub-catchment level, and depth surveys in the reservoir could be employed.

- To support monitoring of PFES mechanisms nationwide under the new PFES decree, it will be essential for the Ministry of Agriculture and Rural Development on one hand, and the Ministry of Natural Resources and the Environment on the other, to collaborate more effectively, to harmonise efforts, and to clarify roles.

- Setting up the PFES pilot policy and implementing it appropriately required the collaboration of many disparate stakeholders at national and provincial levels. As such, subordinate technical agencies did not always work closely together or in a timely fashion, resulting in slow implementation, especially in allocation of the budget to the province.

- Key to the success of the valuation studies was the involvement of the Da Nhim Hydropower Station technical staff. Their involvement in the design and implementation of the valuation studies assured that relevant research questions were being asked; as a result, they were better able to articulate the results to policy decision-makers.

- Although increased forest patrols through the forest protection contracts raised the likelihood of detection of illegal logging, the entire enforcement system should be evaluated to determine the likelihood of arrest, successful prosecution, judgments, and penalties paid in cases where illegal activity can be proved.

- To implement the recently issued national PFES Decree, it is important to promote the Lam Dong Province PFES pilot area as a centre for learning, sharing, and improving the PFES mechanism for the whole country.

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5. The contribution of water technology to job creation and development of enterprises

Karl-Ulrich Rudolph[20]

"Green technologies can contribute to green growth because they have the potential to create new business opportunities, markets and jobs. They can boost water and energy use efficiency and contribute to achieving the Millennium Development Goals and building the green economy. Innovative water technologies can increase the amount of water available for drinking, agriculture, and manufacturing and can allow us to use water more efficiently. This can be done by technologies in areas such as water resources assessments, reduction of water losses, waste water treatment, efficiency of water utilities, bio technologies, etc.

Technology development – if combined with public awareness – can also contribute to decreasing water footprints through increased conservation, reuse and recycling, and greater efficiency in most water using sectors, particularly agriculture. This can enhance overall poverty reduction and socio-economic development.

Research and development (R&D) and innovation are central to the green economy since they can reduce the costs of existing environmentally sustainable technologies and deliver the new technologies that are needed to advance efforts to cut emissions, reduce waste and increase resource efficiency. In both developed and developing economies, innovation plays a critical role in generating employment; enhancing productivity and growth; increasing energy, carbon, water and material efficiency; improving performance of goods and services and creating new markets and jobs through knowledge creation and diffusion."

Information Brief: Technology, UNW-DPAC

Technological challenges for green growth in the water sector

The challenges to implement advanced and more efficient water technologies and management have been highlighted in the Sick Water Report of UNEP and UN-HABITAT (2010), especially for urban areas:

"*Already, half of the world's population lives in cities, most of which have inadequate infrastructure and resources to address wastewater management in an efficient and sustainable way. Twenty-one of the world's 33 megacities are on the coast where fragile ecosystems are at risk. Without urgent action to better manage wastewater the situation is likely to get worse: By 2015, the coastal population is expected to reach approximately 1.6 billion people or over one fifth of the global total with close to five billion people becoming urban dwellers by 2030. By 2050, the global population will exceed nine billion.*"

The combination of population growth, rising water consumption, improvements in public health and welfare, rapid urbanisation (causing problems like contamination of raw water

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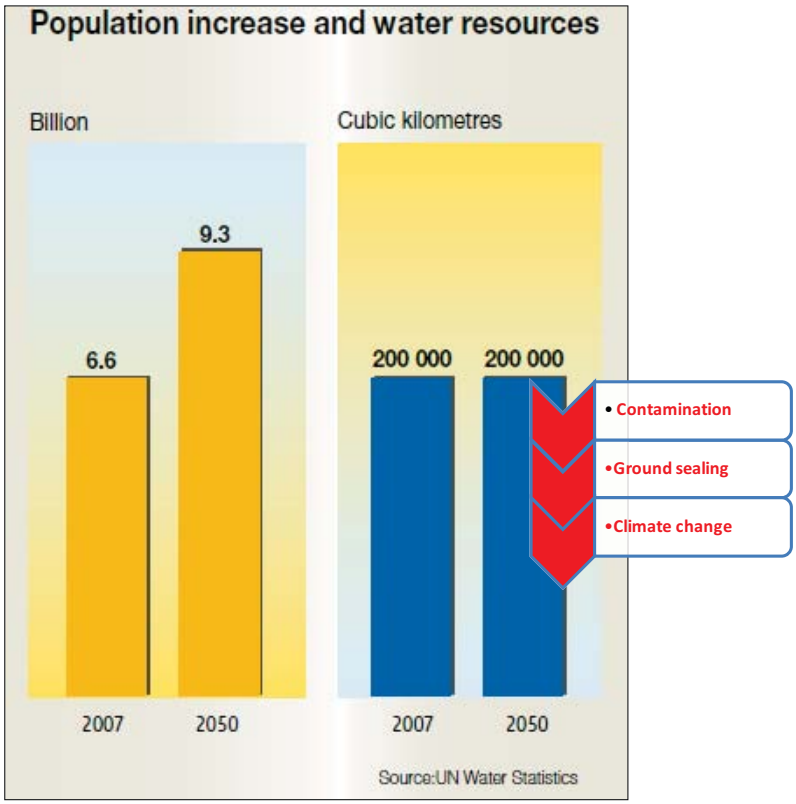
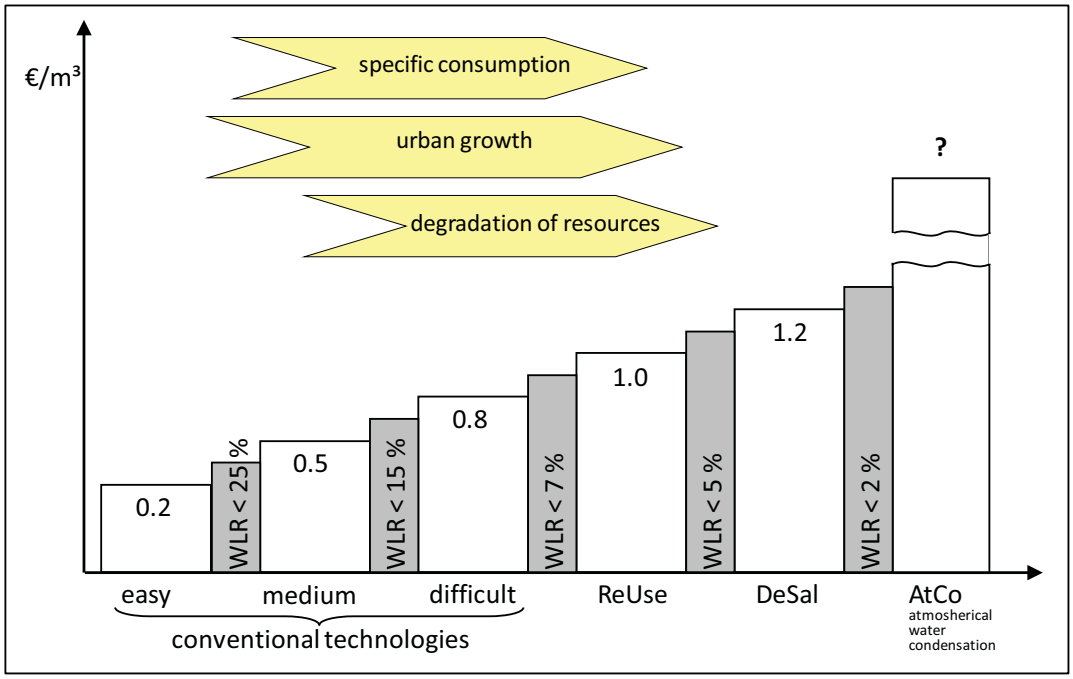
resources, widely spread land sealing with prevention of natural groundwater recharge), and the impacts of global climate change, will undoubtedly lead to more pressure on politicians and industry to resolve water problems (see figure below).



Water supply is a regional issue and shortages depend on location and time (seasons). This stands in contrast to energy supply, where problems (e.g. greenhouse gas emissions) are not related or limited to particular regions.

Water demanding agriculture, industry and settlements should (preferably) be located wherever cheaper water resources are available – from the view of water management. However, there are often other and more dominant factors driving spatial planning, meaning that it is impossible to prevent water intensive activities in arid areas or in urban areas which are short of water.

The need for improved technologies to expand water supply production and enhance water efficiency (the latter can be understood as driver of the green growth) is visualised in the following figure "Hierarchy of Water Production Costs".



The higher the costs of water production are, the more water saving measures, water loss reduction (WLR), and sophisticated water recycling technologies become profitable. WLR, selected for the figure above, is one important method within a broad toolkit to enhance water efficiency.

In locations where water production is easy and cheap (e.g. in towns with clean mountain water which needs no pumping to reach consumers), it may well be acceptable to tolerate water losses of 25 %. As soon as water production has to pump deep groundwater or purify contaminated raw water, requiring significant technical effort, water loss should be reduced and the economic optimum might range between 15 % and 7 %. In water scarce locations, conventional water production will need to be accomplished with more expensive technologies, like water reuse (wastewater re-cycling resp. down-cycling) and brackish-water or seawater-desalination. Under such circumstances, water loss rates above 5 % would not be feasible, economically. In cases with very high water production costs (like for supply-water condensed from the air, atmospheric water supply), the water losses should be as low as around 2 % (about the very best benchmark currently achieved in water distribution networks in Germany, where the national WLR 2010 is reported to be 6.8 %).

Considering the effort and status of WLR in many countries worldwide, one could say that the real value of water and water utility is not reflected appropriately in day-to-day water operations, and that there seems to exist a great potential for profitable WLR measures in many places.

Besides solutions contributing to water efficiency (i.e. efficiency in water consumption, such as water saving technologies and water demand management, water loss reduction, water reuse, utilisation of unused water resources such as rainwater harvesting, etc.), there are technological challenges contributing to non-greentech growth. Examples include seawater desalination technology which requires considerable energy consumption, as well as oil-, coal- or gas-powered, or high-energy consuming water reuse technologies (e.g. multi-stage

membrane technologies with reverse osmosis). However, even for these technologies, a trend towards greentech is happening (e.g. solar-powered desalination).

Another issue is improved welfare leading to water consumption in the "health and wellness sector" associated with a wide range of technologies from necessary medical applications to luxury applications, such as private pools and spas in arid and water scarce settlements. This field of water consumption bears a "green image", but is often accompanied with extensive water use and cannot be regarded as "green growth", at least not in water scarce locations and seasons.

Overall, the technical challenge in the water sector is advancing a multi-coloured growth, with strong elements of green-growth. Depending on market prices and the political costs of raw water resources and environmental pollution through wastewater discharge (which is very much a matter of governance and law enforcement), the powers of the market (which are stronger than political talking, in the long run) will focus either on GREEN or UNGREEN growth.

The role of the water sector regarding green growth is ambiguous, due to the fact that the sector is incorporating both strong drivers and strong barriers for green growth business development.

Value-wise, the water sector is less important (in nearly all countries, worldwide) than the power sector, the IT-/communication sector and (in industrialised, fully developed countries) strong industrial branches such as automotive. Furthermore, within the water sector, water supply is definitely stronger, value-wise, than wastewater and sanitation. This may contradict the importance that water supply and sanitation certainly has for the survival of deep land economies. And, it may be a strong contradiction to official statements from scientists, NGOs and politicians. Nevertheless, it is a fact that much more is paid for power, IT and cell phones in many countries, as well as in many slum settlements, than for water and sanitation.

Technology-wise, there has been huge progress in the development of new, adapted technologies in the water sector. Many of these are "collateral gains" from higher-valued sectors, like membrane technologies (first applied in industry and marine technology), IT/automation (most hardware and software originally developed and applied in higher-valued fields of business asset management etc.) or high-tech bio-technologies (many coming from organic chemistry or the pharmaceutical industry).

Barriers for technology in the green economy

Technological innovations may have unprecedented good or harmful impacts in the future and accountability for the harmful impacts is often lacking. Much depends on the framework in which it is developed and disseminated. More could be done to assess social, environmental or other impacts more thoroughly and holistically before they are embraced, disseminated and promoted on a large-scale.

The technological development cycle does not exist in a vacuum. It is influenced by government priorities, market interests, social trends and risk thresholds, and power dynamics. As a result, policies and market mechanisms do not necessarily direct

technological innovation to areas or people who need it the most or to advance sustainability.

If technological development is not regulated, the current uneven technological capabilities may aggravate existing inequalities between the developed and developing world and perpetuate polarities of have and have not's.

Structural or policy obstacles to technology transfer and dissemination due to intellectual property barriers, lack of investment in research and extension, lack of funding, may lead to regional disparities in access, potentially aggravating the current income gaps. Such gaps in access already exist, with small pockets of private sector interests holding the majority of public-interest patents and intellectual property rights.

Cultural obstacles to technological uptake, such as the resistance to the recycling of sewage water for drinking, can delay the adoption of technology. WWDR4

Technology is often seen as a proxy for progress and has sometimes raised unrealistic expectations as a cure-all for what ails society. More consideration could be given to broader implications of its development and dissemination – or lack thereof in some sectors. (SG Panel)

Inadequate governance and decision-making systems may create market distortions towards inefficient technologies, for example through inappropriate subsidies or a lack of long-term vision. (WWDR4)

The focus of investments is too often exclusively on those areas that will make returns at shorter term (i.e. specific renewable technologies that some governments favour more than others with specific subsidies). (UNECE)

The current economic and financial crisis lowers the financial potential of many countries to implement innovative water technologies. (UNW-DPC)

To understand the barriers to green growth in the water sector, it is necessary to highlight the specifics of the water sector, especially those in the DDM (donor-driven markets; in contrary to the CDM, customer-driven markets).

Water sector specifics	Greentech as a "state-guaranteed market"
The water sector (in the utmost of all countries) is state-guaranteed (especially wastewater, sanitation, which cannot survive without enforcement of environmental standards).	According to environmental standards set and enforced by the state (e. g. wastewater treatment plants for natural water body protection), greentech can be profitable or not.
The water sector (in utmost all countries) is state-regulated (the state defines which standards, which rules, which organisational structures, which technologies are admitted to that market).	Wastewater treatment is seldom serving the final beneficiary (this would be the water consumer, not the municipal utility or so, asking for private technology providers, operational services etc.).
The water sector is dominated by public entities (only 5 to 10 % of water services are provided by private industry, nearly 98% of water resources worldwide are owned, governed by the public).	Water greentech is working mostly for public customers (municipalities, water associations, municipal companies).
Due to the "natural monopoly" of network-bound infrastructural services (supply or disposal), there is no, little or limited competition.	Greentech providers have to obey public procurement procedures (in developing countries strongly influenced through donor banks).
Water tariffs, wastewater charges are no "real" prices, due to the lack of competition under the economic balance of supply and demand.	Greentech provider is mostly a contractor in a service market fed through state-set “prices” (water and wastewater fees, solid waste charges, carbon credits, subsidies for regenerative energies, etc.)
The need for better water services is not the same as the demand for better water services.	Wherever the public water utility does not fulfil the demand, customers who can afford to do so, seek other “unofficial” services.
There is a great difference between customer-driven markets (CDM) and donor-dominated markets (DDM) (the latter existing especially in developing countries).	Greentech in DDM is pioneering, but in CDM it is usually more efficient and financially sustainable.

Furthermore, greentech is seldom a "stand-alone-business":

- Sometimes, environmental protection is the main purpose of a business (e.g. a sewage sludge incineration plant)
- More often, environmental protection is one of several purposes of an investment (e.g. for a solid-waste-fed combined power plant)
- Very often, environmental protection is just side-purpose of an investment (e.g. for energy- and valuables-recuperation from wastewater).

The approaches

The importance of success stories

Taking into account the needs in the day-to-day operations of water utilities (which must provide reliable and safe, continuous water services and must try to avoid risks) and taking into account political decision-makers governing the water sector and local utilities (who want to be re-elected and tend to avoid to introduce promising technologies and solutions unless all related political risks are eliminated), it is obvious what the water sector needs.

Green growth must be explained, yes, but of greater value than general explanations and arguments are success stories from locations, situations, site-conditions, and cultures that seem comparable or transferable to the case under discussion.

Considering exceptions

There may be some important exceptions, such as: (1) biological water process technologies, such as the activated sludge process, forest removal, algae production or no-dig-pipe rehabilitation with robot-driven underground machines; and (2) the anaerobic process technology for biogas generation from organic waste. These technologies have been developed predominantly in and for the water and sanitation sector, with a spill-over of inventions and technical progress to other sectors of industries.

Learning from other sectors

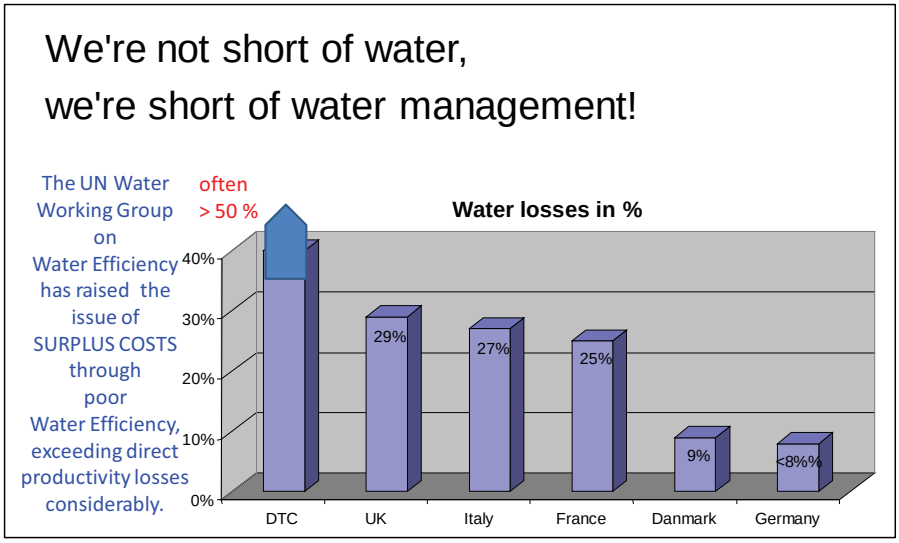
Water technology researchers, project developers and project implementers may be advised, in general, to have a closer look at other sectors of industry that are more technologically developed than the water sector, such as: (1) network construction and management for precious chemical gases; and (2) the technological set-up of the supply change in the automotive industry, such as monitoring and control systems in industry.

Technology choice

In the past, as long as water was not scarce, it has been reasonable to apply low-tech plus low-cost technologies in the water sector, even when neglecting certain negative side effects like secondary contamination (such as emissions of volatile organic compounds from water plants) and energy consumption (such as for robust pumps or aerators with limited efficiency, but easy maintenance and reliability, and cost-efficient in times when power was cheap).

Nowadays, as the transition to greentech is needed and becomes increasingly economically viable, there is a lot to do in the water sector.

The following figure highlights the gap between the current situation and the situation which should be realised in future, illustrating with the example of water loss.



There are huge deficits, especially in the developing and emerging countries. This also means there are huge opportunities to develop green business when moving from low to high water efficiency.

International cooperation and local collaboration on research and development (e. g. through networks or clusters) contributes to developing, absorbing, adapting, nurturing and diffusing innovation and green technologies.

One example, well known in the water and sanitation sector, is the progress in the use of small scale biogas plant technologies for rural farm estates, delivering gas for cooking and heating. This could not have happened without research collaboration in process and tank construction technologies, including international as well as local players, and strongly supported through multi-lateral donors for implementation.

The least developed countries' early stage of industrialisation offers avenues for leapfrogging and adopting technologies which offer greater energy and resource efficiency. They can adopt new and state-of-the-art technologies.

One very important example is the advances made in analysis technology for metering water toxicity on-line to locate harmful substances like pesticides, hormones, heavy metals and all kinds of non-degradable xenobiotics. Even though clearly high-tech and expensive, the analyser can bring enormous savings (a) for factory owners to detect and eliminate spill-overs of precious chemicals (e.g. in factories producing or mixing chemicals for agriculture) and (b) for environmental monitoring, to eradicate hazardous pollution near-to-source.

The experience with information and communication technologies is revealing of the capacity of poor countries and poor communities to achieve a jump in the technological development process"

One good example, although under political controversy, is the development and implementation of computer based remote controlled pre-paid systems technologies, allowing water utilities to serve poor income zones, without having to provide water without revenues from tariff payment, and without powers to prevent excessive waste of water. Pre-payment systems allow the limiting of free water service to e.g. 6 kl per connection and month.

Lessons learnt from the case studies

Two general mechanisms can be observed, which might be valuable elements for building a strategy for green business development:

1. Political governance and donor finance have been able to open up opportunities to unlock greentech development potentials, for example launching pilot projects for water loss reduction under a public-private partnership scheme, generating savings for the benefit of the utility which exceed the expenses (even though, due to low water tariffs, the utility has not yet reached the level of financial sustainability).

2. Greentech developments have generated technologies which have proven strong enough to overcome down barriers and governance-deficits well-known in the water sector. One deficit is the huge gap between environmental law and the environmental situation, as can be found in many developing and transition countries due to poor law enforcement. One example of technology which has been able to overcome this challenge is the online monitoring of wastewater effluents, with real-time data transmission preventing manipulation in sampling and analysis data, thereby increasing transparency in countries with poor law enforcement. Another example is decentralised technologies for water treatment and wastewater reuse, allowing for small-scale investment and development outside of fixed network structures, setting a strong benchmark in water and economic efficiency by producing "virtual competition" to non-efficient utilities. (The author has seen hotels operating their own small water supply after the public utility had failed to provide services, with membrane plant, greywater reuse and stormwater harvesting, and at a level of managerial and technical efficiency the politicians managing the utility could never achieve).

As a general, overall conclusion, it seems justified to say:

1. In this world, there is no lack of water resources; there is a lack of water management. Once water efficiency levels are equal to good technical practice, most regions suffering water scarcity will find themselves sufficiently served.

2. Subsidised water tariffs suppress green growth. From the author's view, it would be wise to subsidise the poor, not the water tariffs.

3. Green business needs business structures. There is a need to transition from charity to investment, including PSP options, to unlock potential and meet the demand for greentech-based water sector development.

All of the above statements may have to be differentiated and modified for implementation on a case by case basis, depending on political, cultural, regional priorities and conditions.

Web-based System for Water and Environmental Studies

Dr. Hani Sewilam, UN-Water Decade Programme on Capacity Development (UNW-DPC)

Type of tool: information technology / education and capacity development for providing the green market with qualified personnel
Location: MENA (Middle East and North Africa) with main focus on Egypt

Introduction

Egyptians have been managing the Nile water for irrigation for more than 5,000 years. However, water scarcity and the dramatic increase in population make the management task more complex because of the conflictive interaction between economical, social, and environmental aspects. Water management has never been only a technical or engineering problem as commonly recognised. Water management must be carried out in an interdisciplinary environment. Water engineers must cooperate with socio-economists and environmentalists to sustainably manage water resources. In Egypt, there is a marked lack of cooperation between farmers and water officials on one hand and even between water officials themselves (irrigation engineers, environmentalists, socio-economists) on the other hand. The exclusive focus on technical aspects in water management is causing many conflicts and problems for the Egyptian water system. Without interdisciplinary and integrated water management procedures, maximising the economical outcomes of agricultural lands leads to minimising the environmental outcomes. Water logging and soil salinity is becoming a serious problem in Egypt. Saline areas in the Nile Valley and Delta were estimated at 1,210,000 ha. Deterioration of water quality is a significant issue caused by the use of chemical fertilisers, which increased fourfold in the last two decades. Many social problems exist. For instance, the involvement of women in irrigation activities does not exceed 4% of those economically active in agriculture, and this ratio rises only to about 10% when unpaid family labour is included.

There is an urgent need not only in Egypt but also in the MENA countries to improve water resources management and water services, and to accelerate sustainable development in the water sector. Training of different stakeholders, networking of national experts, information exchange and dissemination of proven experiences are essential for the implementation of interdisciplinary water management. Blended learning and exchange of information

electronically can contribute to capacity building in water management and sustainable water development. These activities can also provide a framework for North-South and South-South cooperation.

TOTWAT

Think Interdisciplinary: A Training of Trainers Program in Interdisciplinary Water Management (TOTWAT) is an EU funded project under the umbrella of the TEMPUS programme. The consortium of this project is composed of five partners: the Cairo University (Egypt), Alfayounm University (Egypt), the National Water Research Center (Egypt), the RWTH Aachen University (Germany) and the Institute of Advanced Studies (Austria). This project has the development of a Training of Trainers (TOT) programme as a main objective. The training programme should be developed during the project lifetime (3 years) and be made available for the water officials from Egypt and other MENA countries. The specific objectives of the project can be summarised as follows:

- To design the course structures and develop courses' contents.
- To improve the training skills of the trainers of the three Egyptian partners to successfully deliver the training programme.
- To afford the necessary tools and equipments to successfully carry out the courses at both Egyptian universities.
- To develop multimedia, web-based and eLearning tools to support the training programme.
- To improve the skills of the IT administration team of both Egyptian Universities to be able to cope with the new multimedia-based training programme.

The main eLearning platform used in this project was Moodle Learning Management System which supports Arabic language. However, some adaptations were necessary to develop Arabic materials for certain courses. For example, Arabic video integration with PowerPoint was necessary to develop the online lectures. In addition, Arabic language Quiz for self-assessment was also a challenging issue to have a complete LMS.

Training Needs Analysis (TNA)

It was necessary to conduct an up-to-date and comprehensive training needs analysis (TNA) prior to the implementation of most of the TOT activities. This activity has been devoted to assessing the qualifications of the ministry staff responsible for the management of the Egyptian water system. The qualifications that have been assessed through questionnaires (first source of information) include the scientific background, IT skills, the knowledge of using computer models and the level of communication between different disciplines (engineers, socio-economists and environmentalists). The second source of information for this activity was direct interviews with the ministry staff. Almost 90 questionnaires were filled by the ministry staff members from all over the country and 20 interviews have been carried out. As an example of the results of the TNA, Figure 1 shows that the majority of the questioned staff members do not use computer models in their daily water management activities.

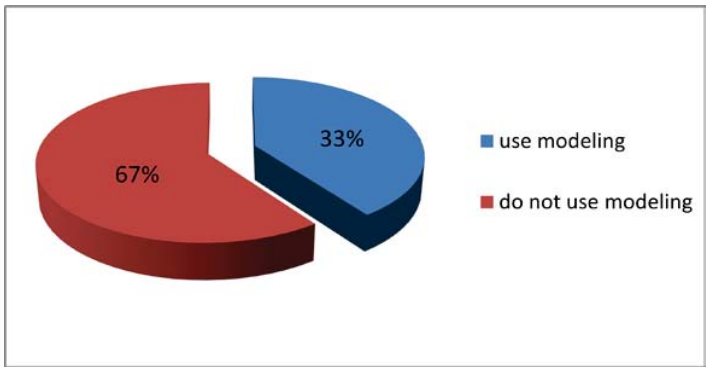


Figure 1. The TNA results (% of using computer modelling)

The TNA showed also that there is a lack of interdisciplinary water management and there is a need to bring engineers together with ecologists and socio-economists in day-to-day water management (Figure 2).

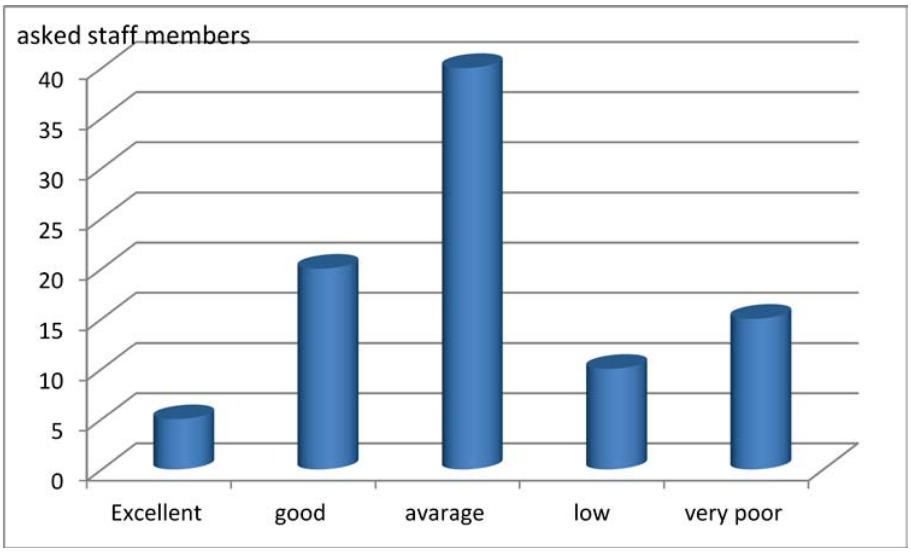


Figure 2. The level of interdisciplinarity in managing water resources

TOTWAT Training Programme

The TOTWAT Training programme has four targeted groups; water engineers, socio-economists, ecologists and modellers. Therefore, four TOT modules have been designed for the different targeted groups; Water Modeling and eLearning Module, Socio-Economic Module, Water Management Module and Environmental Module. Each target group had to attend two training courses (two weeks each in Egypt and Europe). More than 60 trainees have benefited from TOTWAT so far. All the four groups had to attend the same interdisciplinary training module (Module 5). This training module was composed of practical sessions. The trainees are exposed to a real-world water management problem, and their main task is to solve it in an interdisciplinary environment.

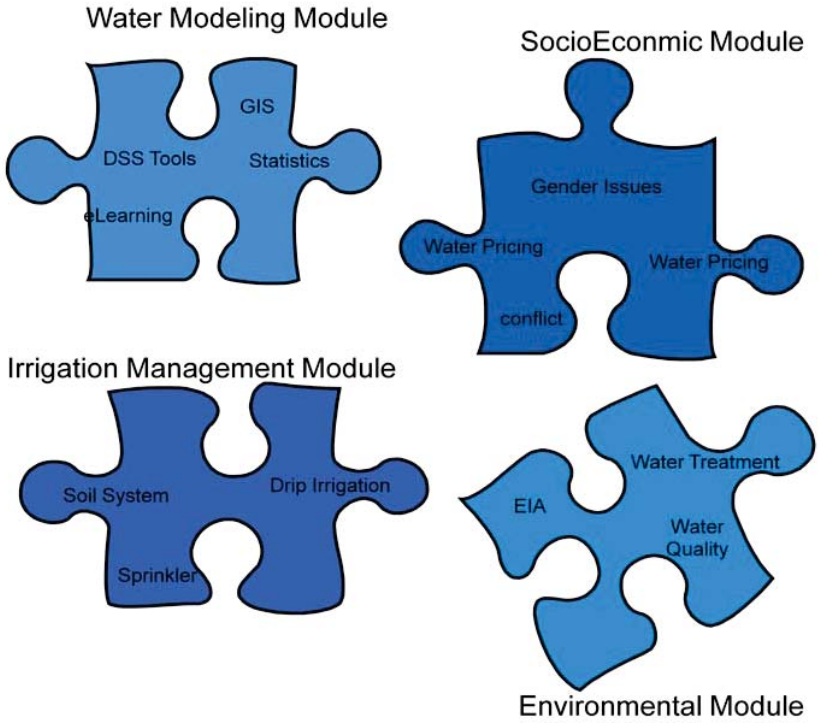


Figure 3. The first four modules of the TOTWAT

Overcoming barriers to technological development and adoption

The main technical challenge in the use of the eLearning technologies of TOTWAT was the unreliability of available home internet connections and their bandwidth.

To offer the users of the system the opportunity to overcome the bandwidth problem, computer labs were established at each of the involved universities with suitable internet connection. In addition, the system was adopted to offer Audio online lectures in addition to the video ones.

The developed LMS enables flexible accessibility for the mentioned target groups from any location and at any time. The system provides online courses to cover topics such as IWRM, EIA, water quality assessment, sustainable resource management, gender issues, socio-economical, desalination, water treatment etc. The courses were designed in a way to ensure understanding the interrelationships between technical, social, economical and environmental aspects related to water management. The LMS includes also a self-assessment tool that enables the learner/trainees to assess their knowledge before and after participating in any online course. The platform (LMS) also offers communication tools that ensure the continuous communication and social learning among the learners from different levels and target groups.

Lessons learnt: North-South knowledge transfer

This project provides several lessons that can be very important for furthering North-South cooperation in the MENA region. Two main lessons will be highlighted in the next sections.

Knowledge transfer through capacity building

Capacity building and knowledge transfer are critical tools without which developing countries and transitional economies will remain disadvantaged and unable to reap the environmental, social and economic benefits of a green economy. The strategy of TOTWAT aimed to transfer the European knowledge in interdisciplinary water management to enhance the skills of the Egyptian staff members through a capacity building programme. Five training modules have provided a great opportunity for transferring European know-how in interdisciplinary water management to the Egyptian trainees. Lessons learnt from the implementation of these five training modules can be summarised as follows:

- All training modules provided by trainers from European countries should be based on local problems in the south. The main task of the trainers should be trying to introduce European solutions for similar Egyptian situations. The solutions are normally intensively discussed until the trainers and trainees reach an agreement on the adopted knowledge.
- European trainers from different backgrounds had to be involved in the training modules (engineers, ecologists, sociologists, economists, etc.).
- Only trainers who understand and accept other cultures should be involved in such training courses.
- Materials must be as simple as possible because of the various backgrounds of the trainees.
- The training should consider the educational level of the trainees and their English language level.
- Social, religious and cultural habits have to be taken in to consideration while setting the training programme (praying time, feasts, etc.).

Knowledge transfer through blended learning

In TOTWAT, blended learning activities have been implemented very intensively for different reasons:

- To enable knowledge transfer without necessarily being available at the same location (trainers/trainees).
- Digital materials are easily transferred and usable online.
- Dissemination of knowledge to other groups who are not directly involved in the project is quite simple.

The TOTWAT activities are based on the Selection-Organisation-Integration theory (also called SOI theory). The fundamentals of the theoretical SOI model are:

- Human knowledge processing strictly separates aural and visual inputs (two separate channels for information entrance).

- The processing capacity of those two input channels and the short-term memory is limited (the magic seven).

- Learning is always an active process; we have to develop a coherent mental model (or reproduction) of the learning objects.

Based on the assumptions of the SOI theory, Clark & Mayer (2002) developed six principles that should be obeyed during the conception and creation of multimedia contents. The TOTWAT project has made the best out of combining both theories together. The characteristics/principles of the developed eLearning materials for the knowledge transfer can be summarised as follows:

- Multimedia Principle: a combination of text and diagrams/illustrations is a more effective method of knowledge transfer than text only.

- Modality Principle: explanations and descriptions dedicated to illustrations and diagrams are better grasped in spoken form (aural) than in written presentation.

- Continuity Principle: text information and diagrams that refer to each other are presented interrelated.

- Redundancy Principle: never present the contents in written and spoken form simultaneously (q.v. Dual Code Theory by Paivio).

- Coherence Principle: media elements should be used in a targeted and economical (thrifty) way; an overkill will have negative consequences for the learning process.

- Personalisation principle: expert sociolects should be avoided; in general, comprehensible explanations enhance and enrich the learning effect.

Based on the SOI theory and these principles of multimedia-based learning, in TOTWAT the materials have been designed in such a manner that more or less 80% of the information to transform into knowledge is presented in an aural way (independent of setting up a classical face-to-face or a pure eLearning module). Animated graphs, flash files or video sequences will fill the residual part.

Blended Learning Modules for the MENA Region

Two years of the project lifetime have been spent developing the blended learning materials. The final product is a blend of training technologies that answer the needs of many water institutions in the MENA region. The most important characteristics of the developed web-based systems are:

- Materials are available online and in Arabic language

- The training covers water related issues that fit the MENA region problems

- Moodle system (Learning Management System) also supports the Arabic language

- Simplicity of "learning how to learn online" – 10-15 minutes are required to learn navigation basics and some more time is needed to master learning in this type of environment

The eLectures are an essential tool for learning online. For each of the five modules, a series of eLectures have been developed. The lectures include a video of the lecturer synchronised with the PowerPoint presentations. This makes learning online very easy for the trainees. The techniques adopted allow any user to access the LMS and simply watch the lecture without any additional installations. Figure 4 shows an example for one of the lectures under the socioeconomic module that covers gender issues.

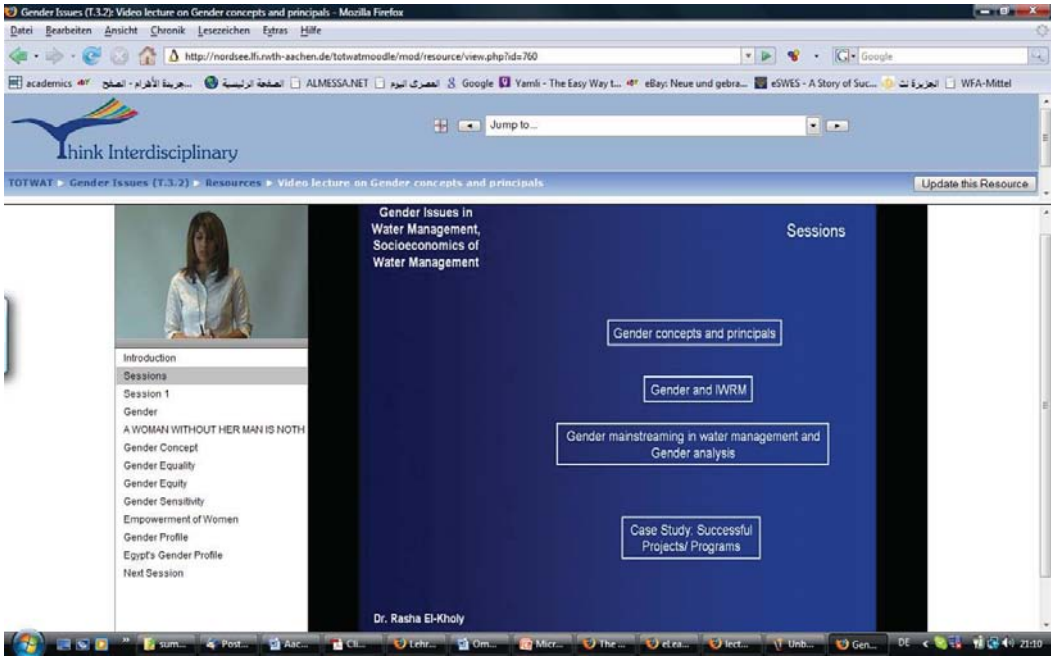


Figure 4. An example of the gender issues lecture of Module 4 (socio-economic in water resources)

In addition to the eLecture, the Learning Management System includes for each lecture a handout in the form of a pdf file. The handout describes the details of the lecture and provides references and case studies for the investigated subject. To assess the gained knowledge of the trainees, the LMS also offers a self-assessment system. This self-assessment system allows each trainee to go through an assessment process composed of ten different types of quiz (multiple choice, matching, short answer, essays, etc.). Each trainee can try the assessment and get the final grade of his/her answer. The trainees can also view the correct answer to enhance their knowledge.

Scaling up and relevance for developing and transition countries

The developed LMS and training materials of this project were used by other Egyptian universities. At a later stage the Ministry of Higher Education realised the acceptance of such technologies for education and capacity development. The government started to promote using such technologies for undergraduate students by motivating the professors to develop their undergraduate courses using web-based techniques.

Evaluation: economic, environmental and social benefits

Economic

The developed LMS is officially used by Zagazig University for civil engineering undergraduate students. More than 1,200 students have used this system for their courses. The impact assessment of the project on this group has shown enormous enhancement of the quality of graduates, especially in their knowledge of sustainable water management. In some cases, students started up their own business mainly in areas related to decentralised small water treatment unities for rural areas.

Two universities in Egypt (Helwan and Ain Shams Universities) are now using this system to enroll and teach a postgraduate diploma on “water and environmental management”. The universities have already signed different agreements with the local water and environment companies/consultancies to supply them with engineers with specific qualifications.

The LMS now enables Cairo University together with the National Water Research Center to offer training services for the professionals of the Ministry of Water Resources. According to the assessment of the impact of such training activities, the training has enhanced the skills of a large number of the water professionals responsible for managing water resources as well as researchers from the NWRC.

Environmental

The online modules developed included many environment related courses which helped thousands of people enhance their environmental capacities and knowledge.

Social

Although eLearning is often seen as a tool that has negative impacts on social communicating, such systems include social networking tools that bring not only people from the same country to communicate and work together but also people from all over the world who have common interests.

Conclusion

Knowledge transfer is one of the key tools to help the MENA Region to cope water scarcity and the serious impacts of climate change. One of the main mechanisms for knowledge transfer is capacity building. North-South cooperation to develop and organise training programmes is a key approach. Using blended learning techniques facilitates knowledge transfer and allows more countries and stakeholders to benefit from such programmes.

TOTWAT is an example of such north-south cooperation, serving to transfer European knowledge in the field of interdisciplinary water management to Egypt. More than 10 training courses have been organised in the fields of modelling, water management, socioeconomics, environmental engineering and interdisciplinary water management. The project also produced blended learning contents for dissemination and use by other water institutions in the MENA region. Through a network of national institutions and on-going projects of technical cooperation in the water sector, RWTH Aachen, along with other international partners, can organise and facilitate the exchange of capacities, experiences and relevant information with potential multiplier effects.

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Improvement of water supply through a GIS-based monitoring and control system for water loss reduction

Yamba Harouma Ouiba, Director General of ONEA, Ouagadougou, Burkina Faso

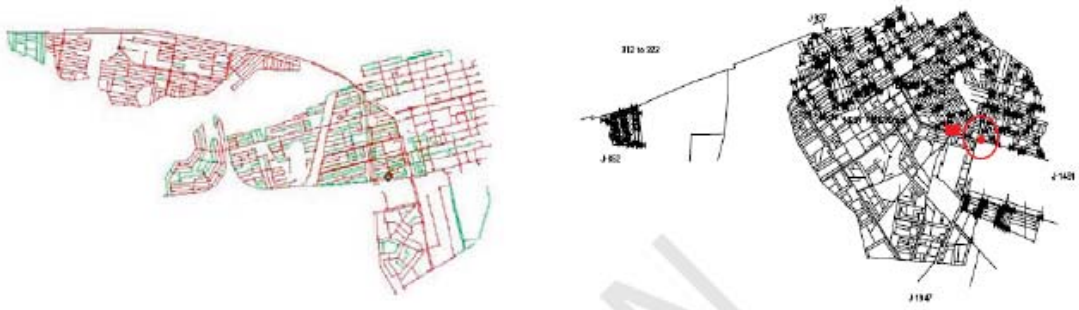
Type of tool: technology for efficient water use (specifically: GIS-supported dynamic pressure control, automated valves and leak detection systems)
Location: Ouagadougou, Burkina Faso, Africa, with the municipal water utility operated by ONEA, Office National de l'Eau et de l'Assainissement

The relevance of the challenge and objectives

In many countries of the developing world, including regions with water scarcity, water losses (technical leakage and water theft) are very high, mostly exceeding 40% and often even exceeding 60%. To improve water supply and serve more consumers (preferably from low income areas, which often remain unserved), the capacities of water supply systems must be increased. Very often, the necessary increase can be achieved through water loss reduction (WLR). WLR may be much more feasible (in economic and ecological terms) than the expansion of water production, i.e. through new river dams, desalination plants, underground well fields or else.

In Ouagadougou, a pilot project has been implemented, to reduce water losses within the distribution system of the municipal utility. The technical components of the process are leak detection devices, pressure and flow control sensors with real-time and online data transmission, automated pressure valves and an intelligent GIS-based computerised system to steer the whole process. The figure below shows the GIS (Geographical Information System) file of the distribution zone (left), with the most critical point of pressure and water

losses to be controlled through pressure reduction (right part of the figure below), as simulated with the hydraulic modelling tool EPANET.



Représentation SIG du secteur de distribution R7 (gauche) et identification du point critique par EPANET dans le secteur de distribution RE (droite)

The drivers of technological change

There has been tremendous progress in the use of computer-based control, both for pump efficiency (accompanied by energy efficient pumps) and for network management, especially dynamic pressure control. This provided the opportunity to introduce the water loss reduction programme. The driver of change to develop these technologies was, of course, water scarcity and the water losses being too high in the utility. Anyhow, the basic technological development has already taken place in other sectors from industry, dealing with higher financial volumes than in the public water sector (e.g. pump efficiency established at a very high technological level in the chemical industry, pressure control of gas pipeline networks, or oil pipeline networks in industrialised countries).

Barriers to technological development, adaptation and adoption

The strongest barrier slowing down technological development, adaption and adoption is the subsidisation of water tariffs. Full cost-recovery of water services provision cannot be achieved in many developing countries, due to political restraints and the need to support the poor with subsidies. The greatest barriers are the lack of willingness to charge and the lack of willingness to pay for water. In order to overcome these barriers, the implementation of the project was supported by an extensive capacity development programme to secure the necessary change process.

Lessons learnt from implementation

Implementation was successful for a limited zone within the city and service area of the utility. Due to the unstable political situation in the country and due to other issues being prioritised over water loss reduction (politically as well as financially), full implementation has not yet been achieved.

Scaling up

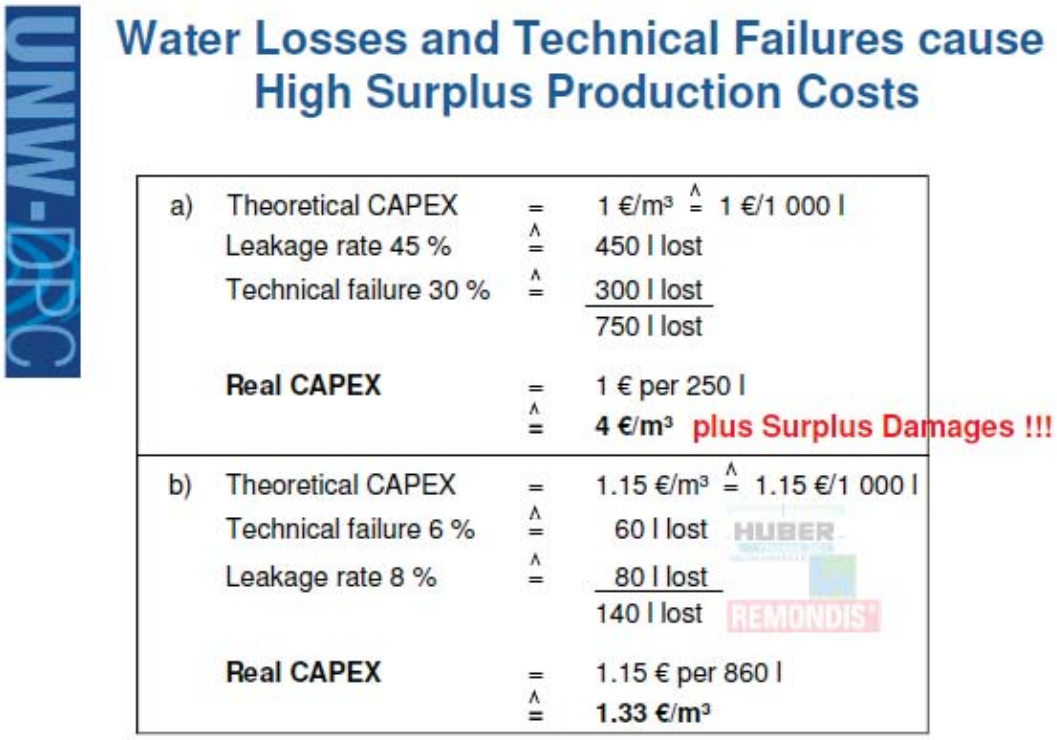
Regretfully, the Water Loss Reduction Programme has not yet been extended throughout the region, even though the profitability of the water loss reduction programme has been verified (taking the "low-hanging foods" first, in a priority of actions).

With support of UN-Water DPC, the scaling up of such water loss reduction technologies and programmes in other developing and transition countries could be done. One very helpful activity was a workshop with the African Water Association in Ouagadougou, where the success of the project was presented to other utilities, lessons learnt were shared and training activities were undertaken with participants from all over Africa. Furthermore, UN-Water DPC has disseminated the technologies and overall management concepts, including economic and financing aspects in other regions such as Latin-America and Asia.

Evaluation: economic, environmental and social benefits

The programme has generated positive benefits for the local economy. Local jobs have been created through the investment in and continuous operations of the water loss reduction programme. More importantly, the project has leveraged job creation due to the fact that economic development, public health and a comfortable environment are based on the quality of water and sanitation onsite – which has improved significantly since water efficiency had been increased through WLR.

The figure below indicates the direct monetary profit of the water loss reduction programme, accompanied by improvements of general maintenance and operations. Once the water losses are reduced from approx. 45% to 6%, and the technical failure from 30% to 6%, the water service costs would be reduced from 4 EUR/m³ to 1.33 EUR/m³ (see calculation in the slide below).

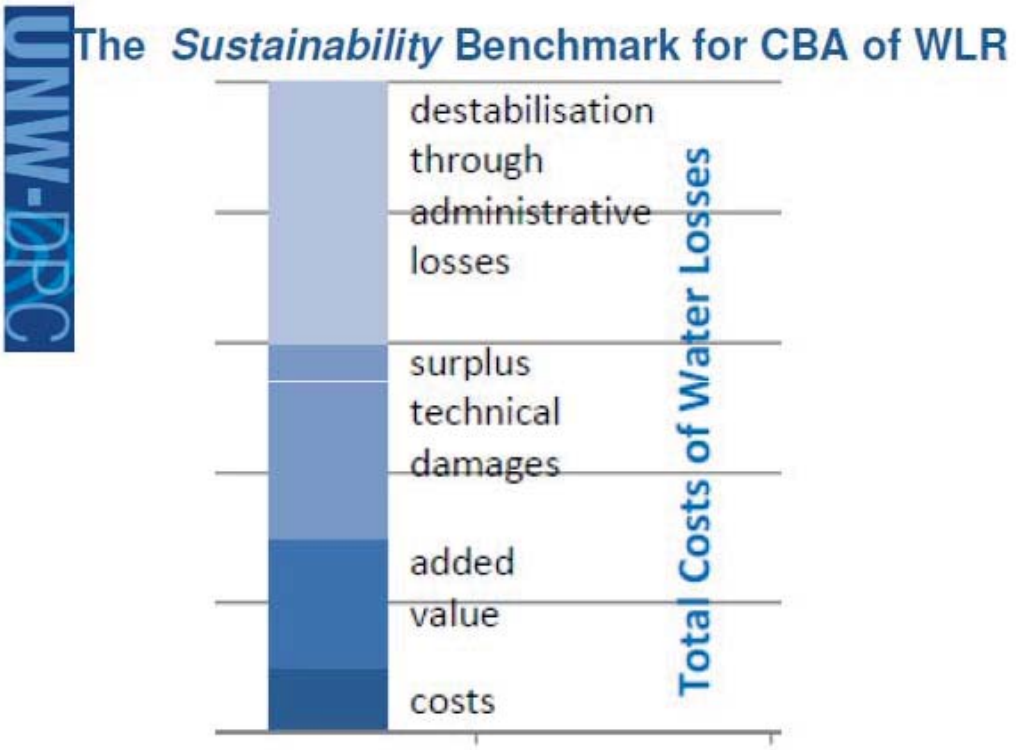


Additional economic gains are expected through the reduction of damages which accompany water loss ("surplus damages") in technical terms (especially reduced lifetime of the pipe network, caused by mechanical stress with non-continuous supply generating hydraulic

shocks) and in administrative terms (reduced willingness to pay from customers facing high water losses that see other consumers who are not charged or do not need to pay).

For the case of Ouagadougou, the direct savings of the water loss programme has been estimated to be around 0.8 EUR/m³. With the surplus costs on top, the total economic profit might well exceed 2.0 EUR/m³ (not yet calculating the external profits for public health and the gross national economic product.

The figure below indicates the factors that should be considered when defining a "sustainability benchmark" for cost-benefit calculations of water-loss reduction programmes and target values, site-specific standards of water losses (set as % percentage of raw water abstraction, or as m³ per day, or as m³ per pipe km).



Along with the improvements in water efficiency, the environmental situation will improve step by step, provided that the development of sanitation will follow the development of supply water efficiency.

Social benefits are derived from the enhanced performance of the utility and water services provision. The situation before project implementation was characterised by poor or no water supply in certain town areas and at certain times, water theft and a lack of concern about taking care of resources and public water properties. Since improving water efficiency, the water utility has been empowered to introduce transparent structures, cut water theft and raise awareness among the public and its customers of the need to take care of water properties.

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The role of water technology in development: a case study of Gujarat State, India

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Type of tool: technology
Location: Gujarat State, India

Introduction

This article traces the historical water problem in Gujarat both for drinking and irrigation that affected the development of the State, caused regional imbalances and increased incidence of rural poverty. Technological initiatives like the State Wide Water Grid, Micro Water Harvesting, Inter-Basin Transfer of Water and Power Sector Reforms have changed the entire water scenario in the State. There has been a great deal of emphasis on peoples' participation in water governance as well.

Water challenges in Gujarat

Gujarat has just 2.28% of India's water resources and 6.39% of country's geographical area. This is again constrained by imbalances in intra-state distribution. The State has an average annual rainfall of 80 cm with a high coefficient of variance over time and space and as a result droughts have been frequent. Out of 185 rivers, the State has only eight perennial rivers and all of them are located in southern part. Around 80% of the State's surface water resources are concentrated in central and southern Gujarat, whereas the remaining three-quarters of the State has only 20%. On average, three years in a cycle of 10 years have been drought years. Since Indian independence in 1947, the drought years of Gujarat have been as follows: 1951, 1952, 1955, 1956, 1957, 1962, 1963, 1965, 1968, 1969, 1972, 1974, 1980, 1985, 1986, 1987, 1991, 1999, 2000 and 2003 (Gupta, 2004).

Before the year 2001, drinking water scarcity posed a serious threat to human and cattle populations in Gujarat. Governments had to spend billions of rupees on temporary measures to supply drinking water by road tankers and sometimes even through special water trains. The State, which generally had a track record of peace and harmonious social ethos, even witnessed 'water riots' due to severe water scarcity compounded by poor water resources management.

Over drafting of ground water (as compared to annual recharge) caused serious water quality problems due to excessive fluoride, nitrate and salinity. The number of fluoride affected habitations increased from 2,826 in the year 1992 to 4,187 by the year 2003. The fluoride concentration in these villages ranged from 1.5 mg/litre to as high as 18.90 mg/litre. Fluoride has been the cause of extensive health damages in many parts of Gujarat. Dental fluorosis causes permanent pigmentation of teeth in children and bone deformities are caused by skeletal fluorosis even in adults. Other serious problems experienced due to high concentration of fluoride have been anaemia, loss of appetite, nausea and thyroid malfunction which sometimes results in brain impairment of children and adverse impact on foetus, in some cases causing abortion or stillbirth in expectant mothers.

The water problem also led to intra-state migration from drought prone regions like Saurashtra and Kutch (Western & South Western Gujarat) to the Central and South regions

of the State. Often this migration of people was accompanied by the migration of livestock population and also caused the shift of prime workforce of hundreds of thousands of people, dislocating them economically, socially and culturally. Therefore, the regional imbalances in Gujarat were accentuated because of increasing water scarcity (Gupta, 2003).

Earlier most of the drinking water supply was based on ground water for which deep tubewells with high capacity pumping machinery were being utilised in the State, leading to tremendous electricity consumption and high carbon footprints of water supply.

Technological initiative for drought proofing

During last one decade the State drew up an ambitious strategy for creating a '*State Wide Drinking Water Grid*' for bulk water transmission from sustainable surface water resources to water scarce and poor water quality habitations. Large scale infrastructure has been created which includes 1,987 km of bulk pipelines and more than 115,058 km of distribution pipelines. 10,781 hydraulic structures like elevated storage reservoirs with a total capacity of 1,164 million litres and 10,683 storage sumps and high ground level reservoirs with a capacity of 2,504.80 million litres have also been constructed in the State. Along with this 151 water filtration and treatment plants with a total capacity of 2,750 million litres per day (MLD) have been constructed. About 2,250 MLD of treated water is delivered to more than 10501 villages and 127 towns in the State, ensuring safe and assured water supply to about 65% of State's population in draught prone and water quality affected areas through the water supply grid.

Evaluation of the technical initiative for drought proofing

This major technological initiative has not only largely solved the drinking water problem but has also made a significant impact on water quality problems faced earlier.

Reduction in fluoride

All these efforts have resulted in considerable relief from the problem of excessive fluoride contamination. As per a recent survey, only 987 habitations have been found to be affected and the range of fluoride content has also been reduced considerably.

Table 1. Status of fluoride affected habitations

District	No. of Total Habitations	As per 2003 survey	As per recent survey	Maximum Fluoride level (PPM)
Ahmedabad	727	120	20	7.20
Gandhinagar	424	132	2	6.27
Patan	651	246	43	13.25
Mehsana	851	176	2	4.40
Sabarkantha	2438	531	9	6.93
Banaskantha	1736	521	20	5.75
Surendranagar	696	205	72	8.72
Rajkot	871	126	120	5.40

Jamnagar	756	52	5	2.00
Junagadh	925	76	48	2.80
Porbandar	184	46	0	3.70
Bhavnagar	804	108	66	6.40
Amreli	650	49	146	3.20
Kutch	1126	34	6	3.20
Vadodara	2187	438	189	5.81
Narmada	722	49	0	2.60
Kheda	2101	406	52	10.03
Anand	920	96	17	5.89
Panchmahals	2531	401	86	6.40
Dahod	3168	286	0	12.50
Surat	3258	44	29	2.20
Bharuch	790	21	30	4.00
Valsad	3923	2	25	1.79
Navsari	2080	22	0	--
Dangs	326	0	0	--
Total	34845	4187	987	

Source: Gujarat Water Supply and Sewerage Board, 2009

Less expenditure

This has also resulted in sharp decline in expenditure on tanker water supply in the State from 2003-04 onwards which is another indicator of creation of water security in the State.

Table 2. Annual expenditure on tanker supply from 1990 to 2009

Year	Village	Cost (Rs. in Million)*
1990-91	896	23.40
1991-92	1,943	92.90
1992-93	700	14.00
1993-94	1,803	83.00
1994-95	724	24.96
1995-96	1,619	96.30
1996-97	1,642	123.95
1997-98	1,447	62.19
1998-99	1,215	41.02
1999-2000	2,987	346.20
2000-2001	4,054	436.94
2001-2002	2,959	348.11
2002-2003	3,961	475.36
Sub-total		2,168.06

2003-2004	600	47.38
2004-2005	869	92.32
2005-2006	398	77.06
2006-2007	207	17.08
2007-2008	188	14.17
2008-2009	326	13.94
Sub-total		261.95
Total		2,430.01

Source: Gujarat Water Supply and Sewerage Board, 2009 * 1 US $ ≈ Rs.46

Reduction in carbon footprints in water supply

In several villages, the borewells are now utilised as a dual source and the operational hours have been reduced. Based on a random survey, it has been observed that a significant saving has been achieved in electricity consumption that is now available for alternative uses, proving to be an eco-friendly achievement. Solar pumps have also been commissioned in 260 villages in the State and about 200 more solar pumping systems will be installed in the near future. In various parts of the State, including coastal and tribal areas, roof top rainwater harvesting structures have also been taken up in public buildings, schools and individual household level, which is also resulting in substantial electricity savings. Comprehensive energy audits for various group water supply schemes have also resulted in energy savings.

Table 3. Emission savings in drinking water supply

Sr. No.	Particulars	Energy Saving MWh per annum	Equivalent Carbon Dioxide Emission per annum in tones
1.	Piped water supply to villages and towns	65,905.00	14,696.82
2.	Savings due to energy audit	5,184.78	1,156.21
3	Solar based pumping systems	611.16	136.29
4	Rooftop rain water harvesting	386.74	86.24
	Total	72,087.68	16,076.14

Source: Gujarat Water Supply and Sewerage Board, 2009

Paradigm shift

With a paradigm shift from dependence on drinking water supply by tankers, trains and deep bore wells to safe surface water, much of the fluoride affected habitation have been covered by piped water supply.

Technological interventions like defluoridation through reverse osmosis have also been taken up in some villages. In the remaining villages safe water sources have been identified or created and are being used for drinking water purpose. Thus, a 'vicious circle' has been transformed into a 'virtuous cycle' with a win-win situation for water, energy, environment and health sectors and with considerable economic benefits. In short, this is Gujarat's technology oriented response to the existing and future water stress and insecurity due to climate change.

New water governance model

The creation of the Water and Sanitation Management Organisation (WASMO) was a significant shift in the role of governance from provider to facilitator by empowering village level institutions through extensive capacity building and pro-active facilitation. Since its inception, WASMO has brought about effective citizens' engagement through its innovative governance model for facilitating the successful community led water supply programme throughout the State of Gujarat. Now more than 16,740 Village Water and Sanitation Committees have been formed in the State and are ready to take the responsibility for managing of service delivery and water resources at the decentralised level. More than 6,500 villages have already commissioned the infrastructure and water conservation projects in a demand driven mode. Another 4,547 villages are presently implementing the decentralised community managed rural water supply programme in their villages with a strong sense of ownership.

WASMO's strength lies in its organisational professionalism, innovations in governance, and strong partnerships with about 48 civil society organisations. The rural community is the central focus of WASMO's decentralised approach. Its innovation has led to the scaling up of reform processes to cover the entire State. Its professionals have created an enabling environment which has resulted in the community being fully empowered to take ownership of their water service delivery wherein operation and maintenance is done through tariff mechanism devised by consensus in the village assembly. It has also been able to institutionalise the rural water quality monitoring and surveillance programme. The majority of villages are now able to monitor their water quality teams which are duly trained. WASMO's innovation by Gujarat has emerged as a model for learning and exchange, influencing policy initiatives in the water sector at the country level. WASMO has also been given the United Nations Public Service Award in the category of fostering participation in policy-making decisions through innovative mechanisms (Modi, 2010).

Inter-basin water transfer through Sardar Sarovar Project

The Sardar Sarovar Project on river Narmada is a multi-State, multi-purpose river valley Project, borne out of deliberations of a constitutional body, following the principles of 'Equality of Right' and 'Equitable Utilisation' of the whole course of an Inter-State River. This unique project will irrigate 1.905 M ha of land, increase the agricultural production by 8.7 million tons per annum (worth US $ 430 million), generate environment friendly

hydropower with installed capacity of 1,450 MW, supply drinking water to 8,215 villages and 135 urban centres of Gujarat (around 20 million population), generate 1 million jobs (mostly in rural areas), and prevent rapid processes of desertification, salinity ingress and rural to urban migration being experienced in many parts of Gujarat. The command area and drinking water supply areas of the project are exactly the worst water scarcity-hit areas of the State (Gupta, 2003).

Stage	2003	2004	2006	Ultimate
Height	100 m	110.64 m	121.92 m	138.68 m
Gross storage	2,602.6 MCM (3.00MAF)	3,700 MCM (3.00 MAF)	5,265.8 MCM (4.27 MAF)	9,460 MCM (7.7 MAF)
Live (usable) Storage	_ _	_ _	1,565.8 MCM (1.27 MAF)	5,800 MCM (4.77 MAF)

Table 4. Sardar Sarovar Dam height and storage increase in the Sardar Sarovar Project

Source: Sardar Sarovar Narmada Nigam Limited 2009

Increased dam height and storage

With a concerted strategy and satisfactory compliance of the project obligations in terms of rehabilitation of project affected persons and environmental measures, the dam height was raised to 100m in 2003, 110.64m in 2004 and 121.92m in 2006. This facilitated a much higher increase in storage of Narmada waters.

Raising the dam height and the corresponding increase in the storage capacity have significantly improved the water supply. The real benefits of the project which were awaited for almost 15 years have now started flowing. Diversion of Narmada water to the main canal of the project (world's largest lined irrigation canal) was just 705 MCM in the year 2001, but it spectacularly increased to 5,195 in 2003 and to 6,194 MCM in 2004. Although the water flow has been decreased in subsequent years due to consecutive good monsoons, it remained to the extent of 4,201 MCM in 2005, 4,292 MCM in 2008 and 5,870 MCM in 2008 and 5,870 MCM in 2009. The construction of the main canal was also completed in the year 2008 and water supplies to neighbouring State – Rajasthan – were initiated in March 2008, fulfilling real objective of this project as an Inter-State River Project.

Not only this, with the command area being covered to the extent of around 500,000 ha, significant interlinking has been achieved in many rivers by the interbasin transfer of Narmada waters using the Sardar Sarovar Canal Network.

Hydro Power

Another long pending issue was that of operationalising the 250 MW Canal Head Power House (for want of required water head in the reservoir). We operationalised this power house in August 2004, and thereafter a river bed power house of 1,200 MW capacity was also put into operation in a phased manner starting from February 2005 to June 2006. The hydropower generation that commenced in the Sardar Saroval Project since August 2004 has resulted in the generation of 15,070 million kWh of electricity up until March 2010.

Micro Water Harvesting

The miseries of millions of small and marginal farmers due to vagaries of nature and difficult terrains have been reduced through rainwater harvesting by micro irrigation structures implemented through people's participation.

Sardar Patel Participatory Conservation Project (SPPWCP)

This scheme stipulated that checkdams and village tanks/ponds could be taken up for construction by a beneficiary group or any Non-Governmental Organisation (NGO) with technical and financial assistance from the District Panchayat (local representative body). They were initially required to contribute 40% of the estimated costs (later reduced to 10%) and the rest was to be funded by the Government depending upon the progress of the work. In 2007 they were also given the option of contributing their 10% by way of physical labour and, therefore, increasing their sense of belonging to the project by 'the gospel of dirty hands'. Six prototype designs were circulated with a maximum cost of Rs. 1,000,000.

However, the beneficiary groups were also given the latitude to take up the work as per their own design if necessary and feasible. The technical scrutiny and work supervision would be done by the engineers of local body. The entire responsibility of the quality of construction of work, however, would rest with the beneficiary group/NGO under continuous guidance and technical inputs from the Government technical staff. Maintenance works for these micro water harvesting structures would be carried out by the beneficiary group at their own expense. A total of 353,937 checkdams and village ponds/tanks have been created in the last eight years providing direct benefit to over 13 million people in rural Gujarat.

Drip irrigation - Gujarat Green Revolution Company Limited

Gujarat has created the Gujarat Green Revolution Company Ltd, a special purpose vehicle to popularise the adoption of drip irrigation among farmers. GGRC offers attractive subsidy-loans to adopters, but more importantly, it has fast-tracked and simplified the administrative procedures for accessing these. Farmers contribute only 5% of the cost initially; GGRC provides a 50% subsidy and helps arrange a loan for the 45% balance. Around 100,000 ha are covered by drip irrigation, and most of these have been moved to high-value crops (Gulati, 2009). It has been estimated that around 74.1 million kWh energy has been saved in just one year due to the adoption of drip irrigation by Gujarat Green Revolution Company – a body especially created for the purpose.

Jyotigram Scheme (technological initiative in power sector for irrigation needs)

Like elsewhere in India, unreliable farm power supply in Gujarat had been anathema for farmers as well as rural society as a whole. Uncontrolled farm power subsidies led to unsustainable increase in ground water withdrawals and left the Gujarat Electricity Board nearly bankrupt. To control farm power subsidies the government began to reduce the hours of three phase power supply used by tubewell owners while providing 24 hours single/two phase supply sufficient for domestic users. In response, farmers in many parts began using capacitor to run heavy motor-pumps on two-phase or even single phase power. This resulted in poor power supply environment in rural areas.

International donors and power sector professionals advocated metering of tubewells and consumption-linked charging for farm power. However, for a variety of reasons, farmers

strongly resisted metering. Researchers had advocated a second best policy of intelligent rationing of farm power supply by separating feeders supplying power to tubewells. In 2003 the Gujarat government implemented the Jyotigram Scheme (JGS – the 'lighted village' scheme), which incorporated the core ideas of the second best strategy of intelligent rationing. Jyotigram's aim was to provide three phase power supply to Gujarat's 18,000 odd villages; but this could be done only if effective rationing was imposed on farmers. During 2002-2006 around US $260 million were spent on the project, to ensure 24 hour, three-phase power supply for domestic and commercial uses in schools, hospitals etc. and eight hours a day, three-phase full voltage power supply for agriculture, i.e. continuous and full voltage power especially for agriculture at predictable timings for villages across Gujarat. By 2007/08, all the 18,066 villages were covered under JGS. With this, Gujarat has become the first State in the country where villages get three-phase power supply, and farmers get three-phase, uninterrupted power supply at 430-440 voltage for eight hours according to a strict, pre-announced schedule.

Jyotigram pioneered real-time co-management of electricity and groundwater for agriculture, found nowhere else in the world. Farmers were also happy that they were spared the very high repair and maintenance cost that poor power supply imposed on them. Moreover most farmers welcomed Jyotigram for limiting competitive pumping of water and addressing the common property externality inherent in groundwater irrigation. Ground water and power rationing through the Jyotigram scheme not only increased efficiency of water and power utilisation for agriculture, but also freed up these resources for the rural nonfarm economy to grow.

Higher access to water not only had a land augmenting effect, but also allowed for multi cropping and growth of high value fruits and vegetables like mango and banana (that require much water). More water has also been available for livestock, animal husbandry and fisheries, which are significant sectors in Gujarat's economy.

Evaluation of technological initiatives: economic, environmental and social benefits

There have been wide ranging impacts of both large scale water management and micro water harvesting in improving ecology of other rivers, reversing the trend of depleting water tables and generating tremendous growth in agricultural production.

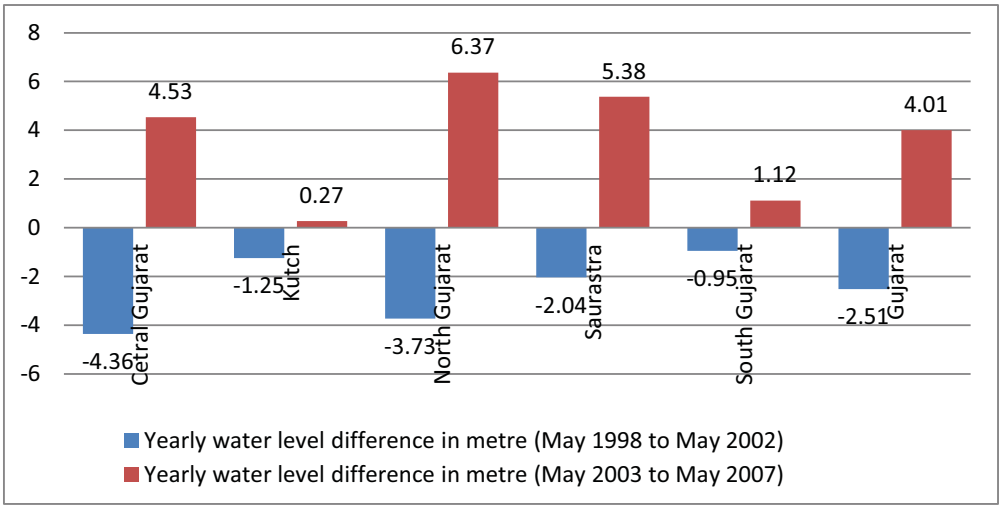
Greening of other rivers

Narmada water has been released in the dry beds of Heran, Orsang, Karad, Dhadhar, Mahi, Saidak, Mohar, Shedhi, Watrak, Meshwo, Khari, Sabarmati and Saraswati rivers. The ecology and water quality of these rivers have drastically improved over the last couple of years. In addition to minor rivers, around 700 village tanks have also been filled-up with Narmada water as part of drought management measures, which has substantially improved the water availability for irrigation in these villages.

Increasing water tables

The average depletion of water levels in north Gujarat before the launch of this massive programme was around 3m per year, which by now would have cumulatively declined almost 20-26m – leading to a sharp rise in electric consumption for withdrawal of ground water. But there has been a reported average water level rise of about 4m during recent years.

Figure 1. Groundwater level fall/rise (in metres)



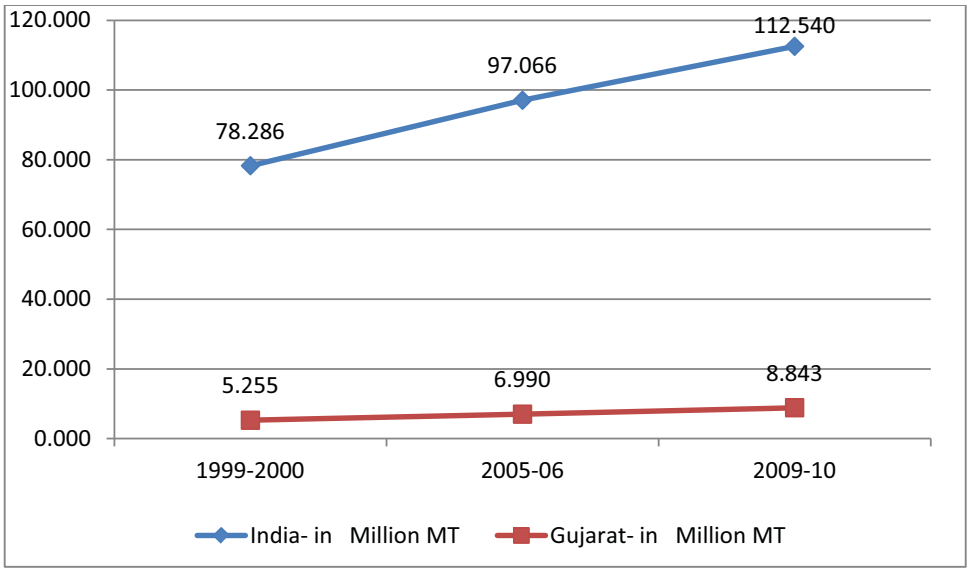
Source: Narmada, Water Resources, Water Supply and Kalpsar Department, 2009

Boost to the rural economy

Myriads of micro water harvesting structures dotting the landscape of Gujarat have led to the reduction in soil moisture evaporation in the surrounding agricultural fields and have facilitated the creation of orchards in places which barely used to produce single rain fed crops. Employment opportunities have been created for local residents, agricultural production has been enhanced, leading to rise in household incomes. The living standards and the average productivity of milk cattle have also gone up due to year-around availability of fodder.

The average annual growth rate of milk production of the State during last decade has been recorded as 6.83% whereas the same of entire country has been 4.38%.

Figure 2. Comparative growth of milk production in the last ten years



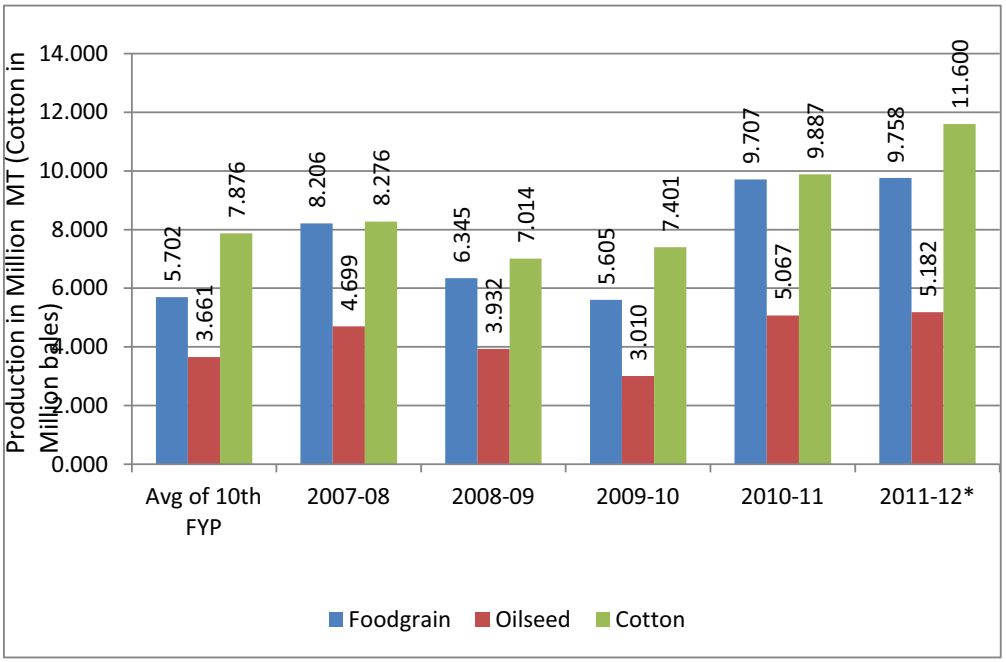
Source: Directorate of Animal Husbandry, 2010

This is in turn has bolstered the rural economy of Gujarat, particularly for the 4.2 million families of the State who rear animals for their livelihood.

Outstanding performance in agriculture

The cumulative effect of all these innovative technological and participative water management initiatives has been an increase in productivity of the major crops of the State, despite 0.1° to 0.9° average increase in temperatures recorded at various locations during the last couple of years. As compared to other States in India, Gujarat is an outstanding performer in agriculture, growing at the rate of 9.6% per annum. Though there is high volatility in the agricultural growth rate for almost all States in India, performance of Gujarat's agriculture is more than thrice the figure for the whole of India. The International Food Policy Research Institute, in a 2009 document, has especially commended Gujarat's recent growth in cotton, fruits, vegetables and wheat production.

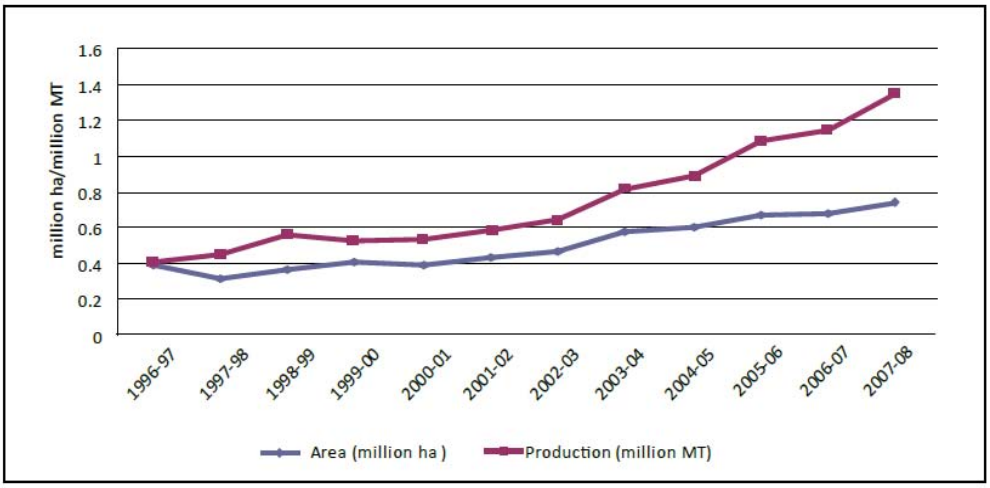
Figure 3. Agriculture production scenario



*Data of 2011-12 is provisional

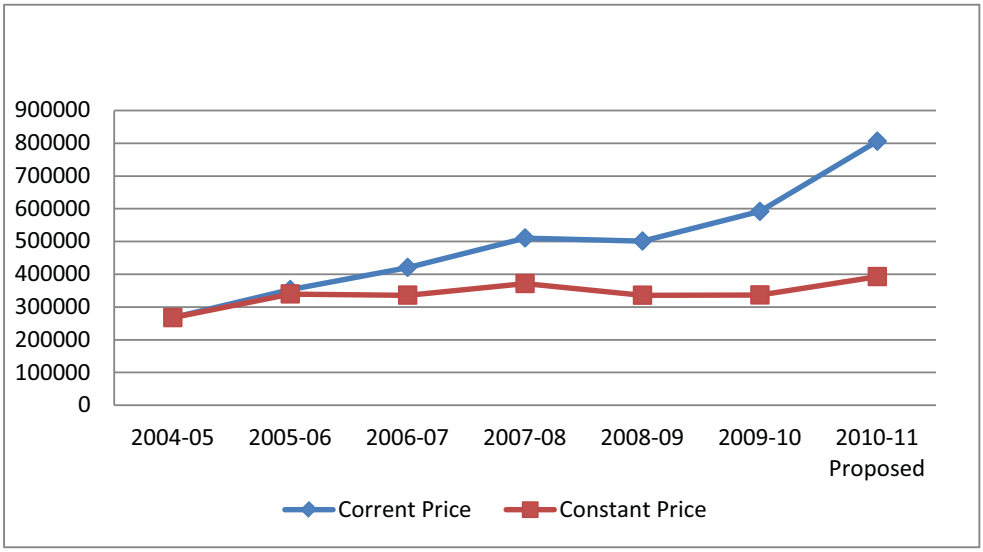
Source: Agriculture and Cooperation Department, 2011

Figure 4. Area and production under total fruits and vegetables in Gujarat (Area in Million ha, Production in Million MT)



Source: Directorate of Horticulture, 2011

Figure 5. Growth in agriculture income (Rs in Millions)



Source: Agriculture and Cooperation Department, 2011

Conclusion

The most important lesson that emerges out of the foregoing discussion is that technological initiatives to improve the drinking and irrigation water supply have to be duly complimented by grassroots people's participation in management of water distribution. The decentralised community managed water supply programme in Gujarat has proved to be an emulative model for the entire country. Another very significant lesson is the balanced importance that has been given to both micro-water harvesting and large water resources development projects, leading to unprecedented agricultural growth in the State. Increased water availability and reduction in consumption of conventional power has also led to a reduction in the carbon footprint of water supply, further promoting the development of a low carbon economy in the State.

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Industrial wastewater reclamation technology for urban irrigation

Piet DuPisani, Head of the Water and Wastewater Department of the City of Windhoek

Type of tool: technology for efficient water use, specifically: industrial wastewater treatment for reuse (irrigation) using a modified process technology for local operations, including MBR (membrane bio-reactor) and UV-disinfection
Issue: industry, agriculture
Location: City of Windhoek, Namibia, Africa.

Challenge and objectives

Many cities in Africa (and elsewhere worldwide) suffer from water scarcity. Fresh and clean water resources may be too valuable to be utilised for the irrigation of urban green, parks, small scale agriculture. In most cities, industrial compounds generate wastewater of quantity and quality that is worthwhile purifying to a standard adequate for irrigational reuse. Figure 1 shows some basic information about the City of Windhoek and its very scarce water resources.

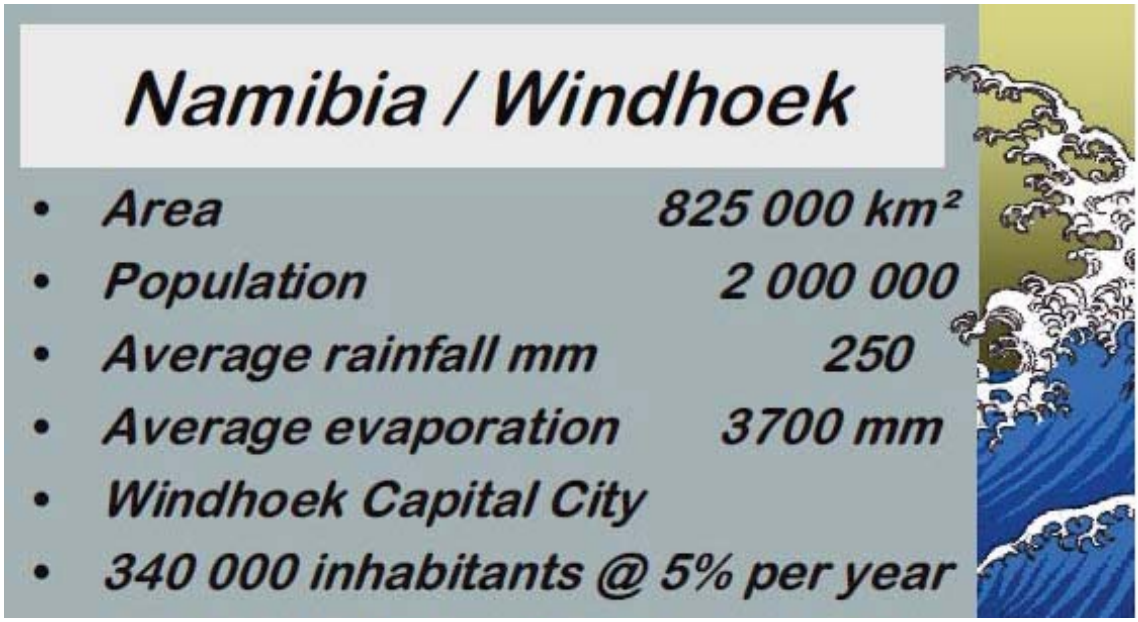

Figure 1. Data of Windhoek City, Namibia

The City of Windhoek is well known for being the first city worldwide to operate a wastewater recycling plant for direct, potable water reuse. The City is already operating a number of reclamation facilities, including for irrigation from domestic wastewaters (see Figure 2). The effort to utilise industrial wastewaters is however new and requires more ambitious treatment technologies exceeding semi-purified irrigation.

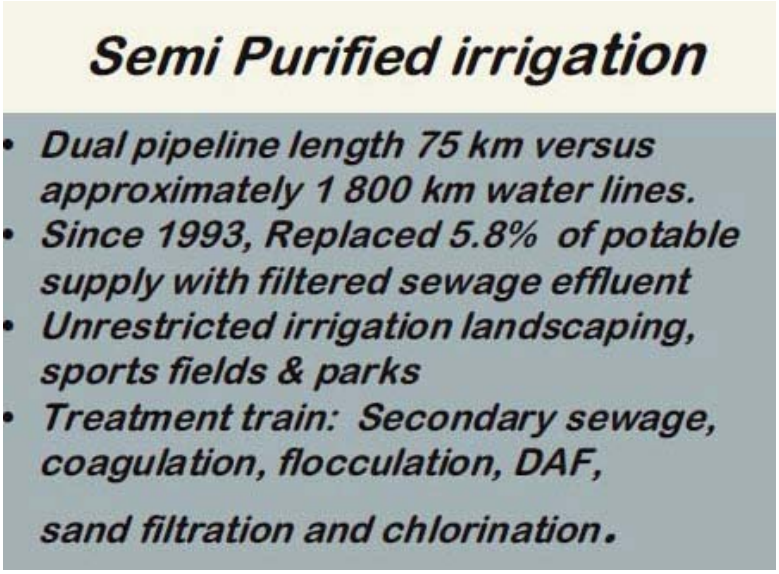

Figure 2. Semi purified irrigation

The objective of the project was to realise a wastewater reclamation plant, based on cost- and energy-efficient technologies, but still viable for local operations. The specific focus was on industrial wastewaters, which may not be suitable for drinking water reclamation, but suitable for irrigational use.

The technical components of the process are conventional mechanical treatment (buffer tank, robust type screening and sand trap), advanced biological treatment (membrane bioreactor, equipped with instrumentation for remote control, automation and easy operations onsite, see Figure 3), compact final settlement tank and post-disinfection through UV (with additional chlorination on request). The standards for wastewater disinfection are quite stringent, not only for crop irrigation, but also for Greenland irrigation (especially for golf courses). To avoid odours, a UV radiation unit for post disinfection of reclaimed wastewater for irrigation was installed (see Figure 4).

Figure 3. The membrane bioreactor with membrane units visible underwater (left), the membrane bioreactor aerated (right)

Figure 4. UV radiation unit for post disinfection of reclaimed wastewater for irrigation

The drivers of technological change

The membrane biological process – adapted to local conditions and with some simplification of the process technology – has made it possible to build a plant of the size and standards under discussion here. Other existing technologies, such as an activated sludge plant with post-treatment (of advanced purification) in a sand filter plus activated carbon etc., would have been too complicated and expensive.

Barriers to technological development, adaptation and adoption

The greatest barrier existing today is the specific cost for purified wastewater, purified up to a standard adequate for safe reuse in irrigation. Compared to the tariffs existing and affordable to be paid through the local industries, it was possible (using all means of cost reduction and efficient financing) to make ends meet.

How were the barriers overcome

The process of implementation was realised through a BOOT-type contract (build, own, operate and transfer), with a contractors consortium consisting of companies located in Africa and companies from Europe. A similar technology (operated on site by the same contractors) had already been proven to be viable for wastewater reuse, with non-industrial wastewater sources (easier treatment) and direct reuse for potable purposes [note: Windhoek was one of the first cities worldwide to realise direct wastewater recycling for supply water].

Lessons learnt from implementation

Without the cooperation of professional technology providers from the private sector and a very proactive public utility, both focusing on greentech business development in their local water sector, the scheme could not have been realised. Technological progress, as well as BOOT and good municipal governance and national finance, were all essential to the successful implementation of this greentech project.

Significant governance changes and institutional development in the local water sector are induced wherever wastewater is regarded as valuable resource, treated with care and reused instead of simply discharged to a sensitive environment.

Scaling up and relevance for developing and transition countries

Scaling up of this project is expected, once project success can be demonstrated and once water tariffs and wastewater charges are reflecting a reasonable portion of real costs (whereas scale-up would be difficult wherever water and wastewater are free of charge, and represent no or little value to the consumers and decision-makers).

Figure 5. Industrial wastewater reclamation technology

Evaluation: economic, environmental and social benefits

Economic benefits

Economic benefits of the project relate to increased land value. Whereas dry land with no water resources available for irrigation is worth little in the project area, irrigated land has quite a high value. This higher value is reflects the economic potential related to land use –

from luxury purposes like a golf course down to small agriculture or green land parks. These land use activities will generate new jobs and business opportunities.

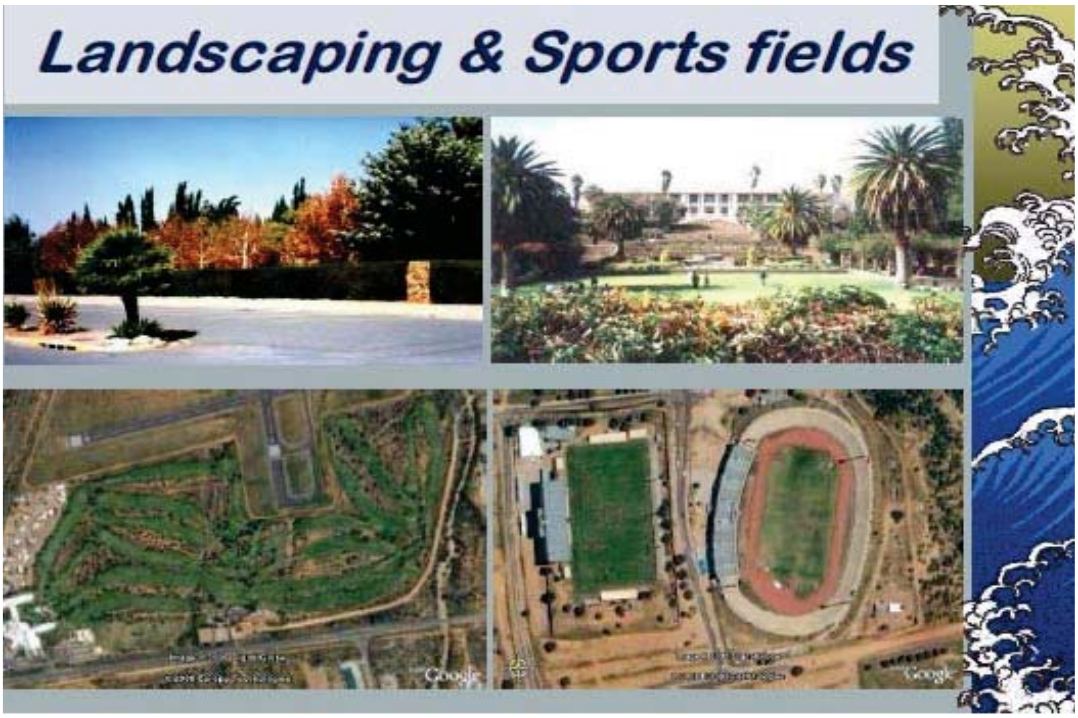

Figure 6. Economic opportunities stemming from water reuse for irrigation

Calculating (1) a rise in land value from 2,500 to 20,000 EUR per ha, once irrigational water is available, and after converting bare land to a golf course or high-yield crop land, and expecting (2) that 3,000 m³ of irrigational water is required for each ha per year (with the UJAMS plant producing estimated mio 1,5 m³/a, sufficient for 500 ha), the direct economic value generated through the water reclamation plant is about 17,500 EUR per ha, which is mio 8.75 EUR.

The macro-economic multiplier (reflecting the jobs and incomes generated by the local business developed on the irrigated land, within the economic cycle of salaries spent generating income and salaries for third parties, fourth parties and so on) may be estimated at 2.3 (taking into account what extensive cost-benefit analyses have shown for similar infrastructural investments and operational outcomes), and the macro-economic capital value generated would be 2.3 times higher than mio 8.75 EUR and make as much as mio 20 EUR.

This economic perspective justifies the expenses for the wastewater reclamation plant, which will need an investment of about mio 8 EUR, and total costs of around 3 EUR per m³ (OPEX plus CAPEX under the BOOT contract).

Environmental benefits

Water reuse, in general, results in huge benefits for the environment. The reduction of fresh water intake and the elimination of contaminated wastewater discharge prevent negative environmental impacts.

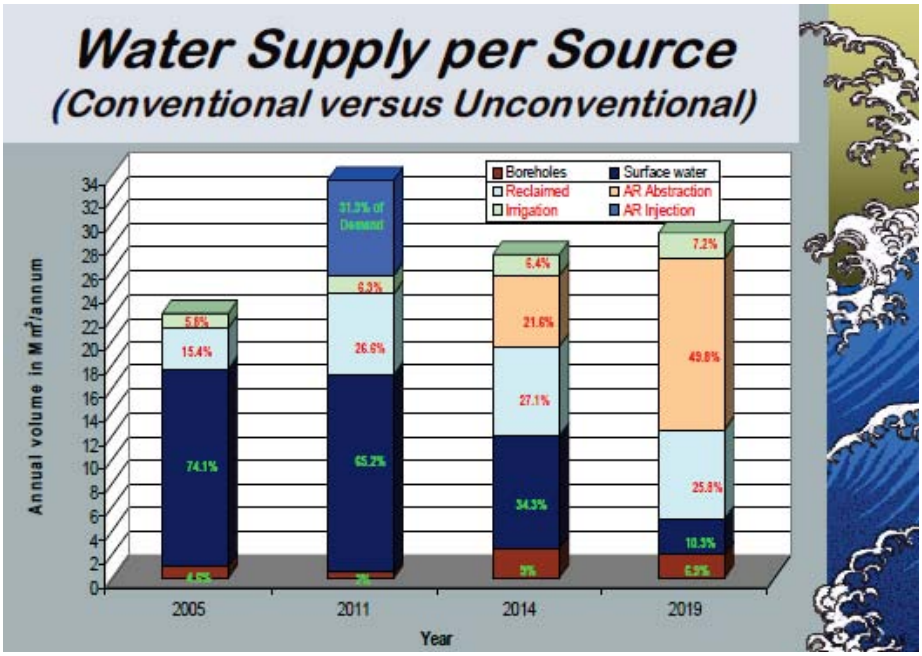

Figure 7. Water supply per source

Social benefits

The project does not directly target low income settlements or poverty alleviation. However, it will generate a considerable social benefit due to the increased availability of land for use after reuse water is available for irrigation. This land will generate business activities, contributing to the economic development of the City of Windhoek, and generating revenues which will serve the public budgets, including those for social welfare.

Furthermore, contamination of the receiving river will be eliminated after the reuse plant comes into operation. This will decrease pollution of the drinking water (raw water) of poor populations downstream who are forced to rely on this source (as they have no other source, or cannot afford water from public stand pipes or elsewhere).

Hydropower for the green economy: a new approach to capacity building and sustainable resource development

International Hydropower Association

Type of tool: assessment tool
Issue: watersheds, industry
Location: worldwide

Challenges

In many countries there is considerable potential for hydropower to contribute to the emergence of a green economy, as it offers much-needed low-carbon electricity for development. However there remain significant challenges to ensure that hydropower can deliver sustainable developmental benefits locally, regionally, and globally, and meet the expectations of all stakeholders.

A key challenge is the institutional capacity to effectively integrate sustainability into the design, construction and management of hydropower projects, and, prior to the design of a project, to assess alternative options. Sustainability in hydropower is complex, involving a broad range of economic, social and environmental aspects, and often requiring trade-offs between these aspects. Reaching consensus continues to be a challenge – between government and non-governmental stakeholders, nationally and internationally – at all stages of the development of a project. In turn this lessens the willingness of financial institutions to provide essential finance and expertise, thereby reducing prospects for the green economy. The Hydropower Sustainability Assessment Protocol is a response to these challenges.

Objectives

This case study presents the Hydropower Sustainability Assessment Protocol 2010 ('the Protocol')[21], a globally applicable framework for assessing the sustainability of hydropower projects. The Protocol enables project operators to assess the sustainability of projects according to a range of sustainability topics and to get an overview of where current operations meet basic good practice and proven best practice, as well as scope for improvement. It will show that sustainable hydropower plays a significant and growing role in the green economy and that the last decade has provided the sector with insight on lessons learned from previous tools and applications. Moreover, the Protocol has benefitted from significant multi-stakeholder engagement during its Protocol, and these stakeholders continue as members of the committee governing the Protocol.

In the green economy, hydropower plays a key role in both climate change mitigation (in its function as a low carbon electricity source, as well as an enabler for other renewable energy source) and climate adaptation (for example, reservoirs play a key role in water resources management infrastructure, and often include hydropower, often the primary or only source of funding for the development of this infrastructure).

[21] http://hydrosustainability.org/

Drivers of change

The Protocol was developed by the Hydropower Sustainability Assessment Forum, a wide-ranging multi-stakeholder forum convened by the International Hydropower Association, over a period of three years from 2008 to 2010. The range of stakeholders involves was extensive, with government and non-governmental stakeholders, developed and developing country stakeholders, and industry and financial organisations each involved, and convening their own reference groups to discuss and agree on key issues.

The approach: the Hydropower Sustainability Assessment Protocol

a. Protocol principles and structure

The Protocol assesses the four main stages of hydropower development: Early Stage, Preparation, Implementation and Operation. Assessments rely on objective evidence to create a sustainability profile against some 20 topics (Table 1) depending on the relevant stage, and covering all aspects of sustainability.

Table 1. Protocol topics that are typically addressed during an assessment: Sustainable development requires people to look for synergies and trade-offs amongst economic, social and environmental values. This balance should be achieved and ensured in a transparent and accountable manner, taking advantage of expanding knowledge, multiple perspectives, and new ideas and technologies.

Cross-cutting	Environmental	Social	Technical	Economic / Financial
Climate Change	Downstream Flow Regimes	Resettlement	Sitting and Design	Financial Viability
Human Rights	Erosion and Sedimentation	Indigenous Peoples	Hydrological Resource	Economic Viability
Gender	Water Quality	Public Health	Infrastructure Safety	Project Benefits
Livelihoods	Biodiversity and Invasive Species	Cultural Heritage	Asset Reliability and Efficiency	Procurement

It is important to emphasise that a Protocol assessment will provide a sustainability profile (Figure 1) of a particular hydropower project/facility at a specific stage of its development, but not a 'pass' or 'fail' result. There is a common view across a diversity of sectors (e.g. governments, NGOs, civil society, industry, banks) on the important sustainability considerations that need to be taken into account to form a view on hydropower project sustainability. The Protocol itself however makes no specification on requirements for acceptable performance. Instead, it aims to provide an analysis of the various sustainability topics being assessed. As is presented in Figure 1, scores are allocated in a range from 1-5,

with a 3 score 'basic good practice' and a 5 'proven best practice'. Thus, the scoring system highlights areas for improvement and provides an incentive for continuous improvement of the operations.

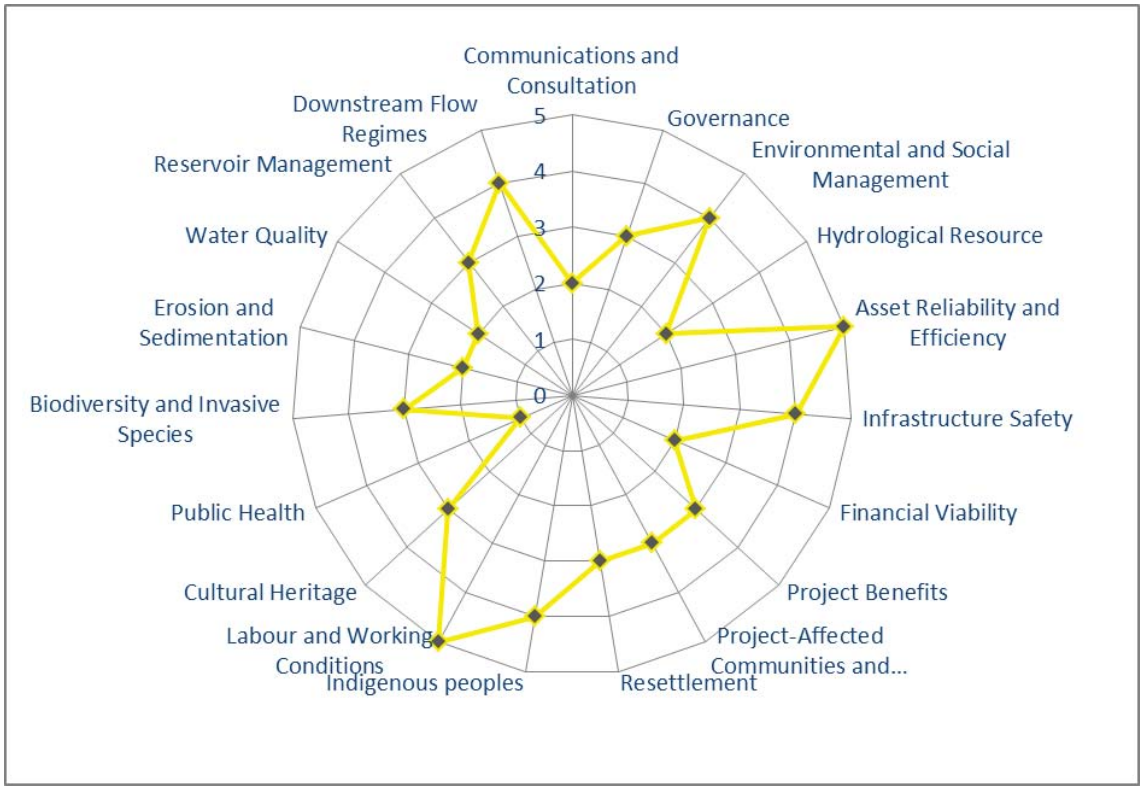

Figure 1. Sustainability Profile: For each sustainability topic, performance is scored from 1 to 5, with 5 being proven best-practice, and presented in an easy-to-read profile

b. Protocol development

The Protocol is the result of intensive work from 2008 to 2010 by the Hydropower Sustainability Assessment Forum, a multi-stakeholder body with representatives from social and environmental NGOs (Oxfam, The Nature Conservancy, Transparency International, WWF); governments (China, Germany, Iceland, Norway, Zambia); commercial and development banks (Equator Principles Financial Institutions, The World Bank); and the hydropower sector, represented by IHA[22]. Further to the variety of stakeholders within the Forum, the development and review process of the Protocol was substantial, with four drafts developed over a period of two and a half years, 20 field trials in 16 countries across 6 continents, and overall stakeholder engagement with 1,933 individuals in 28 countries (Figure 2). Several of these trial reports are available on the internet[23].

[22] http://hydrosustainability.org/Hydropower-Sustainablility-Assessment-Protocol/Phase-1--Protocol-development-%282007-2010%29/About-the-Forum.aspx

[23] Hydropower Sustainability Assessment Protocol 2011, http://www.hydrosustainability.org/

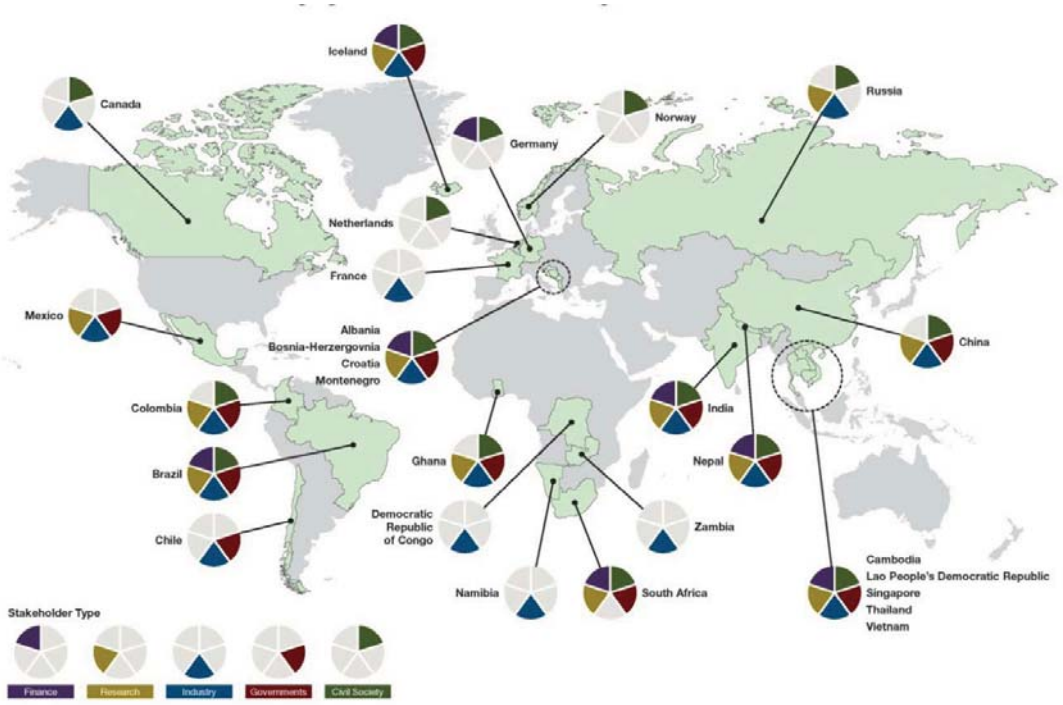

Figure 2. Extent of HSAF Engagement Activities during Consultation Phases

The Hydropower Sustainability Assessment Forum completed its work in November 2010. Between November 2010 and June 2011, an interim governance committee developed both the Terms and conditions for use of the Protocol[24] and a Charter for the Hydropower Sustainability Assessment Council[25]. The latter document outlines the permanent multi-stakeholder governance framework for the Protocol. This Council comprises several chambers representing environment or conservation organisations, social impacts and indigenous peoples' organisations, and project affected communities, development, public or commercial banks, financial organisations, and private investors/ investment funds, emerging and developing economy country governments, advanced economy country governments, hydropower consultants, contractors or equipment suppliers, and hydropower operators or developers.

These chambers will elect representatives to a governance committee tasked, among other things, with ensuring that assessments constitute appropriate applications of the Protocol and with considering and approving formal training material for use with the Protocol. Dr Joerg Hartmann, Water Security Leader, WWF International, is the first chair of the Protocol Council's Governance Committee.

In addition to the governance committee, a management entity exists to manage the day-to-day operations relating to the Protocol, including ensuring compliance with the terms and conditions for use. The management entity currently resides within the International Hydropower Association's Central Office in London.

[24] http://hydrosustainability.org/Hydropower-Sustainablility-Assessment-Protocol/Phase-2--Protocol-implementation-%282007-2010%29/T-C.aspx
[25] http://hydrosustainability.org/Hydropower-Sustainablility-Assessment-Protocol/Phase-2--Protocol-implementation-%282007-2010%29/Interim-Governance-Committee.aspx

c. Protocol application

The core strength of the Protocol is that it provides decision-makers, both internal and external, to a project in development or a facility in operation, with a powerful tool to guide informed decision-making. An assessment using the Protocol provides a clear snapshot of a project's strengths and weaknesses, based on a rigorous analysis of a wide variety of verbal, visual and documentary evidence. It also allows the decision-maker in question to overlay their own regulatory or financing requirements over the results.

i. *Sustainability Partners*

In initial discussions with potential Protocol stakeholders, it became clear that a 'package' of Protocol activity would be most beneficial to potential participants so that they could clearly see the process of continued improvement which occurs from multiple Protocol applications. Accordingly, a package was developed whereby project participants would work with IHA as Sustainability Partners and receive the following:

- Pre-assessment visit and training

This is a workshop for participant organisations and nominated external representatives (e.g. from NGOs or relevant regulators) to ensure that participating staff are sufficiently prepared for the Protocol assessments, and that the unofficial Protocol assessment can be conducted in accordance with guidelines for official assessment. The intent of including external representatives is to both communicate information on the project to a wider range of stakeholders, and to demonstrate the participating organisations' sustainability commitment to organisations such as external stakeholders, agencies or regulators and assist in the building of on-going relationships. It is also intended to embed Protocol systems into participating organisations.

- Unofficial Protocol assessment

This is, in essence, a 'training run' Protocol assessment on a specific hydropower facility. Engagement around this assessment will enable staff of the participating organisation not only to conduct further internal Protocol assessments, but also to prepare for official assessments, understand project sustainability weaknesses and strengths and address them, and to promote the incorporation of sustainability criteria into management and reporting systems. This assessment provides a valuable opportunity to implement the learning developed through the in-country training and capacity building phase of the partnership.

- Official Protocol assessment

Subsequent to the unofficial assessment, an official Protocol assessment of the project will be conducted. An official Protocol assessment is defined in the Protocol Terms and Conditions[26] and must meet key conditions. These include that the assessment is carried out by an accredited assessor and with the written support of the project developer or owner. At the partner organisation's discretion, this assessment can include the participation of regulators to demonstrate broader regulatory compliance. This engagement is intended to increase knowledge and capacity around the Protocol and hydropower sustainability more generally. Publicising the results of this assessment is encouraged as it can serve as a powerful

[26] http://hydrosustainability.org/Hydropower-Sustainablility-Assessment-Protocol/Phase-2--Protocol-implementation-%282007-2010%29/T-C.aspx

indicator of commitment to sustainability, and will promote more informed dialogue and decision-making.

ii. Life+

In 2010, the European Parliament approved substantial funds to enable application of the Protocol. This project is called Hydro4LIFE[27] and comprises a €1.2 million investment over three years (2010-2013), 50% co-funded by the European Commission's Life+ Environment Policy and Governance programme, and 50% by IHA, focusing on implementing the Protocol within the European Union. Sustainability Partners operating within the European Union will participate in Hydro4LIFE.

d. Development of a database based on past assessments on basic good and proven best practices

In order to share experiences and knowledge of good and best practices, an assessment database is being developed. This database will be available online and capture the results of all official Protocol assessments. The intent of the database is to present the results of Protocol assessments and provide information to allow the Protocol and its implementation to be improved over time. This database will also enable operators to learn from lessons at other projects and to liaise with the operators on potential impact mitigation and benefit maximisation opportunities.

Further to the database, which will be an on-going tool for practice sharing, past findings on sustainable hydropower are presented online[28] as a guidance and learning tool for operators, researchers, practitioners, policy makers and regulators.

Evaluation: economic, social and environmental benefits

a. The protocol from a sustainability perspective

The sustainability principles upon which the Protocol is founded include the critical concept of considering synergies and trade-offs between economic, social and environmental values. The balance between these trade-offs should be achieved and ensured in a transparent and accountable manner, taking advantage of expanding knowledge, multiple perspectives, and innovation. The approach of the Protocol can be considered a 'hard sustainability' approach as it calls for key natural and social assets, such as biodiversity or cultural heritage to be addressed, and not considered convertible to physical or financial capital vis-à-vis 'soft sustainability'. Other core sustainability principles include social responsibility, transparency and accountability. It is also notable that the Protocol takes an integrative approach, prompting consideration of aspects of hydropower that cannot be easily categorised as one of economic, social or environmental.

It is critical to assess the sustainability of hydropower, because if it is developed and managed in a sustainable manner, it can provide national, regional, and local benefits, and has the potential to play an important role in enabling communities to meet sustainable development objectives.

[27] http://hydrosustainability.org/Hydro4Life.aspx
[28] Sustainable Hydropower Website, http://www.sustainablehydropower.org/

The Protocol allows consideration of hydropower under the traditional sustainability perspectives. With regard to environmental considerations, the Protocol promotes improved performance in environmental and social assessment and management, hydrological and sedimentation management, and water quality and biodiversity for example. Social and poverty alleviation impacts are addressed through improved performance in a wide range of social issues, e.g. project-affected communities, resettlement, indigenous people, working conditions and cultural heritage. From an economic point of view, the Protocol promotes improved performance in financial and economic viability of hydropower projects, as well as sharing of project benefits. By providing a common platform for dialogue on sustainable hydropower, the Protocol promotes the contribution that sustainably developed hydropower will make to economic development.

All countries and organisations adopting and supporting this Protocol respect the need for institutions to have their own policies and positions on acceptable performance for a hydropower project. All organisations expressing support for the Protocol recognise that a Protocol assessment can make a substantial contribution towards understanding and achieving sustainable projects. In producing a sustainability profile, the Protocol can help inform decision-making on projects, which can be done by individual institutions and organisations or even country governments.

b. The protocol for capacity building

There are three aspects related to the use of the Protocol and capacity building.

Firstly, any Protocol assessment is accompanied by training on sustainable hydropower, which is provided to industry partners, local NGOs as well as relevant regulators. This is being done under the Sustainability Partnership model, which has been developed as part of Protocol implementation. The training builds capacity of the participants and thus enables them to apply the Protocol to other projects and also enables the operator as well as local regulators and civil society to understand requirements a sustainable hydropower project would be required to meet. Sustainability considerations can thus be incorporated in a broad range of stakeholder activities.

Secondly, it is an integral part of the requirement for an official protocol assessment that the assessor is officially accredited to carry out Protocol assessments. The Protocol governance committee is currently developing a system to qualify and accredit assessors. There will be an incentive for existing assessors with relevant experience to receive training to become accredited to carry out Protocol assessments on a variety of sustainability considerations.

Thirdly, since the Protocol is freely available and written in accessible language, it has the added value that it can be used to provide general guidance. For example it may be used in training, in internal objective-setting, or to provide inspiration for hydropower sectoral guidelines for environmental impact assessment. Thus the Protocol provides guidance to operators and regulators beyond the immediate projects that are assessed.

c. Context of hydropower in the green economy

If well managed, hydropower provides many solutions for energy and water management in a green economy. With regard to climate change mitigation, hydropower as a clean, renewable energy source contributes directly to global low carbon energy goals, and

therefore to climate change mitigation. Hydropower's capacity to enable the further development and use of other renewable energy sources, such as wind and solar, means that it has a vital further mitigation role to play.

Climate adaptation, on the other hand, is now increasingly considered on a par with climate change mitigation as critical to the success of international efforts to deal with climate change. It is often acknowledged that extreme weather events will become more frequent. World economies will be increasingly vulnerable to the devastating consequences of droughts and floods if their development agendas exclude investment in water management.

Hydropower offers a number of benefits by enabling current and future adaptation to the effects of climate change. A reservoir, as part of hydropower infrastructure, has the advantage of offering multiple services. As well as offering clean, renewable energy, a hydropower reservoir can enhance water security and management, providing flood mitigation, storage for irrigation and other purposes, and the stabilisation of downstream flow regimes. Other facilities a hydropower reservoir offers include tourism and recreational facilities, habitats for biodiversity, and increases in income generation options for example through fisheries.

Lessons learnt from implementation

The single most important lesson from the development of the Protocol is that consensus on sometimes controversial sustainability challenges *can* be achieved, with some persistence and a willingness to engage on the part of all. The diversity and breadth of stakeholders – some with highly divergent views and previously entrenched positions – agreeing to the detailed content of the Protocol documents (and the terms and conditions for its use, and governance mechanisms) is unprecedented. Only one area of non-consensus remains, in the issue of consent of project-affected communities, displaced people, and indigenous peoples.

Since agreement on the Protocol document was reached in late 2010, one Protocol assessment has been carried out, offering useful lessons for protocol implementation. The assessment of the Shardara multi-purpose project in Kazakhstan (in support of the GTZ programme *Transboundary Water Management in Central Asia*) Programme provided important experience in the practicalities of Protocol assessment, confirming the need for clearly-defined roles during Protocol assessment, detailed preparation which is critical to evidence-gathering, and the importance of carefully scheduling consultations with local communities. These lessons have been used in the compilation of a series of training and reference manuals which guide the lead assessor, assessment team and project developer/operators (and others) during a Protocol assessment. These lessons and manuals will be drawn upon in up-coming Protocol assessments scheduled in the near future in Australia, Southeast Asia, Europe and Latin America.

Global application and relevance for developing and transition countries

The Protocol as a globally-applicable framework; indeed it was actively designed to be globally-applicable, and applicable to all types and sizes of project. The application of the Protocol is particularly important in developing countries in Asia and Africa, where there is significant un-tapped hydropower potential and yet there are highly significant sustainability risks and weaker institutional capacity to manage and deliver sustainable outcomes. IHA is looking for Sustainability Partners to implement the Protocol in developing countries and

elsewhere. Sustainability Partners are organisations that are keen to take a take on the challenge of continuously improving hydropower sustainability performance. Sustainability Partners receive training and capacity building on the Protocol, an unofficial assessment of a chosen project/facility and finally an official assessment of the same project.

Conclusion

Sustainable water resources development will be crucial for implementation of the green economy in all countries. Hydropower development or review of existing practices will be an important consideration in many countries. The Hydropower Sustainable Development Protocol provides a means to build capacity, learn from past lessons and implement future hydropower with a consideration of local communities, maximising benefits from multi-purpose development as well as the broader sustainability topic.

ZINNAE: Zaragoza Urban Cluster for Efficient Water Use

Marisa Fernández Soler and Clara Presa Abós, Technical Secretariat of ZINNAE

Type of tool: technology
Issue: cities
Location: Zaragoza, Spain, Europe

Challenges

The city of Zaragoza has made important collective efforts to increase efficiency in water use in all social sectors. The combined process of institutional and technological change and adoption has lead to the creation of specialised companies and to accumulated experience. The city has become a space for permanent demonstration and innovation for projects related to urban water use.

Zaragoza:

a) Concentrates a varied critical mass of companies linked to the water cycle, covering different activities related to the efficient use of water (supply, treatment, products, green areas, etc.).

b) Public administrations in Zaragoza have been engaged in water quality improvement and water demand reduction.

c) It has research and training centres linked to water and energy efficiency with an important international tradition.

d) The demonstration project "Zaragoza, Water Saving City" has been developed in the city since 1997, the purpose of which is to save water and to use it efficiently in the city through changes in both behaviour and technology.

The city was the venue for the Expo Zaragoza 2008 exhibition, which had the motto "water and sustainable development". The event reinforced the brand of the city in relation to the efficient use of water.

There was a need to realise synergies and maximise potentials for companies in Zaragoza and nationally. In 2009, several organisations fostered the creation of an Urban Cluster for the Efficient Use of Water, focused on boosting the innovative business sector linked to water use efficient in urban areas, thereby creating employment in the city. In addition, a new variable to this initiative is to be introduced: the energy efficiency linked to the urban water cycle.

The drivers/ opportunity for creation of the cluster

Two external global trends guarantee the timeliness of this initiative:

- The water market is one of the first five markets of the world, with a turnover reaching US$400 billion and an annual growth rate of 7%, according to data disseminated by Watertech Online.

- Global water demand will continue to increase, largely due to the growth of urban population (in 2020 “over 50% of the population in developing countries will be urban”).

The approach

Defining the mission and the vision

The Urban Cluster for the Efficient Use of Water in Zaragoza was created with the following mission: To promote efficient and sustainable use of water as well as associated energy consumption in urbanised areas of Zaragoza, getting different public and private actors to collaborate, starting with knowledge generation, demonstrative projects and innovative solutions.

And with this vision: To become a leading international collaboration, knowledge and innovation example for efficient and sustainable water use in urbanised areas as well as a driver of quality employment for Zaragoza.

Establishing strategic targets

These mission and vision were translated into three strategic targets:

1. To boost efficiency and sustainability in water use and management as well as in the associated energy consumption of the city of Zaragoza.

2. To position the AEI on a national and international level as a collaboration, knowledge and innovation referent for efficient and sustainable water management in urbanised areas and for the reduction of the associated energy consumption.

3. To turn water use efficiency into a driver of quality employment for the city.

Establishing membership

In 2011 ZINNAE includes twenty six public and private entities which take part in the hydrological cycle management in the urban area. They are all part of the water efficiency sector in Zaragoza:

Business Sector (17 members):

- Alfredo Sanjuan
- Aquagest
- Aqualia
- Barrabes
- Brial
- Contazara
- DAM
- ESHYG
- Griferías Grober
- Grupo Raga
- IDATA
- Jacob Delafon
- Libelium

- Mann+Hummel
- Sopesens
- Veolia Agua
- Zeta Amaltea

Regional and Local Authorities (4 members):

- Ayuntamiento de Zaragoza
- CHE
- INAEM
- Gobierno de Aragón

RTC Centres (2 members):

- CIRCE
- Universidad de Zaragoza

Other members (3):

- ECODES
- Ecociudad Valdespartera
- Feria de Zaragoza

Implementing actions

ZINNAE has four axes of action:

1. Demonstrative projects

- Research on urban water demand in Zaragoza
- Demonstrative projects for the improvement of urban water demand efficiency and sustainability

2. R+D+i, new technologies and experimentation

- Fostering and supporting R+D+i projects
- Identifying and disseminating new knowledge and emerging technologies

3. Development of the innovative business group

- Dynamising the local sector
- Exploring opportunities to collaborate with external agents, both nationally and internationally

4. Sectoral development

- Favouring the local establishment of actors belonging to the sector (projects, entrepreneurs, institutions, companies, etc.)

- Building capacity for the professionals of the sector (architects, installers, tradesmen, etc.)

Partnering for implementation

ZINNAE members participate actively in the cluster's activities. The cluster's priority initiatives are defined annually in the Assembly, identifying projects and actions for which working groups and commissions are created. Depending on the aims and contents/subjects of the projects, each member is represented in the working groups or commissions by the Area or Department that best defends its interests: Environment, Marketing, I+D+I Department, or other.

As well as specific Cluster projects, ZINNAE promote active cooperation among its members, facilitating bilateral or multilateral initiatives which contribute to the overall targets established in the Strategic Plan 2010-2013.

Lessons learnt from implementation

The general lessons learnt from implementation are:

- A cluster must be mainly composed of business and the RTD sector (linked to water in ZINNAE), but it is crucial to launch the initiative with the collaboration and support of regional and local authorities, to attract the most innovative agents.

- It is necessary to articulate and organise the participation of the RTD Sector. It usually runs many initiatives relevant to the business sector but they often not known.

- The cluster secretary must analyse its members' activities and priorities individually in order to promote active cooperation among the cluster members to launch multilateral initiatives.

Approach	Lessons learned
Formulation of Strategic Plan	The Strategic Plan formulates the mission and vision of ZINNAE. This is essential to set up a multisectoral organisation such as a cluster.
Identification of 13 possible cooperation projects	The technical secretariat of the cluster, which organises the initiative, analyses the activities and priorities of each member. This is necessary to promote cooperation between the different partners and to launch the multisectoral initiatives.
Commissions and Project Groups	The urban water cycle covers a wide range of companies. Many of these companies do not compete, but are complementary. The key for achieving cooperation between the different members is to facilitate and stimulate bilateral meetings between these members.
The three sectors that are integrated in the cluster are:	To attract the most innovative agents, a cluster must include companies and research centres, but it is also crucial to gain

research community, private sector and public administration	support of the local and/or regional public authorities.
Two of the main research centres of Zaragoza joined the cluster	Water-related initiatives are often isolated and not shared between the public and private sector. It is essential that the research community and technical sector participate in the cluster.
Recruitment of members	ZINNAE does not focus on the recruitment of new members, but aims to deepen the collaboration with existing members. Still, the number of members has doubled in the two years since its foundation. It should be the members who set the pace of growth of the cluster, combining the joint activities with the recruitment of new members.
Launch of the Waterlabs: identifying urban spaces for innovative experiments	Although there are already examples in Zaragoza of demonstration and innovation via “living” laboratories, it is critical to count on the research community and technical sector to systemise the results of these demonstrations and innovations.
Workshop Waterlabs: national experiences with innovation through the Living Labs methodology	All living labs at the national level start with a large initial investment to ensure the monitoring and analysis of results. In Zaragoza we have to use the existing platforms (Ecocity Valdespartera, Brial experiences in hotels, Switch experience in Actur) if we want to implement a "living laboratory" for products and services related to water.
Implementation and leadership of projects 2011-2012 The Strategic Plan defines 13 cooperation projects. The first year started with Waterlabs, a proposal from the technical secretariat. In the second year (2011-2012) we will initiate two other projects (one as a continuation of Waterlabs), led by two member companies.	The companies know the need for action and innovation in the water sector and are the engine of the cluster and of the cooperation projects that they set into motion.

Follow up for scaling up

In 2010 the Waterlabs project was established, based on Living Labs methodology for innovation. The project aims to boost Zaragoza as an experimentation site in order to test the

effectiveness of existing practices, solutions and technologies for efficient and sustainable water use, in terms of water consumption and energy. WATERLABS' targets are:

- To fit out and facilitate settings for permanent experimentation in the city.
- To attract the most innovative agents of both the sector and complementary sectors to R+D+i projects in Zaragoza.
- To boost R+D+i of products and efficient solutions for water and energy (associated to the water use) consumption.
- To develop new technological solutions that are marketable on both national and international levels.

Both the cluster development and Waterlabs project should increase the innovation potential of the business sector, and identify RTD projects for the Research Centres. This is relevant for developing countries in two ways:

- Launching Research and Technology Development projects for water solutions.
- Favouring the cluster working methodology which involves joining efforts between the research sector, business sector and local and regional authorities.

6. Water planning in the transition towards a green economy

Rafael Romeo (Ebro River Basin Authority), Manuel Omedas (Ebro River Basin Authority), Rogelio Galvan (Ebro River basin Authority), Carlos Mario Gomez (University of Alcalá and IMDEA Water Foundation)

Freshwater is a finite and vulnerable resource, essential to sustain life, development and the environment;

Water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels;

Women play a central part in the provision, management, and safeguarding of water;

Water has an economic value in all its competing uses, and should be recognised as an economic good.

The Dublin Principles

The opportunity to improve governance arrangements is one of the biggest opportunities to speed transition to a greener economy. In any area where there is water scarcity, it is critical that governance arrangements are put in place to prevent over-use and overdevelopment of the available water resources.

UNEP (2011)

The challenge for planning

Water is not only essential for the production of single commodities, goods and services and for meeting individuals' drinking water and sanitation needs. Water is also fundamental for the maintenance of the entire economy. Development prospects in any nation are propelled or constrained depending on the way water resources are managed. Welfare advances and economic progress in poor and rich nations are more or less vulnerable, depending on the state of conservation of water resources and water infrastructures. Personal development opportunities depend on the access people have to basic drinking water and sanitation services. The fragile border between social peace and civil conflict often depends on how the benefits and costs of water use are shared amongst individuals and countries. Ultimately, the future of humanity depends on the conservation of the earth's ecosystems and their ability to provide the critical environmental and water services the economy and the entire global society depend upon.

For all the aforementioned reasons, decision making on how and how much water to use in the economy or to conserve in nature cannot be simply left to individual interest. *Water needs to be governed*. But water planning is not only concerned with building the infrastructures to satisfy rising water demand as a result of economic and population growth. This is not possible in the long term because, firstly, water resources have a limited capacity

to cope with water abstractions and effluent discharges, and secondly, because the benefits we obtain from using and transforming water ecosystems (by abstracting, diverting, degrading water sources, etc.) enter in conflict with other important economic benefits whose provision depends on the conservation of water sources and their associated ecosystems. The last services include, for example, security in the face of droughts and future uncertain water supply due to climate change, flood control, self-treatment and depuration, biodiversity support, navigation, landscape and recreational opportunities and also the regulation of the water cycle which the provision of water depends on.

The transition towards the green economy requires improvements the water environment without harming prospects for economic development. This implies not only making welfare and social improvements compatible with the preservation of water resources but also finding new and innovative opportunities for economic growth and social development through sustainable water management. *Water plays a key role in economic development and water planning is a powerful social instrument for optimising growth, poverty reduction and environmental benefits.* This is the case in advanced, transition and poor economies as the cases of Spain, Korea and Laos show.

Water planning has a distinct role to play in less developed countries. The benefits of providing basic water and sanitation services in this early stage of development are of paramount importance for lifting people out of the poverty trap. Gains in health and education opportunities mean increased prospects for personal and social progress if revenue raising opportunities are also available (e.g. food production in rural economies). Water planning is important to start and sustain the development process. But water development can be challenging if water is scarce, requiring substantial investments in public infrastructure or the development of alternative water sources (such as water harvesting or desalination).

Climate change will increase the uncertainty and variability of water availability and will reduce the security of water services. Increasing water scarcity and variability (occurrence of droughts and floods) will affect rain-fed agriculture and water supply for domestic use, energy, industry and agriculture, and will likely generate pressures for increasing irrigation and cultivating marginal lands. *Water planning must provide the institutional space to build a collective response to the climate change challenge and build the resilience of water management.*

The alternative to water planning is allowing the spontaneous, unplanned and uncoordinated actions of anyone affected by water stress; actions that could lead to increased vulnerabilities. Spontaneous responses from people, businesses, and farmers in rural communities depend on their perception of value and risk, the options available to them and their individual economic incentives. These responses may not necessarily produce the most sustainable outcomes. For example, they may add more pressure to cultivate marginal land, or unsustainable cultivation practices may be adopted when yields are reduced because of erratic rainfall. The end result may be increased water scarcity, land degradation and the endangerment of biodiversity, thus increasing vulnerability and reducing capacity to respond to climate change and other risks later on.

Planned and anticipated responses are needed to ensure the provision of water services which underpin the economic system. Water planning is also necessary to cope with

environmental challenges such as water scarcity, water quality degradation and climate change risks.

Approach: the elements of planning

Reaching a social agreement on the desired balance between water use and water resource conservation

The first purpose of water planning is reaching a social agreement on the desired balance between water use and water resource conservation, or in other words, agreeing on the balance between water use and pressures on the one hand, and conserving water on the other. This basic but politically challenging agreement is a necessary condition for successful water planning. For example, since 2002, the Water Framework Directive of the European Union has set the objective for water planning as making economic progress compatible with the improvement and protection of the status of the affected water bodies (any exception to this principle requiring a special justification in terms of improvements in economic welfare).

In an international river basin, this basic agreement on the balance between water use and water resources conservation might only be driven by the need to cooperate in sharing the benefits derived from the river. By specifying the responsibilities of each country and by enforcing the agreement among them, all the countries ensure their contribution to the benefits of preserving the international river basin. Successful cooperative agreements of this kind are based on the mutual responsibility to comply with some precisely defined and observable environmental standards. A practical way to implement this kind of cooperative agreement is to incorporate these standards in national and local water planning so that the fulfilment of the international agreement and the credibility of the national partners are reinforced and foster cooperation. This is the case for the Mekong River basin international agreement and its important influence on the goals and means of water planning in the Lao PDR.

Harnessing development opportunities and coping with water and development challenges

In the Ebro River basin, water management has been a tool for development. Water underpins the powerful agro-food industry, based on the development of irrigation systems, and a dynamic energy complex, centred on hydropower along the main river and its tributaries but also replying on water to cool thermal fossil and nuclear power plants. The river valleys are also essential for transport, the manufacturing industry and population settlement. Water planning has undoubtedly played a role in the progressive economic development of the region, but the amount of water used has exceeded its sustainable limits and recent efforts have been made to reduce water pressures and increase conservation of water resources. Modernising irrigation systems is now a priority for guaranteeing water supply and increasing the resilience of agriculture to droughts.

The existing dams in the Ebro basin are able to provide a reliable supply of water for urban areas and for irrigation as well as flood control services, but some efforts are required to avoid negative impacts on sediment balances, river bed encroachment and saline intrusion in the lower Ebro. Water development has been able to provide enough water of the desired quality for a variety of water uses, but increased use has reduced the amount of water stored

and the potential for hydropower, thus reducing the value of the installed power generation capital. All this has reduced environmental flows and altered the habitat conditions, making river restoration one of the main objectives of recent water planning. The main objective of water planning in the Ebro today is recovering the balance between the status of water resources and their critical environmental services, and the gains already achieved in economic development.

The case of Laos is distinct because the country has abundant water resources (in fact most of the runoff of the lower Mekong comes from Laos). Moreover, in the Mekong river basin, Laos is a late comer to economic development and water resources are affected by water regulation in the upper basin, and in particular the significant hydropower projects already built or under construction in China. The transboundary nature of the river basin also means that intensive water use in Laos might have detrimental impacts on the already developed irrigation fields and populated areas of Vietnam and Cambodia in its delta. The development of Laos is only possible if water planning is able to address potential conflicts between water users and uses, and able to transform competition over scarce resources into mutual cooperation to conserve and share the benefits of improved water resources. Adapting hydropower dams in China in order to meet irrigation needs in Laos, and water uses in Laos to help maintain environmental flows required in the Vietnamese Mekong delta, are examples of such mutually beneficial arrangements.

In contrast to the Ebro, Korea is a transition economy where there are still opportunities for the construction or the expansion of dams and weirs as a central element of water planning. Nevertheless, environmental objectives are still important as public demand for recreation and well preserved water landscapes increases with income levels. Moreover, there is a commitment to preventing further deterioration of water quality and water landscapes due to the perceived importance of water security and the need to meet water demand in the long term.

Building governance and institutional capabilities

Building governance and institutional capabilities is essential for agreeing on, designing and effectively implementing long-term integrated water management plans in order to support the transition towards green growth. The Laos experience illustrates a progressive strategy of improving water governance, by developing technical abilities, creating river basin management institutions, improving information systems and promoting stakeholder engagement.

Coordinating public policies

Water planning can only contribute to green growth if water is not perceived as a simple policy area (e.g. agricultural, energy or industrial policy). In the transition to the green economy, water planning needs to be converted into a cross-cutting policy, in order to guarantee that all other policies and projects – from urban planning to agricultural policy – are coherent with the collectively agreed objectives of water planning.

Policy coherence is critical because of the limited ability of water ecosystems to meet all the increasing and competing demands for water in the economy. Global water demand is increasing due to population growth, rising living standards, and expanding production of agriculture, hydroelectricity, and the many goods and services for which water is an essential

input. Water requirements today and in the future cannot be met unless all these uses of water are coordinated and water sources are conserved. Water planning enables the coordination and alignment of the many public policies (such as land use, urban and rural development, manufacturing and energy policies) and public policy objectives (such as economic efficiency, equity, basic needs coverage or cost recovery) which influence and are influenced by water management. Instead of being another public sector action, water planning makes water policy a horizontal axis connecting and coordinating many individual areas of public policy.

Green growth means increasing economic wealth and welfare without further deterioration of the water environment, and this is impossible without more efficient water allocation. But efficiency arguments are not valid when used to oppose the legitimate option of charging less than full cost recovery prices to provide basic water services in order to reduce poverty. Even in this case, there is a dilemma between subsidising water services and sustaining the provision of these services in the long term, for which self-financing is required. Cost effectiveness and budget constraints might also lead to excessive focus on the urban poor, offering them the lower cost alternative rather than providing water services to scattered populations in the rural areas. Deciding on the objectives for a river basin is a political and not a technical exercise. Identifying tradeoffs between different objectives and decision criteria in water management (such as efficiency, fairness, financial and environmental sustainability) is key to the planning process and provides the basis for political decisions to be made over what actions to take. A transparent planning process with stakeholder participation at all stages is essential and ensures that all voices are heard.

Stakeholder engagement and public participation

Effective water planning requires the cooperation and engagement of a wide range of stakeholders. Public participation helps construct a shared vision of the objectives, opportunities, challenges and collective and individual responsibilities involved in the management of water resources. It helps foster the perception of water as a collective asset to be preserved by mutual cooperation rather than a common pool resource to be depleted by open access and competition.

When people are aware of the benefits of cooperation through, they have incentives to build a reputation of good behaviour and social responsibility, fines can be perceived as fair and the threat of moral sanctions can deter misbehaviour. But this collective action can only be based on the common perception that water benefits are distributed fairly. This requires trust that the water authorities represent the common interest and follow transparent rules instead of their own discretion. Cooperation also requires that individual behaviour is observable in such a way that deviations are detected and pay a cost. Building effective participatory water planning therefore requires proper incentives, and must ensure that decisions are perceived as fair, rules are enforced, and there is transparent and adequate information available to all.

Aligning private decisions with collectively agreed goals

Within limits any water user has the option to decide how much water to use, for what purpose, in combination with what other inputs. These decisions depend on many factors such as income generated by the productive activity, water prices, and installed water use technologies. For water planning, it is essential that all the decisions taken by water users are

compatible with the different objectives of water policy. Incentives and regulations are then an important part of the package of measures in water plans. Charges for water services are one instrument to consider. If, for example, water is charged for with a flat rate, productive uses might have an incentive to use more water than their legally authorised water use rights, neglecting the needs of other downstream users and causing negative environmental impacts. These external impacts are not taken spontaneously into account in private decisions unless there are adequate incentives in the form of tariffs or penalties, controlled by a regulator. Energy subsidies, yield-linked agricultural subsidies and even water flat fees are all examples of incentives that may not be compatible with the objectives of water plans, including environmental goals. Water planning needs to address the compatibility of incentives transparently, identifying situations where these incentives are justified, and where they are not.

Establishing collective responses to scarcity and risk

Poor and water-scarce societies that are now trying to develop their water resources and provide basic water and sanitation services are faced with the potential adverse effects of climate change, constituting a real threat to development (World Bank 2010). Water planning is the proper institutional framework for coping with the challenge of adapting to climate change and for developing resilient and adaptive responses to drought, floods and other water related risks. Increasing uncertainty and competition for reliable water supplies makes devising water policy difficult and requires adaptive responses. Water allocation decisions and water demand management are especially crucial in the context of increasing competition and scarcity.

The options that may need to be considered in water planning include, as proposed by the IPCC, no regret strategies and climate justified strategies. No regrets strategies are measures that are worth taking anyway, regardless of climate change. Water storage schemes and infrastructures, water conservation programmes, and improvements in efficiency are examples of the kinds of measures already considered as beneficial but that are even more valuable in a climate stressed context (see Korea's four rivers programme). Climate justified strategies are measures which need only be considered in the face of uncertainty, for example, diversification of water sources (such as desalination or non-conventional sources), the upgrading of storm water systems, the reversal of coastal developments to reduce exposure, the recovery of floodplains for flood protection, and the recovery of aquifers for buffering security stocks. Achieving water security requires agreeing on a combination of the available options.

Summary of the elements of the approach

- Obtaining consensus of the population. Not only are the goals and instruments of water planning important but also the procedural aspects of how these goals and instruments are chosen with the participation of all the potential stakeholders. Participation can promote the vision of water as a social and economic asset that needs to be properly preserved instead of only as a provider of services. This way water planning promotes a common and shared vision of water assets such as aquifers and river basins.

- Providing guidelines for economic activities and cities to make decisions on water use. Once the goals and instruments of water policy are agreed upon, many practical recommendations are given to individuals, firms and institutions so that they

can adapt their actions in order to improve their contribution to water conservation and green growth.

- Making sustained welfare improvements and economic growth compatible with the recovery and adequate protection of water providing ecosystems. This is the essence of sustainable green growth.

- Coordinating individual actions with collectively agreed goals in terms of water use and water resources conservation. Water planning can be a powerful instrument to ensure that the actions of individual water users are not in contradiction with the common social goal of protecting water resources, making growth sustainable, and ensuring intra- and intergenerational justice.

- Avoiding the negative impact of individual, spontaneous and uncoordinated responses to natural disasters and climate change. These kind of responses can lead to water scarcity, impair water related ecosystems and increase inequalities and social exclusion. Water planning can foster collective, anticipated and planned responses to climate change, water scarcity, floods, droughts and other water related risks.

- Conflict resolution and management of the many social conflicts associated with the distribution of water among people, economic uses, time and regions. Planning is a means to foster collective agreements, public participation and consensus building which are basic elements to promote a common vision of the river basin as a collective asset.

- Promoting social justice by guaranteeing basic human needs are met, despite the lack of market incentives to provide basic water and sanitation services. Planning can also promote equitable distribution of water use rights and water development opportunities among potential water users.

- Helping preserve water resources and water providing ecosystems. Instead of adapting water resources to the needs and demands of the economic system, the focus of IWRM is to ensure that economy expansion is not obtained at the expense of further degradation of water providing ecosystems, but on their improvement and adequate protection.

Lessons learnt from implementation of planning processes

The approach	Lessons learnt from implementation
Reaching a social agreement on the desired balance between water use and water resource conservation	Setting the achievement of a good or fair ecological status of the water bodies as the main objective of River Basin Management Plans in the European Union has been an important element of water planning in the Ebro River Basin in Spain and has helped make economic development compatible with environmental objectives. Adopting a set of international commitments regarding the environmental status of the Mekong River Basin in Laos has been a central element of the coordination of water planning with national development policies. In Korea, clear objectives for the recovery of river ecosystems has been a critical element for increasing legitimacy and gaining public approval of an extended programme of water works and infrastructure development in Korea that is critical for sustaining economic growth.
Harnessing development opportunities and coping with water and development challenges	Water planning has played an essential role in the development of the agro food and energy complex that now represents a competitive advantage and a defining characteristic of the Ebro River Basin in Spain. In Laos, water policy has been the cornerstone the country's success in progress with the Millennium Development Goals and in the ongoing transition from a rural to a urban economy. In Korea, water planning has been developed as an anticipatory strategy to foster economic growth, preserve the welfare gains already achieved and provide water security in the future.
Building governance and institutional capabilities	An ambitious programme of building water governance structures is already in place in Laos. Transparency, regulation and enforcement, and building technical competences are key elements for this strategy to succeed, as seen in the Ebro river basin.
Coordinating public policies	The simultaneous development of the energy, the agro food industry as well as urbanisation and the expansion of the manufacturing industry have been possible within the capacity of the limited water resources available in the Ebro river basin. The agreed commitments of the international Mekong agreement have been a central element in the National Development Plan of the Lao PDR and have contributed to the coherence between objectives in the different economic sectors and the general

	objectives of water policy.
Stakeholder engagement and public participation	Active participatory mechanisms have contributed to the design of water management plans in the Ebro River, are being used in Laos and are an integral part in the management of water at local scales in Korea.
Establishing collective responses to scarcity and risk	The Water Framework Directive and the Mekong Agreement are promising examples of collective responses that have served to develop systematic efforts at a national and local level to respond to water challenges.
Monitoring progress and compliance	The acquisition of technical skills, the development of information systems, the building up of reporting strategies, etc. are all elements that have contributed to the reputation and credibility of river basin authorities in the Ebro and in the case of Korea. The capacity of the Lao PDR to manage its own water challenges have given credibility to its commitments in the Mekong agreement and has allowed Laos, in spite of being a LDC, to improve its position with respect to other national partners.

Lesson learnt from the specific cases

The lessons learnt from planning experiences are the following:

Cases	Lessons learnt from implementation of planning processes
Laos	Water planning needs to be based on and accompanied by institutional development. It is important to foster water governance structures such as the establishment of River Basin Authorities. Investment in the appropriate technical skills and the information technology is essential for assessing the status and the potential of water resources for development, verifying the actual outcomes of water policy and for monitoring and enforcing the compliance of water regulations. Specific attention has to be given to the development of participatory decision frameworks and to favour stakeholders' engagement in the policy making process. Focused efforts to improve the ability of stakeholders to manage information, compare complex water management options and also to agree on the objectives and instruments of water management are paying off. Fostering transparency of water allocation decisions and the gradual replacement of discretional decisions by rules and the application of norms

	is proving key to the avoidance of conflicts. Improving reporting and communication skills can foster the ability of water management to fulfil international agreements in the framework of the Mekong river agreement.
Korea	Establishing clear objectives: The Four Major Rivers Restoration Project of South Korea is to restore the Han River, Nakdong River, Geum River and Yeongsan River in order to provide water security, flood control and ecosystem vitality. It has five key objectives: 1) securing abundant water resources against water scarcity; 2) implementing comprehensive flood control; 3) improving water quality and restoring ecosystems; 4) creation of multipurpose spaces for local residents; 5) regional development centred on rivers. More than 929 km of national streams will be restored as part of the Four Major River Restoration Project. Linking it with national policy: This project was first announced as part of the "Green New Deal" policy launched in January 2009. It was later included in Korea's five-year national plan released in July 2009. Coordination of sectoral Ministries: The Four Major Rivers Restoration Project systematically approaches its objectives of restoring the rivers. As a comprehensive public project, the program includes a variety of plans submitted by several ministries, but coordinated by the Office of National River Restoration under the Ministry of Land, Transport and Maritime Affairs. The overall project consists of three sets of projects: 1) Main projects: the Han, Nakdong, Geum and Yeongsan rivers revitalization projects; 2) projects on the 14 tributaries of the four major rivers; 3) refurbishment for other smaller-sized streams.
Spain (The Ebro River Basin Management Plan	Establishing social development objectives: The Ebro Water Plan is a social opportunity to build a system of water management which is ethical, efficient and sustainable within the Ebro River Basin in Spain. Under the principles of Integrated Water Resources Management it includes ambitious environmental objectives (at least 85% of river water bodies will achieve good status by 2015), and also contributes to sustainable growth, strengthening the agro-food complex in the Ebro valley and the role of water as an energy source in a future which relies on energy from mostly renewable sources, and encourages the inclusion of new uses of water, such as recreational uses. Implementing key measures: The commitment to reduce pollution and the efforts to increase water efficiency are cornerstones of a process contributing to green growth. In particular, technologies for modernisation of irrigation in Ebro basin are necessary for efficient water management and the reduction of diffuse pollution, whilst simultaneously facilitating higher productivity. On the other hand, reducing pollution from point sources implies the creation of many green jobs. All in all, 56% of all the investments considered in the Ebro Water Plan are to improve water environmental status.

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The Four Major Rivers Restoration Project

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Type of tool: water planning
Issue: watersheds
Location: South Korea, Asia

Challenges

The project is designed to address the significant environmental challenges faced by the Han, Nakdong, Geum and Yeongsan rivers in Korea. Repeated flooding and droughts have caused human casualties, ecosystem loss and habitat degradation, property damage and forced displacement of riverine residents. Extreme weather events that lead to flooding and droughts are expected to worsen in frequency and intensity due to climate change impacts. In the case of the Yeongsan River, toxic contamination from domestic and industrial waste disposal has resulted in water quality levels unfit even for agriculture and industrial use. These environmental challenges have dramatic economic consequences.

In Korea, cases of torrential rainfall over 100 mm in a day have increased by 1.7 times during the last 10 years. In 2002, Typhoon Rusa brought record-breaking rainfall of 870 mm a day in Korea. Moreover, torrential rainfall is expected to increase by 2.7 times and droughts are expected to become 3.4 times more frequent in the near future.

The annual average precipitation of Korea is 40% greater than the world average. However, the amount of water available per capita in a year is only about 12% greater, because two-thirds of the annual rainfall occurs during the rainy season from June to September, and almost no rain occurs in the dry season. As a result, disasters caused by repeated floods and droughts used to be commonplace. In addition, the river reaches in Korea are relatively short and channel slopes are steep. Therefore, flooding occurs quickly, peak flood discharges are great, and flow variations are comparatively large.

Objectives

The goal of the Four Major Rivers Restoration Project of South Korea is to restore the Han, Nakdong, Geum and Yeongsan Rivers and to provide water security, flood control and ecosystem vitality. The project will prevent natural disasters such as floods and droughts, protect the environment and promote historical and cultural tourism. The project will result in the creation of many new jobs, furthering economic growth and broadening the horizon of Korea’s green growth initiative.

The Four Major River Restoration Project consists of three sets of projects: (1) Main projects – the Han, Nakdong, Geum and Yeongsan rivers revitalisation projects; (2) projects on the 14 tributaries of the four major rivers; and (3) refurbishment for other smaller-sized streams. The project has five key objectives: (1) securing abundant water resources against water scarcity; (2) implementing comprehensive flood control; (3) improving water quality and restoring ecosystems; (4) creation of multipurpose spaces for local residents; and 5) regional development centred on rivers.

This project was first announced as part of the "Green New Deal" policy launched in January 2009. It was later included in Korea's five-year national plan released in July 2009. The Four

Major Rivers Restoration Project systematically approaches its objectives of restoring the rivers. As a comprehensive public project, the programme includes a variety of plans submitted by several ministries, but coordinated by the Office of National River Restoration under the Ministry of Land, Transport and Maritime Affairs.

Drivers of change and project initiation

The Four Major Rivers Restoration Project is a comprehensive, pan-governmental project, representing the planning commitment of several Korean governmental ministries to work together to restore the Han, Nakdong, Geum and Yeongsan rivers.

The roles of each Ministry in subsequent projects are as follows:

- The Ministry of Land, Transport and Maritime Affairs: Restoration of the four rivers and local tributaries
- The Ministry of Culture, Sports and Tourism: The "Rivers of Culture" project
- The Ministry of Knowledge Economy & Korea Communications Commission: Production of new and renewable energy and information technologies
- The Ministry for Food, Agriculture, Forestry and Fisheries: The "City of Beautiful Scenery" project, known in Korean as "Geum-Su-Gang-Chon," and maintenance of forests in the upstream watersheds of the four rivers
- The Ministry of Public Administration and Security: Restoration of small branch streams flowing into the four rivers.

At the level of planning and even during project implementation, the government set expert advisory groups from seven different fields: senior committee meeting, policy advisory meeting, water resources, water quality, ecology and environment, landscape, culture and tourism, and local development. The advisory groups consist of professors, specialists, academics, and local representatives. In addition to the operation of the expert advisory group, the government gathers NGOs such as religious groups, environment groups, local citizens associations, etc. on a regular basis to discuss and gauge opinions.

From these participatory processes, twelve cities and provinces submitted 836 recommendations worth 98.3 trillion KRW. 213 river-related cases worth 6.9 trillion KRW that were coherent with the master plan were incorporated into the Four Major Rivers Restoration Project at the beginning. Examples are dredging sediments, fortifying existing levees, and restoring ecological rivers.

The government has taken the following steps toward implementation:

1) Dec. 2008. The Project was commenced at the Presidential Committee on Regional Development as part of the "Green New Deal Project." A master plan was drafted by the Korea Institute of Construction Technology and the Korea Culture and Tourism Institute. The first projects were launched: December 2008 in Andong and Naju, February 2009 in Chungju, and March 2009 in Busan.

2) Feb. 2009. The Ministry of Land, Transport and Maritime Affairs established a joint task force comprised of several ministries to supervise the restoration as a comprehensive pan-governmental project. The Project has since developed as follows:

- In April 2009, the task force, which had operated at the directorate level, became the Office of National River Restoration at the ministerial level to improve relations and communications among the participating ministries.

- The Association for Government Support at the Office of the Prime Minister began operations, along with the Local Government Association of the Four Rivers, which collects input from local communities.

3) April 2009. A joint briefing was convened with three committees and the four participating ministries and government agencies.

4) May 2009. A series of regional conferences and forums were held with public officials, experts and distinguished guests.

5) June 2009. The Master Plan for the Four Major Rivers Restoration Project was published.

6) Dec. 2009. Ground-breaking ceremonies were held.

The approach: how the Four Major Rivers Restoration Project addresses the challenges

The Four Major Rivers Restoration Project comprises the following activities to achieve its five objectives:

- *Water storage.* The project will aim to secure sufficient water quantities by building waterways and 16 weirs. These 16 weirs are expected to secure 800 million cubic metres of water. The project will increase peak water levels of 96 agricultural reservoirs so as to secure 250 million cubic metres of water. Additionally, the construction of three small and medium size multipurpose dams is expected to yield another 250 million cubic metres of water. These infrastructures will enable the storage of water needed during the dry season. By dredging riverbeds, the flood water level will decrease, and the water flow capacity will increase significantly. This will significantly reduce annual floods and the damage they cause.

- *Flood control.* Flood control measures involve an expansion of the water gates of tributaries, allowing a quick water level decline and fast draining of flood. In addition, two flood-control areas and three underflow areas of riversides will together expand the flood control capacity up to 920 million cubic metres of water.

- *Water quality and ecological restoration.* By 2012, the water quality of the mainstream will be improved to an average of level two (Biochemical Oxygen Demand less than 3ppm) by expanding sewage treatment facilities and establishing green algae reduction facilities. Moreover, the ministry is trying to restore ecological rivers, create wetlands, and relocate farmlands in the rivers to rehabilitate the river ecosystem.

- *Creation of multipurpose spaces for local residents.* To create the riverfront as a multipurpose area for improving lifestyle, leisure, tourism, cultural activities, and green growth, bicycle lanes (1,728km) will be developed, hands-on tour programmes will be promoted, and walkways and sports facilities will be expanded.

- *River-oriented community development.* The project will also contribute to regional development through various plans that utilise the infrastructure planned in the project and the scenery. The examples are 'our major rivers that flow with culture' of the Ministry of Culture, Sports, and Tourism, and 'Creating a vivid land of beautiful scenery' of the Ministry for Food, Agriculture, Forestry, and Fisheries.

The implementation of the project follows three phases. In phase 1, approximately KRW 16.9 trillion will be spent on the 'main project' dredging operations, and building dams and reservoirs on the four major rivers. Most of the main projects are planned to be completed by 2011; projects for dams and reservoirs for irrigation will be completed by 2012. In phase 2, another KRW 5.3 trillion will be invested on improving water flow and sewage systems of tributaries. Projects for the development of Sumjin River and other tributaries to the four rivers would be completed by 2012. Phase 3 includes restoring local and small rivers, and developing cultural and tourism attractions around the four major rivers. The Ministry of Culture, Sports and Tourism is involved in this phase.

The Office of National River Restoration under the Ministry of Land, Transport, and Maritime Affairs is the lead agency for the project. In the implementation of the project, the office will operate in cooperation with the Ministry of Culture, Sports and Tourism, the Ministry for Food, Agriculture, Forestry and Fisheries, the Ministry of Environment and the Ministry of Land, Transport and Maritime Affairs.

Assessing the environmental impact of the project

The Korean Government conducted an environmental impact assessment (EIA) of the Four Major River Restoration Project in order to assess the potential effects of the project and to devise response measures. The results of the EIA were announced on November 6, 2009.

The Environmental Impact Statement (EIS) was prepared by the Regional Construction Management Administration after collecting opinions from various stakeholders. The EIS includes the anticipated and assessed environmental impacts. The draft was shared with the local residents, environmental organisations, and relevant experts to gather diverse opinions for 20 days. The EIS was then submitted to the Regional Basic Environmental Offices, under the authority of the Ministry of Environment. To verify feasibilities of the EIS, Korea Environment Institute (KEI) and the Environmental Assessment Team comprised of independent experts were entrusted for review of the EIS. The final EIS agreement was set after the opinions of KEI were considered. The final EIS, agreed by the Regional Basic Environmental Offices and the Regional Construction Management Administration, covers four categories (ecosystem, natural environment, water quality, and others).

On ecosystems, the assessment identified around 68 legally designated protected species and natural treasures that may be affected by the Four Major River Restoration Project. The assessment concluded that direct impacts would be minimal if mitigation measures are implemented. Measures planned include an adjustment and reduction of the intensity of the construction work during the winter time when migratory birds arrive. Small size habitats such as small rivers corridors and food places will be created to provide sanctuaries and places for laying eggs. In addition, green belts will be constructed to provide additional habitats for animals to live in a natural environment.

With regard to the natural environment, the assessment mainly addressed potential risks to wetlands that surround the four rivers. It was found that out of 100 wetland sites located in the project area, 54 wetlands may be directly or indirectly affected by the project. These 100 wetlands cover 12.5 per cent of the total area which will be affected by the project. Considering the ecological functions of the wetlands, the Korean Ministry of Environment decided to conserve wetlands that have high ecosystem value. Parts of the wetland areas that are likely to be affected are compensated for through the construction of man-made wetlands. As a result, after the four major rivers projects, a total of 84 alternative or new wetlands are expected to be created and ecological and environmental functions of the rivers are expected to be improved. In addition, lower river ways will be created with mild slopes of 1.5 ratio so as to lead to a natural creation of wetland areas after the completion of the projects.

Regarding water quality, Korea's National Institute of Environmental Research, which was entrusted with an assessment of water quality, concluded that water quality will generally be improved as a result of the project. It has been estimated that pollution from mud that may occur during the construction phase will not lead to weighted density (by standard of dry season) of more than 10 mg/litre. In the case that floating matters exceed 15 mg/litre, it is planned that the construction period and intensity will be adjusted and that additional pollution reduction facilities will be installed. As 570 million of cubic metres of dredged materials will result from the dredging of the rivers, there is a plan to create a sedimentation basin and a diversion waterway will be installed at the storage yards of the dredged material in order to prevent secondary water pollution. The Korean government is considering options for a differentiated use of the dredged material according to the grain size and the level of contamination.

The Korean Ministry of Environment has the responsibility to ensure follow-up and implementation of the conclusions of the IEA. In that process, the existing Environment Evaluation Board will be transformed into a Post-management Investigation Commission after a re-composition of its membership. The future Post-management Investigation Commission will be entrusted with monthly investigation, monitoring and inspection of the implementation of measures to mitigate identified environmental effects.

Main implementation barriers that were overcome

Political opposition was a major challenge faced by this project. The opposing political party utilised environmental groups and NGOs to voice opposition to the project. Continuous communication, education and public relations were the main tools used to overcome the barriers. More than often, opponents had wrong information about the project; providing the correct information with project briefing and data helped to gain understanding and acceptance. Establishing a project advisory group with regional citizens, professionals, and academics has provided a means to gather the views of stakeholders.

A dispute started to arise when environmental societies asserted that the rare wild plant 'Danyang aster helophyllus' only found around the Southern Han River was threatened with extinction because of project constructions. The ecoactivists have called for the closure of the project. The wild plant is classified as the 'Endangered Species Plant 2nd Grade', being the biennial plants of Asteraceae Class. However, the Office of National River Restoration officially announced on 2 May 2010 that there was no founded danger of extinction even for

'the Danyang aster helophyllus' (Danyang Ssukbujaengi) due to implementation of the project.

The Gangcheon Isle, Gangcheon-myeon, Yeoju-gun, Gyeonggi-do (province) is located inside of the construction area of 'the 6 Sector' of the Project. There is a plan to create a 'Nature Ecological Experience Park' with protected wild species including 'the Danyang aster helophyllus'. The government also announced an official plan for their preservation in all the habitats except the area that will be inevitably damaged in the creation of an artificial stream. This indicates that both government and constructors have environmental values, recognising the importance of protecting endangered species like 'the Danyang aster helophyllus'. The government and constructors designated the habitat bed as 'reservation area' so that with visible boundaries, damage from construction activities is minimised. Presently 'the Danyang aster helophyllus' is waiting mass proliferation due to the successful research for proliferation by the authorised institutes of 'Hwanghak Mount Arboretum', 'Pyeonggang Botanical Garden', 'the Botanical Garden of Shingu University', 'Danyang Technical Center of Agriculture', and a private farm in Danyang county (all the spots have the permissions from the Ministry of Environment under the Clause 14 of the Endangered Species Act). Provided that soil condition meets the standards level, this plant can grow well.

At the end of 2010, Buyeo County conducted a survey with approximately 12,000 residents to gather their views on the appropriateness of the project. The survey revealed that 70% voted in favour of the project. Also 70% answered that they were aware of the project, suggesting that those who knew about the project voted in favour of it. It seemed that the remaining 30% did not have appropriate information on the project.

Effective contribution expected or already delivered to green growth

The project seeks to achieve, by 2012, a 90 percent increase in water quality (BOD less than 3ppm) by expanding sewage treatment facilities and establishing green algae reduction facilities. In terms of adaptation strategies to climate change and sea level rise, federal and local governments are bound to maintain an adequate level of salinity concentration to protect drinking water supply and other water usages. In order to monitor water quality, Korea’s Ministry of Environment is expanding the existing Tele-Monitoring System (TMS) to 586 sewerage and waste water treatment facilities by the end of 2009. This includes 323 sewerage facilities, 58 waste water treatment facilities, and 205 operating sites.

On ecosystem restoration, an Eco-river Restoration Program (ERP) initiated in 2008 is being implemented in the context of the Four Major River Restoration Project. One of the ultimate goals of the program is to restore indigenous and endangered aquatic species and maintain the quality of water and ecosystems. The other national program to restore freshwater ecosystems is to develop an aquatic ecosystem-monitoring network. Since 2007, preliminary field surveys have been conducted at more than 540 locations. More than 929 km of national streams will be restored as part of the Four Major River Restoration Project. A follow-up project will be planned by 2010 to restore more than 10,000 km of local streams. More than 35 riparian wetlands will also be reconstructed. Riparian areas will be afforested or reforested, and will also be used for biomass production.

Finally, the project seeks to support regional economic development. This is pursued through the creation of multipurpose spaces for cultural and touristic activities near rivers which are expected to contribute to job creation and local economic revitalisation. Overall, it

is expected that the project will create 340,000 jobs and generate an estimated KRW 40 trillion of economic benefits.

- 340 thousand (340,000) jobs created by the project is calculated from the project as a whole including major projects by several ministries (MLTM, ME, MA, Etc). The number includes direct and indirect employment inducement effect. In addition, Korean government is expecting that there will be more new jobs created in leisure, tourism, cultural industries, etc by this project.

- The number is calculated based on the Construction Employment Induction Factor from the Bank of Korea (2006) which provides the most objective data.

- The Ministry of Land, Transport and Maritime Affairs, initially in the presentation of the master plan, estimated job creation in the whole industrial field to be 340,000 (Ministry of Land, Transport and Maritime Affairs: 231,142 / Ministry of Environment: 67,236 / Ministry of Agriculture: 40,098) with application of 'the coefficient of employment induction' (17.3 per 1000 million people) of 'Korea Bank'.

Evaluation of benefits already delivered

A typhoon in June proved the Four Rivers 'flood-proof'. It was predicted that this year's summer would have more frequent torrential rainfall with a larger amount of rain than average. As the first 'attack', the Typhoon Meari in June and the subsequent rainy season were enough to make those involved with the project tense and nervous. Paradoxically, this torrential rainfall became a good opportunity to demonstrate the effect of the project. From June 22 to 27, it rained a total national average of 207.7 mm. This is equivalent to 20 billion ton reaching 17% of annual rainfall. Despite the concerns about safety on the sites of the Four Rivers, damage turned out to be meagre. Particularly, the northern area of Gyeongbuk Province, Daejeon and some areas of Chungcheong region had no considerable damages. This is due to the effect of lowered flood level achieved from dredging.

The sites have already experienced lowered flood levels from dredging 420 million m^3 soils. According to a survey of Ministry of Land, overall water levels have been lowered: 2.55 m in Yeoju (the Han River), 3.5 m near Sangju (the Nakdong), 0.84 m in a vicinity of the Buyeo Weir, and 1.12 m near the Seungchon Weir of the Yeongsan River. The construction of weirs will be completed by late June or July, so the condition of flood prevention can be said to be improved. As for devastating flood damage, the safety level has been dramatically elevated. Before the typhoon and rainy season came, the sites were fully prepared. Cofferdams and construction roads were taken away. Meanwhile, riverbed maintenance structures (structures for preventing erosion of the riverbed) were completed to be installed. Waterfront parks under construction were accelerated in its final touch. By late June, dredged soils piled up on the terrace land of the river were moved outside of the riverside area in order to prevent them from crumbling and also to secure more space for water flow.

There have been significant economic benefits derived from the project due to job creation. According to the Ministry of Labour (at an employment policy inquiry commission, Press Center, Seoul, 30 June), an analysis shows employment effects to be equivalent to KRW 7.37 trillion from 2009 to 2010 for 2 years, creating job opportunities for 88,400 workers. Those were fewer amounts (11,852 – 11.8%) than the 10,252 released from the master plan of the

Ministry of Land. However, since the Four Major Rivers Restoration Project consists of complex processes including civil engineering, construction, landscape architecture and more technologies, the employment induction effect in other fields might compensate the gap. In addition, the Korean government is expecting that there will be more new jobs created in leisure, tourism, cultural industries, and so on, by this project.

We have been making the participation of local construction companies mandatory, and advising the clean allocation of constructions for the local subcontractors. This will ultimately provide support to local economies.

The Korean Government has identified several policy tools to maximise local development potential through the river restoration initiative. The Master Plan mandates that local companies should account for at least 40% of all joint ventures (with the exception of turn-key projects, which require 20% participation of local companies). Currently, 187 of 338 companies (55%) are implicated in the project. Specific lots have been consigned to the local government; as of March 2011, local governments are coordinating nearly a quarter of the lots associated with the project.

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Water planning in LAO PDR

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Type of tool: water planning
Issue: watersheds, industry, agriculture, cities
Location: Lao PDR, Asia

The challenge and aims: water and growth in LAO PDR

Although it still is one of the poorest countries in South East Asia, Lao People's Democratic Republic might actually be one of the most dynamic and rapidly transforming poor economies in the world. The economic reforms carried out since 1986 – when the transition from a centrally planned to a market economy started – represent in many ways the breaking free from the low income and poverty situation in which its rural and traditional society was trapped. The first decade of the new century was marked by rapid economic transformation with rates of economic growth that averaged 9% annually. In spite of rapid population growth that averaged 2.8% in the eighties and nineties, the economy was able to grow enough to improve the per capita gross national product in such a way that the real purchasing power parity per inhabitant in 2009 was more than four times that of 1970 while the population increased from 2.8 to 6.4 million in the same period[29]. These favourable trends and the current macroeconomic equilibrium make the prospect of becoming a middle income country before 2020 likely, as intended in the National Socio-Economic Development Plan.

Advances were not only significant in terms of the scale of the economic activity but also in some relevant aspects of human development. Life expectancy at birth improved from below 50 years in 1980 to more than 65 in 2010 and the average years of schooling more than doubled in the same time averaging 4.6 in 2010. When compared with other countries Lao PDR was ranked sixth in the list of countries showing greatest improvements in the 20 years since the Human Development Index making assessments.

Successful economic growth is behind the steady decline in poverty indices which, as measured by the Millennium Development Goals Assessment Criteria, passed from 46% to 33% between 1992 and 2002. While the number of those below the poverty line is diminishing and they are becoming less poor on average, economic growth is also increasing economic inequality and the share of the poorest quintile in national consumption also fell from 9.6 to 8 percent. Net enrolment rates in primary also rose from 58% of primary school-age children in 1991 to 84% in 2005, although progress in retaining students is still low at this level. Significant advances have been made in gender equality (the number of girls for 100 students rose from 77 to 86 in primary school between 1991 and 2006 and these advances are lower but still significant in secondary and higher education). Advances in the MDGs are completed with relevant improvements in child mortality, maternal health, steps

[29] These figures were obtained from using the Penn World Tables (Heston, A., Summers, R and Aten, B. (2011) Penn World Table Version 7.0. Center for International Comparisons of Production Income and Prices. University of Pennsylvania May.

against malaria, HIV and other diseases and the country is considered to be on a relatively safe track to reach the MDGs by 2015[30].

The challenges for water planning

The significant increase in the number of people with access to safe water, rising from 30% to 60% of the total population between 1990 and 2003, is associated with relevant reductions in the time required to meet basic water needs for many households, freeing time that is now available for education, child care and income earning activities with important benefits also in terms of gender equality. Apart from its undeniable relevance for the many concerned households, in a context of economic growth, these benefits lead to an increase in the labour supply and therefore the productive potential of the entire economy.

In addition to that, the increased coverage of improved sanitation facilities (from 11% to 45% between 1990 and 2003) means an effective reduction in water related diseases. This is association with significant improvements in the effectiveness of education, the productivity of labour and in life expectancy at birth which all contribute to increased and improved human capital, a crucial production factor in any growing economy.

Subsistence agriculture still accounts for nearly half of the gross domestic product and provides 80% of the employment as 69% of the population still live in rural areas. Nevertheless, low lands suitable for agriculture are relatively scarce in Laos (no more than 13% of the watershed, compared with 72% in Cambodia and 65% in Thailand) and without modern techniques and appropriate soil preparation, Laos' arable land is mostly suitable for rice cultivation. As a consequence, cropping still follows the natural supply of rain, being at its peak during the monsoon season and declining to less than 10% in the dry season. Food security is still heavily dependent on water supply. Improvements in health, water supply and sanitation, as well as some irrigation development, are responsible for the substantial reduction in rice shortages in most of the lowland cultivated areas of Laos. Rice pads also provide fish which is the other important protein source in rural Laos[31].

Growth in population and income levels leads to an increased demand of agricultural products that, without the development of competitive products to be exchanged in the international markets, can only be satisfied by increasing local production of food. This is possible with both the above mentioned improvements in human capital as well as the existence of abundant water resources. The increase in rice yields per hectare, due to mechanisation and irrigation development, has led to higher amounts of stubble available for grazing and feeding more pigs, chickens and ducks. In terms of growth and development, this productive transformation allows food production to increase, even when part of the rural workforce are migrating to expanding urban areas. It also serves to diversify the rural economy beyond traditional subsistence, allowing for the production of market and income earning goods and integrating the rural economy into the local and international economy.

[30] See Government of Lao PRD and the United Nations (2010) Millennium development Goals: Progress report Lao PRD 2008.

[31] See also: Nessbitt, H. Johnston, R. and Solien, M. (2004) Mekong River water: Will river flows meet future agriculture needs in the Lower Mekong Basin? In. Seng, V.; Craswell, E.; Fukay, S. and Fischer, K. Water in Agriculture. ACIAR Proceedings 116e.

Development also comes with and is supported by an increase in energy consumption. Although Laos has only developed about 4% of its potential for hydropower, it is already recognising the value of expanding power generation capacity and distribution networks in order to foster economic development both in rural and urban areas. It is estimated than 26 hydropower projects are under construction in the lower Mekong basin and at least 12 mainstream projects and 30 tributary dams are planned for the next 20 years, mostly in Lao PDR. Although hydropower is the main purpose, the water storage capacity that comes with it is important for promoting development in other critical areas and particularly for providing reliable water supply for new irrigation developments (covering between 100 to 300 thousand hectares in Laos in the next 20 years), providing flood control, aquaculture, and an opportunity to develop tourism.

The drivers of planning

Although access to water and sanitation services has been extended rapidly, further advances require reaching populations in upland regions and scattered rural areas. Providing these services in hard to reach areas where crop yields are often lower and more uncertain (due to poor soil and traditional practices) is still financially challenging, due to both provision costs and low capacity to pay in the receiving communities.

In the years to come, economic growth is expected to continue to be based on economic diversification, integration in the regional and international markets, and progressive advances in infrastructure and human capital development. Expanding populations with improved living standards will lead to the demand for agricultural products and electricity that will become the main driver of the transformation of the rural economy. In spite of its relative abundance, water development needs to consider the compatibility between the multiple uses of water. For example, hydropower might result in alterations of river flows and sediment balances with consequences for fishing, biodiversity, and the water supply for irrigation. The changes required to increase crop yields might also alter water quality with significant impacts on biodiversity. The expansion of agriculture and livestock in uplands might result in significant losses in forest and biodiversity with impacts on runoff and erosion.

All countries in the Mekong River basin are dynamic transition economies and compared with China in the upper basin, and Vietnam and Thailand in the lower basin, Laos is in the relatively early stages of water development. This means that development strategies need to be coordinated in order to avoid water conflicts and to guarantee the sustainability of social improvements. Laos provides at least 35% of the renewable water resources of the Mekong River basin and has well preserved water ecosystems whose services can be harnessed for economic development. But water development in Laos might have significant consequences for the water resources in Cambodia and Vietnam, particularly for their extended irrigation systems. Developments in Laos could potentially aggravate saline intrusion problems already present in the river delta, just as hydroelectric development in China has had impacts on the lower basin.

Main barriers to planning

The main barrier is the lack of institutional development, the limited information available and in general the short history of water governance in the country. All this makes reaching

the required consensus, involving relevant stakeholders, defining a set of measures, selecting projects, and implementing and monitoring them a difficult task.

The approach to water planning in Lao PDR and the green economy

Water management has played a crucial role in starting and sustaining growth as well as in the advances made so far in human development. The development of water resources represents a mix of opportunities and challenges for the transformation of the Lao PDR's economy. Water policy plays an essential role in a progressive economic development strategy with already proven benefits in terms of poverty reduction, gender, and equity. Despite the multiple challenges faced, a development strategy based on an integrated water resource management framework has the potential to make the transition of the economy compatible with conservation of the water resources. Water planning requires the development of an institutional framework and the social and technical capacity to implement development strategies agreed on through a participatory and transparent decision-making process. The building of these institutional abilities is already in progress.

Water development can make a real contribution to economic growth and socio-economic development in the whole river basin, but decisions need to be coordinated to avoid conflicts between competing water development priorities both at a national level, between water users, and at an international level. Coordination is also required to guarantee the welfare gains of economic development are preserved in the long term.

The Agreement for Cooperation

By subscribing to the Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin in 1995, the governments of Cambodia, Laos, Thailand and Vietnam agreed to jointly manage the basin's water resources and to coordinate decisions concerning the use of these resources for economic development. The Mekong River Commission (MRC) was formed for this purpose and in 1996 China and Myanmar became dialogue partners of the agreement and they are now working together within a common cooperation framework.

Developing a shared understanding of the opportunities and risks: creating a shared strategy and defining priorities and objectives

For the first time since the Mekong agreement was signed in 1995, the member countries have developed a shared understanding of the opportunities and risks of the national plans for water resources development and agreed in 2010 on an integrated water resource management based basin development strategy for the Lower Mekong basin. This strategy is based, first on the identification of a set of "strategic priorities to optimise the development opportunities and minimise uncertainty and risks associated with them"; second on the agreement on the "urgent priority to develop and agree on basin-wide environmental and social objectives and baseline indicators, against which to apply future developments"; and third on the understanding of the "critical importance of strengthened basin management and in particular a strong programme of institutional, technical, organisational and human resource capacity building for sustainable basin development"[32].

[32] See Mekong River Commission (2010) IWRM Based Basin Development Strategy for the Lower Mekong Basin.

Coordination of national water development

Provided the institutional framework is already in place, international cooperation can be a powerful instrument to coordinate national water development, transforming potential conflicts into mutually beneficial agreements. Advances have also been made in translating river basin priorities to national basin development plans[33] and in particular, for the case of Laos, to integrate them into the economic development strategies[34].

Water planning at the basin level enables an assessment of the costs and benefits of the different development options from a social perspective, rather than only on the basis of private and individual interest. Some examples in the Mekong River show how, for example, existing and planned hydropower development in the upper basin in China can be adapted to provide sufficient dry season flows to meet all consumptive demands in the lower basin as projected in the national development plans for the next 20 years while maintaining the baseline water flows.

Establishing an IWRM approach

Besides the VII NESDP, some other National Policies and Strategies should be taken into account, such as the National Water Resources Policy and the Strategy and Action Plan. The main objectives and challenges were agreed to be the following:

- Institutional strengthening and cooperation
- Legislative and detailed strategies
- River basin and sub-basin water resource planning
- Data collections and analysis
- Water allocation
- Protection of water quality and natural health
- Management of water resources risk
- Financial aspect of water resource management
- Awareness, participation and capacity building

Considering all potential benefits and costs of different development alternatives

Water planning at the river basin level allows for the consideration of all the potential benefits of hydropower development, for example, fishery or tourism potential in the reservoirs and the reduction of flood damage and salinity intrusion downstream. However, costs and environmental impacts also need to be recognised, in particular when these impacts are unavoidable and irreversible. Hydropower development, for example, can result

[33] See Mekong River commission (2011) Planning for BDP 2011-2015 Bridging Period.
[34] See: Lao People's democratic Republic. Ministry of Planning and Investment (2011) The Seventh Natonal Socio-Economic Development Plan (2011-2015).

in changes in sediment flows causing irreversible river bed incision and bank erosion with some predictable impacts such as wetlands losses, impaired agricultural productivities, reduced potential of freshwater fisheries and potential impacts on marine fisheries depending on the river's nutrients loads. Understanding all costs and benefits and the associated risks of different development options is essential for agreeing on which options to adopt, the distribution of the costs and benefits, and the necessary measures to compensate or mitigate potential damages and minimise the risks[35].

Creating institutional capacity and generating hydrological information

Institutional capacity development is critical in all member countries for the effective implementation of surface and groundwater monitoring, water use permitting, compliance assurance of permit conditions and regulations, and maintaining a water information system. Most of the procedures to be implemented have been developed and adopted in the framework of the Mekong River Committee and others are under study.

Engaging and coordinating national public actors

A number of government bodies are involved in water resources management in some way:

- The Lao National Mekong Committee (LNMC): responsible for coordination with the Mekong River Commission and for supervising the planning and the management of river basins in Lao PDR consistent with the Mekong Agreement and its plans and strategies. It works as the national water resources apex body.
- The Ministry of Agriculture and Forestry (MAF): deals with issues related to cultivation, irrigation, livestock, fisheries and forestry.
- Ministry of Communication, Transport, Post and Construction: responsible for urban water supplies and inland waterways.
- The Ministry of Energy and Mines: responsible for electricity, hydropower and mining.
- The Ministry of Health: responsible for safe drinking water.
- The Prime Minister's Office.
- The Science Technology and Environment Agency (STEA)
- The Water Resources and Environment Administration (WREA), including a Department of Water Resources, Department of Meteorology and Hydrology and environment responsibilities. It has a mandate for management of water resources, the environment, meteorology and hydrological activities throughout the country.
- The National Tourism Authority

Lao PDR has the following levels of administration:

[35] See Mekong River Commission (2010) Assessment of Basin Wide Development Scenarios. Technical Note 13: Economic Benefits and Costs.

- The National Government
- 16 Provinces and Vientiane Municipality
- 142 districts
- About 11,400 villages

Creation of River Basin Committees

One of the most important aspects of this scheme is that a body of 17 Provincial Water and Environment Offices are represented. These Provincial organisations will work in close cooperation with the River Basin Committees (RBCs). As a matter of fact, WREA works mainly as the technical support organisation for the RBCs. The RBC is a non-permanent organisation. It has a mandate to act as a water resources executive in the river basin under the direction of the Lao National Mekong Committee for the management, development, conservation, rehabilitation and utilisation of water resources in the river basin area.

The RBC will be chaired by a Provincial Governor, elected on a five-year basis by the Riparian provinces, along with a supporting Secretariat. The Secretariat acts as a technical advisory body to assist the RBC in facilitating and monitoring all its activities. The RBC consists of government and individual representatives and other related sectors who are nominated by the Prime Minister of Lao PDR based on the proposal of the Prime Minister's Office, the Head of the WREA. The chairperson takes initial action based on the agreement of provincial river basin representatives.

The very first RBC was the Nam Ngum River Basin Committee. The NNRBC was established by the Prime Minister's Decree 293 on June 15th, 2010 as the first of several such organisations in the country. The importance of this particular RBC is strategic because it was the first IWRM plan and will serve as template for River Basin Committees elsewhere in the Lao PDR.

The following main objectives and plans for the future of the NNRBC have the highest importance for the future of water management in the country:

Task 1: Building the capacity to manage the NNRBC

Task 2: Encouraging sustainable water use

Task 3: Optimising hydropower outcomes

Task 4: Developing the sustainable potential of the basin

Task 5: River sub-basin management

Task 6: Reducing risks and impacts from water related disasters

The main tasks for the NNRBC are clearly closely related to the goals of the VII NSEDP.

Developing the legal framework

The main legal documents are the following:

- Decree on the Establishment and Activities of Water Resources and Environment Administration, No. 149/PM, dated May, 10th, 2007.
- Decree on the Establishment and Activities of Lao National Mekong Committee, No. 197/PM.
- Decree on the Establishment and Activities of the River Basin Committees, Nº 293/PM, dated 15 June 2010.

The last of the aforementioned Decrees, Decree 293, puts into place an intergovernmental and multi-sectoral body to sustainably manage the priority river basins and sub-basins of the country. The Decree is a significant milestone for implementing several water resource management programmes and projects in Lao PDR.

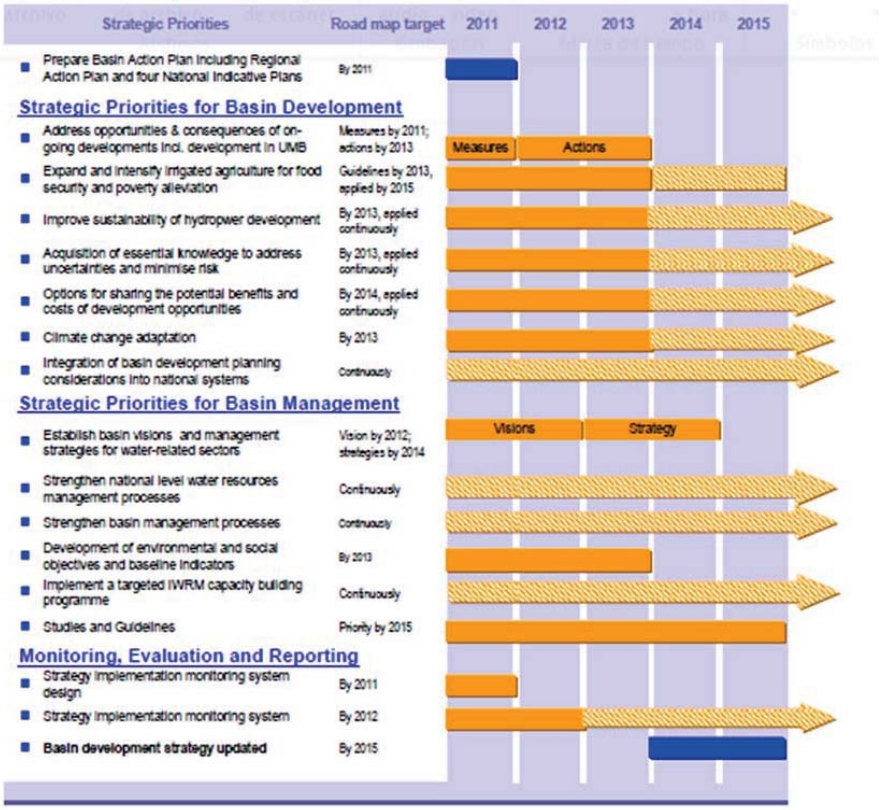
Decree 293 outlines the responsibilities, duties, jurisdictions, organisational structure and working methodology of the River Basin Committee to promote water resource management through systematic planning and implementation. The objective of the RBC is the achievement of the following goals:

- Supply sustainable water resources to water sectors through systematic planning and implementation
- Reduce socio-economic and environmental impact from water related disasters
- Manage water quality in the country
- Improve livelihoods
- Contribute to the national socio-economic development plan

Agreeing on a roadmap and ensuring national ownership

The whole strategy is outlined on a road map which guides its implementation until the end of 2015. The strategy is owned and implemented by each member country.

The Road Map of IWRM: 2011-2015



Evaluation

Considerable progress has been made so far in the development of an institutional framework for water planning. These advances are more evident at an international level and they provide the basis for developing water planning institutions at national and local levels.

The Nam Ngum River is a main tributary to the Mekong River in the Lao PDR. The area of its basin is 16,841 km^2 (7% of the country) with a population of some 550,000 people (8% of the country). With a rainfall of 2,200 mm per year and a discharge of 22,000 million m^3 per year, the basin contributes 14% of the flow of the Mekong River at the confluence, and 5% of the total discharge to the sea.

The benefits of a functional RBC to coordinate the many agencies and levels of government became clear during the preparation of the Nam Ngum River Basin Development Sector Project (2004-2010). This project developed the approach and capacity for river basin management including the development of a comprehensive knowledge base, the preparation of a basin development plan, and the generation of human skills and capacity.

The NNRBC now operates under the umbrella of the Lao National Mekong Committee for national water resources management as well as in compliance with the Mekong Basin Agreement and in collaboration with the Mekong River Commission.

Main lessons learnt

The approach	Lessons learnt from implementation
Reaching a social agreement on the desired balance between water use and water resource conservation	Adopting a set of international commitments regarding the environmental status of the Mekong River Basin in Laos has been a central element of the coordination of water planning with national development policies.
Harnessing development opportunities and coping with water and development challenges	Water policy has been the cornerstone in Laos' success regarding the Millennium Development Goals and in the ongoing transition from a rural to an urban economy.
Building governance and institutional capabilities	An ambitious programme of building water governance structures is already in place in Laos. Transparency, regulation and enforcement, and building technical competences are key elements for this strategy to succeed.
Coordinating public policies	The agreed commitments of the international Mekong agreement have been a central element in the National Development Plan of the Lao PDR and have contributed to the coherence between objectives in the different economic sectors and the general objectives of water policy.
Stakeholder engagement and public participation	Active participatory mechanisms are being used in Lao PDR and are an integral part of water management at local scales throughout the whole country.
Monitoring progress and compliance	There have been advances in the acquisition of technical skills, the development of information systems and of reporting strategies. The capacity of the Lao PDR to manage its own water challenges have given credibility to its commitments in the Mekong agreement and has allowed Laos, in spite of being a least developed country, to improve its position with respect to other national partners.

Water planning towards a green economy in the Ebro River Basin

Manuel Omedas, Rogelio Galván, Carlos Mario Góme
Type of tool: water planning
Issue: watersheds
Location: Spain, Europe

The challenges for water planning and the green economy in the Ebro

Spain is a pioneering country for water management at a basin level. Since its foundation in 1926 as a partnership of private users and public authorities to promote and exploit common interest public works, the Hydrographical Confederation of the Ebro River Basin (CHE by its name in Spanish) was the first water authority created to coordinate water policy in a river basin in Spain. During the last century water and water management have played a central role in the process of economic development and particularly in transforming the pre-existing semiarid Ebro Valley and its influence area into a prosperous economy. Demography, agricultural expansion, energy and manufacturing development are all growth processes that cannot be properly understood without recognising the critical role played by water management.

The role of water management has gradually evolved through several stages. Its initial objective was to promote and coordinate the building and operation of water infrastructures to support productive transformation, initially based on the agricultural development. An intermediate stage saw water policy being used as an instrument to meet water demands stemming from economic growth. Today, the primary objective of water management is reconciling economic growth with the protection and improvement of the water resources which are critical to sustaining economic welfare in the long term. By focusing on the last two decades and ongoing innovative water planning processes, this case study illustrates the transition towards green water planning in the Ebro River basin.

Located in the North East of the Iberian Peninsula, the Ebro river basin covers 85,700 square kilometres (17.3% of the Spanish soil). The average rainfall of 622 mm/year is unevenly distributed both in time and space. The spatial distribution can vary from 3,800 mm/year up in the Pyrenees to just 100 mm/year down in the central river valley where the main economic activities are located. A Mediterranean river basin rainfall is variable through time and may range between 800 and 450 mm in wet and dry years.

Meeting the challenge of governing this uneven and uncertain supply of water lies at the heart of both the relative success and the current challenges of economic development in the Ebro River basin. To adapt the available water resources to the times, locations and quantities of services demanded by the economy, the Ebro has been gradually transformed into one of the most regulated river basins in the world. The 108 big dams built provide a storage capacity of 7,580 million cubic metres, equivalent to more than half of the average long-term renewable water supply of the river basin (estimated at 14,623 million cubic metres).

By building collective facilities to support the accumulation of capital in agriculture, manufacturing, energy and drinking water provision industries, water policy has played a role as an engine of growth in the region. Indeed the availability of water infrastructures has

so far been perceived as the critical factor underlying both the constraints and the opportunities of economic growth in the region.

The complex agro food system which gives the economy of the Ebro River basin its main competitive advantage now accounts for one fifth of the agrarian production and about one third of the meat supply in Spain. The decline in agriculture in the upper ranges of the Pyrenees is accompanied by the modernisation and transformation of agriculture in the lower valleys.

Irrigated agriculture, covering an area of 700,000 hectares in the valleys of the Ebro and its main tributaries, is the basis of the agro food system. Apart from the financial support provided in the past by the Common Agricultural Policy of the European Union, the market advantages are based on the availability of land, a relatively cheap labour supply, the proximity to markets in Spain and central Europe and also on the capacity of using crops as inputs for livestock activity in the upper river basin and the low Pyrenees. The viability, profitability and success of agriculture in the region relied on the development of water-related infrastructure for storage, transport, distribution and irrigation.

Water development has also played an essential role in the emergence of a highly competitive power generation sector in the river basin. Currently the basin produces about one third of the nuclear power of the country, it has one fifth of the installed capacity of hydropower of the country shared between 360 plants across the basin, and one tenth of the country's thermal generation capacity. This important contribution to the generation of electricity is based on a heavily engineered hydrological system, providing a convenient supply of stored and running water, turbinating 38,000 million cubic metres per year (four times the average water runoff in the basin) and using more than three thousand million cubic metres to refrigerate nuclear and thermal power plants.

Although the amount of water used in the manufacturing sector represents a minor fraction of the total water used in the basin, the sector depends on raw materials produced by the agricultural sector (for food production) and the local demand of inputs for that activity (agrochemicals, equipment, etc.). The Ebro valley is an industrial corridor and the sector provides almost 30% of the value added in the basin economy (compared with a contribution of less than 23% of the same sector to the entire Spanish economy).

Water development is also important factor influencing the dynamic of population trends in the basin, both directly through the provision of drinking water and sanitation, and indirectly through the development of employment and production opportunities as above mentioned. The Ebro River basin has only 34 inhabitants per square kilometre, less than one fifth of the average in the European Union and only two fifths of the Spanish population density. However, thanks in part to water development the Ebro valley has become an important settlement axis linking the rich industrial economies of the north of Spain, from the Basque Country to Catalonia, along an economic corridor.

The drivers of change

The collective success in making water an integral part of economic development in the Ebro River basin has been accompanied by the emergence of new problems, requiring changes to traditional water policy in order to cope with them. New challenges include the limited ability to cope with increasing water demand as the population and the size of the economy grow, the limited ability to meet these new demands with the traditional means of new infrastructures and subsidised water facilities, the difficulty of meeting competing demands from different sectors and reconciling these demands with the available supply of resources, and increased vulnerability to droughts as water withdrawals increase.

The emergence of new challenges is the main driver of the gradual transformation of water planning and policy in the basin, from the early focus on building water infrastructures, to meeting the needs of an expanding economy and population, to the introduction of integrated water management to ensure water use is compatible with the preservation of the ecosystems and the ongoing provision of services underpinning economic growth. It is in this context that the connection between this new kind of water planning and green growth can clearly be established. Before showing how water planning is coping with emergent water problems, the following insights about the interlinkages between water and economic growth in the Ebro River basin can illustrate the current challenges for water planning.

The consumptive use of water in the river basin each year already represents more than 34% of the average long term renewable resources of the basin (5 billion cubic metres of 14.6). According to the European Environmental Agency, the water Exploitation Index of the Ebro, although high when compared with other central European river basins, is lower than in other southern Spanish river basins, such as the Guadalquivir and the Segura where the water used every year exceeds 50% of the long term renewable resources and where, due to a competitive agricultural sector and higher water scarcity and drought vulnerability, water is perceived as more valuable than in the Ebro.

Apart from regional disagreements, water development is also a growing source of potential conflict between the different economic sectors and water users within the river basin. Although the figures mentioned in the previous paragraph indicate that available resources are sufficient to cover all the existing demands, water demand and supply vary in space and time and in fact deficits and vulnerabilities have increased over time. For example 200,000 out of the 700,000 potentially irrigable hectares (mainly in the right margin of the Ebro River) suffer from structural deficits meaning that their needs cannot be met in all years.

In the new European water policy framework, the main long-term objective of water policy is making the maintenance and expansion of economic uses of water compatible with the improvement and adequate protection of water providing ecosystems. Thanks to this development, the environmental objectives, which were already considered in the hydrological plans legislation of 1985, are not only more stringent and more precisely defined but are the dominant criterion to judge the success or failure of water policy in the years to come. The setup of the Water Framework Directive has allowed for a systematic analysis of the detrimental impacts caused by the pressures of the economy on water bodies. The prospective analysis of water use and its pressures and impacts resulted in the identification of surface and ground water bodies in risk of non-compliance with the good status requirements for the years 2015 and 2021.

The challenges for change

Motivated by the importance of promoting rural development, all public authorities are reluctant to give up ambitious plans for developing new irrigation areas, despite the lack of water regulation infrastructures and decreased guarantee of supply. The number of projects approved or under study for the years to come is still considerable and new provisions are required to coordinate this effort with the existing water resources and the other actions required in order to make them viable in economic and financial terms (see CHE, 2008 EPTI, p. 92).

Given the priority given by national policy to drinking water, the irrigated sector supports the risk associated with the variability of water supply in the river basin. Although the average long-term resources are about 14.6 cubic kilometres per year, they may range from 24 on wet years to only 8.4 cubic kilometres during meteorological droughts. In spite of the stabilising effect of the 7.6 cubic kilometres of storage capacity, the expansion of the agricultural sector is associated with an increasing insecurity in the water supply which affects the profitability of existing and new irrigation developments. This has contributed a shift in focus from increasing irrigation capacity to growing concerns over the guarantee of supply.

Meeting the increasing demand for water means diverting greater amounts of the resource, resulting in a reduction in river flows and in the water effectively stored in the system. Aside from the environmental impacts, this represents another source of potential conflict as there is less water available for non-consumptive uses (particularly for the more than 360 hydropower plants along the river network). In fact due reduced water availability, the hydropower system delivers a volume of energy every year which falls short of its installed capacity (no more than 50% even in rainy years and falling to only 11% in dry years). These stylised facts show the importance of coordinating the investments in infrastructure in the different sectors such as irrigation and hydropower as well as the potential gains from improving the conservation of water resources.

An analysis of the factors driving water demand in the river basin shows, in the business-as-usual scenario, a trend towards a significant increase in water demand for drinking water (fostered by population growth, better living standards and urban growth), irrigation water (from new developments despite the considerable gains from current programmes for modernising and improving irrigation technology) and for power generation (from existing hydropower and thermal projects). Without actions to reduce water demand or improve water use efficiency, these new developments are generally feasible within the range of the existing resources nor compatible with the improvement of the ecological status of the water bodies in the basin.

All the above mentioned factors are also associated with an increased risk of hydrological droughts (distinct from meteorological droughts which are associated with natural causes, these refer to the ability of the system, given a natural rainfall, to cope with existing water demands). Furthermore, simulation and statistical models shows some evidence of a likely reduction in water runoff attributable to climate change. A reduction of 5% flow in the Ebro River basin is projected by 2027, based on studies carried out by CEDEX on assessing the potential impact of climate change on water resources. The combination of increased

scarcity, higher drought risk and uncertain supply due to climate change is a powerful argument for prioritising water resilience and security in the water policy agenda.

The planning approach for transitioning to a green economy in the Ebro River basin

Water planning has played a key role in the productive transformation and economic development in the Ebro River basin. The perceived role of water planning has changed through time as new challenges have emerged. The transition towards integrated water resource management in the last decades shows how water planning can make a real contribution to sustainable development and green growth. Water planning has responded to the aforementioned challenges in many different ways that can be summarised as follows:

The setting of an institutional framework for transparent stakeholder involvement and public participation

There has been a long tradition of public participation in the Ebro basin since the foundation of the Hydrographic Confederacy of the Ebro: regions, municipalities, central government agencies and civil society are represented in several participatory bodies of the Ebro Water Authority and take part in the decision making process.

The Water Framework Directive has demanded even more active public participation. An extensive public participation network was created reaching all the sub-basins in the river basin. This network has proven successful in providing a forum to share information and fostering a common understanding of water challenges and measures to be taken. Public participation has also provided a means to pursue the coherence of water policy with other public policies (e.g. land use, urban and rural development, energy). Public participation is a learning-by-doing process and substantial advances are expected as information and skills improve over time.

Public participation is also a proven institutional framework for agreeing on practical, observable and enforceable environmental objectives. This has been demonstrated in the Ebro River basin, for example through the setting of targets for the status of water bodies and minimum flows, as well as drought indicators. Since 1998 thousands of initiatives (public and private projects) have been studied by the river basin authority in order to determine their compatibility with the environmental objectives of the river basin management plan.

Establishing ambitious environmental objectives

In the Ebro River basin, the institutional decision has been made to give primary importance to the environmental objectives of water planning. This has resulted in the setting of precise environmental objectives in terms of the quality of water bodies. It is against these objectives that competing demands of water users and other stakeholders must be accommodated. Once these objectives are set, they become the criteria that the water authority adopts to allow new water uses.

The new water policy framework allows for the actions and measures that guarantee the achievement of environmental objectives and that generate minimum economic losses (i.e. cost effective analysis used to choose the set of measures in the river basin management

plan) or maximum welfare gains (e.g. from more efficient water provisioning systems or alternative water supply sources).

So far the still ongoing public consultation is addressing the objective of achieving good status in 85% of the water bodies by 2015. By comparing information on the current status of water flows with that of the natural conditions, an agreement is expected to be reached on the minimum environmental flows needed to be maintained in the different rivers. This agreement must consider the uses affected by minimum flows and the potential benefits of improving the habitat conditions. The minimum environmental flows decided upon will be verifiable and enforceable through the monitoring network of gauging stations.

The allocation of water resources needs to be balanced in such a way that by 2015, total water consumption will not exceed 34% of the long term available resources.

Creating opportunities for productive uses whilst respecting environmental standards

Water policy is an instrument to advance sustainable development. In the Ebro basin, water has a particularly important role in strengthening the agro food complex, as a source of renewable energy, and increasingly for new uses such as recreation and tourism services.

Without discarding current plans to expand water using activities (such as existing urban or irrigation developments) the plan conditions their implementation to the proven existence of available resources. This way the emphasis is placed on an ambitious programme to modernise the irrigation systems as a necessary condition for increasing water efficiency and reducing diffuse pollution.

Building a strategy to manage uncertainty including drought management and flood control

So far the institutional response to drought has been reactive and usually late reactive actions. Recent institutional changes have been aimed at replacing unplanned emergency management responses with new anticipated, preventive and planned responses.

The Special Action Plan in Situations of Alert and Temporary Drought for the Ebro Basin has been approved and incorporated as an integral part of the river basin management plan. The drought contingency plan defines a set of observable indicators to classify the drought situation (as normal, pre-alert, alert and emergency) and outlines a clear set of actions to be taken in each case, including the reduction of water use rights. The replacement of discretion by decision rules is considered a positive step forward in water governance.

The identification, assessment and selection of projects to restore the water environment

The water planning process for the Ebro River basin has contributed to the selection of a combination of projects aimed at restoring the water environment. They include an ambitious programme for water quality improvement through a mix of effluents treatment and water reuse projects combined with a zero tolerance programme to monitor and control pollution discharges.

A set of water saving measures have also been identified, combining intake, transport, treatment, distribution and efficiency projects throughout the entire river basin. These programmes are accompanied by a set of projects focused on the restoration of rivers and river banks, the recovery of wetlands, the restoration of sediment balances and hydrological regimes, the removal of polluted sediments, the control of invasive species and other measures aimed at improving the ecological status of the river basin ecosystem.

The twelve key elements of the Ebro River Basin Management Plan 2010-2015

- A social opportunity to build a management system that is ethical, efficient and sustainable within the whole framework of the basin, creating a symbolic reference point for the Ebro.

- Integrated management, under innovative principles of public participation and a historical cooperative model that includes all stakeholders within the shared authority of the watershed organisation.

- Ambitious environmental objectives. At least 85.3% of river water bodies will attain good status by 2015.

- A firm commitment to reducing pollution, both from diffuse agricultural sources and other sources, such as urban centres and industry.

- A proposal for realistic environmental flow regimes, set for the main gauging stations, allowing habitat conditions according to prescribed methodologies. These should be enforceable and verifiable.

- Sustainable development that contributes to strengthening the agro-food complex in the Ebro valley, strengthens the role of water as an energy source in a future which relies on energy from mostly renewable sources, and encourages the inclusion of new water uses, such as recreational uses.

- The modernisation of irrigation as a necessary action for efficient water management and the reduction of diffuse pollution.

- Balanced allocation of resources. By 2015, water consumption will be around 34% of the available natural water resources.

- Participation is the cornerstone, from start to finish and from bottom to top. The Water Council of the River Basin leads the project, but with a participatory network that reaches throughout all the sub-basins of the main basin.

- A financial effort shared by all administrative bodies.

- A commitment to cost recovery through the prism of socioeconomic territorial balance and targeted rural development programmes.

- Vigilant and adaptive monitoring. Implementation of extensive monitoring networks and procedures to verify the adoption of measures and achievement of objectives.

Evaluation: economic, social and environmental benefits

Social

Public participation has been particularly important for increasing understanding of the tradeoffs between the environmental, economic and social objectives that need to be considered in water policy. Water has been key rural development, for example by providing alternative development opportunities such as rural tourism. These ambitions sometimes conflict with the limited capacity of rural areas to finance their own water management projects or even to pay for the entire cost of the water services they receive. For this reason, with the support of public participation processes, the development of the river basin plan focused on identifying actions with the highest potential for promoting local development in sensitive rural areas. The planning process also assessed and identified low income areas where social objectives should be prioritised and exceptions to full cost recovery of water prices permitted.

Economic

Although significant progress has been made, the coordination of agricultural, land use, energy and other sector policies in the water policy framework is still to be achieved. Around 70% of the new irrigation areas proposed in the 1998-2008 planning period were carried out. Many irrigation expansion projects are still pending for implementation or under study, and some of them have been implemented but unable to achieve their objectives due to a lack of sufficient water resources. The importance of sustainable water management and environmental conservation is increasingly being recognised and accepted, in contrast to the sole promotion of local development.

Environmental

Significant advances have been made in controlling diffuse pollution, mainly through changes in agricultural practices and also through the management of pollution from scattered livestock in the upper reaches of the river basin. In 2008, already 74% of the water bodies assessed were of a good ecological status.

Lessons learnt

The approach	Lessons learnt from implementation
Reaching a social agreement on the desired balance between water use and water resource conservation	Setting the achievement of a good or fair ecological status of the water bodies as the main objective of River Basin Management Plans in the European Union has been an important element of water planning in the Ebro River basin in Spain and has helped make economic development compatible with environmental objectives.

Harnessing development opportunities and coping with water and development challenges	Water planning has played an essential role in the development of the agro food and energy complex that now represents a competitive advantage and a defining characteristic of the Ebro River basin in Spain.
Building governance and institutional capabilities	Transparency, regulation and enforcement, and building technical competences have been key to successfully building governance capabilities in the Ebro River basin.
Improving the information and analysis base	The Ebro River basin boasts an efficient hydrological information system open to stakeholders, researchers and private and public institutions.
Coordinating public policies	The simultaneous development of the energy, the agro food industry as well as urbanisation and the expansion of the manufacturing industry have been possible within the capacity of the limited water resources available in the Ebro river basin.
Stakeholder engagement and public participation	Active participatory mechanisms have contributed to the design of water management plans in the Ebro River basin.
Aligning private decisions with collectively agreed goals	There are clear regulations for water abstraction and quality requirements, a transparent playing field and indicative planning for private investments.
Establishing collective responses to scarcity and risk	The Water Framework Directive is a promising example of a collective response that has served to develop and coordinate efforts at a national and local level to respond to water challenges.
Monitoring progress and compliance	The acquisition of technical skills, the development of information systems, the building up of reporting strategies, etc. are all elements that have contributed to the reputation and credibility of river basin authorities in the Ebro basin.

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7. Water and the green economy in Latin America and the Caribbean: regional context and lessons learnt

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Regional context

Latin America and the Caribbean possesses about a third of the world's water resources. However, these resources are spread unevenly among and within countries. Many large urban centres and important economic activities are settled in arid or semi arid areas and water availability is increasingly reduced by intense use and or water pollution. Latin America is already the world's most urbanised developing region, with more than 80% of the population living in towns and cities, in many cases in precarious conditions, such as the 100 million people still living in slums.

Water management in Latin America and the Caribbean has evolved over time. Attention has shifted from the construction of large infrastructure projects for irrigation and hydroelectricity generation in the 50s and 60s to the provision of water supply and sanitation services in the 70s and 80s, to increasing emphasis on non-structural measures, water conservation, environmental management and pollution control in the 90s and 2000s, as the region started facing challenges of increasing water scarcity, pollution and climate change. The governments of the region have also recognised the importance the water sector can have in creating conditions for economic growth and in the alleviation of poverty.

The main issues facing the countries of the region in water management have not changed significantly in recent years. There has been a widespread inability to establish formal institutions that are able to deal with water allocation issues, extreme events and externalities (water pollution, aquifer depletion, etc.) under conditions of scarcity and conflict. The water sector still exhibits many examples of poor management; when formal norms exist, they are often inadequate to deal with the problems at hand and the operational capacity to implement them tends to be extremely limited. There is a general absence of self-financing and a consequent dependence on fluctuating political support. In general, there is an inability to respond to crises. Despite much improvement, reliable information is often missing, including on the resource itself, its availability and use, on the infrastructure, on institutional responsibilities and on future needs. Poor water management in the region means conflicts over the resource are still persistent and widespread. Issues over water allocation and competition amongst sectors – e.g. agriculture, industry, mining, urban water supply, water for environmental protection and indigenous groups – will increase significantly as economic development continues to augment. It is estimated that the region will keep on growing – regional growth is projected to exceed 4% for 2012. At the same time, Latin America and the Caribbean has the most inequitable income distribution in the world. Universal service coverage and resolution of environmental problems have been hampered by these inequalities.

Important efforts have been made to improve water supply and sanitation coverage. At the regional level the Millennium Development Goal to reduce by half the proportion of people without sustainable access to safe drinking water has been already met with few exceptions

(Haiti, Dominican Republic, Peru, Jamaica, etc.). However, service quality (intermittency, water quality control, etc.) is mediocre and infrastructure is often in bad condition, which is illustrated by high water losses that can reach up to 50-75%. Coverage in rural areas is much lower and those without drinking water and sanitation services are the most impoverished segments of society. Almost 40 million people still lack access to safe drinking water, while almost 120 million people do not have access to sanitation. And more than 70% of sewage is discharged into the nearest water bodies without any treatment causing alarming water pollution problems.

Agriculture is the main user of water in the region representing over 70% of the total water extractions in almost all countries. Currently, the region produces 31% of the global supply of bio-fuels and 48% of soybean. Tendencies show that agricultural production will keep on growing in most of the countries in Latin America resuming the expansion achieved between 2000 and 2007. Irrigation can play an important role in increasing agricultural yields. In many Latin America and the Caribbean countries, the levels of irrigation efficiency are in the range between 30% and 40%. Expansion of the area under irrigation has slowed down in many cases and an increasing urban population will add pressure to reallocate water from the agricultural sector to urban drinking water supply in cities.

Many parts of the region are highly vulnerable to the adverse consequences of climate change, and this could potentially threaten the progress made towards achieving the Millennium Development Goals. The expected effects of climate change will generate risks, challenges and opportunities for water management. The risks and challenges can be seen in the Andean countries which experience El Niño-Southern Oscillation (ENSO) and in the succession of long droughts in the northeast of Brazil. Moreover, the countries estimated to be in areas of high and extreme risk from global climate change are the poorest countries of the region in Central America, the Caribbean and the Andes. The most serious challenges arising from climate change for the management of water resources in Latin America and the Caribbean can be expected to lie in the following areas:

- A significant deterioration in the quality, quantity, and availability of water for all uses in many areas.
- Damage to coastal areas owing to a potential rise in sea levels, which in turn will affect river regimes.
- Increased economic damage from the greater intensity and frequency of hurricanes and tropical storms due to higher ocean surface and air temperatures

Challenges

The issues that water management in Latin America and the Caribbean has to confront do not all come from within the water ‘box’. There have always been strong external drivers or forces affecting both water management and the water resource. The more significant of these come from general social change, but also include macroeconomic policies, often with a negative influence, stemming from abrupt changes in domestic policies and from outside, such as the international financial crisis of 2008-2009; but sometimes with positive effects as macroeconomic administration has improved domestically and globally, as with the expansion of world markets in recent years.

Water resources management often presents problems requiring a holistic approach. Among these the following are significant: coordination of supply and demand policies; policies for the quality and quantity of water resources; the joint use of surface and groundwater; the multiple use of resources and multi-purpose projects; coordinated management of land use, vegetation cover and water; management of externalities; improvements in data collection and information management; and environmental conservation policies.

In Latin America and the Caribbean, institutions are often weak, they lack operational capacity and rules are insufficient or not enforced. Fragile institutional frameworks and corruption, not only in the water sector, but in general have affected water management. The absence of appropriate water management institutions causes uncertainty, deepens conflicts over water and hampers economic development. Water provision and allocation needs clear rules, strong government institutions, transparency and a holistic approach which in most of the countries of the region are missing. There has been an effort to transit towards integrated water resource management as a framework for helping overcome these challenges; however, it often remains as a concept difficult to translate into reality.

Advances have been achieved both at the national level, through the implementation of new water management systems based on new legislation; and at the river basin level with watershed or river basin organisations, however these efforts have been isolated and had limited success. Over the last two decades, the water supply and sanitation sector has been subject to extensive reforms in the majority of the countries of the region. Unfortunately there have been few success stories, as in many cases reforms encountered difficulties or went astray due to the lack of consensus, capture by special interest groups, and especially failure to consider the structural limitations of national economies and sound principles of public utility regulation and economics of service provision. Lack of integrated planning has hindered advances in many countries. Public awareness and stakeholder participation are key to solving conflicts. Not involving communities in decision making has proved to have explosive effects (e.g. Cochabamba). Although the situation has improved over the years, it is in general still affecting the proper management of water resources in the Latin America and the Caribbean region.

Aging water infrastructure, insufficient investments and inadequate regulatory frameworks are at the heart of the challenges for the provision of drinking water and sanitation services. Tariffs should serve as a proper signal to water users, however they often do not reflect even operational and maintenance costs. Some countries, such as Chile, have implemented full cost recovery tariffs supported by subsidy systems for the poor; however this is not the case for many countries in Latin America and the Caribbean. Water operators find financial sustainability difficult to attain due to high levels of poverty and the fact that decisions, often taken outside the economic realm, set tariffs that are too low. There is a need to bring tariffs to cost recovery levels, but accompanied by significant public investment (political priorities are very important) and creation of effective subsidy systems for the poor.

Approaches

Some countries have implemented significant reforms. For example, Brazil has adopted a new water legislation and a national water management policy; new water laws have also been recently adopted in Honduras, Nicaragua, Peru, Venezuela, among other cases; Chile has reformed its water law and the water supply and sanitation sector, and privatised all

water-related utilities; and Mexico reformed its water legislation and created river basin councils. The water supply and sanitation sector has been subject to extensive reforms in the majority of the region's countries particularly in Argentina, Bolivia and Colombia. In addition, a large number of countries are currently discussing modifying or reforming their water-related legislation.

Economic instruments, such as subsidies, tariffs, fees, incentives to mobilise resources, regulatory controls and prices signals have been implemented in the region with mixed results. In the countries of the region – which do not have the human and financial resources of developed countries, nor a State or private apparatus with the equivalent organisation and management capacity – interest in trying to apply economic instruments is not always compatible with the basic conditions they require. Good results are generally vetoed by the prevailing conditions of user informality, lack of information, perverseness or ignorance about good practices concerning the use (or rather abuse) of water, in combination with an almost absolute inability to enforce the law even where formal legal conditions exist. Among other basic conditions that are lacking, most of the countries of the region do not have efficient institutionalised systems of water management. Without this, very little can be done, bearing in mind the enormous fragmentation of institutions and responsibilities involved in water management. Widespread poverty, lack of trained personnel, lack of control and monitoring systems, the concentration of economic and social power, the ease with which regulators or managers (where they exist) can fall under undue influence, all constitute impediments to the use of economic instruments.

Reforms in the water sector have taken place, yet there is still work to be done as many of the changes undertaken have not yet yielded the benefits they were expected to produce. It has been acknowledged that to achieve universal coverage and good quality services, systems need to be financially and economically viable. Many systems charge for the cost of administering water resources. There are also examples of charges intended to recover costs of water works, pay for water-related services and treatment of wastes, cover administrative expenses and induce water conservation and environmentally sound behaviour. However, legislation charging for water as such is not so abundant. Nevertheless, some countries of the region have already implemented or are implementing systems of charges for water as a resource.

Improving efficiency helps achieving equity. By providing services efficiently, costs can be reduced allowing the allocation of resources into maintenance programmes or even new infrastructure investments.

To transition towards a green economy, Latin American and the Caribbean countries will need to focus on elements such as:

- Water use efficiency, loss reduction, metering, efficient water use.
- Energy efficiency in the provision of drinking water supply and sanitation services.
- Drinking water supply and sanitation in the fight against poverty, for social cohesion and integration, green employment and their role in countercyclical policies.

- Generation and management of new and unconventional water sources (such as seawater and brackish water desalination, wastewater reuse, market reallocation, watershed management and payments for environmental services) for human supply and other competing uses (especially mining).

- Domestic wastewater treatment and recycling, full water cycle management.

- Climate change adaptation and mitigation in drinking water supply and sanitation; methane recovery in wastewater treatment.

Water management, direct regulation and economic instruments: the Colombia case

For more than 35 years, Colombia has been building a wide range of instruments for water management: regulatory controls of quality and quantity, price signals to encourage efficient use of the resource, and obligatory investments to protect water resources. Sometimes, productive sectors respond effectively to price signals and command and control measures. Nevertheless, despite some advances, various limitations hinder sustainable use of water in accordance with the challenges of economic growth. This case shows that:

a) When price signals are applied properly and with appropriate institutional enforcement, the positive effects on the rationalisation of the use of water are clear and effective.

b) A financial strategy of environmental investment associated with economic growth and the use of natural resources is more effective than exclusive dependence on the political will of national authorities.

Source: http://www.faae.org.co/PolicyPdf/policy-26.pdf

Lessons learnt

There is a need for integrated water planning to satisfy economic objectives, environmental requirements and social concerns, through the generation of a shared vision regarding the future evolution of water availability and use at the river basin level. These are some of the main lessons that have been drawn from experiences across the region and the consensus that has been built amongst stakeholders and experts to improve water management in the region:

Water legislation

- Water laws must clearly state that water belongs to the public domain of the State.

- Water laws must determine specifically that water use rights, when granted under conditions of, or which aim at, effective and beneficial use and that do not cause environmental damage, are protected by private property clauses in the constitution.

- In the case of water rights and uses that were in existence prior to the legislative change, including traditional and indigenous uses, they should be recognised in accordance with their effective and beneficial, historical and current use, without this affecting the possibility of imposing appropriate regulations.

For the regulation of drinking water supply and sanitation services

- Reasonable tariffs and profits. It is important to bear in mind that privatisation does not miraculously make unprofitable operations profitable.

- A subsidy system that avoids as far as practicable cross-subsidies and that guarantees the low-income groups a basic minimum supply.

- The right to adequate and opportune information, both for the regulators and for customers.

- Obligatory uniform regulatory accounting; and control of transfer prices, holdings and intra-holding transactions.

Regarding centralisation and decentralisation

- Depending on the activities involved, determine the appropriate level for decentralisation or centralisation, in accordance with technical considerations and economies of scale and scope.

- Preserve a residual capacity at the central level, to promote or implement the necessary activities or measures in the event of decentralised bodies being negligent or unable to carry out their functions.

- National legislation should recognise the two basic principles that govern disputes between decentralised authorities: (i) equity and reasonableness; and (ii) not causing significant harm.

Regarding water management institutions

- The authority responsible for water allocation and management should be independent from sector influences, with authority and resources in line with its responsibility.

- Inserting water management within environmental agencies may result in minimising its potential for driving socioeconomic development.

- Therefore, it seems appropriate that the water resources have their own stable and independent institutions, even when these are closely linked to institutions responsible for the strategic vision of national development.

- Water-related decision making has economic content, and special interest group pressures can promote or dissuade certain decisions. Accordingly, water authorities should have independent budgets and chief executives appointed for fixed terms and protected from arbitrary removal.

- River basin level organisations are valid options for water management. Critical requirements for their creation include a precise definition of their specific exclusive functions focused on water resources, and adequate authority and funding.

Regarding regulatory agencies for drinking water supply and sanitation services

- Clear institutional separation between the functions of sector policy formulation, regulation and provision of services.
- The regulator must have independence and stability, and be subject to rules of good conduct and ethics.
- The regulator must have the necessary powers and resources.
- The regulator must have appropriate legal capacities.

Lessons learnt from selected cases in the LAC region

Case	Lesson learnt
Greening (ecologizacion) the economic regulation for the provision of drinking water and sanitation services in Peru: lessons from SUNASS	Cost recovery tariffs coupled with clear and transparent subsidies for low income families is an efficient way to rationalise water use and increase coverage of water and sanitation services; however an important precondition is public investment in the universalisation of service coverage. Providing access to drinking water and sanitation services can be used as a way to alleviate extreme poverty and social exclusion. Projects which are designed considering environmental dimensions can reduce their maintenance and operative costs, avoiding future expenditures on new supply infrastructure. Communities accept subsidising those who cannot afford to pay for water services, however, they are not willing to pay on behalf of "free riders". It is necessary to acknowledge the cultural and environmental context on a case by case basis; there is no solution that can fit all. Transparency on the water bill enhances the end user understanding of its water consumption.
Design and approval of the Multi-annual Sectoral Plan for Water and the Environment of the Republic of Guatemala and the creation of the Water Advisory Group (Gabinete Específico del Agua GEA)	Policy coherence and coordination is necessary to improve water management. Consensus building at the national and local level among relevant stakeholders is key for success. The role of institutions and organisations outside of the water sector can be critical to the success of water governance within the sector. Political commitment and innovative approaches can generate positive changes.

Public management of water in Colombia	Colombia has a legal, institutional and financial framework that allows the implementation of measures for the regulation of water use and for ensuring the sustainable development of production and consumption. When price signals are applied properly and with appropriate institutional enforcement, the positive effects on the rationalisation of water use are clear and effective. A financial strategy of environmental investment associated with economic growth and the use of natural resources is more effective than exclusive dependence on the political will of national authorities. Financial sustainability of water authorities is necessary, but not sufficient, to ensure the effectiveness of water management. As well as supervision and control of water users being necessary, appropriate monitoring of water authorities by the control entities and citizens is also essential.
Community water management in Central America as an environmental, economical and socially feasible choice	Community based management can be a low cost efficient initiative especially for low income groups. This level of involvement generates economies of scale that enhance the provision of services. The approach used by the communities now involves not only water management but also the protection of forests, recharge areas, integrated watershed management, and sustainable agricultural practices. Water has become a valuable resource for agricultural purposes and for small scale hydroelectric generation. The development of networks has allowed knowledge sharing and the adoption of best practices in different communities.
Prices that reflect the costs and benefits to the poor in Bogotá and Medellín, Colombia	Cost recovery and financing- economic instruments helped reduce water consumption. Financial sustainability of water utilities can be attained, reducing their dependence on government budget allocations. The introduction of a law requiring the implementation of full cost tariffs set a clear legal framework. Communication strategies to emphasise the value of water and the value of paying its cost, and the support from the local mayor were necessary for the successful implementation of the tariffs.

Gabinete Específico del Agua de la Presidencia de la República de Guatemala, mecanismo para definir, coordinar y dar seguimiento a la política pública del agua, su estrategia, programas, acciones y presupuesto

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Tipo de herramienta: políticas e instrumentos económicos
Tema: Ciudades
Localización: Guatemala, América del Sur

Introducción y descripción del problema

Guatemala se sitúa en el norte de la región centroamericana, lindando con México; al sureste, con El Salvador y Honduras; al sur con el Océano Pacífico y al Oeste, con el Mar Caribe. Su extensión territorial es de 108,000 km3 y su población se estima en 14 millones de habitantes, de los cuales el 52% se sitúa en el área rural. La ciudad capital, Guatemala, alberga cerca de 3 millones de personas en tanto que los demás centros urbanos reúnen entre 100 y 200 mil personas, como máximo.

En el 2008, el producto interno bruto PIB de Guatemala ascendió a 2,850 dólares, tres veces menor al promedio de América Latina (CEPAL, 2010); la tasa de alfabetización es del 72% y el promedio de educación formal, solo llega al 4º grado del nivel primario.

Se estima que cerca del 50% de la población son pueblos indígenas de ascendencia maya. Del total de hogares, el 51% son pobres y de éstos, el 15% son indigentes. La pobreza alcanza el 70% en el área rural, en donde se concentra la población indígena, en tanto llega al 15% en las áreas urbanas; y en la región de América Latina, la desigualdad en el ingreso en Guatemala, aplicando el índice e GINI (0,59), solo es superada por el de Brasil.

El Estado de Guatemala cuenta con disponibilidad teórica de agua más allá de su demanda y de los requerimientos previstos; pero no ha sido capaz de articular la gestión y gobernanza del agua al cumplimiento de metas y objetivos nacionales, de interés público y social. Utiliza sólo el 10% de este capital natural, mas aún no cuenta con cobertura universal de servicios públicos de agua y saneamiento y los servicios existentes se consideran, en general, de muy baja calidad—calidad, costo, continuidad.

El potencial hídrico para fines agrícolas se aprovecha en un 25% y el energético en cerca de un 19%, más no se producen alimentos para toda la población, la matriz energética se basa en el empleo de derivados del petróleo y por otro lado, y la cobertura de servicios de energía eléctrica no es aún universal. Por su posición geográfica, Guatemala está expuesta a fenómenos hidroclimatológicos extremos como huracanes, depresiones tropicales, La Niña, el Niño, entre otros, acentuados por la variabilidad climática y el cambio climático, lo cual exige una buena gestión de riesgos.

La cobertura de agua para consumo humano con servicio mejorado alcanza el 78% (2006), con grandes diferencias según regiones; en las zonas urbanas la cobertura alcanza cerca del 80% mientas en el área rural es cercana al 53%; y el servicio de saneamiento promedia el 47% a nivel nacional—77% en ciudades y 17% en el área rural. Se estima se tratan cerca del

5% del total de aguas residuales, lo que se han constituido en el problema de contaminación de las aguas más común y grave.

El sistema de gobierno de Guatemala es unitario, representado por un Presidente y un Vicepresidente, quienes actúan en Consejo de Ministros, mediante gabinetes específicos y comisiones ad-hoc, y al nivel nacional actúa principalmente a través de ministerios y secretarías de estado y, al nivel local, a través de las gobernaciones y delegaciones sectoriales.

Administrativamente el estado de Guatemala se divide en 22 departamentos y 334 municipios y conforme la Ley de Descentralización y la Ley de los Consejos de Desarrollo, los Consejos Departamentales de Desarrollo CODEDES son quienes disponen como invertir los fondos en su territorio, instancias que se integran con representantes de los consejos municipales y comunitarios de desarrollo.

Aún cuando se han dado pasos muy importante como la firma de los Acuerdos de Paz (1996) y en materia de descentralización de la planificación, presupuesto y ordenamiento territorial , el régimen legal de los recursos naturales sigue siendo centralizado y causa de no pocos conflictos sociales, especialmente los aprovechamientos mineros e hidroeléctricos, situación que se torna aún más complicada en el caso del agua porque el país no ha contado con un régimen legal e institucional especial para administrar el agua como bien natural, social y económico ni para administrar el conjunto de derechos y obligaciones de los diversos usos y aprovechamientos (1963-2007).

El gobierno central aún se organiza a partir de sectores usuarios del agua y del ambiente. El desempeño de las atribuciones de Ministerios rectores y de Secretarías de Estado ha carecido, inclusive, de planes sectoriales del agua, y hasta ahora se plantean herramientas comunes de política nacional del agua (2008-2011). En la gestión pública descentralizada, los consejos departamentales de desarrollo carecen de orientación y líneas estratégicas para disponer de los fondos públicos y las municipalidades, en su tarea fundamental de prestar los servicios públicos de agua potable y saneamiento.

Dado el estado de cosas, es evidente que el desempeño institucional público (1970-2007) no ha sido capaz de desarrollar los recursos hídricos ni en razón de objetivos sectoriales ni en función de contribuir al logro de objetivos y metas superiores, nacionales de interés público. Este desempeño institucional ha favorecido el deterioro del agua; no ha permitido cerrar la brecha de las demandas sociales insatisfechas, entre éstas, las de agua potable, saneamiento y seguridad alimentaria; ni promover los usos productivos del agua de manera estratégica; tampoco ha sido capaz de resolver conflictos por acceso al agua; y posee bajísima capacidad para gestionar el agua ante riesgos naturales.

Retos, objetivos, componentes y procesos de implementación

En respuesta a la necesidad de articular la gestión y gobernanza del agua al desarrollo nacional, el Gobierno Central crea el Gabinete Específico del Agua GEA (2008-2012), conforme disposiciones de la Ley del Organismo Ejecutivo, como instancia de coordinación de política, planificación y presupuesto. El Vicepresidente de la República preside y coordina el GEA, integrado[36] por 10 Ministerios y 5 secretarías de estado, dos consejos nacionales y la

[36] Ministerio de Relaciones Exteriores, del Ministerio de Finanzas Públicas, del Ministerio de Comunicaciones, Infraestructura y Vivienda, del Ministerio de Educación, del Ministerio de

red de gestión de riesgos. El GEA se reúne ordinariamente una vez al mes, es permanentemente apoyado por las carteras de relaciones exteriores, ambiente, agricultura, salud e infraestructura; y cuenta con el apoyo de una Secretaría Técnica, integrada por 8 profesionales, quienes se reúnen periódicamente con el señor Vicepresidente para informar avances y recibir instrucciones, apoyan los requerimientos de Ministerios y Secretarías de Estado e integran comisiones técnicas interinstitucionales especializadas.

El mayor reto institucional del GEA ha sido generar condiciones favorables para promover e implantar un proceso nacional de gestión estratégica del agua que promueva el desarrollo de los recursos hídricos a favor de metas y objetivos del desarrollo nacional. Con la emisión de la Política Nacional del Agua (2011), se han definido objetivos, principios, orientaciones y líneas estratégicas comunes, de manera tal que las acciones y presupuestos sectoriales de nivel nacional, cumplan tanto metas y objetivos sectoriales/temáticos como nacionales y de interés público; y los gobiernos municipales y el sistema de los consejos de desarrollo cuenta con un referente nacional.

Sin embargo, la voluntad política del Ejecutivo debe enfrentar el reto de carecer de institucionalidad para hacer operativas todo el conjunto de medidas de la Estrategia de la Política Nacional del Agua, actuar efectiva y eficazmente en su labor de coordinación de planes operativos con múltiples instituciones; y especialmente enfrenta el reto de no contar con un sistema de información del agua robusto, más si con un conjunto de demandas sociales, políticas y ambientales a las cuales debe e intenta encontrar solución que, en general, exigen mejorar notablemente la calidad de la gestión y gobernanza del agua.

En el 2008 el GEA adopta seis líneas de trabajo definidas por el Gabinete General de Gobierno y organiza su plan estratégico de coordinación de política, planificación y presupuesto en relación con los ejes siguientes: (1) Agua y saneamiento para el desarrollo humano, cuya rectoría corresponde al Ministerio de Salud Pública y Asistencia Social; (2) Gobernabilidad y planificación del agua, cuya dirección corresponde al grupo asesor GEA, por carecer el país de autoridad rectora del agua; (3) Manejo de bosque, suelo y calidad del agua en cuencas, cuya rectoría corresponde al Ministerio de Ambiente y Recursos Naturales; y (4) Aguas internacionales, cuya rectoría corresponde al Ministerio de Relaciones Exteriores, con el apoyo del Equipo Nacional de Expertos, coordinado por Grupo Asesor del GEA.

Paralelamente el GEA trabaja la definición de la Política Nacional del Agua PNA y la *Estrategia Nacional del Agua ENA* y su grupo asesor participa activamente en otros procesos de planificación y presupuesto, entre los cuales destaca el *Plan Sectorial Multianual de Ambiente y Agua PSMAA* (2010), la *Política Nacional de Cambio*

Agricultura, Ganadería y Alimentación, del Ministerio de Economía, del Ministerio de Salud Pública y Asistencia Social, del Ministerio de Energía y Minas, del Ministerio de Cultura y Deportes, del Ministerio de Ambiente y Recursos Naturales, de la Secretaría de Comunicación Social, de la Secretaría de Coordinación Ejecutiva de la Presidencia de la República, de la Secretaría de Planificación y Programación de la Presidencia de la República, de la Secretaría de Asuntos Agrarios, de la Secretaría de Seguridad Alimentaría y Nutricional de la Presidencia de la República, del Consejo Nacional de Áreas Protegidas, del Consejo Nacional de Ciencia y Tecnología y de la Coordinadora Nacional para la Reducción de Desastres

Climático y el *Plan de Reconstrucción con Transformación* (2010); y establece vínculos con el *Sistema Nacional de Diálogo*.

El objetivo general de la PNA es "*Asegurar la contribución del agua al cumplimiento de metas y objetivos de desarrollo económico, social y ambiental del país, mediante la institucionalización del sistema nacional de gestión y gobernanza del agua que satisfaga el mayor número de demandas, prevea los requerimientos futuros, gestione los riesgos hídricos y proteja el bien natural, en un marco de armonía social, desarrollo humano transgeneracional y soberanía nacional;* y sus objetivos específicos, concretados conforme los avances habidos al dar cumplimiento a los compromisos del *Plan Estratégico del GEA 2008-2011*, y son los siguientes:

1. Contribuir al mejoramiento de las condiciones de calidad de vida, bienestar individual y social como parte del desarrollo humano de los habitantes de Guatemala, mediante el mejoramiento de la gestión pública sostenible de los servicios públicos de agua potable y saneamiento y de las prácticas de manejo del agua para el consumo humano;

2. Contribuir a la adaptación nacional al cambio climático mediante la conservación, protección y mejoramiento de las fuentes de agua y de los bosques, suelos y riberas de ríos que regulan el ciclo hidrológico en cuencas;

3. Contribuir con los objetivos de desarrollo económico y social y con la adaptación nacional al cambio climático, mediante la gobernabilidad y gestión eficaz del agua, la planificación hidrológica y el sistema nacional de obras hidráulicas que regulen el ciclo hidrológico para satisfacer el mayor número de demandas, prever requerimientos futuros y gestionar los riesgos hídricos;

4. Adoptar gradualmente un sistema nacional de gestión del agua que promueva la modernización del régimen legal e institucional para asegurar la implementación de acciones de planificación, programación y presupuesto vinculadas a las políticas sociales, económicas, ambientales y de relaciones exteriores del país; y

5. Contribuir al logro de los valores de justicia, seguridad y bien común del país, mediante la implementación de los lineamientos y principios de negociación que establezcan esquemas de compensación para proteger los cursos de agua internacionales a través de tratados bilaterales y que primero Guatemala debe satisfacer las necesidades de su población, economía y ambiente.

La Estrategia Nacional del Agua ENA identifica dos escenarios, el tendencial, dejar pasar y dejar hacer, y el escenario probable, el cual adopta. Este segundo escenario se funda en dirigir iniciativas más allá de los sectores usuarios del agua (doméstico, agrícola, energético) y en adoptar medidas de protección (incipiente control de contaminación), a favor de acciones estratégicas que favorezcan la competitividad del país, el cumplimiento de las metas de los Objetivos de Desarrollo del Milenio y de los objetivos sociales y ambientales de la política gubernamental.

La *ENA* define líneas estratégicas y propone un conjunto de medidas para ordenar y hacer eficaces las acciones y recursos institucionales, focaliza actividades y tiene como fin

instrumentalizar los objetivos de la Política Nacional del Agua. Las líneas estratégicas son las siguientes:

(1) Agua potable y saneamiento para el desarrollo humano, cuyas líneas de acción son las siguientes: (1.1) Ampliación de cobertura y mejora del funcionamiento de los servicios públicos de agua potable y saneamiento; (1.2) vigilancia, monitoreo y mejoramiento de la calidad del agua para consumo humano y saneamiento; (1.3) Gestión social en APS; y (1.4) administración, operación, mantenimiento de los servicios públicos de APS.

(2) Conservación, protección y mejoramiento de fuentes de agua, bosques, suelos y riberas de ríos en cuencas cuyas líneas de acción básicas, las siguientes: (2.1) formulación, aprobación y/o implementación de la Políticas, Normas y Programas para la conservación, protección y mejoramiento de bosques, suelos, fuentes de agua y riberas de ríos en cuencas; (2.2) formulación, aprobación e implementación de normativa y del programa nacional de valoración y esquemas de compensación por bienes y servicios ambientales hídricos; (2.3) Formulación e implementación del programa nacional de protección y recuperación de la calidad de las aguas; (2.4) formulación e implementación el programa nacional de recuperación de cuencas estratégicas; (2.5) Diseño e implementación del sistema de información para la conservación, protección y mejoramiento de la calidad el agua, bosques, suelos, fuentes de agua y riberas de ríos en cuencas (2.6) Ciencia y tecnología para la conservación, protección y mejoramiento de bosques, fuentes de agua, riberas de ríos y calidad del agua en cuencas; (2.7) Educación y participación ciudadana para la conservación, protección y mejoramiento de la calidad del agua, bosques y suelos en cuencas; y (2.8) Programa de Manejo integrado de la zona costera.

(3) Planificación hidrológica, Obras hidráulicas de regulación y Gobernabilidad del agua, cuyas líneas de acción son las siguientes: (3.1) Formulación de lineamientos nacionales para la planificación hidrológica y obas hidráulicas de regulación; (3.2) Diseño e implementación del Sistema de información y conocimiento del Agua de Guatemala enfocado al uso, sequías e inundaciones; (3.3) Diseño y construcción de sistemas de micro y pequeñas obras de regulación del agua en cuencas medias y altas, vinculadas a la región semiárida del país; (3.4) Formulación de lineamientos nacionales de participación ciudadana para promover la construcción de acuerdos sociales que favorezcan la gobernabilidad eficaz del agua; (3.5) Diseño y promoción de estrategias y lineamientos nacionales para la modernización del régimen legal e institucional del agua; (3.6) Formulación e implementación del Programa nacional de identificación y sistematización de prácticas sociales de gestión y gobernanza del agua; (3.7) Formulación e implementación del programa nacional de mediación y resolución de conflictos del agua; (3.8) fortalecimiento del sistema CONRED para elaborar e implementar el Sistema Nacional de Gestión de Riesgos Hídricos para sequías e inundaciones; (3.9) Formulación e implementación de Políticas y Planes de los usos sectoriales del Agua; y (3.10) Diseño e implementación del Plan Nacional del Agua, el Sistema Nacional de Inversión Púbica del Agua y el Sistema nacional de Administración del Agua.

(4) Política pública y régimen legal e institucional de Cursos de Aguas Internacionales, cuyas líneas de acción son las siguientes: (4.1) Preparación, desarrollo e implementación de la Estrategia de comunicación para la coordinación y socialización de la Política de Estado en Materia de Cursos de Agua Internacionales; (4.2) Preparación, desarrollo e implementación del Diagnostico y Estrategia para la Negociación Bilateral de las

Aguas Internacionales con visión de soberanía nacional guatemalteca; (4.3) Diseño e implementación del Sistema de Información y Comunicación de Aguas Internacionales para la toma de decisión; y (4.4) Preparación, desarrollo e implementación del Diagnostico y Estrategia a Nivel Multilateral para favorecer la implementación de la Política de Estado en Materia de Cursos de Agua Internacionales.

(5) Acciones principales, plazos e institucionalidad responsable, que consisten en las matrices de cumplimiento—actividad, plazo e instituciones responsables—elaboradas por todos y cada uno de los Ministerios y Secretarías de Estado que integran el GEA.

Cambios hacia el crecimiento verde y beneficios en la economía

a. Cambios Significativos generados por GEA

Los cambios significativos generados por la instancia GEA son básicamente los siguientes: (1) colocar la definición y seguimiento de las políticas públicas de gestión y gobernanza del agua dentro de las prioridades de la política pública nacional; (2) Instituir una instancia de coordinación al más alto nivel político, en el seno del Gabinete General de Gobierno, presidido por el propio Vicepresidencia de la República; (3) Articular la política nacional del agua principalmente con la política social, la política de desarrollo rural, la política ambiental y la política de cambio climático ; (4) Fijar objetivos, metas y líneas estratégicas de acción comunes para todas las agencias del gobierno central y con ello establecer un referente para la institucionalidad local; y (5) contribuir a mejorar el desempeño institucional de ministerios rectores y secretarías de estado, dándole valor agregado a sus acciones en función de cumplir tanto metas sectoriales como objetivos superiores de índole nacional.

b. Impactos en el ambiente

En materia institucional, la labor de coordinación del GEA ha permitido diferenciar la gestión y gobernanza del agua de la gestión del bien natural en el ambiente; ha permitido identificar las relaciones de interferencia e interdependencias entre el agua y los otros bienes naturales y el ambiente; y ha hecho evidente la necesidad de administrar los bienes y servicios ambientales proveídos por el agua de manera específica y especializada, distinguiéndolos de aquéllos proveídos por el bosque y la biodiversidad.

Por otro lado, ha hecho evidente que la función rectora del Ministerio de Ambiente y Recursos Naturales de proteger, mejorar y recuperar el bien natural, debe ser fortalecida, precisamente para ejercer funciones de dirección, regulación y vigilancia respecto a la calidad, cantidad y comportamiento; y al mismo tiempo debe diferenciarse de acciones que competen a otros entes rectores, como es el caso de la medición del recurso y la administración de derechos de aprovechamiento, y de aquéllas en donde las acciones conjuntas y horizontales son indispensables, como la gestión de riesgos.

c. Impactos sociales y efectos en la reducción de la pobreza

Como consecuencia de las medidas de ajuste estructural promovidas por el sistema financiero internacional, durante la década de 1980 la capacidad del Estado de Guatemala fue totalmente debilitada; y la relativa al acceso universal al agua para fines domésticos sencillamente desapareció. En el 2008 se confirma que las leyes del mercado no ofrecieron a los segmentos pobres del país, que infortunadamente abarcan cerca del 50% de la población y además padecen niveles vergonzosos de desnutrición, acceso a estos servicios públicos.

Actualmente, 50% carece de servicios mejorados de saneamiento y cerca del 25% de servicios de agua potable.

El Gobierno 2008-2011 define una política social integral; el sector público central de agua y saneamiento inicia su recuperación, el contexto del GEA se organiza el Programa Presidencial Agua Fuente de Paz, para facilitar el proceso político de restablecer la rectoría en el Ministerio de Salud Pública y Asistencia Social, cuyo despacho instituye la Unidad de Seguimiento de la Rectoría del Agua Potable; y para coordinar acciones con entes descentralizados responsables de ejecutar fondos públicos. Se promueve un sistema nacional de administración de los servicios públicos de agua potable y saneamiento, que integre también a las municipalidades y a los operadores privados y comunitarios. Se logra refinancia el sector (US$150 Millones contra US$2 Millones encontrados en el 2008). En este proceso se cuenta con los análisis y propuestas planteados por CEPAL[37]; y con la experiencia del proceso de negociación de una donación proveniente del Fondo del Agua de España y de un préstamo BID para agua potable y saneamiento 2008-2010.

Cambios en la gobernanza y gobernabilidad

En la gobernanza del agua se transitó de una gestión pública sectorial sin planificación ni coordinación interinstitucional alguna, hacia una coordinada, estableciendo herramientas de política, planificación y presupuesto, basadas en una política y estrategia común; se avanzó en la definición de un Plan Sectorial Multianual de Ambiente y Agua; y en materia de gestión de riesgos, transitó de atender las emergencias provocadas por los eventos naturales hacia abordar causas de los riesgos hídricos.

Aún está pendiente el proceso de articular el sistema de los consejos de desarrollo y los grupos organizados de la sociedad civil al proceso de definir políticas locales y con ello mejorar las condiciones de gobernabilidad del agua.

Coherencia, integración e impactos de la política en otros sectores

El aspecto relevante de las labores del GEA precisamente se caracteriza por la coherencia de sus propios planteamientos y de éstos con los otros procesos políticos, de planificación y presupuesto en que participa, como lo evidencian principalmente el Plan Sectorial Multianual de Ambiente y Agua PSMAA y el Plan de Reconstrucción con Transformación, ya comentados.

El PSMAA es el resultado del trabajo de las 34 instituciones gubernamentales que integran la Mesa Sectorial de Ambiente y Agua, instituida por el Gobierno a fines de 2008, para dar cumplimiento a las declaraciones de Paris (2005) y de Accra (2008). El PSMAA constituye el Marco Estratégico del Sector de Ambiente y Agua e innova el carácter de la planificación pues la establece en función de resultados. El PSMAA se construye a partir de planes y políticas sectoriales o temáticas, entre éstas la del agua; identifica los bienes y servicios que conforme sus mandatos legales las entidades del sector ambiente y agua deben proveer así como los costos de su producción; los vincula con el presupuesto; y da seguimiento y evalúa el desempeño institucional y los resultados alcanzados. Finalmente identifica vacíos para la

[37] Servicios de Agua Potable y Saneamiento en Guatemala: beneficios potenciales y determinantes de éxito, por E. Lentini para CEPAL; y Taller celebrado en Ciudad de Guatemala, organizado por CEPAL, diciembre 2010

eficiente, eficaz y oportuna producción de bienes y servicios y define los proyectos necesarios para superar brechas institucionales y presupuestarias.

El PSMAA define 4 objetivos estratégicos y 58 resultados, los cuales prioriza. El objetivo estratégico 2 literalmente dice *"gestionar de forma integrada las cuencas hidrográficas y el recurso hídrico para hacer accesible el agua técnicamente factible a beneficio del desarrollo humano transgeneracional y la economía nacional, promoviendo mejores prácticas de uso y saneamiento, en un marco de gobernabilidad del agua"* que comprende 15 resultados, de los cuales 4 se incluyen como las prioridades uno, dos, tres y nueve de los 58 resultados del Plan.

Los fenómenos hidroclimatológicos extremos han impactado (1541[38]), impactan (Huracán Mitch 1996, tormenta tropical Stan 2005, Sequía 2009, tormenta tropical Agatha 2010) y se prevé que en el futuro lo harán con mayor frecuencia e intensidad. Se estima que las pérdidas económicas ocasionadas por estos fenómenos, sin incluir los de la sequia 2009, ascienden a US4 2718.3 millones, que según Vargas superan el crecimiento económico del país habido en las 4 últimas décadas[39]. Mejorar la gestión y gobernanza del agua, como lo plantea el GEA, es sin duda un mecanismo estratégico para contribuir a la mejor gestión de estos riesgos, asociada con otras medidas.

El Plan de Reconstrucción con Transformación PRT (2010) elaborado luego del paso de la Tormenta Agatha y de la erupción del volcán de Pacaya de abril-mayo 2010, incluye en la ficha 14 el programa GEA de Planificación Hidrológica y Gobernanza del Agua. La aplicación del Plan corre a cargo de la Comisión Nacional de Reconstrucción CNR, presidida por el Ministerio de Ambiente y conforma dos subcomisiones, la de gestión de cuencas y la de Planificación Hidrológica, Obras Hidráulicas de Regulación y Gobernanza del Agua. Durante la Conferencia de Donantes 2010 convocada por el Presidente de la República para dar a conocer este Plan a la comunidad internacional, Doña Soraya Rodríguez, Secretaría de Estado para la Cooperación del Reino de España, compromete la suma de 30 millones de euros para financiar el programa de la ficha 14, cuya formalización está en proceso.

Así mismo, la labor del GEA es complementaria y coherente con las políticas sociales, ambientales, de cambio climático y seguridad alimentaria.

Lecciones aprendidas y tipo de intervenciones

La voluntad política al más alto nivel es fundamental como también lo es contar con la institucionalidad apropiada para traducirla en planes, programas y proyectos así como contar con el presupuesto necesario para garantizar acciones.

Apoyar el cumplimiento de metas de otros sectores del desarrollo, se constituye en una ventana de oportunidad para favorecer se mejore la institucionalidad del agua, cuando el país carece de cultura institucional hídrica.

[38] El acta del escribano de gobierno, referida a las lluvias del 12 y 13 de septiembre de 1541 dan cuenta de cómo la capital del reino de Guatemala fue destruida por la lluvia , deslizamientos de tierras y lahares del volcán de Agua

[39] Vargas

Contar con recursos hídricos suficientes no garantiza se articule el desarrollo del agua a objetivos superiores Guatemala no padece en sí de una crisis de escasez de agua sino más bien de una crisis de gobernabilidad que sumada a los previsibles impactos de la variabilidad climática y el cambio climático, hace crítico el favorecer condiciones en pro de la seguridad hídrica del país.

El tipo de intervención es eminentemente político, de coordinación de entes rectores que participan en el proceso de gestión del agua, pero año con año se integran a los planes operativos institucionales sectoriales y reciben presupuesto.

Aún cuando las intervenciones del GEA tienen vocación de constituirse en política pública en tanto no estén basadas en mandatos legales de ministerios y secretarías de estado, se convierten en políticas gubernamentales y corren el riesgo de ser deslegitimadas por próximos gobiernos.

Innovación

Dadas las circunstancias del contexto político, legal e institucional, el GEA se constituye en un mecanismo alterno de gestión del agua que integra elementos innovadores como la planificación hidrológica y resalta la importancia de promover condiciones para la gobernabilidad eficaz y equitativa del agua. En medio de las limitaciones, mejora la capacidad del Organismo Ejecutivo de cumplir con mandatos legales existentes, en tanto el Congreso de la República no emita legislación capaz de modernizar la institucionalidad del agua.

Innova el GEA al integrar acciones a favor de otras políticas, lo cual le permite favorecer el desarrollo de los recursos hídricos en función del cumplimiento de metas y objetivos naciones, entre estos, las de carácter social, desarrollo rural, seguridad alimentaria y cambio climático, mediante trabajo interdisciplinario e interinstitucional favoreciendo cultura de trabajo en equipo y de adaptación de medidas basadas en conceptos comunes y únicos, como por ejemplo, delimitación de la zona semirárida, definición de boletas para recabar información sobre fuentes de agua y sobre estado de los servicios púbicos de agua potable y saneamiento..

Aplicación práctica

A lo largo de tres años y medio, el mecanismo de coordinación GEA ha podido concretar la Política Nacional del Agua y su respectiva Estrategia; participa en la construcción y aplicación del Plan Sectorial Multianual de Ambiente y Agua así como en la elaboración y aplicación del Plan de Reconstrucción con Transformación. Principalmente, logro cambios institucionales en el Ministerio de Salud Pública y Asistencia Social, en cuanto a la rectoría en materia de calidad de los servicios públicos de agua potable y saneamiento; y en relación con la definición y aplicación de la Política de Aguas Internacionales.
Como ya se mencionó, los ministerios y secretarías de estado miembro del GEA son fiscalizadas por el propio Vicepresidente y se comprueba su voluntad política en la medida que integran en sus planes operativos anuales (presupuesto) las acciones comprometidas ante el GEA, lo cual verifica la Secretaría General de Planificación y el Ministerio de Finanzas Públicas, en el proceso de preparar el presupuesto anual con el apoyo del Grupo Asesor del GEA.

Replicabilidad

El mecanismo institucional de coordinación de políticas del agua al más alto nivel, como el GEA, podría tomarse como modelo para aquéllos casos en que los Estados carecen de estructuras institucionales sólidas; así como en aquellos Estados que carecen de política nacional del agua y que por tanto, los sectores y rectores nacionales no contribuyen al logro de metas y objetivos superiores, nacionales y de interés público. Igualmente, se proyecta sirva el GEA para dar seguimiento y evaluar los avances en el cumplimiento de la política nacional de agua y de aquéllas metas parte de otras políticas nacionales.

La ecologización de la regulación económica de los servicios de agua potable y saneamiento en el Perú. Lecciones aprendidas de la implementación de un esquema de pago por servicios ambientales. Caso EPS Moyobamba

José Salazar, Presidente SUNASS

Tipo de herramienta: políticas e instrumentos económicos
Tema: ciudades, cuencas hidrográficas
Localización: Perú, América del Sur

Retos para la gestión del agua y la regulación económica en el Perú

El Perú viene liderando una nueva ruta al desarrollo sostenible a partir de la conservación de los ecosistemas estratégicos y sus servicios ambientales para asegurar el recurso agua a las EPS, y el agua potable a las ciudades, y la gobernabilidad en la cuenca. Las inversiones en agua potable y saneamiento en Perú se han modificado, desde la perspectiva del regulador económico sectorial, SUNASS (www.sunass.gob.pe), desde que se inició la ecologización de la SUNASS (año 2007) hasta la fecha, año 2011. La experiencia el caso de la EPS Moyobamba, región de San Martin, Perú es un ejemplo que ilustra su aplicación y resultados.

Motores del cambio para la ecologización de la regulación de los SAPS en Perú

Entre los motores del cambio en Perú, se encuentran:

- Mantener el crecimiento económico más limpio con justicia social, requiere invertir en nuevas fuentes de agua y de energía renovable, con tarifas justas.
    - Presión sobre el recurso hídrico en la cuenca por grupos de interés, e.g., agrícolas y mineros que restringen el paso del agua cruda a ciudades, limitando su desarrollo urbano.
    - Reducción de cantidad y calidad de la fuente de agua por cambio climático y pérdida de cobertura arbórea, limitan el crecimiento económico regional.
- La decisión política del Presidente de la República de incluir el acceso universal en la agenda política-económica, con tarifas justas.
    - Millones de ciudadanos sin acceso exigen al candidato-Presidente, una política pública.
- La decisión política de crear el Ministerio del Ambiente, y apoyar una agenda ambiental.
    - Conservar el capital natural para usarlo, vía valorización económica total.
    - Sin embargo, la autoridad del agua (ANA) se quedó en el sector agrícola, desconectada de la política de ordenamiento territorial y del ente rector ambiental.
- Decisión del regulador: con enfoque de gobernabilidad armoniza los motores de cambio antes expuestos, hibridando teorías, instrumentos para hacer sostenible el servicio público.

Barreras para la implementación del Pago por Servicio Ambiental (PSA) en las tarifas de agua potable y saneamiento

- Empirismos aplicativos[40]: la teoría regulatoria no entiende-gestiona la compleja realidad porque las fallas sistemáticas de la teoría económica del mercado no reconoce el valor ambiental, y crea una ilusión de sostenibilidad económica y tarifaria.
- Discordancias normativas[41]: la organización del estado en sectores estancos ha creado una ilusión de sostenibilidad legal. Estas leyes sectoriales entran en conflicto al confrontarse con la cuenca.
- Distorsiones[42]: El desconocimiento de la población de la realidad de la cuenca, origina que no valoren los servicios ambientales, que no conecten la ciudad y el campo (que les provee de energía, agua, alimento), que no se identifiquen como co-responsables de la cuenca, que no paguen el valor de los servicios, que no demanden a los políticos una agenda hídrica.

El modelo de SUNNAS de nueva regulación económica del siglo XXI

Aspectos generales

Aportando soluciones, SUNASS ha iniciado el proceso de "ecologizar la regulación del servicio de agua potable". Primero: incorporando proyectos sostenibles (infraestructura+conservación), junto con el pago por servicios ambientales en las tarifas (necesaria, legítima, no legislada). Segundo, la incorporación del enfoque de gobernanza-gobernabilidad (a partir del usuario-ciudadano y la gestión de riesgo ante desastres naturales de la empresas de agua) (Salazar, 2010).

Nuevo modelo de pagos a los ciudadanos rurales por los servicios ambientales

A partir del reto de gobernabilidad, SUNASS promueve un nuevo enfoque en la formulación de los proyectos de conservación de fuentes de agua que reconozcan la complementariedad entre proveer agua (obras de infraestructura) y hacerlas sostenibles (conservación de fuentes de agua), que beneficia al usuario-urbano-EPS, que paga al ciudadano-rural por su servicio ambiental. Así se reconecta campo-ciudad, a partir de una estrategia de carácter integral, transversal, inter-generacional y multi-dimensional.

Según Salazar (2011), SUNASS aprende-haciendo una hibridación de teorías económicas, ambientales y de gobernabilidad, que avanza de la eficiencia a la sostenibilidad. La estrategia fue ecologizar la regulación económica del servicio público, incorporando una tarifa ambiental e instrumentos económicos-financieros-ambientales para conservar fuentes naturales de agua.

Regulador independiente

Esta regulación tarifaria, gira alrededor del regulador neutral-independiente (impone orden en monopolios naturales, protege al usuario de abusos de las EPS y hace sostenibles las EPS) enfrenta retos ambientales, de gestión-riesgo-desastres por cambio climático y de

[40] Cuando el planteamiento teórico no se acomoda a la realidad.
[41] Cuando una norma se contrapone a otra norma no ajustándose a la realidad
[42] Cuando externo al sistema en estudio, existe un elemento que ajeno a la realidad, impacta en la actividad en estudio.

gobernabilidad. Entonces, dos décadas después, la regulación económica del servicio público ha evolucionado frente a su enfoque del siglo XX. Estos cambios responsables reflejan la necesidad del regulador de: a) entender la realidad (múltiples escenarios ambientales y sociales), b) enfrentar la problemática (multiplicidad de actores, discordancias normativas, empirismos aplicativos, etc.), c) monitorear los resultados multi-dimensionales-temporales del agua potable, d) asegurar la sostenibilidad ambiental-financiera-social de la EPS, en el siglo XXI.

Los principios del modelo

1.- Reconocimiento de que la ciudad depende del campo para existir

En la teoría regulatoria económica, la sostenibilidad del servicio se genera dentro del sistema cerrado de agua potable-saneamiento, de la EPS hacia adentro, y considera a la fuente de agua desde su captación (no en la fuente). Esta teoría niega que su sistema depende de la existencia del agua en la cuenca, que por su naturaleza es aleatoria, finita y valiosa; pues responde a leyes naturales (no humanas). En cambio, para la teoría de la economía ambiental, la disponibilidad de agua en calidad y cantidad depende del ciclo del agua y no de tecnologías humanas. Aquí se reconoce la dependencia de la ciudad del campo y por lo tanto que la sostenibilidad del servicio (EPS) está ligado a la sostenibilidad de la cuenca.

2.- Incorporación de las externalidades ambientales en las tarifas (principio contaminador-pagador)

La teoría regulatoria económica, calcula la tarifa basada en un modelo matemático donde el ambiente es una externalidad (externalidad positiva). Esto se refleja hoy en la herramienta regulatoria, el plan maestro optimizado (PMO), el cual no incluye la variable ambiental, ni los costos ambientales. Estos costos ambientales, según la teoría económica ambiental, son resultado de los impactos negativos de las actividades económicas desarrolladas por los diferentes actores en la cuenca, por ejemplo deforestación que reduce la captación de agua, o aumenta la turbidez, la descarga de efluentes en cauces de agua. Estos impactos son absorbidos por los ecosistemas cuando no sobrepasa el límite de resiliencia de los mismos, pero cuando sobrepasan este límite, se degrada irreversiblemente los ecosistemas, agotando en calidad-cantidad el recurso agua. Su impacto no es internalizado por los responsables (efecto *free rider*), y son los usuarios a través de la tarifa que subsidian a los contaminadores. Esta situación es insostenible e injusta. En la dualidad ciudad-campo, la ciudad no reconoce el valor real del agua que consume, y que proviene de las zonas altas de la cuenca; aquí esa ciudad debe pagar por potabilizar el agua contaminada por las externalidades negativas de las actividades, cuenca-arriba. El nuevo modelo regulatorio debe corregir las externalidades en ambos sentidos (Salazar, 2011).

3.- *Incorporación del valor económico de los servicios ambientales hídricos*

La economía regulatoria define beneficios desde el punto de vista de la teoría microeconómica, como la diferencia entre el valor que tienen los bienes resultado del proceso del proyecto (e.g., agua potable) y los que se emplearon en el mismo (CAPEX-OPEX), deducidos los demás gastos de operación y mantenimiento (OPEX). Esta definición, sesgada al principio "valor por dinero" establece que "un servicio público debe ser suministrado ofreciéndose una mayor calidad a un determinado costo o los mismos resultados de calidad a un menor costo, contemplando solo en los costos los inmersos en el

proceso de potabilización, distribución, alcantarillado y tratamiento final. La economía regulatoria, maximiza la satisfacción de los usuarios del servicio y optimiza el valor del dinero, solo reconociendo los valores de uso directo en la tarifa que se calcula por la prestación del servicio. Este análisis limitado no reconoce en la tarifa otros valores que dan sostenibilidad al servicio. Entonces, el PMO solo reconoce los valores de uso directo sin contabilizar los valores de uso indirecto que representan todos los beneficios intangibles que se generan con la conservación de fuentes de agua. A pesar que la academia ha desarrollado metodologías que cuantifican los beneficios de proyectos ambientales, estas herramientas no son usadas en beneficio a la gobernabilidad sectorial. Así las EPS no contabilizan los beneficios de los proyectos ambientales en la sociedad en general como empleo, calidad de vida, resiliencia, gobernabilidad.

4.- Incorporación de proyectos ambientales beneficiando al usuario-ciudadano y la EPS

En la regulación económica tradicional, la herramienta principal de planeamiento y de eficiencia de los servicios de agua potable y saneamiento es el Plan Maestro Optimizado (PMO), no incorpora al capital natural con su valor económico total, sino bajo el sesgo antropocéntrico donde el recurso natural genera valor a partir de la extracción y/o aprovechamiento del recurso, por tanto, el valor se genera si se cuenta con proyectos de infraestructura que permiten captar y transformarla en agua potable, hasta la descarga de las aguas residuales tratadas. Este enfoque antropocéntrico, donde el mundo gira alrededor del ser humano, define al agua como recurso renovable-ilimitado-barato, lo cual es irreal e insostenible frente a la realidad. La economía ambiental sostiene que el capital humano, financiero y físico dependen del capital natural de la cuenca (léase las funciones hidro-ecológicas que crea el ciclo del agua), con procesos independientes de la intervención humana y del dinero, en función de procesos bio-geo-químicos del ciclo del agua. El capital natural traducido a proyectos de conservación de fuentes de agua, y el capital físico como proyectos de infraestructura ingenieril, son complementarios, haciendo rentable a las EPS, con menores incrementos tarifarios para los usuarios y con servicios sostenibles. Los proyectos de conservación de fuentes de agua, cuentan con pocos beneficios de corto plazo pero son durables, y cuentan con beneficios múltiples intangibles, los cuales hacen sostenible la EPS, mejoran la calidad de vida del usuario-ciudadano y de futuras generaciones, y a la gobernabilidad democrática de la cuenca (Salazar, 2011).

5.- Reconocimiento del usuario como un ciudadano con derechos políticos

Bajo la teoría de la gobernabilidad, la EPS pública considera al usuario actual como consumidor así como al usuario futuro, ciudadano con derechos políticos que elige a su gobernante y le exige una agenda política hídrica y de agua potable. Un usuario-ciudadano, representa a un individuo que: i) tiene disponibilidad a pagar la tarifa de acuerdo a los beneficios que el servicio representa en calidad y acceso, ii) exige a sus autoridades elegidas los proyectos que aseguraran el acceso y la calidad del servicio que esperan recibir, iii) reconoce el VET pues está conectado con el capital natural. La teoría económica regulatoria considera al usuario parte de una transacción-oferta-demanda, donde como consumidor paga la tarifa por la prestación del servicio de agua potable y saneamiento pero que ignora el VET-agua y los servicios ambientales. Esto por la desconexión entre el usuario-citadino con la realidad de la cuenca, por desconocer su dependencia del capital natural. Esta teoría ignora la población sin acceso, que crece en número, sin derechos ante el regulador, pero elige a las autoridades de la ciudad y de la cuenca para exigirles una agenda política; pues los

ciudadanos sin acceso son los más sensibles a la conservación y uso racional, porque es sinónimo de calidad de vida (SUNASS, 2011-c).

Los elementos del modelo en la práctica

Para pasar de grandes ideas a acciones concretas, se requiere de un claro enfoque conceptual para no confundirse, pues se hibridan teorías, instrumentos para resolver la problemática.

Identificar la cadena de valor ambiental a partir de costos evitados: materializa los beneficios para el usuario-ciudadano, la EPS y la cuenca

La disponibilidad de agua (cantidad y calidad) que hace posible la vida, es uno de los servicios que se obtienen de los ecosistemas, pero la realidad ambiental de la cuenca (deforestación, cambio climático, contaminación, etc.), reduce sus caudales a calidad, arriesgando la sostenibilidad de las EPS y las ciudades. Ante esta situación, el regulador ha identificado la problemática ambiental en la cuenca y su impacto en la cadena de valor ambiental en el sistema de agua potable (Sunass, 2011-c). Si bien cada EPS presenta una problemática diferente, el regulador ha logrado tipificarlas traduciéndolas en impactos para la región a través del uso de herramientas como *waterfootprint* de las ciudades y costos evitados a la EPS. La metodología de los costos evitados es usada por la economía de mercado y por la economía ambiental, y permite interconectar al mundo financiero con el mundo ambiental. Los costos ambientales se reflejan en la reducción de la disponibilidad del recurso hídrico (cantidad y calidad) en la cuenca, pero si se reconocen como costos-evitables se reduciría el impacto en el flujo de caja de las EPS, en los costos (CAPEX, OPEX) y en los incrementos tarifarios. Así los costos evitados por la complementariedad entre el capital natural (proyectos de conservación) y capital físico (proyectos ingenieriles) en el PMO aporta en la sostenibilidad de la regulación de los servicios de agua potable y saneamiento. Según Salazar (2011), costos evitados, es una herramienta ambiental de valoración económica de los costos ambientales, en la cual el regulador ha encontrado un instrumento que puede adecuarse a diversos escenarios de cuenca, en cuanto a ubicación, problemática, variables y soluciones; es de fácil entendimiento, bajo costo y practicidad en el cálculo. Así el regulador, viene aplicando el planeamiento de escenarios futuros con costos evitados, que identifica el proyecto ingenieril y ambiental, impactos en calidad y cantidad, del recurso agua a largo plazo y que suponen menores costos.

Valorar para conservar e invertir en las fábricas naturales de agua potable para lograr ciudades sostenibles

Los ecosistemas (e.g., humedales, manglares, bofedales, aguajales, bosques relictos, bosques secos, pajonales, paramos), son las fábricas naturales de agua, que se ubican en las partes altas-medias de las cuencas, y alimentan a las EPS con materia prima necesaria para la prestación del servicio de agua potable (SUNASS, 2011). Estos ecosistemas y los servicios ambientales, no son reconocidos económicamente por el modelo regulatorio tradicional. Del VET-valor económico total, en el PMO tradicional solo se incorpora el valor de uso directo, es decir el costo del proceso de potabilización de agua; no reconoce el valor de uso indirecto ni el de opción que es generado por el ciclo de agua el cual asegura la disponibilidad del recurso agua para su tratamiento. Tampoco se reconoce los valores de no uso (opción-existencia), que son aportes a la gobernabilidad (Salazar, 2011).

El actual sistema de agua potable y saneamiento está definido como aquellas instalaciones y procesos que están dentro del ámbito de la EPS, es decir desde la captación de la fuente de agua hasta el tratamiento y disposición final de aguas residuales. En este contexto, quedan sin incluir la fuente de agua, conllevando a que la EPS no pueda incluir en su PMO y destinar una partida presupuestal al desarrollo de proyectos de conservación de fuentes de agua, por ejemplo: aportes a fondos de agua en la costa, conservación de cabeceras de cuenca en zonas alto-andinas, de protección de áreas forestales en la amazonia pues se encuentran fuera del ámbito geográfico del servicio (léase la ciudad).

Valoración contingente refleja la confianza del ciudadano en su EPS, en su estado-nación

SUNASS usa la valoración contingente que considera a la disponibilidad de pago del usuario-ciudadano como la aceptación de un incremento tarifario por la inclusión de nuevos proyectos, como el beneficio que el proyecto representa para este, o una preferencia del consumidor ante el servicio. Desde el enfoque de la gobernabilidad, representa un voto de confianza en la EPS, el regulador, en el Estado que proporciona el servicio público, reconociéndose que la confianza es la columna vertebral de la gobernanza en la cuenca y dando sostenibilidad social a la EPS (SUNASS, 2010). Entonces, el modelo matemático arroja una cifra y la D.A.P arroja otra cifra, aquí el regulador decide por la franja inferior, para avanzar progresivamente en la recuperación-confianza.

Así por ejemplo en el caso de SEDAPAL se realizaron estudios sobre la capacidad y disponibilidad de pago de la población, con el propósito de cuantificar el nivel tarifario máximo que los usuarios podrían afrontar con sus ingresos y la disponibilidad a pagar un mayor recibo por la prestación de los servicios. La información mostró cómo los hogares limeños gastan en los servicios de saneamiento un porcentaje muy inferior al 5%, que es establecido como umbral de gasto. Los resultados obtenidos, que representan el pago aproximado por el servicio de agua en viviendas conectadas, según la división por Niveles Socio Económicos, son resumidos en el siguiente cuadro:

NSE	Intervalo 95% conf. (mínimo)	Capacidad de pago predicha (S/.)	Intervalo 95% conf. (máximo)
A	44,12	46,80	49,49
B	39,82	41,57	43,31
C	33,58	35,02	36,47
D	23,93	26,32	28,72
E	17,53	19,62	21,71

Sin embargo, un Estudio Complementario realizada por la Consultora Directo para la SUNASS estimó la Máxima Disposición a Pagar por la ejecución de nuevos Proyectos en SEDAPAL, estableciéndose que más del 50% de las familias de bajos recursos manifiestan su imposibilidad de pagar un adicional para destinarlos a proyectos, En el nivel E se llega a 64.6%. Casi el 50% del total de entrevistados manifiestan no tener la intención de pagar más en su recibo. Del resto típicamente, los niveles altos pueden pagar 5 soles más y los bajos entre 1 y 2 soles más inclusive.

Los eco-proyectos con mayor encadenamiento-sinergético, se incorporan en el PMO- EPS, y crean mayor valor durable para la EPS y fortalecen la gobernabilidad

Por definición un proyecto de índole ambiental, trasciende este ámbito; impactando positivamente en las dimensiones cultural, social, económica y política. En este contexto, es más rentable para las EPS incorporar en su PMO proyectos de conservación de fuentes de agua que generen beneficios sinergéticos directos o indirectos en la cuenca, lo cual se aprecia en el V.E.T. (Salazar, 2011).

A partir de las funciones ecológicas que aseguran la cantidad y calidad de la fuente de agua, se identifican los proyectos de conservación así como los impactos directos a las fuentes de agua como resultado de la ejecución del proyecto y otros beneficios sinergéticos en la cuenca. Esta metodología define una prelación entre los proyectos de regulación atmosférica, climática, amortiguación de perturbaciones, regulación hídrica, disponibilidad hídrica y sujeción de suelos, para efectos de su inversión. Desde el lado de proyectos ingenieriles, debe evaluarse la mejor combinación posible, que pueda crear valor durable para la EPS y la cuenca (e.g., represas, transvases, recargas de acuíferos, nuevas captaciones, plantas de tratamiento de sedimentos, de tratamiento de contaminantes, de cloración, diques de defensa ribereña.

Identificar, armonizar, cuantificar y monetizar las inversiones en la cuenca, permite visualizar el aporte de la inversión ambiental en la gobernabilidad de la cuenca

Todavía existen restricciones para invertir fuera del ámbito geográfico que se fija en los contratos de explotación entre las EPS y los Municipios. Por esto, se necesita articular las inversiones de los municipios-regiones que están fuera de esa demarcación geográfica-legal dentro de la cuenca. Los aqua-fondos son parte de la solución pues articulan fondos privados y fondos públicos para invertir en la cuenca bajo un nuevo paradigma de sostenibilidad, y con un claro liderazgo político por cuenca.

Debido al alto encadenamiento sinergético entre las inversiones ambientales, que sustentan las actividades humanas (las económicas entre otras), toda la infraestructura ecológica, genera empleo desde abajo hacia arriba, revaloriza las técnicas ancestrales peruanas, evita la migración del campo a la ciudad, no se requieren de tecnologías sofisticadas difíciles de mantener, crea un espacio de encuentro de las diferentes generaciones y pueblos en zonas de amortiguamiento (que antes eran zonas de conflicto limítrofe), es el sustento de la paz social en la cuenca (que resuelve disputas centenarias por el agua), entre otros. Todo esto no está cuantificado por la métrica del mercado (que sólo mide dinero por producto-servicio en función de la oferta y demanda), y requiere un nuevo abordaje conceptual para valorizarlo en diversas unidades de medida, que el regulador lo contabiliza como un aporte a la gobernabilidad de la cuenca, complemento a la definición tradicional de desarrollo sostenible acuñado en la comisión Brutland.

Para aplicar el principio contaminador-pagador, se debe delimitar la responsabilidad de pago de la EPS frente a los contaminadores (free-riders) de la cuenca

En la cuenca se presentan externalidades resultado de las actividades de los actores (agricultura, ganadería, industria, minería, ciudades, entre otros) estas impactan

negativamente en el recurso agua, afectando a la cuenca, a la población y a la EPS, estas últimas ubicadas en la parte baja. Entonces, se presentan responsabilidades compartidas pero diferenciadas, donde la EPS no puede pagar los pasivos ambientales de todos los actores de la cuenca. También se ha incluido las externalidades positivas, la existencia de servicios ambientales que proveen agua en calidad y cantidad (SUNASS, 2011). Diversos actores ubicados en la cuenca alta y media, no limpian sus efluentes y los descargan en los ríos, lagos, los cuales contaminan las fuentes de agua natural de las EPS, lo cual se refleja en mayores costos de potabilización, que deben pagar todos los ciudadanos. Esto es injusto, pues no cobrar a estos contaminadores (denominado *free rider*), genera incentivos perversos a incumplir con la norma. Entonces, se debe promover leyes para incorporar el esquema de contaminador-pagador en todos los sectores económicos, para reducir los costos de limpieza del agua en la zona baja de la cuenca.

El Sector de Saneamiento ha promovido un Decreto Supremo Nº 021-2009-VIVIENDA, publicado en el diario oficial El Peruano el 20.11.2009, se aprobaron los Valores Máximos Admisibles de las descargas de aguas residuales no domésticas en el sistema de recolección del servicio de alcantarillado sanitario. En base a esta normativa la SUNASS ha determinado la metodología para la determinación de los pagos adicionales para los usuarios del servicio de alcantarillado que efectúen descargas de aguas residuales no domésticas cuyos valores se encuentren por encima de los establecidos en el Anexo Nº 1 del mencionado Decreto Supremo que son la DBO, DQO, Aceites y Grasas y Sólidos Suspendidos.

Para efectos de establecer el Pago Adicional, de acuerdo a cada rango, se establece un Pago por Exceso calculado en base del ajuste realizado a la facturación del servicio de alcantarillado por un Factor (F), que interioriza los niveles de concentración de los parámetros de DBO, DQO, AyG y SST. En ese sentido, se ha establecidos los siguientes límites del pago adicional para cada rango establecido en el cuadro siguiente:

Definición de Límite de Pago Adicional

RANGO	LIMITE DE PAGO ADICIONAL
Rango 1	25% del importe facturado por alcantarillado
Rango 2	75 % del importe facturado por alcantarillado
Rango 3	100% del importe facturado por alcantarillado
Rango 4	10 veces del importe facturado por alcantarillado
Rango 5	20 veces del importe facturado por alcantarillado

Fuente: SUNASS

Dónde:

- Primer rango: Concentraciones de transición en donde los valores atribuidos no causan problemas serios considerando una dilución en la ciudad.
- Segundo rango: Concentraciones que siguen siendo de transición, generando algunos sobrecostos operativos para la EPS y potenciales riesgos en el deterioro de la vida útil de

las tuberías y operación de las plantas de tratamiento de aguas residuales.

- Tercer rango: Concentraciones que generan mayores costos operativos para la EPS y potenciales riesgos en el deterioro de la vida útil de las tuberías y operación de las plantas de tratamiento de aguas residuales.
- Cuarto rango: Concentraciones elevadas que ocasionan sobre costos operativos (para tratar de cumplir con los grados de remoción exigidos por la normativa vigente) y de mantenimiento. Además ocasiona el deterioro de la vida útil de la infraestructura.

De esta manera, se internaliza los costos ambientales en las empresas que hoy contaminan sin pagar los costos. SUNASS ha avanzado con nuevos parámetros (basado en el nuevo marco legal aprobado por el ministerio del ambiente y ministerio de vivienda, construcción y saneamiento), para fijar las tarifas por carga contaminante, pero corresponde a la autoridad de la cuenca (ANA), cobrar a estos contaminadores, y enviar un mensaje claro, el pago-tarifa no es una licencia para contaminar.

Armonizar los marcos legales institucionales de los actores de la cuenca para permitirles conectar la compleja realidad peruana con su institucionalidad y la política pública

El Estado y sus instituciones no están integrados a la cuenca, por el contrario se encuentran sectorizados por compartimientos estancos, esto sumado a la falta de armonización de los marcos legales institucionales, por falta de una visión holística del ciclo del agua en la cuenca, hace necesario proponer fórmulas que ayuden a lograr complementariedad y no la desarticulación entre los diferentes niveles de gobierno para ejecutar las políticas de Estado, respetando las autonomías respectivas. Este es un tema pendiente.

Según Salazar (2011), el marco legal sectorial no ha sido adaptado al enfoque de cuenca ni al eco-sistémico, por lo que no contempla el funcionamiento del ciclo del agua ni del servicio público en la cuenca. Esta situación ha generado un descalce entre la realidad ecológica y la legalidad, creándose una realidad desconectada y fragmentada en la cuenca, y por lo tanto, discordancias normativas entre los actores, que tienen marcos legales desintegrados, generando conflictos-confusión. Entonces, ninguna autoridad local, regional, o nacional de una cuenca está obligada a coordinar sus intervenciones en la misma cuenca, a diferentes cotas. No existe ley que los obligue a coordinar, lo cual hace ineficiente, ineficaz, inefectiva la política pública ambiental y de saneamiento, en una cuenca (SUNASS, 2011).

Incorporación de variables ambientales en el PMO

El PMO, es la herramienta sombrilla del regulador económico (SUNASS) para ordenar el planeamiento de largo plazo de la EPS y aprobar tarifas para pagar el portafolio de proyectos que la ciudad necesita (SUNASS, 2011-c). La incorporación de variables ambientales en el PMO sincera los costos totales del servicio, pues modela escenarios de su realidad de la cuenca, que afecta su disponibilidad de agua en cantidad (por razones climáticas o de explotación no racional), y en calidad (por contaminación de las mismas). Por ejemplo: capacidad, rendimiento y calidad de las aguas de cada fuente de agua. Se incorpora un análisis de hechos naturales-externos a la EPS, que ponen en riesgo los servicios de saneamiento (cambios en el clima que disminuyen la capacidad de las fuentes, ubicación de infraestructura en zonas inundables, de riesgo sísmico, de deslizamiento de tierras, o de contaminación) (SUNASS, 2011-c).

Herramienta de planeamiento flexible: Tarifa de costes e inversiones de mediano y largo plazo

Un PMO-plus, resulta ser una herramienta de planeamiento flexible, con enfoque holístico e integral de los recursos hídricos, permite emplear instrumentos ambientales con el propósito de abordar (en el diagnóstico y solución de los sistemas de agua potable y alcantarillado) el proceso de adaptación de las EPS al cambio climático, mitigar presiones sobre sus fuentes de agua y sumideros, y enfrentar los riesgos por cambios imprevistos en las condiciones externas, asegurando la materia prima de las EPS y gestionando el paradigma-sostenibilidad en las EPS (EAD, 2009). La incorporación en la tarifa del pago por servicios ambientales y la gestión de riesgos ante desastres naturales asegura la fuente de agua de las EPS. El regulador convierte iniciativas voluntarias (PSA) en ingresos mandatorios, permanentes con bajos costos de transacción para conservar la fuente de agua. Ha combinado PSA (instrumento ambiental) con tarifa (instrumento económico) con fiducia (instrumento financiero) con institucionalidad-local para ecologizar los servicios de agua potable (Salazar, 2010).

En suma, se obtiene una menor Tarifa Media de Mediano y Largo Plazo por costos e inversiones evitadas por la conservación y/o recuperación de las fuentes de agua. Se aporta a la sostenibilidad de los servicios de saneamiento, se evitan conflictos sociales por el agua entre los diversos actores (EPS, agricultores, usuarios de los servicios de saneamiento que presta la EPS, otros demandantes de recursos hídricos).

El recibo de agua potable instrumenta el nuevo contrato social entre campo-ciudad, porque el usuario-ciudadano tomará conciencia de su dependencia del campo

Las empresas de agua están diseminadas, dispersas, desconociendo el vínculo campo-ciudad en una cuenca hidrográfica. De esta forma, la ciudad y el campo existen como dos mundos separados, sin reconocer que la ciudad depende del campo para su agua, alimentos y energía. Por ello, las EPS no se integran con las EPS de la misma-cuenca, generándose proyectos contra-puestos, ineficiencias, conflictos todo lo cual se refleja en mayores tarifas que paga el usuario. El regulador ha incorporado el concepto de usuario/ciudadano en la regulación, como eje de la demanda del servicio, de las políticas públicas y la elección de autoridades que garanticen el acceso universal y sostenibilidad del operador (SUNASS, 2010).

El recibo de agua potable, resume un conjunto de actividades-proyectos que la EPS ejecuta, como parte de su PMO, y es la conexión directa entre el ciudadano cosmopolita-urbano con el campesino-rural, que no se conocen ni reconocen, que no intercambian información ni dinero. Entonces, si en el recibo se incluye (a título nominal) el V.E.T. de los subsidios del campo hacia la ciudad, el ciudadano urbano tomará conciencia del subsidio que recibe y estará dispuesto a pagar por servicios ambientales intangibles.

Maximizar el uso del financiamiento concesional para acceso universal, adaptación-mitigación al cambio climático, gestión-riesgo-desastres-naturales se traduce en menores tarifas para la población y mayor valor-EPS

Existen fondos concesionales (con bajas tasas de interés, largo plazo de pago) que no se usan por falta de proyectos de calidad, buena estructuración financiera, operadores-calificados. Esta adecuada combinación crearía mayor valor en menor plazo para la EPS y la sociedad en su conjunto, y facilitar la participación del sector privado en actividades donde si crea valor durable (Salazar & Salardi, 2011-b).

Los resultados de los últimos desastres naturales han demostrado el incremento de la vulnerabilidad provocada por la acción del hombre, ha aumentado la frecuencia y el impacto de los desastres, esto sumado a los efectos del cambio climático impactan en los servicios de agua y saneamiento-EPS con pérdidas por los cuantiosos daños directos e indirectos que se generan en sus sistemas por los desastres, directos como los daños físicos a la infraestructura, e indirectos como los costos de manejo de emergencias a los que se suman los costos adicionales por la búsqueda de nuevas fuentes de agua (infraestructura de captación y conducción) y a la falta de recaudación o morosidad por la falta y baja calidad del servicio; presentándose en la población impactos negativos en su bienestar y salud a falta del servicio de agua potable y saneamiento (EAD, 2009). La experiencia ha revelado que usar financiamiento privado ha duplicado el valor-final-obras y demandado mayores tarifas (en menores plazos); y que contar con financiamiento concesional, ha reducido a la mitad el valor-final-obras, con mas obras con el mismo techo-tarifario (Salazar & Salardi, 2011b). En suma, una combinación de fuentes de fondos (públicas y privadas) bien calzada con los tipos de proyectos y los diferentes ciclos de negocios que conviven dentro de una EPS, crean mayor valor durable.

Transparencia en el recibo de agua potable contribuye a la gobernabilidad

Este nuevo enfoque de gobernabilidad en la cuenca, se debe traducir con transparencia en el recibo de agua potable, como reflejo del nuevo contrato social del tercer milenio y de la primacía de la realidad: sin agua no hay vida, y que no existe substituto humano para el agua potable. Por tanto, el recibo de agua se convierte en una fuente de información para la toma de conciencia de los usuarios-urbanos sobre su dependencia del agua, ubicada en las zonas rurales; y en una rendición de cuentas de su EPS ante sus clientes, consumidores, usuarios, ciudadanos.

Capacitar a nuevos líderes cívicos del agua ayuda a mantener un balance político de las localidades, y recuperar la confianza del usuario–ciudadano en su Estado-Nación

Se requiere para armonizar los intereses de empresas-públicas, autoridades, con privados (hidroeléctricas, mineras, agroindustrias, comercio) porque hoy no existe marco legal que los obligue. Las autoridades de la cuenca no tienen la obligación de coordinar sus inversiones, sin embargo, con el liderazgo político se puede crear un espacio de diálogo en la cuenca para una nueva generación de líderes del agua. A nivel municipal, mantiene un balance político porque revela la voluntad de los ciudadanos-usuarios en su esencia-misma, como fuente de legitimidad de las decisiones comunales (SUNASS, 2009).

El ciclo político del agua revela que la ley electoral peruana puede elegir al alcalde con el 20% de los votos válidamente emitidos pero tiene control total del concejo municipal y decidir la asignación de subsidios con presupuesto municipal. La evidencia empírica ha revelado que en algunos casos, la autoridad local tiene prioridades que entran en conflicto con el 80% de la población (que está de acuerdo con el portafolio de proyectos-SUNASS-EPS). También ha sucedido que líderes comunales (no electos por la ley electoral) aprueban proyectos y no las autoridades formales, lo cual crea mundos paralelos que no se reflejan en la ley electoral. Entonces, este desbalance entre legalidad y legitimidad requiere de una nueva generación de líderes cívicos del agua, que debidamente entrenados recuperan el balance de gobernabilidad (Salazar, 2011). Sin embargo, el fin último es legitimar la función de las entidades públicas (gobiernos nacionales o sub-nacionales, EPS), sobre la base de confianza y efectividad de las

políticas públicas. Entendemos legitimidad, al igual que Habermas, como: ”el hecho por el cual un orden político es merecedor de reconocimiento, basado en las razones de la ciudadanía para obedecer al poder” (Habermas, 2002).

Beneficios de la ecologización de la regulación de los servicios de agua potable y saneamiento en el Perú

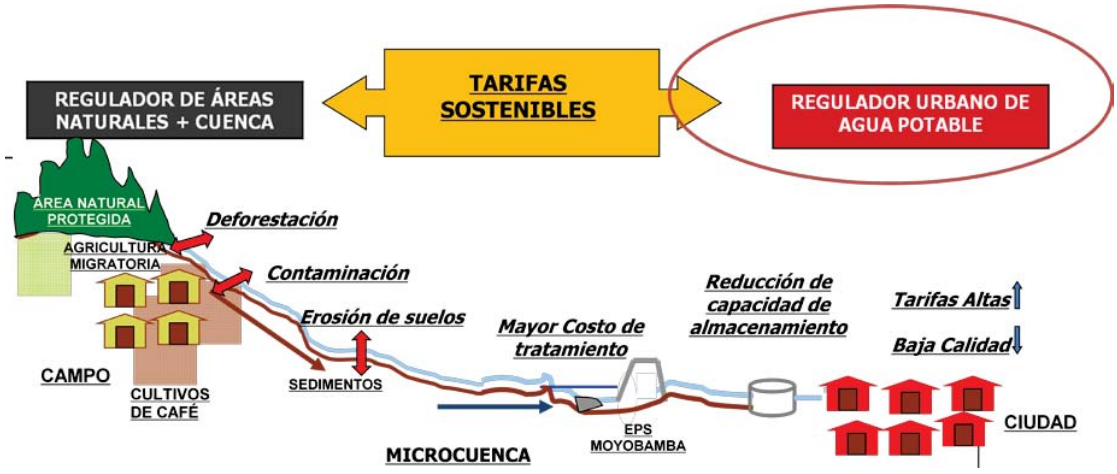
Para la cuenca	
Desde la dimensión económica-financiera	- Aumento de valor de propiedades urbanas al asegurarse el servicio de agua potable. - Reducción de la migración empresarial por falta del recurso agua para sus actividades productivas y por deficiencias del servicio de agua potable en sus instalaciones. - Reducción en inversiones para nueva infraestructura de captación o tratamiento de agua en la cuenca. - Menor pérdida de exportaciones en el marco de los TLCs debido a la reducción en disponibilidad del recurso agua y del servicio de agua potable en calidad y cantidad. - Aumenta potencial turístico por la conservación de bosques y por prestación de servicios de agua potable de calidad y cantidad, aumentando el empleo y los ingresos de los habitantes de la cuenca alta.
Desde la dimensión ambiental	- Asegura supervivencia del ser humano: mantener los ecosistemas que sustentan el ciclo del agua, vital para mantener los sistemas de vida del planeta tierra. - Reduce incremento de enfermedades infecciosas por deficiencias del servicio de agua potable en las viviendas, instalaciones hospitalarias y otros. - Al conservar los bosques, se conserva la biodiversidad de la zona, y los ecosistemas estratégicos que brindan el servicio ambiental hídrico. - Se generan negocios ambientales en la cuenca, gracias a la existencia del agua.
Desde la dimensión social-gobernabilidad	- Se detiene la migración poblacional de áreas urbanas, de la cuenca, o región hacia otras zonas por la deficiencia del servicio de agua potable y del recurso agua para las actividades agrícolas. - Se mejora la calidad de vida de los habitantes de la cuenca, en forma tangible e intangible. - Se generan beneficios tangibles e intangibles en la cuenca impactando positivamente a todos los actores ubicados en ella. - Existirá paz social, porque la población tendrá acceso a los servicios de agua y saneamiento, a una tarifa justa y sostenible. - Menor pérdida de capital político de autoridades locales por no tomar acciones a tiempo. - Se reduce los conflictos políticos generados por el problema de suministro (calidad y cantidad) de los servicios de agua potable, por los incrementos tarifarios de las tarifas, y por mantener la reducción del recurso agua para el desarrollo normal de las actividades económicas en la cuenca. - Reconectar las poblaciones de ciudad-campo, sin violencia cultural, reconociendo su interdependencia.

Para la EPS	
Desde la sostenibilidad ambiental	- Al conservar los ecosistemas estratégicos se conserva los servicios ambientales y la regulación hídrica, lo cual permite atender los servicios de agua y saneamiento según las necesidades de la población.
Desde la sostenibilidad económica-financiera	- Reduce nuevo presupuesto para una nueva captación de agua. - Aumenta el tiempo de vida de la infraestructura de la EPS, reduce la necesidad de nuevas inversiones. - Reduce costos de potabilización por sedimentos o sustancias contaminantes, traduciéndose en menos costos de operación y mantenimiento (OPEX). - Fortalece la capacidad de resiliencia para prevenir desastres naturales (huaycos, inundaciones, etc.) porque la cobertura forestal funciona como barrera natural a los desastres. - Asegura la provisión de agua en cantidad, calidad y oportunidad, se ofrece un buen servicio público, y se puede cobrar el íntegro de la tarifa al ciudadano.
Desde la relación usuario-ciudadano con la EPS	- Aumenta la capacidad de almacenamiento de la EPS, reduciéndose las interrupciones del servicio y aumentando la continuidad del servicio para la población. - Mejora la relación usuario-ciudadano-EPS, por mejor calidad de los servicios de agua potable. - Reduce las necesidades de incrementos tarifarios mayores, por menores costos en la potabilización.

Retos en la EPS Moyobamba

Hoy, el cambio climático, la deforestación y contaminación de aguas por agricultura migratoria (café), en las microcuencas Rumiyacu-Mishquiyacu y Almendra, zonas donde se ubican las fuentes de agua de la ciudad de Moyobamba, impactan negativamente en la prestación de los servicios de agua potable y saneamiento brindados por la EPS Moyobamba. Estos impactos son: a) Disminución de la disponibilidad del recurso hídrico, b) Mayores costos de tratamientos para la potabilización del agua, c) Mayores incrementos tarifarios, d) Disminución de la calidad del servicio, e) Mayores quejas y reclamos por parte de los usuarios.

Figura 1. Problemática de las EPS Moyobamba



Fuente: SUNASS, 2011

Modelo aplicado en la EPS de Moyobamba

Complementar los proyectos de ingeniería con proyectos de conservación

En la Tabla N° 1, se muestra la propuesta de SUNASS es avanzar hacia una regulación sostenible que complementan los proyectos ingenieriles del PMO-EPS con proyectos de conservación de la fuente de agua actual, fortaleciendo la gobernabilidad en la cuenca.

Tabla 1. Problemática-Soluciones de la EPS-Moyobamba, región San Martin, Perú

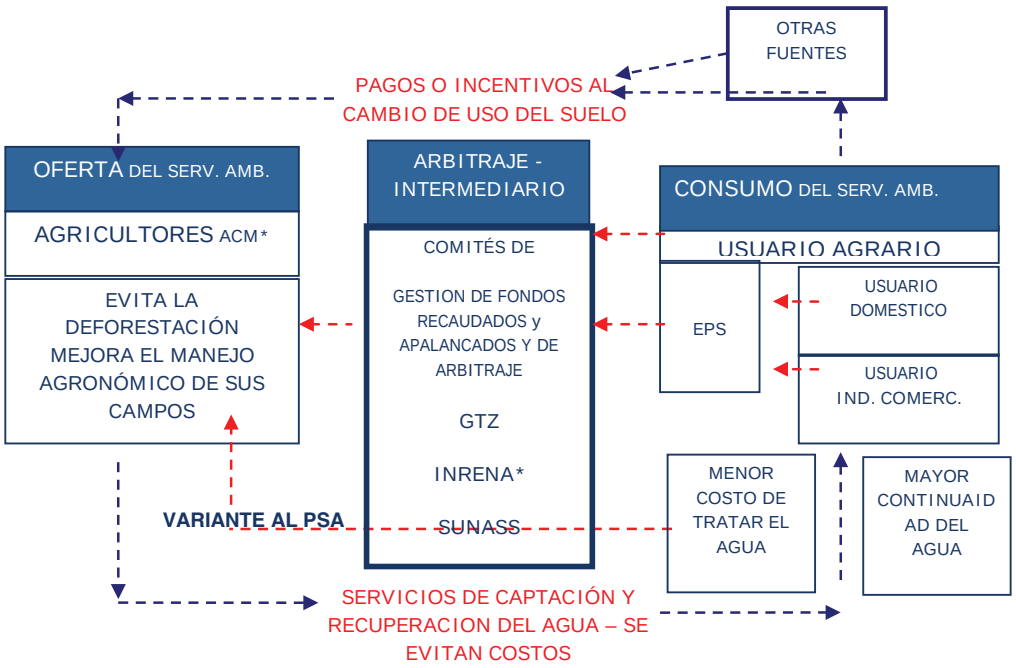
EPS	Región	Problemática	Solución ambiental	Proyectos ambientales
EPS Moyobamba	San Martin (selva)	Reducción de disponibilidad de agua en cantidad y en calidad (presencia de sedimentos) a causa de la erosión resultado de la deforestación de la cabecera de cuenca.	Esquema de pago por servicios ambientales hídricos en las quebradas Rumiyacu, Mishquiyacu y Almendra	Nueva captación + Conservación de las nacientes y fajas marginales. Recuperación de las nacientes y fajas marginales. Mejoramiento de prácticas agrícolas, cacao (PEAM). Desarrollo de experiencias agroforestales (PEAM).

Elaboración propia. Fuente: Salazar (2011)

Compensación a los agricultores y reinversión en formación y asistencia técnica

La implementación de un PSA-hídrico, donde la población urbana financia la conservación y recuperación de los servicios ambientales hídricos a través de la compensación a los agricultores y el financiamiento directo de acciones de reforestación y monitoreo del área; donde, dicha compensación es entregada a los agricultores través de una capacitación y asistencia técnica orientada a la transformación de un sistema de producción (tradicional) de café a un sistema de producción agroforestal, así como la transferencia de pequeña infraestructura (pozos y letrinas) a los agricultores.

Figura 2. Esquema de Pago por servicios ambiental – EPS Moyobamba



*ACM: Área de Conservación Municipal.

Plan Maestro Optimizado para el incremento de tarifas sostenibles

La incorporación del PSA en la tarifa[43] de agua se hizo incorporando proyectos ambientales en el programa de inversiones de la EPS, el cual forma el Plan Maestro Optimizado-PMO que es base de los incrementos tarifarios a ser aplicados a las tarifas de los servicios de agua potable.

La estructura tarifaria de la EPS consideró la aplicación de un incremento tarifario condicionado de 3,0% y 6,5% al segundo y cuarto año para el servicio de agua potable y de 3,0% y 6,6% al segundo y cuarto año para el servicio de alcantarillado:

Proyecto	Año	Incremento tarifario	
		Agua potable	Alcantarillado
Mejoramiento de la calidad y cantidad del recurso hídrico mediante la intervención en las fajas marginales de las fuentes de agua adyacentes a las zonas de captación de la EPS – Moyobamba.	Año 2[1]	3,0%	3,0%
	Año 4[2]	6,5%	6,6%

(1) El primer incremento tarifario estará condicionado a la presentación a SUNASS, por parte de la EPS-Moyobamba S.R.Ldta, de:

[43] Resolución de Consejo Directivo 080-2007-SUNASS-CD.

Condiciones	Situación actual
a. Acta de constitución del Comité Gestor de Servicios Eco-sistémicos en la región de San Martín.	Cuentan con Estatutos, y son conscientes de su función supervisora de los proyectos Falta Inscribirse en Registros Públicos
b. Documento de conformidad del directorio de la EPS – Moyobamba S.R.Ltda., para que los recursos recaudados por este incremento se depositen en el fondo exclusivo de inversión, constituido por la EPS Moyobamba S.R.Ltda. para financiar sus inversiones. El incremento condicionado, para efectos de su inclusión en el fondo exclusivo de inversión, equivale a un nuevo sol por mes por conexión activa, desde el año 2 al año 5 del quinquenio.	Falta la conformación del fondo exclusivo de inversiones
c. Estudio a nivel de perfil del Proyecto "Mejoramiento de la calidad y cantidad del recurso hídrico mediante la intervención en las fajas marginales de las fuentes de agua adyacentes a las zonas de captación de la EPS – Moyobamba S.R.Ltda.", elaborado de acuerdo al contenido mínimo establecido en el anexo SNIP 05-A. El presupuesto estimado para la implementación de este Proyecto es S/. 500,000.00.	Están al 80% en la elaboración del Proyecto para su aprobación por la OPI Saneamiento. Piensan realizar convenio de cooperación con PDRS-GTZ para ayudarlos en la elaboración del proyecto. PEAM-GTZ se han comprometido en iniciar un proceso de sensibilización sobre este proyecto y el aprobado para el PEAM por S/ 1,500,000 para la misma área
d. Documento metodológico que describa el sistema de monitoreo del Proyecto, basado en "indicadores de resultados objetivamente verificables", que reflejen las mejoras en las condiciones ambientales en las fuentes de captación de interés para la EPS- Moyobamba S.R.Ltda.	El Próximo mes, agosto 2008, llega una experta colombiana que determinará los Indicadores para monitorear estos proyectos (PDRS-GTZ).
e. Documento de aprobación por parte de INRENA, de acuerdo al Convenio Marco de Cooperación Interinstitucional entre INRENA y SUNASS, del sistema de monitoreo descrito en el literal anterior.	La propuesta de indicadores debe ser aprobada por la EPS, SUNASS e INRENA, para el proyecto de interés de la tres instituciones

(2) El segundo incremento tarifario estará sujeto a la conformidad con la ejecución del Proyecto en los años 2 y 3 del quinquenio, emitida por el INRENA, como supervisor técnico del Proyecto en mención (de acuerdo al Convenio Marco de Cooperación Interinstitucional entre INRENA y SUNASS). Este incremento no se hará efectivo en caso que la EPS Moyobamba S.R.Ltda. haya utilizado el dinero del fondo intangible, conformado por este incremento condicionado, para otros fines; o la ejecución financiera del proyecto no guarde relación con el avance de las metas físicas.

SUNASS lo operacionalizó con:

i) la herramienta de costos evitados (enfoque de oferta), en donde se ha valorado los beneficios para la EPS en el desarrollo de proyectos ambientales para la conservación de sus fuentes de agua. El cálculo de costos evitados del proyecto ambiental en Moyobamba en un período de 30 años, a la EPS le ahorraría un V.P.N[44]. al 2010 costos de S/. 2,991,579. La población evitará a V.P.N. al 2010 costos de S/. 1,204,932 y a la cuenca (ecosistemas) evitará a V.P.N. al 2010 costos de S/. 2,017.734. Esto quiere decir que el desarrollo de esquemas de PSA genera beneficios adicionalmente a la EPS, a la población y a la cuenca.

ii) la valoración contingente para determinar la disponibilidad de usuarios-ciudadanos de pagar por proyectos (enfoque de demanda). Como resultado de la encuesta desarrollada en Moyobamba se obtuvo que los usuarios-ciudadanos estaban dispuestos a pagar el valor de S/. 1 nuevo sol mensual por la incorporación del proyecto ambiental a través del esquema de PSA.

Con esta combinación el regulador ha convertido aportes voluntarios (PSA tradicional, liderado por ONG y cooperantes) en flujos estables-mandatorios usados como capital semilla para apalancar aportes de otros actores de la cuenca: ej. Presupuesto Participativo Regional o Local, donaciones corporativas y/o bilaterales, aportes de industrias ubicadas en la cuenca, entre otros.

Coordinación y participación de actores en la aplicación del modelo

Actor	Rol
EPS Moyobamba	Prestación de los servicios de agua potable y saneamiento en la ciudad de Moyobamba, región San Martin, Perú
Usuario-ciudadanos	Usuarios del servicio de agua potable, con derechos políticos. Revelaron su disposición a pagar por eco-proyectos.
Cooperación Técnica–GIZ	Cooperación Técnica: estudio de DAP, institucionalidad inicial.
PEAM	Programa del Gobierno Regional para el desarrollo sostenible del Alto Mayo
Comité Gestor del Área Natural Protegida	Administrador y tomador de decisión del fondo, conformada por la sociedad civil, gobierno regional y municipal, entre otros actores de la cuenca
Superintendencia Nacional de Servicios-Saneamiento-SUNASS	Regulador de los servicios de agua potable. Institución que aglutina y genera confianza entre los actores.
Ministerio del Medio Ambiente –MINAM	Regulador de las áreas naturales protegidas. Autorizó la creación de la zona de conservación municipal

[44] Valor Presente Neto

Lecciones aprendidas en la aplicación práctica del modelo

Elementos del modelo	Lecciones aprendidas: ¿Cómo hacerlo mejor?
Identificar la cadena de valor ambiental a partir de costos evitados	Los proyectos diseñados con dimensión ambiental reducen costos de operación y mantenimiento y evitan a futuro inversiones en infraestructura para abastecimiento. Por tanto, los costos evitados estima el valor evitado como consecuencia de la implementación del Proyecto ambiental.
Valorar las fábricas naturales de agua para lograr ciudades sostenibles usando valoración contingente	Encuesta para estimar la disposición a pagar de los diferentes usuarios de la cuenca por proyectos ambientales.
Identificar, armonizar, cuantificar y monetizar las inversiones en la cuenca	Permite maximizar la inversión ambiental en la gobernabilidad de la cuenca.
Invertir en las fábricas naturales de agua para lograr ciudades sostenibles	Los eco-proyectos con mayor encadenamiento-sinergético se incorporan en el PMO-EPS.
Armonizar marco legal institucional de los actores de la cuenca	Incorporando el enfoque de cuenca-eco-sistémico en el rediseño legal institucional del estado, caso por caso.
Delimitar la responsabilidad de pago de la EPS frente a los contaminadores (*free-riders*)	La población es solidaria con el que no tiene, pero no acepta subsidiar a los agentes económicos que evaden su responsabilidad.
Incorporación de las variables ambientales en el PMO agrega sostenibilidad	Reconocer la heterogeneidad cultural y ambiental, caso por caso, porque no existe una receta de talla única.
Establecer la Tarifa de costes eficientes e inversiones de largo plazo	Maximiza el uso del financiamiento concesional para acceso universal, adaptación-mitigación al cambio climático, gestión-riesgo-desastres-naturales se traduce en menores tarifas para la población y mayor valor-EPS
Transparencia en el recibo de agua potable como el nuevo contrato social entre campo-ciudad	La población se conecta con la EPS cuando lee-paga la factura, la cual aporta información de proyectos, como rendición de cuentas permanente.
Concienciación del usuario-ciudadano de su dependencia del campo a través del recibo del agua.	El usuario paga en función de su DAP, que depende de la percepción de beneficios que la conservación genera para él. La información es clave para que el usuario recupere la confianza en su EPS.
Capacitar a nuevos líderes cívicos del agua con enfoque de interculturalidad	La sociedad civil participa mejor si está informada y entrenada. La heterogeneidad cultural requiere de capacitar a líderes de identidades colectivas regionales, porque ellos traducen el mensaje de la EPS en lenguaje del pueblo y le agregan credibilidad.

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8. Water and the green economy in Western Asia: regional context and lessons learnt

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Regional context

The Arab region is one of the most water scarce regions in the world, as most countries are located in arid or semi-arid areas. In 2008, 16 out of 22 Arab countries were below the annual per capita water poverty threshold of 1,000 m^3 of total renewable water resources[45], a situation that is rapidly worsening as populations continue to grow. Rapid population growth also boosts demand for food, in turn driving intensive domestic agricultural water use and threatening the sustainability of water resources. Energy poverty of Arab countries outside the Gulf Cooperation Council (GCC) limits the ability to produce and distribute water resources to urban, rural and remote communities in an optimal manner since the production and distribution of water is closely related to the availability of energy. Improvements in the quality of water have been limited by sewage infiltration to water networks resulting from poor infrastructural investment and maintenance as well as intermittent water supply. Climate change is also expected to have negative impacts on water resources of the region. These water challenges restrict progress towards achieving the MDGs related to poverty and hunger, health, education, gender equality, and environmental sustainability.

Arab countries have responded to these water challenges with various policies. GCC countries as well as Egypt, Iraq and Jordan have constructed desalination facilities. The reuse of treated wastewater is also being encouraged for use in irrigation as to help protect and alleviate some of the pressures on the limited fresh water resources. Integrated water resource management (IWRM) principles and tools, natural resources accounting, and virtual water calculations have been promoted by international and regional organisations to improve the valuation of water resources as an integral component of development planning. This has contributed to the reform of water tariff structures and gradual phase-out of agricultural subsidies in some parts of the region. These measures, however, have not been sufficient to meet the growing regional water demand and to ensure the sustainability of water resources in the region. Most countries continue to consume more water than their renewable water resources budget can bear, which is leading to the reduction of water resources on a net and per capita basis. As a result, progress towards the achievement of the MDG targets on water supply and sanitation is limited and has not resulted in the multiplier effects that a sound and sustainable water sector can provide for achieving the other MDGs.

Arab countries have shown some progress in achieving the MDG targets related to access to improved water and sanitation services, although the Least Developed Countries – including Sudan and Yemen – and countries in conflict are still suffering from limited access to improved water and sanitation services in urban and rural areas. As of 2008, eighty-five percent of Western Asia used improved sanitation (an increase of 5% from 1990) and 90% had access to improved drinking water sources (an increase of 4% from 1990)[46]. However, with intermittent water supply most people in the region do not receive a sufficient amount

[45] FAO, AQUASTAT

[46] WHO and UNICEF, 2010

of good quality water services. This has imposed an additional economic burden on the general population, and particularly on the poor, since most people still resort to private water vendors or informal mechanisms to offset gaps in the quality or quantity of water provided through the public water distribution networks. In response to this challenge, the Arab Ministerial Water Council (AMWC) mandated ESCWA to lead a regional coordination mechanism involving the Arab Countries Water Utilities Association (ACWUA), the Arab Water Council (AWC), the Centre for Environment and Development for the Arab region and Europe (CEDARE) and the Arab Network for Environment and Development (RAED) to develop, on the basis of the basic water and sanitation MDG indicators, a monitoring mechanism that incorporates an additional set of indicators specific to the Arab region. Reporting on the progress of the Arab countries in achieving the basic as well as the additional indicators is expected to be done through this regional monitoring mechanism and under the political umbrella of the AMWC.

MDG-7 on ensuring environmental sustainability has often been considered at odds with efforts to achieve rapid economic growth. Aggressive economic growth has in turn been negatively associated with environmental degradation, which has left many to perceive economic growth and environmental sustainability as competing goals. In the end, both must be pursued in a manner that supports progress towards sustainable development.

Efforts to foster a green economy seek to highlight opportunities that the environment sector presents for development by attracting new investments, as well as cleaning up existing inefficient or polluting industries. An improved water sector is one of the industries that can lead the way towards a greener and cleaner future by providing the enabling infrastructure and input needed to meet sustainable development targets. However, care must be taken to ensure that efforts to promote opportunities in the water industry and associated sectors that seek improved service delivery from the industry (e.g. agriculture, tourism, etc.) do not neglect questions of water resource sustainability, particularly in the water scarce ESCWA region. Doing so can result in serious implications for rural poverty, employment, food security and human health.

A green economy would thus facilitate the search for alternative solutions for multifaceted challenges through a sustainable development lens. This includes highlighting how new technologies and traditional techniques can be used to build a bridge and find a balance between the needs of today and the future.

Some recent projects in the Arab region show how green economic thinking has already resulted in new initiatives that are driven and derived from the unique regional setting. ESCWA countries have started to deploy different technologies and technical solutions to meet regional challenges. Some are adaptations of ancient techniques, while others are grounded in the research and development of new technologies. These examples are then complemented by lessons learned from building the capacity and strengthening the institutions responsible for delivering modern and improved water services in the ESCWA region.

The session on water and the green economy in the ESCWA Region focuses on how progress towards the MDG targets related to water supply and sanitation can contribute to fostering a green economy within the context of sustainable development and poverty eradication. This is realised through efforts to improve the technical and financial capacity of water utilities to

deliver accessible and reliable water services for domestic use in urban and rural communities. This is examined through two case studies elaborated by the session panellists, which will showcase different models for improving the efficiency, performance and service delivery of publicly and privately operated water utilities through centralised and decentralised approaches.

In addition, case study briefs are provided to offer insights into other success stories and challenges facing the water sector in the ESCWA region that complement many of the lessons drawn from the two case studies. These include reference and recognition of regional specific characteristics and concerns related to the water-energy nexus, the use of traditional knowledge, and efforts underway to overcome the extreme level of water scarcity faced in the region through the development of non-conventional water resources and management schemes.

Challenges

The main challenges for water management in the ESCWA region are:

(a) Water scarcity and water quality

While many countries in the world do not enjoy sufficient amount of water resources, water scarcity of the ESCWA region in terms of per capita availability of renewable water resources is unique. In 2008, the total annual per capita share of renewable water resources in the ESCWA region was only around 566 m^3, while 5 out of the 14 ESCWA countries had an annual per capita share of even less than 100 m^3. Furthermore, this extremely low level of water resources availability is rapidly decreasing with the blossoming regional population that quadrupled in the last half century from about 67 million in 1961 to over 250 million in 2009.[47] This lack of water resources constrains the economic and social development of the region which also affects the progress towards achieving the MDGs. Moreover, the quality of water is poor in several countries mainly resulting from discharge of untreated wastewater, and poor maintenance and lack of investment. Increasing salinity of groundwater due to excessive pumping of groundwater and sea water intrusion due to reduction of river run-off is also affecting the quality of water resources.

(b) Shared water resources and conflicts

Water resources in the region are mostly shared among countries, thus leading to competition over their use. Most of the major rivers of the region including the Nile, the Euphrates and Tigris as well as many groundwater aquifers are shared between countries inside and outside of the ESCWA region. Without adequate mechanisms to reduce the risks of conflicts over shared water resources, the region is a candidate for disputes and conflicts, not only between riparian countries of international watercourses, but also between riparian countries of smaller shared surface water and transboundary aquifers. Geopolitical factors and power imbalances significantly contribute to the existing low level of cooperation in the management of shared water resources in the region.

(c) Water, food and energy nexus

[47] World Bank, World Development Indicators; FAO, AQUASTAT

Excessive agricultural water use and energy shortages in several ESCWA countries are additional water challenges of the region. Agriculture is still a very important economic sector in many countries of the region and employs large segments of the population. In particular, for many people living in rural areas, agriculture is still probably the most important source of income. Also, domestic agricultural production can reduce external commodity price shocks that have been witnessed globally between 2007 and 2008. However, agricultural sector consumes over 80% of total water withdrawals in Yemen, Oman, Saudi Arabia, Syria and UAE, all of which suffer from extreme water scarcity.[48] This level of agricultural water use seriously threatens the sustainability of water resources of the region, particularly the non renewable aquifers. Additionally, the high scarcity value of water in the region makes water use in non-cash crop irrigation economically unfeasible. Nevertheless, considering the rooted role of agricultural sector in the lives of people living in the rural areas of the region, national agricultural policies need to be reviewed in light of the growing water scarcity and a holistic socio-economic and political perspective on food security.

The linkage between water and energy adds another water challenge to the region. In energy deficient ESCWA countries, water supply is sometimes limited due to energy shortages as energy is required for the production and distribution of water. The Yemen case represents this issue well. In the case of the energy rich GCC countries, although they, to certain extent, have been able to address the water challenges through increasing investments in desalination, the large government subsidies for the construction and the operation and maintenance of these desalination plants is viewed to be economically unsustainable on the long run.

(d) Climate change

It is predicted that climate change will have significant impacts on the water accounts, and this in turn threatens to negatively affect water availability in the region. While the impacts of climate change is expected to vary from country to country, from the regional perspective, the ESCWA region is expected to suffer a reduction in its water availability as a result of less precipitation, higher temperature and more active evapotranspiration. Although detailed impacts of climate change on water resources are still to be scrutinised, considering the high water scarcity level in the ESCWA region, even a slight reduction of water availability or a change in the pattern or frequency of its flows will result in significant social and economic national and regional impacts. Moreover, as a result of climate change, extreme weather events such as droughts and floods are already increasing in the region. Cyclone activity in the Gulf region has also recently intensified with the three strongest cyclones occurring since 2000.[49]

Approaches

Financing, capacity building, water planning, and technological application and development are commonly used tools identified from regional experiences. In order to address the increasing gap between water supply and demand, some countries in the region have

[48] FAO, AQUASTAT

[49] Gulf news, "*Facts about Tropical Cyclone Phet*", 6 June 2010, available at http://gulfnews.com/news/gulf/oman/facts-about-tropical-cyclone-phet-1.636372

undergone institutional reforms adopting the principles of integrated water resources management within their policies.

Many countries of the region have tried to strike a balance between supply and demand management approaches in order to satisfy the growing water demand. Among the tools that are being adopted by an increasing number of the region's countries is an increasing reliance on the use of non-conventional water resources, namely desalinated water and treated wastewater. Investment in desalination of sea water and brackish groundwater is growing in the region, particularly in the energy rich GCC countries, and to a lesser extent in other countries of the region; although use of desalinated water is mostly confined to domestic and industrial uses only. Treated wastewater has also attracted interest in many countries of the region, not only because of the direct benefits that are realised from its reuse especially for irrigation thus alleviating some pressure on the limited freshwater resources, but also for the direct and indirect environmental benefits realised from the treatment of domestic and industrial wastewater that would otherwise be a source of public health hazards and a source of contamination of other fresh surface and groundwater resources. Treated wastewater, although representing only a small percentage of national water demand, is considered a significant and reliable water resource in and around the large urban centres. In this regard, treated wastewater from the city of Cairo, Riyadh, or Damascus constitutes a water resource that can contribute to partly satisfying the demand for irrigation water within and around those cities.

For the water and sanitation service sub-sector, the adopted national reform programmes have also led to the establishment of more efficient decentralised water and sanitation utilities. Both the utilities and consumers have directly benefited from these reform programmes. Tariff readjustments, autonomy and commercialisation have allowed the utilities to provide better and more reliable and predictable service levels, relieving consumers from the need to seek other less quality and more expensive water services from private vendors.

The use of traditional water management approaches is also considered to be an important tool that can contribute to effective management of water resources. Some countries of the region are investing in maintaining and restoring some of these traditional water collection systems like terracing of mountains in Yemen and household level rainwater harvesting reservoirs in Palestine and Jordan as well as the revitalisation of traditional rules, customs and norms for water allocation in Yemen. Traditional landscaping, urban planning and traditional architecture are also being considered in some areas as an integral part of water and environmental management. Reintroduction of local indigenous plants within national efforts to create work opportunities and generate income by increasing the competitiveness of micro and small agro-industries is being implemented in South Lebanon. Similarly rooftop water rainwater collection and farming help some Palestinian households to partly satisfy their water and vegetable needs.

Like traditional approaches, advances in technology are also considered to be an important tool in the management of water resources. Advances in desalination technology have assisted some countries of the region to adopt strategies that rely on desalinated water to satisfy growing domestic water demand. In this regard, the UAE have adopted strategies that promote the recharge of groundwater with excess desalinated water in an effort to establish a strategic groundwater storage reserves. Oman, in an effort to maintain groundwater reserves

for future generations, has also adopted a strategy that prohibits the use of groundwater and promotes investing in desalination as an alternative source for domestic water supply. Water planning and technological application and development is also actively pursued to address interrelated challenges of water, food and energy. In Saudi Arabia, solar energy desalination technologies are pursued to reduce energy costs of desalination, while greenhouse hydroponics farming has been experimented in the ESCWA region including Lebanon, UAE and Qatar, where over 90% of food is imported. Many of the countries of the region are realising the benefits of applying water saving technology, especially in agriculture. In this regards some countries have introduced financial incentives for farmers to invest in sprinkler and drip irrigation.

It should also be realised that while the application of technology has led in some cases to water savings and higher water use efficiency and productivity, in other cases the use of technology, like the introduction of deep drilling and heavy submersible pumps have led to the near exhaustion of many aquifers, like is the case in the highlands of Yemen. The shift from rain-fed farming to irrigated agriculture in Syria has also lead to higher land productivity, but leading at the same time to wasteful irrigation practices in areas relying on surface water and to depletion of aquifers in groundwater irrigated lands.

Lessons learnt

- Although most countries of the ESCWA region have already achieved, or are on track to achieve, the water and sanitation MDGs targets, financial constraints and political instability of some countries are considered to be the main reasons for their inability to achieve those targets.

- Water planning and capacity building (management, human resources, institutions, etc.) have played an important role in increasing access to water and sanitation services.

- Having been developed mainly on the basis of health considerations, the current water and sanitation MDG indicators do not reflect the level or quality of water and sanitation services. This in turn has raised the need to develop a regional initiative to complement the current MDGs with additional indicators that, while clarifying the level and quality of services; take also the specificities of the region into account.

- In the ESCWA region, water challenges are closely connected to agricultural development and food security as the agricultural sector consumes the majority of the available water resources. Nevertheless, the agricultural sector is economically sensitive since in many countries of the ESCWA region it provides the largest employment opportunities.

- Current levels of agricultural water use in many of the countries of the region are not sustainable and irrigation practices are not efficient. Agriculture, on the other hand contributes to the social stability of the region. Ideally scarce water should be allocated as to optimise the social and economic value derived from its use. In this respect, sustainability of groundwater use needs to be realised and considered within the national plans of the region's countries.

- Agricultural subsidies in the region need to be reevaluated as to promote water saving and increase the water use efficiency in irrigation. Cost recovery of water supply and

sanitation services is a strong element of the financial sustainability of water utilities and allows for better service delivery to consumers.

- Education, awareness raising and communication programmes that target the agricultural sector are likely to have significant impact, especially when integrated with other programmes and projects that introduce water saving technologies and techniques.

- Water challenges are also connected to the energy sector as the production and distribution of water requires energy. Frequent energy cuts have contributed to depriving consumers of adequate water supply services.

- As shown from regional experiences, technological developments play an important role in addressing water challenges in the region. Advancements in desalination, wastewater treatment, and water loss reduction can contribute to facing the water challenges in the region. Nevertheless, technological advancements in drilling and pumping have contributed to the near exhaustion of many aquifers.

- Traditional water systems and knowledge need to be revitalised and integrated into the concepts and principles of integrated water resources management. Rain-fed farming, rainwater harvesting, reintroduction of indigenous agricultural species, and customary water allocation rules are examples of these traditional water management systems.

- While the region shares common aspects of some water challenges, differences between countries of the region require taking into account national specificities when addressing ways to tackle these challenges at the national level.

- Integrated planning among national institutions and stakeholder participation are important elements of policy development, sustainable water and sanitation services, and successful project implementation.

Capacity development in the Arab Region: The role of ACWUA in promoting the exchange of experiences and expertise

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Type of tool: cost recovery and financing, capacity development
Issue: Cities, watersheds
Location: the Arab Region, Western Asia

Challenges

The Middle East and North Africa Region (MENA) or the Arab region is the most water scarce region in the world. One half of the Arab's population lives under conditions of water stress. Moreover, with the population expected to grow from around 300 million today to around 500 million in 2025, per capita water availability is expected to halve by 2050. The water sector in the Arab region suffers from chronic problems, such as water scarcity, weak water and environmental policies, high investment needs, lack of management and technical expertise, increasing demand due to growing populations, and regional conflicts.

The source of water varies from one country to another. While Egypt and Iraq rely mostly on surface water from large international rivers, others, like Yemen, Djibouti and the Gulf Cooperation Council countries depend almost entirely on groundwater and desalination, while others use a mixture of surface and groundwater. Most Arab countries have mobilised almost all available surface water, and many major rivers do not reach the ocean.

More than any other region, water resources in the Arab region are considered as a development issue. In this respect, Arab countries have responded to scarcity by heavily investing in water related infrastructure. Many have heavily invested in water storage infrastructure and in expanding their irrigation systems. Additionally, the Arab region leads the world in using non-traditional water resources through the use of desalinated water and reuse of treated wastewater is increasingly gaining importance in many countries of the region. However, these large investments have not always been accompanied by the necessary institutional and policy changes, and are often not generating optimum economic returns. Non-water policies in particular create incentives for inefficient water use in agriculture for example, which uses 85 percent of the region's water, and unsustainable pumping of groundwater, which is similarly encouraged in some countries through heavy energy subsidies[50].

The drivers of change

With respect to water supply and sanitation infrastructure, large disparity exists within the Arab region on the level of population access to these facilities. In the Third Arab Report on the Millennium Development Goals prepared in 2010, Arab countries were classified into 4 categories[51]. Overall water supply coverage of the first category comprising the GCC countries (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates) is estimated at 93 per cent while sanitation coverage at 98 per cent. Only Oman stands out as it

[50] The world Bank, Water Sector Brief: http://go.worldbank.org/JQVM8LMP70
[51] ESCWA MDG report 2010

lags behind other fellow GCC countries due to its high percentage of rural population. The second category comprises countries that are on track to achieve the water supply and sanitation targets (From the Mashreq region Egypt, Jordan, Lebanon and the Syrian Arab Republic and from the Maghreb region Algeria, Libyan Arab Jamahiriya, Morocco and Tunisia). Overall water supply and sanitation coverage stands at 96 per cent and 89 per cent, respectively for the Mashreq countries and 87 per cent for both for the Maghreb countries. The third category comprises the Least Developed Countries (LDCs) (Yemen, Comoros, Djibouti, Mauritania and Sudan) that are not currently on track to reach their WSS target. Overall water supply and sanitation coverage is estimated at 66 and 46 per cent, respectively in Yemen while for the LDCs as a group it stands at 67 and 38 per cent, respectively. The fourth category comprises countries in which their respective water and sanitation infrastructure deteriorated due to political instability, occupation and/or internal strife and as such face an uncertain prospect of reaching the desired water supply and sanitation goal. These countries include Iraq, the Occupied Palestinian Territory and Somalia. Overall water supply coverage is estimated at 78 per cent for Iraq and the Occupied Palestinian Territory and less than 30 per cent for Somalia.

The water situation in the Arab region is increasing the cost of supplying water to the Arab population and by association is increasing the pressure on water operators to improve their efficiencies and capacities. In order to improve and promote regional cooperation and exchange of experiences towards improving the efficiency of water utilities in charge of water supply and sanitation, the Arab Countries Water Utilities Association (ACWUA) was founded as a result of an initiative by key water sector representatives in the Arab region. This Association is expected to provide a platform for communications and exchange of experience for water utilities for improving the level of services and benefits. This will be achieved through the development of performance indicators, the development of modern technical standards, building capacity and improving the management of large investment projects.

The approach

1- Creation of the association

At the end of July 2009, the Arab Countries Water Utilities Association (ACWUA) was officially launched in Amman, Jordan. Since its creation, the ACWUA had the support of the Economic and Social Commission for Western Asia of the United Nations (UN-ESCWA) and the German Technical Cooperation (GTZ). Through its working groups, ACWUA focuses on the management of utilities, water resources management, water and health, utilities reform, benchmarking as well as capacity building and training.

ACWUA, as a regional centre of excellence, partners with water supply and wastewater utilities in Arab countries to provide best practice service delivery to their members through:

1. Serving as a regional platform for exchange of knowledge and best practice amongst member experts and professionals.

2. Developing resources, facilitating training programmes, and advocating for professional certification to enable member utility staff to perform their duties in a professional, reliable and cost-effective manner.

3. Promoting standards of performance for the governance, management, operation and maintenance of water supply and wastewater utilities.

4. Supporting the interests of ACWUA members including the provision of advice and consultation in water legislation, policies, and sector management and reform.

5. Developing, promoting and disseminating publications and other knowledge products to meet the needs of members and other regional professionals.

2- Development of capacity building tools

Through its close cooperation with local governments, international associations, training specialists, donors, academic and research institutions, think-tanks, and international organisations, ACWUA was able to offers its members a strong networking platform. This platform included the identification and creation of Technical Working Groups (TWGs), developing training and capacity building programmes along with their associated tools, and the establishment of an e-platform for knowledge management and network collaboration (ACWUA Wiki).

ACWUA Technical Working Groups comprise qualified experts from Arab region and deal with priority areas identified by its members at their general meetings. Members of the Working Groups deliberate on the identified issues and come up with a work plan to enhance exchange of experience and disseminate lessons learnt from best practices. The current technical working groups and associated sub-groups are detailed in table 1 below.

Table 1. Working Groups and associated sub-groups

No.	Technical Working Group	Sub-groups
1	Utilities Management	1.1 Cost Recovery 1.1.1 Non Revenue Water (NRW) 1.1.2 Water for the Poor 1.1.3 Energy Efficiency 1.2 Asset Management
2	Capacity Building and Training	2.1 Training Strategy 2.2 Certification
3	Water Resources Management	3.1 Governance 3.2 Master Planning 3.3 Protection of Resources 3.4 Adaption to Climate Change 3.5 Integrated Water Resources Management (IWRM)
4	Water and Health	4.1 Domestic Water Supply 4.2 Waste Water Treatment and Re-use

No.	Technical Working Group	Sub-groups
5	Utilities Reform	5.1 Autonomy/Commercialization 5.2 Public-Public Partnership 5.3 Private-Public Partnership
6	Benchmarking	

With respect to training and capacity building programmes and tools for water and wastewater utilities, the programmes cover institutional, managerial, technical and financial topics with the aim of building up a regional pool of Arabic trainers to address the needs of the region. Figure 1 below provides an illustration of ACWUA's training practice.

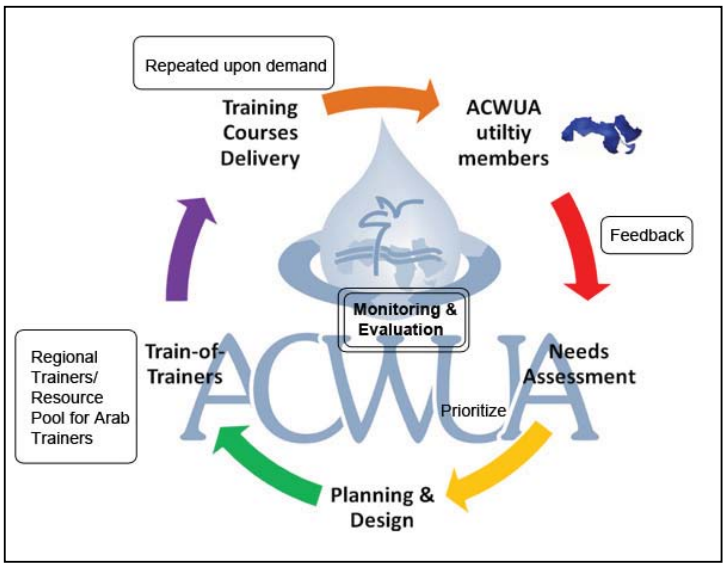

Figure 1. ACWUA training practice

The outcomes and exchange of lessons learnt

1- Development of an Improved Water Utilities Performance programme (WUP-TRAIN)

ACWUA in cooperation with GIZ developed and conducted regional capacity building programmes to improve the performance of water and wastewater operators in the Arab region. Since the launch of the programme, 220 top and middle management staff from the different Arab water and wastewater utilities have been trained. Modules prepared for this programme include:

1. ELAC - Effective leading and communication in water utility management
2. NCCG - Negotiation and cross sectoral coordination for enhanced water governance
3. PIAS - Key performance indicators and benchmarking
4. BPQS - Enhancing business performance of water utilities through quality management and standards

The WUP-Train programme is designed to benefit top management of water utilities and decision makers in the water sector; senior to mid management of technical and commercial

departments in utilities; senior professionals from government agencies involved in policy formulation, supervision and regulation; academia, representatives from the civil society and other water sector professionals and practitioners involved in programme development, formulation and implementation.

2- Water Utilities Management Capacity Building Programme (WUM-CBP)

ACWUA in cooperation with Engicon O&M and the German Association with Water, Wastewater and Solid Waste (DWA) launched in 2011 the Water Utilities Management Capacity Building Programme (WUM-CBP). This programme works on building linkages with the private sector in water industry in order to provide a wider variety of training modules to its members in water utilities management aspects. Modules prepared for this programme include:

1. Operations & Maintenance of Water Pumping Stations
2. Operations & Maintenance of Water Distribution Networks
3. Operations & Maintenance of Water and wastewater Treatment Plants
4. Operations & Maintenance of Sewage Networks
5. Operations & Maintenance of Sewage Pumping Stations
6. Basic/ Medium/ Advanced levels of Non Revenue Water Management

3- Exchange of best practices in Arab Region

More than 100 water experts from the Arab region gathered at the Dead Sea on 15-16 October 2008 in order to exchange their experiences on utility management practices and to set the Arab Region's Standards of Operation and Maintenance (SOMPs) of water and wastewater systems. Such standards are considered essential for improving the efficiency and effectiveness of utility operations. These SOMPs act as risk management measures that reflect positively the delivery of services to consumers. The quality and quantity of distributed water should improve as these procedures are applied. Also, these procedures will act as a base for job descriptions, and help to set training guidelines. Accordingly, the efficiency and skills of the operating workers is expected to improve.

Almost 300 water experts from the Arab region exchanged their best practices on the issue of "Non-Revenue Water in the Arab Region" during a regional conference that was organised by ACWUA and other partners in Rabat, Morocco in January of 2010. The experts reviewed and discussed the situation in different cities of the region and provided up-to-date information and practical examples through numerous case studies on many topics including: rehabilitation methods, company strategies, as well as monitoring and financial strategies to reduce water losses and management of customer relations.

Exchange of lessons from Arab countries on water cost recovery[52]

At present, the Alexandria Water Company (AWCO) is recovering its costs and is generating profit. AWCO's strategic plan till 2037 was prepared based on systematic thinking and scientific analysis methods. A population projection study of Alexandria was prepared and according to this study the future water demand was determined, a technical study of the

[52] Extracted from the proceedings of the Arab Water Week held in Amman Jordan from 5-9 December 2010.

water plants and networks current situation was performed, and accordingly a strategic plan of the necessary projects needed in the future was drafted and included all the economic and financial aspects. Within the strategic plan, the main factors that were considered in tariff setting were:

a. Preparing an overall business plan.
b. Increasing the efficiency and effectiveness of the working environment and reducing costs to the minimum.
c. Categorising the water fees in accordance with the social standards of customers.
d. Enhancing the water fees collection efficiency with an aim to increase it by 10% every 5 years.
e. Reducing both physical and administrative water losses by enhancing network management.

Since 1974, the National Water Supply Authority in Tunis (SONEDE) has been using an increasing block rate structure for charging water consumption. Currently, the modified structure includes five blocks, with a volume of 20 m^3 per quarter in the first block. Separate schedules are applied for standposts and tourism consumption. Through its new pricing policy, SONEDE aims to:

a. Enable the low-income socio-economic segment of the population, located in rural areas and in peripheral urban zones, to have access to drinking water at low cost.
b. Ensure that the water sector is more viable by covering operating and financing costs and partially the set-up costs.
c. Provide a pricing policy that orientates consumers' decisions while seeking an optimum utilisation of water.
d. Ensure that the pricing system is easily understood and accepted by water consumers.

Since introducing the modified pricing structure, SONEDE, through the new tariff system, has been able to cover all the running costs, including depreciation, and increase the capacity of self-financing by around 40%.

In Palestine each local community is responsible for supplying water for the community, each applying a different tariff and not achieving cost recovery. To remedy the existing situation the Palestinian Water Authority prepared a tariff policy guideline. This policy guideline puts the basis and standards upon which tariff and prices are based. It explains and illustrates the procedures and steps for applying the Tariff Regulation. These standards must equally apply to all municipalities, utilities and other water providers. Although the standards have been unified for all service providers, the water prices may be different from place to place or from provider to another, because of the cost to access the different water sources. The Tariff Regulation must fulfil many of the main objectives of water policy. The tariff structure and prices set shall ensure cost recovery for the individual utilities whereby revenues are expected to exceed costs. The water utilities shall increase revenue collection in the following stages until full cost recovery is achieved.

In Yemen, the assessment of the general performance of Local Corporation for Water and Sanitation (LC) in IBB – Yemen took place in May 2007. It showed that the LC was working under difficult technical, administrative and financial conditions. Main recommendations of

this assessment included the need for tariff adjustment according to inflation and electricity prices in coordination with Local Administration; restructuring the customer / management relation to improve process efficiency; starting of GIS based digital customer management systems; introducing GIS in meter reading and quality management for readings; application of DCMMS (Dorsch Consult Maintenance Management System) to improve networks maintenance; and the need for analysis of repair data to prioritise investments. The application of these recommendations resulted in recovery of O&M costs in 2009 and is expected to recover depreciation costs by the end of 2010. In addition to being rewarded the "best public service in 2009", the decrease in total cost of maintenance and the additional services being provided to customers have generated additional income to the LC.

Reform of the urban water supply and sanitation sector in Yemen

Issue: Cities
Location: Yemen, Western Asia

Abstract

This paper summarises the experience of on-going reform in the urban water supply and sanitation (UWSS) sector in Yemen. The reform is supported financially and technically by several international players including the GIZ, World Bank, the Embassy of the Kingdom of the Netherlands (EKN). The reform has dramatically reshaped the UWSS sector shifting power away from a central authority to local agencies. Better customer services, more financial stability, and better protection of the least advantaged groups are some of the most positive outcomes of the reform initiative.

Challenges and objectives

Being one of the least water endowed countries with a high population growth, Yemen is facing a serious water scarcity problem that threatens its socio-economic development. Prior to recent reforms, poor financial performance and inadequate services characterised the Urban Water Supply and Sanitation (UWSS) sector in Yemen chiefly attributable to centralisation of these services in one national agency, the National Water and Sanitation Authority (NWSA). Badly kept infrastructure, weak technical capacity and very high unaccounted-for-water (UFW) rates have adversely impacted the quality of NWSA services and its financial viability. To address these problems, in the early 1990s, the Yemeni Government with financial and technical support from several donors including the GIZ, World Bank, and the Embassy of the Kingdom of the Netherlands (EKN) embarked on a long-term plan to reform the UWSS sector by decentralising services at the governorate level. The main goal of the reform programme is to restructure the UWSS sector to a system composed of several local corporations (LCs) each managed autonomously and independent of the NWSA to serve a specific governorate in Yemen. The reform process was facilitated by an overall national policy for reform and decentralisation.

The framework of the reform process was set in place in 1996 by a Policy and Strategy Study (PSS) authorised by the government and funded by the World Bank[53]. The study highlighted several objectives to be achieved by the reform process including: creating an independent regulatory body separate from the executive, financial sustainability, decentralisation, commercialisation, human resources development, stakeholder participation, and private sector participation. The recommendations of the study were adopted by the National Cabinet in 1997 which passed a resolution (#237) setting the legal framework for the reform of the UWSS sector. The resolution specially set several targets – that parallel PSS recommendations – including increasing UWSS coverage, achieving financial sustainability, separation of the regulatory body from the executive one, decentralisation, capacity development, and community participation.

[53] John Kalbermatten and Associates (1996). "Yemen Water Supply and Sanitation Sector Policy and Strategy Study." Washington, D.C, John Kalbermattern and Associates.

In parallel to this process, a new water and sewerage project was developed in the city of Rada'a where principles of cost-recovery based tariff setting, community participation, and high quality services were emphasised. Learning from the successful implementation of this project the Yemeni government and donors, EKN, the World Bank and GIZ, developed through extensive discussions and consultation, the "Rada'a Principles" to guide the UWSS reform programme. The Rada'a Principles (see Table 1) are essentially a design blueprint of a model autonomous local utility. They emphasise independence from the central agency, separation of regulations and operation, setting local cost-recovery tariffs, and independent auditing.

Table 2. Rada'a Principles

• The Branch will operate independently of NWSA Head Office while remaining accountable to NWSA on regulatory matters and to the Minister of Electricity and Water on policy issues.
• The Branch will be accountable to the community it serves through a Local Advisory Committee which will monitor and review the Branch's activities.
• The Branch will set its own local cost-recovery tariff, apply this upon approval by the Minister, operate its own billing system and retain revenues in its own bank accounts separate from any NWSA authority, while paying an overhead contribution to NWSA Head Office for regulatory/technical services.
• The Branch will appoint its own staff, except for the three main management posts which will be via Ministerial resolution on agreed criteria.
• The Branch will apply a staff incentive scheme based on actual performance to supplement staff remuneration according to civil service standards.
• The Branch will prepare monthly operational reports and quarterly and annual statements of account for NWSA Head Office and the Minister of Electricity and Water.
• The Branch will have its accounts audited by a private auditor appointed by the Central Audit Board while retaining the right of NWSA also to audit the Branch accounts as necessary.

The Technical Secretariat (TS), funded by GIZ,[54] was formed in 1995 to oversee and guide the implementation of the reform programme. The TS articulated the findings of the Policy and Strategy Study into a reform agenda that was adopted in the Cabinet Resolution #237. The reform agenda contained an elaborate array of tasks to carry out the reform process including conducting awareness raising, supporting technical and institutional capacity development. The TS supported the public private partnership (PPP) process in Sana'a LC including contract preparation. The TS also provides technical and financial support for the Performance Indicator Information System (PIIS) which was developed to monitor and assess the performance of LCs. The TS is instrumental in supporting of developing national policy documents and studies. It particularly provided support in the development of the

[54] TS/GIZ refers to Technical Secretariat (TS)/Reform of the Institutional Framework in the Urban Water and Sanitation Sector and GIZ.

National Water Sector Strategy and Investment Programme (NWSSIP) (2005-2009) and carrying out joint annual reviews (JARs) of the NWSSIP for the years 2006, 2007 and 2008.

Implementation of the reform process

Three main activities were considered in implementing the reform process: support of the reform process, decentralisation and development of public private partnerships (PPPs).

Support of the reform process

To support the reform process several key activities were emphasised including technical and institutional development, stakeholder participation, community participation, information sharing, and customer relations. The process of technical and institutional development focused on policy analysis and diagnosis, implementation of the Cabinet Resolution #237, and monitoring and evaluation based on annual joint reviews.

Over 50 workshops were organised between 1996 and 2008 to engage a wide range of stakeholders. The workshops focused on education and building consensus. These workshops acted as a platform to involve local communities. These communities were also involved through the participation of local councils, civil societies, and others members of the communities in the boards of director and the advisory boards of the LCs. Public awareness campaigns and media releases were used routinely to disseminate information on the reform programme.

A great emphasis was placed on customer relations. Dedicated departments were developed in LCs to handle customers inquires and complaints. Community mobilising workers (CMWs) were trained to reach out to the public through awareness activities. Women played a key role as part of the CMWs. In certain areas, such as Sana's and Aden, the LCs have offices that in addition to handling bill payments, respond to customer's complaints and minor technical problems.

Decentralisation

Utilities were supported to achieve independence and maintain financial sustainability. Although LCs were initially required to recover at minimum their operation and maintenance cost (O&M), this requirement was relaxed given that these utilities achieve O&M cost recovery at a later stage[55].

Support for decentralisation was in the form of providing technical and financial assistance to carry out several interventions including for example setting supervisory boards, assessment of investment needs, setting up organisation structure, and developing capacity in modern management tools, accounting, human resources management, tariff analysis, asset management and setting up service agreements.

Public private partnership (PPP)

PPPs have not yet shown great promise in the reform programme. Sana'a LC attempted to establish a PPP. Despite some initial interest from the private sector during the pre-bidding process, no bids were made to undertake a lease offer for 8-10 years. Several reasons were

[55] It is reported that these decisions are primarily in response to local demand and under the pressure of political interventions.

cited for the lack of interest from the private sector including the acute water scarcity conditions in Sana'a, the provision to maintain the current staff, high level of poverty, lack of information on affordability and socioeconomic conditions, and the lack of independent regulation. There was also resistance from the LC staff and board of directors to enter on a management PPP.

Another example of a PPP is the Utility Support Programme (USP) between Taiz Water and Sanitation Local Corporation (TWSLC), Vitens NV and Netherlands government. The USP was established to deal with very poor water utility services. However, after two years the TWSLC could not manage to recover its O&M costs. This poor performance was attributed to weak communications between TWSLC and Vitens, and the ambiguity of the implementation procedure.

Status of the reform programme

The status of UWSS reform programme can be assessed based on changes in the following conditions: sector governance structure, level of coverage, financial sustainability, regulation and human resources development.

Sector governance structure

The reform programme has dramatically reshaped the UWSS sector. By 2008, 95% of the urban populations were served by the decentralised UWSS utilities that include LCs, LC branches and autonomous UWSS utilities (AUWSSUs). These utilities are mostly running their own operation, making investment and staffing decisions. Although the overstaffing problem has been partially addressed through early retirement, this problem is still serious given the high poverty rates in the country and poor social security system.

Level of coverage

Table 2 shows the achieved and target level of coverage for water supply and sanitation. Although changes look modest, it is worth noting that Yemen has one of the highest population growth rates worldwide, with a national annual average of 3% and as high as 7-9% in the main urban centres.

Table 3. UWSS coverage rates

	2002	2007	2009 (target)
Water supply	47%	71%	56%
Sanitation	25%	52%	31%

Financial sustainability

Most LCs were able to achieve full recovery of operation and maintenance costs. Some were also able to recover the electro-mechanical depreciation. Full cost recovery is still not achieved mainly attributed to the substantial cost of capital investment and very low ability to pay due to widespread poverty.

Tariffs were restructured from six to three blocks. An affordable life line rate is charged on the first block or bracket of 5m^3 to 10m^3 to benefit the poor. The lifeline tariff assumes that the water and sanitation bill accounts for no more than 5% of the monthly household income of the poor and there are cross-subsidies from the higher block tariff. The average share of total monthly household expenditure on water is about 1.10%.

Regulation

It was recognised from the onset of the reform initiative that regulation is necessary to maintain adherence to high quality services and financial transparency. A regulation study was completed in 2006 and recommended establishment of a provisional interim unit reporting directly to the Minister of Water and Environment. The unit will support the development of a regulating unit.

Human resources development

The TS conducted a study to set up a human resources development programme, where 30 training modules for professional job categories were developed. 140 short training courses were implemented to enhance the technical capacity of the urban water supply and sanitation staff. It is estimated that the ratio of professionals has increased from 10.8% in 2005 to 12.9% in 2007. Staff with technical background increased from 18% to 24.6% during the same period.

Conclusion

With technical and financial support from international donors including the GIZ, World Bank, and the Embassy of the Kingdom of the Netherlands (EKN), the urban water supply and sanitation sector in Yemen has undergone a major reform since early 1990's where operational and financial management has shifted from the central National Water and Sanitation Authority (NWSA) to several independent local corporations. This has been accompanied with redesign of the tariff structure, the introduction of regulation and an emphasis on cost recovery principles.

The experience has been generally successful with most of the urban users being currently served by LCs. Customer services have also improved. Level of technical competence among staff has increased as a result of an intensive programme of human resources development led by the GIZ. However, although most LCs were able to a recover operational and maintenance costs and few recover electromechanical depreciation, none have achieved full cost recovery due to very high capital investment and high prevalence of poverty.

References

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Chapter 3

Thematic conference papers

This chapter includes the documents prepared for the conference by the session conveners and case study representatives. Each session of the conference includes an overview paper providing an introduction to the tool or the region, as well as two or more case study papers.

1. Economic instruments as tools for water management in the transition towards a green economy

Green growth means fostering economic growth and development while ensuring that natural assets continue to provide the resources and environmental services on which our well-being relies. To do this it must catalyze investment and innovation which will underpin sustained growth and give rise to new economic opportunities.

A return to "business as usual" would be unwise and ultimately unsustainable, involving risks that could impose human costs and constraints on economic growth and development. It could result in increased water scarcity, resource bottlenecks, air and water pollution, climate change and biodiversity loss which would be irreversible; thus the need for strategies to achieve greener growth.

OECD (2011a)

Water is an essential element in a progressive strategy of economic development. The lack of access to sufficient quantities of adequate quality water can significantly hinder growth and human development but improved water management can generate huge benefits for health, agriculture and industrial production providing an opportunity for economic growth, poor eradication and social fairness (OECD, 2011b).

But economic progress can only be sustained if population and welfare trends are decoupled from an increasing use of natural resources. The outlook for water security is not optimistic. The projections of current trends implies a 55% increase in water use between 2000 and 2050, with half of the world population living in river basins under severe water stress by 2050. Over the next 50-100 years, impacts of climate change are projected to lead to severe water shortages in semi-arid regions, and more frequent and severe floods and droughts worldwide. Moreover, water quality degradation is on the rise, resulting both from an increase in contaminants as well as from the degraded ability of water ecosystems to treat them.

Challenges and opportunities

Green development has the potential to address economic, social and environmental challenges and open up new sources of growth through the following channels:

- Promoting greater efficiency in the use of water, enabling an increase the production of goods and services without further detrimental impacts on water sources, and restoration of the water environment without harming the prospect of production and consumption.

- Promoting improvements in the allocation of increasingly scarce water resources to the most beneficial uses in the economy and also in the natural environment, enabling the

generation of welfare gains both from production and consumption of goods and services in the economy and from improved environmental services.

- Fostering knowledge advances and technical development to identify new ways of addressing environmental problems.
- Creation of new markets by stimulating demand for green technologies, goods, and services as well as creating new job opportunities.
- Boosting investor confidence through greater predictability and stability around how governments plan to address major environmental issues.
- Managing water scarcity by rebalancing the equilibrium between natural and human made capital. Preserving natural capital may, for example, be preferable than costly capital investments in desalination to cope with scarcity or in expensive water treatment plants to solve pollution problems.
- Preventing imbalances in natural systems which raise the risk of more profound, abrupt, highly damaging, and potentially irreversible, impacts – as has happened to some fish stocks and as could happen with uncertain water supplies.
- Matching green growth policies and poverty reduction strategies. These include, for example, providing people access to more efficient infrastructure (e.g. in water and transport), reducing health risks associated with environmental degradation, and introducing efficient technologies that can reduce costs and increase productivity, while easing environmental pressure. Given the centrality of natural assets in low-income countries, green growth policies can reduce vulnerability to environmental risks and increase the livelihood security of the poor.

Green growth strategies need to address the following challenges:

- Water is under-priced or not priced at all. In the best of the cases water prices are lower than those required to maintain the financial cost of providing the services and do not cover the capital costs associated with building the water providing facilities or its maintenance and replacement in the long run. Water prices are then far from reflecting the real opportunity cost of provisioning in terms of giving the same water to other alternative and eventually more productive uses (the resource cost) and the degradation of natural capital (or the environmental cost).
- Path dependency and dominance of existing technologies and systems can make it very difficult for some new technologies to compete, establish a place in the market and scale up, which is why temporary support may be needed in certain cases. Innovation support instruments must be carefully designed to foster the emergence and uptake of efficient technologies while minimising the risk of technology lock-in, lack of competition or crowding out of private investment.
- Misguided government policies, market constraints and distortions all lead to or arise from market failures, which mean there is often a gap between private returns from economic activity and the overall benefits that accrue to society. Green growth economic instruments aim to close that gap and raise returns to 'green' investment and innovation. They also aim to minimise the distributional consequences of change for the least

advantaged groups of society and manage any negative economic impacts on firms while retaining incentives for improved economic performance.

- Barriers to trade and investment can place a serious break on the development and diffusion of green technologies globally. Reducing these barriers while providing effective protection and enforcement of intellectual property rights (IPRs) are essential to encourage the development and diffusion of technologies and the facilitation of foreign direct investment and licensing.
- In developing economies there will be opportunities for leap-frogging to new forms of infrastructure development. Leveraging public and private financing – e.g. through public-private partnerships, a mixture of tariffs and taxes, facilitating investment by major institutional partners through reforming regulatory barriers and sound long-term policy signals, and development assistance – will be necessary given the large-scale investments required in most countries.

Ultimately, what matters for the success of a green growth strategy is a well-defined framework for action and a consistent set of economic and environmental policy criteria. A high degree of co-ordination among ministries and levels of government as well as stakeholders outside government will be required to identify a policy mix suitable to local conditions. In many cases, developing appropriate institutional capacity will be an essential condition for integrating green growth into core economic strategies and other government policies, and for ensuring a leading role for finance, economic and environment agencies.

Approaches

Economic Instruments (EIs) have an essential role to play in providing the proper incentives to guarantee that human decisions concerned with water are coherent and make a real contribution to green growth. As part of a green growth strategy, EIs are means to encourage greener behaviour by all water users, to mobilise investments in capital and technology towards greener activities and to provide adequate incentives and support to green innovation.

While national circumstances will differ, putting a price on pollution or on the over-exploitation of water sources – through mechanisms such as prices or tradable permit systems – should be a central element of the policy mix. For example, by reducing demand and rewarding good behaviour, pricing mechanisms help reduce the cost of achieving a given objective and provide incentives for further efficiency gains and innovation. In addition, increased use of environmental and water scarcity taxes can play a role in green fiscal reforms offering an attractive alternative to higher taxes on labour or capital income or deep cuts in public expenditure and public debt.

Not every situation lends itself to market instruments. In certain cases, well-designed regulation, active technology-support policies and voluntary approaches may be more appropriate or an important complement to market instruments. In addition, the responsiveness of businesses and consumers to price signals can, in many situations, be strengthened through information-based measures that highlight the consequences of environmental damage caused by specific activities and the availability of cleaner alternatives.

Barriers are also important and EIs can only be successful if accompanied by a provision of the institutional changes required and a strategy to overcome the many barriers that putting

a price to water might face. In other words, changing the payoffs in the economy is only part of the solution. Societies become dependent on institutions and technologies with which they are familiar. Social and economic inertia can be so strong that even quite large changes in pay-offs will not change behaviour. A strong capability to innovate is essential to establish the capacity for breakthroughs and new patterns of production and consumption.

An economic policy instrument for water management is, by definition, an incentive or a set of incentives designed to produce a desired change in individual (and co-operative) decisions in those activities in which water services are used in the economy. They are means to the collective ends of water management.

Water is a basic input in many production processes. It is also essential for human life and for the preservation of water-related ecosystems and the biophysical flows of services they provide. Not surprisingly the specific decisions that can be targeted by EIs in water policy are pervasive and cover a wide array of situations. Among the decisions and expected targets of EIs for sustainable water management, the following can be mentioned:

- **A quantifiable reduction in the quantity of water services demanded** by a defined set of users in some economic activities at certain particular places. This is, for example, the case of incentives to reduce water demand for irrigation, household consumption or manufacturing.

- **An increase in the efficiency with which these water services are produced.** This refers to EIs designed to abate the pressures on water bodies stemming from the need to satisfy a given demand of water provision services. These tend to include incentives to promote more effective irrigation systems, investment for improving water distribution networks or replacing assets, better water transport systems, use of recycled water in manufacturing processes, etc. Within the same category some other EIs can be found with the potential to reduce the negative impact of providing the economy with waste disposal and treatment services. They include, for example, incentives for investing in more efficient effluent treatment plants, reducing pollution loads, etc.

- **A substitution of water supply sources** in order to reduce pressures on water bodies associated with the provision of a given set of water services both to production and consumption activities. This is, for example, the case of incentives which promote the substitution of alternative resources (such as recycled or desalinated water) for freshwater or shift water supply from some traditional sources to others with lower negative impacts.

- **A reduction in the impact on the structure and functional activity of water (providing) ecosystems** produced by specific economic activities. This may be the case of incentives to promote agricultural practices that increase soil conservation, reduce deforestation, minimise floodplain occupation, etc.

- **A reduction in risk exposure to extreme events such as droughts and floods** as in the case of incentives to deter land settlements in hazard zones or to promote water stress-resistant crops in drought-prone areas.

There are many different alternative EIs that depending on the economic and institutional framework can be designed and implemented in the transition to a green economy. The

following table presents a general classification of the challenges presented above and the set of EIs that can be mobilised to help in its solution.

Table 1. Economic instruments for addressing green growth constraints

Green growth constraints	Policy options
Inadequate infrastructure	• Taxes • Tariffs • Transfers • Public-Private Partnerships
Low human and social capital and poor institutional quality	• Taxes • Subsidy reform/removal
Incomplete property rights, subsidies	• Review and reform or remove
Regulatory uncertainty	• Set targets • Create independent governance systems
Information externalities and split incentives	• Labelling • Voluntary approaches • Subsidies • Technology and performance standards
Environmental externalities	• Taxes • Tradable permits • Subsidies
Low returns on R&D	• R&D subsidies and tax incentives • Focus on general-purpose technologies
Network effects	• Strengthen competition in network industries • Subsidies or loan guarantees for new network projects
Barriers to competition	• Reform regulation • Reduce government monopoly

Source: OECD (2011) Tools for delivering green growth

Lessons from implementation

The challenge for any green growth strategy is making individual decisions coherent with the societal objectives of fostering growth, eradicating poverty and enhancing social justice while protecting water providing ecosystems. This suggests the use of incentives to promote the desired kinds of behaviour through market based mechanisms and pricing instruments. Nevertheless all EIs has advantages and disadvantages depending on the particular problem at hand, and the economic, social and institutional framework within which they are implemented.

For example, in general markets for water rights are less information demanding, more adaptable to changing circumstances and provide farmers with more stable income than water tariffs. But markets have also steep learning curves and potentially high start-up administrative and transaction costs. For this reason, water markets are more difficult to implement when compared with taxes that can be easily created within the existing institutional framework. But water prices, especially for irrigation water and for pollution loads require high monitoring and enforcement costs. Water tariffs and taxes have the potential to increase revenues to finance collective investments in protecting natural capital, fostering innovation or even the transition towards a fiscal green system, while water markets only affect revenues and expenses of those involved in water trading. The right choice of economic instrument is therefore highly context-dependent and will be determined through the water management decision-making process.

Green growth strategies will inevitably result in the call for subsidising green sectors and environmental activities. This is the case for investments in infrastructures to guarantee water security and to facilitate the reallocation of water resources across space and among different economic activities. Subsidies may be appropriate in some circumstances, for example when enforcement or alternative instruments are difficult, economies of scale or market size effects are high and when the subsidy programme can be designed in relatively simple way, for a limited period and with minimal side effects. Nevertheless, in contrast to prices and market based mechanisms, subsidies need to be considered only as transitional instruments in order to foster a desired change for example to substitute current water using techniques and speed up technology diffusion, to compensate potential losers in the job market, or to mobilise the amount of resources required by infrastructures when coordination, network and scale economies are important.

The ideal EI would be that which can effectively generate behaviour change towards more efficient water use, which is stringent enough to encourage innovation, is stable enough to give security to investors, is compatible with legal and institutional frameworks, is politically acceptable, and is implementable at a low monitoring and enforcement cost. Real examples are far from this ideal and the selection implies many tradeoffs that would need to be considered in the collective decision making process.

In choosing the economic incentive to be implemented in any case, attention must be given to the whole implementation process. Introducing EIs in the water management arena entails a long and adaptive social learning process. Starting small and scaling up is more advisable than implementing a fully fledged incentive system from the beginning. The same can be said with respect to overcoming the main barriers that impede the application of EIs. For example, small increases in water tariffs when accompanied by the use of extra revenues

to improve the quality and coverage of water services can contribute to a successful strategy for overcoming the still significant cultural and political barriers to pricing water.

The role of EIs needs to be understood in the context of water development. EIs play an important role in overcoming the barriers for building up the infrastructures for water development when there are significant economies of scale involved, coordination problems among water rich and water scarce regions or uncertainties about the long-term benefits of heavy capital investments. For example, in South Africa water storage, transport and distribution infrastructures are considered the main means to achieve water security and cope with the uneven distribution of water across the territory. Properly managed water infrastructures are expected to provide the flexibility required to allocate water to its most productive use and to adapt water supply and demand. New EIs to manage water demand and promote the reallocation of water use rights, including prices and markets, are being considered as part of a new water development strategy. Marginal pricing and full cost recovery are concepts which are easier to accept in countries where the main objectives of water development are water security and efficiency (as in Australia or Israel) rather than social justice, poverty reduction or supporting the transition of the economy (as happens in South Africa). The prospect for EIs needs to be understood in the context of the country's water development.

In Israel, a combination of increasing block tariffs, excess water use fines, production levies, tariffs to finance artificial recharge, subsidies for well rehabilitation, long term commitments for purchasing water produced by new sources and a close to full cost recovery water price system has proved to be a successful policy reform for addressing severe water scarcity and providing adaptive mechanisms for coping with drought. Water prices and their role can only be understood in the context of an IWRM system and in the context of the different role that water has played in economic development. In Israel, this has shifted from an initial stage where the dominant objective was food and water security to the present when environmental sustainability is a paramount concern.

Consistent policy actions can result in the successful implementation of different EIs making for example water trading the best alternative in some places (as in the Murray-Darling basin in Australia) and command and control and prices in others (as in the case of Israel). The framework conditions and the political process are more important than the instrument itself in explaining the success or failure of each case. This might also explain that why EIs may deliver benefits for the green economy even when their implementation fails. For example, in the case of the over-consumption tax in Israel (which ultimately failed), the initiative helped raise public awareness and discussion of water challenges which can assist in the search for better social responses.

The Murray-Darling basin in Australia illustrates that persistent government policy action to define property rights of water and to combine incentives, markets and regulations are a means to enhance water security, sustain economic progress and improve the environment. Water markets are but one important ingredient in the whole water management system. The success of EIs is also dependent on advances in political leadership, water governance and effective stakeholder involvement, all of which are important not only for convincing those who may benefit from water markets but also for managing potential conflicts. In this respect, good quality, transparent information may support social dialogue and the involvement of those who are threatened by the change process.

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Israel: water pricing and command and control for water demand management in cities and agriculture

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Type of tool: economic instruments, technology
Issue: cities, agriculture
Location: Israel, Western Asia

Challenges and drivers for green growth in the Israeli water sector

Green growth and water

We live in an era where it has been recognised that economic growth and development can be sustained only when we ensure that natural and environmental assets continue to provide resources and ecosystem services. Economic development and growth require investments and innovation, which in turn, open new economic opportunities. Technological innovation and the use of inputs (natural resources, human capital, capital etc.) enable production and contribute to economic growth. However, input scarcity may slow down economic growth unless technological progress can compensate for input scarcity. Such technologies may produce a substitute for the scarce input or enable a more efficient use of that input. For example, water scarcity constraint can be alleviated using technologies that produce desalinated water (sea water reverse osmosis technology), treat/recycle water (sewage treatment technologies) and use water efficiently (drip irrigation). When technological change occurs in such environments, it undoubtedly becomes a key to ensuring co-existence of economic growth and environmental improvements. This paper presents the Israeli case of promoting green growth: while dealing with water scarcity and environmentally-water-related threats, Israel also applies advanced administrative and economic tools and incentives that intend to rehabilitate natural resources and push forward innovative technologies.

Drivers of innovation in water and wastewater

Water scarcity and environmentally-water-related threats enforced Israeli policymakers to introduce advanced regulations, standards, administrative tools and economic incentives to the water sector in order to manage the sector efficiently. That, in turn, promoted the need for research and development of water and wastewater technologies – some of which financed by public funds and some by the private sector.

The unique experience of Israel can be attributed to several factors. Israel is a semi-arid area with an uneven distribution of its water resources and had already decided in its early days of its establishment to develop regions that were also remote from water sources. Blooming the desert was perhaps one of the initial driving forces for the Israeli economy and for which the water sector has responded with the building of the National Water Carrier from north to south. Border security settlements, food security and agricultural development put further pressure on water resources. The response was further development of physical infrastructure and efficient drip irrigation technologies. Increasing population growth and a large inflow of immigration have created an additional burden on the already overexploited and environmental degraded resources, thus requiring reallocation of renewable water from the agricultural sector to the urban sector for drinking purposes. The need to supply water from alternative sources to the agricultural sector has pushed forward innovation in sewage

treatment technologies that produced recycled water suitable for irrigation. Over the years, regulation and standards related to the quality of treated sewage have also contributed to advancing sewage treatment technologies.

Water scarcity also created markets for water saving technologies for domestic uses and for municipal uses. Economic incentives designed for reducing water demand in the urban and agricultural sectors based on increasing block tariffs resulted in the development of innovative water management devices such as water meters that are read remotely and more accurately (including measuring small drops so leakages would be fixed), pressure optimisers devices, computerised irrigation systems, etc. In recent years, increasing standards of living, consecutive years of droughts and peace agreement obligations have put further stress on water resources, pushing the economy to adapt to water production using sea-water reverse osmosis desalination technologies that were developed in Israel over the last few decades.

Contaminated drinking wells and aquifers are also a major factor in developing innovative purification/filters/membranes technologies. Economic incentives for rehabilitation of such water sources are today in place, pushing technology implementation but also innovation as investors are searching to minimise the operation cost of such activities. Finally, highly educated human capital supported by excellent universities and research centres have enabled the industry to use well-trained human power for developing innovative water and waste water technologies.

New challenges: restructuring national and municipal water organisations, rethinking production scales, realising financial sources

In recent years, the rationale motivating the water sector in Israel underwent major changes, embedding economic incentives and environmental and health considerations, striving to become more efficient and responsible for future generations and therefore enhancing innovation of water and wastewater technologies. The changes result from deficiencies in past management of the water sector. The changes indicate a very dynamic and advanced sector that deals with substantial risks and large climatic uncertainty by implementing new technologies of water production and water treatment and advanced supply and demand management tools.

Going big, meant restructuring the way the old Water Commission worked and turning it to a National Water and Sewage Authority with an inter-ministerial Water Authority Commission.

It necessitated dramatic political-structural-economic changes in the way Israel serves its urban customers which resulted in the establishment of 56 Municipal Water Corporations. It meant involving the private sector in PPP, including intervention of international companies and large foreign investments in state of the art desalination plants. It meant major changes in the way Israel realises the potential of waste water. Finally, it meant that water scarcity must be reflected in water prices. Prices increased substantially to reflect cost recovery leading the water sector to become eventually an independent, closed economy sector.

Policy towards water security

Dynamic policy: evolving issues

Policy towards water security has been very dynamic since the establishment of the state. It is irrelevant to report on one specific 'golden' policy that can be applied in a generic way elsewhere. Water policy is always relevant to location, time, culture, politics, social needs, etc.

Water policy has to be adjusted according to the stage of development of each State. Various needs and changing pressures raised different types of concern. Evolving issues, such as vast immigration in the 90's, water agreements with the HK of Jordan and the PA, water pollution, climatic impact, etc forced Israel to rethink its policy continuously. Water was and still is a major engine for economic growth for Israel. In order to secure water sources – natural, produced and treated – Israel has diverted vast financial resources over the years. In recent years, the financial burden has been shifted to consumers that pay higher water tariffs that reflect cost recovery. But tariffs also reflect cost of environmental and natural assets that have been deteriorated in recent years and require large investments for rehabilitation (polluted wells, aquifers and streams). Natural resources that provide ecosystem services such as lakes, streams, wetlands are also in increasing demand as GDP per capita has grown and leisure time increased. Sufficient level of water must be kept for nature in order to maintain and enhance various ecosystem services (biodiversity, recreation, drainage, flood control, aesthetic, property value, etc).

It is possible to indicate several issues that pushed forward the water economy in Israel. At first, survival and security were at the forefront of the agenda whereas today environmental considerations are an integral part of development. Chronologically, issues that have affected policies are as follows:

- **Water and food security** – development of water sources for agriculture, settling borders and developing remote areas. Today, after years of droughts, degraded water quality in aquifers, water is needed for existence and for keeping agreement with neighbours.

- **From an infant economy to advanced industry** – as a new emerging country with infant industry and much need for food security at the time, water was highly subsidised in order to allow for economic growth. Reliable supply along with sufficient quantities where the two major issues. Only in recent decades, as anthropogenic activities have affected water resources, water pollution has become a major issue and provision of clean water is demanded. With increasing demand for water and diminishing availability of natural resources on one side and with growing economic strength, ability to pay and innovative technologies on the other side, subsidies have declined and prices reflect cost recovery.

- **Social and ideological values** – Israel enabled non-urban way of living for various strategic, social and ideological reasons. Customers living in areas remote from water sources did not pay marginal cost and tariffs were highly subsidised. Obviously, such an approach is not consistent with economic theory where subsidies cause inefficiencies. Another important issue was equity. All end users pay same price regardless of distance

from water source. Again, water allocation is not based on the economic principle where water goes to the highest economic use.

- **Health** – today with higher pressure on water resources due to large, dense populations that reside along the coastal line and their activities cause pollution that effects water resources – the public may be subject to health risks. The standards of drinking water quality and the standards of waste water treatment (water is been reused for irrigation or diverted to stream) must be high and carefully monitored for health reasons. Health consideration effected water policy is Israel (e.g. standards, wells' protection zones, etc).

- **Environment** – two major issues are: open space and water treatment. The need to keep open space helps in advocating to maintain land use for agriculture. That in turn, kept the need for water allocation for farmers. The issues of water treatment can be divided to two main issues: (i) rehabilitation and treatment of polluted wells and aquifers; (ii) treatment of waste water – for reuse for irrigation and as a means to prevent pollution in streams where previously untreated waste water was discharged. Preventing stream pollution promotes enhancement of ecological assets and their services.

- **Tourism** – tourism is a source of economic growth. Provision of water supply must reliable and safe.

Supply and demand policies

While Israel during its years of establishment gave importance to water security, agriculture, and settlement along borders, it is clear that water policy was oriented towards the needs of the agricultural sector and those of remote areas beyond urban needs. Engineering and resource exploitation were major means to meet these needs. Through the years, Israel has developed its water management based on principles of supply and demand management.

The following summarises briefly the principles of the supply and demand management:

Supply management:

- Engineering and hydrological based – increase storage capacity, connect remote areas, develop water resources, divert saline water from fresh water sources

- Technologically based – water treatment: desalination of seawater and brackish water, waste water treatment to be reused for irrigation

- Environmentally based – allocate fresh water to the environment in order to maintain ecological assets and services, divert waste water to streams only after treatment, divert saline water, manage resource exploitation

- Efficiency and economically (cost) based – minimise water loss by repairing leakages, managing water pressure, etc.

Demand management:

- Education, awareness, water saving campaigns – encourage behavioural change

- Increasing block tariffs – incentives to consume less
- Fines – pay fines for consumption above allotted quotas (farmers and industry), pay over-use fee during drought period (residential, imposed for limited time)
- Aquifer production levies – pay for water production to reflect water scarcity rent

Financial policy

The water sector in Israel operates as a closed economy. It relies on water tariffs for its financial needs. Water tariffs reflect cost recovery and scarcity of resources. Government backs the sector with long-term commitments for purchasing water from desalinated plants in case water production in plants would not be required in heavy rainy seasons. Government also granted and backed the establishment of Municipal Water Corporations. It is likely that government budget would still be needed for unique projects where decision makers would prefer not to increase water tariffs in order to subsidise unique projects that may be unjustifiable economically but still legitimate at a national strategic level (e.g. expansion of water availability in remote areas such as Arava).

National policy for promoting the water industry, green jobs and export

Since 2005, the government has been promoting a national water technology programme. The goal was to take advantage of the concentration of water technologies in Israel, continue developing and exporting them. This represents true Green Growth in action. Not only do the technologies developed allow for more efficient management of the water (supply and demand) but they also produce many waste water treatment technologies and processes benefiting the environment directly. Also, material, methodologies and technologies for treating polluted wells are been developed, increasing efforts to keep natural water resources clean and available for use. Green jobs have been created in the water industry and green export has developed to about $2 billion in 2010. Connection with other non-water technologies such as the ICT sector has been promoted. Also, many non-technologically based solutions such as economic and statistical models have been developed (pressure management, statistical models for leakage detection, etc).

The program provides: grants for start-ups, infrastructure for water technology incubators, connection between academia and industry, academic site for experiments, beta site in the water sector, education, training, conferences, and international fairs.

Economic and administrative instruments for green growth

Several economic and administrative instruments are being used in Israel in order to achieve efficient management of water resources and of consumption. Among them are:

- Environmental taxes – aquifer levies for water production, sewage treatment fees (not part of the water tariff)
- Water quotas and increasing block tariff – for agricultural and domestic users (industry has quotas and flat tariff)
- Exchange of water rights (scarcity signal) – farmers could exchange fresh water rights for irrigation with recycled water and pay lower prices for actual use

- "Feed in tariff" – payment mechanism for artificial recharge in aquifer (storm water catchment, treated water)
- Government grants for well rehabilitation and water reclamation plants
- Government grants for eco-innovation – national water technology programme

Evaluation: economic, social and environmental benefits

To summarise briefly, among Israel's notable achievements are: the establishment (2005) of one of the world largest reverse osmosis sea-water desalination plant with a capacity of 120 million cubic meter per year (mcm/yr) along with additional plants (2007) with a capacity of 30 mcm/yr – both of which increased production capacity to a total of additional 45mcm/yr. The Government aims to augment sea-water desalination capacity to 750 mcm/yr by 2020.

Additional achievements are: structural changes related to the creation of the Governmental Water and Sewage Authority (GWSA), creation of 56 Municipal Water Corporations, treatment of sewage and recycling of treated effluents for agricultural purposes, thereby freeing up potable water for other uses, raising the quality standards of drinking water and of treated sewage, changes in the structure and the rates of water pricing in all sectors to reflect marginal cost in order to improve efficiency in use, an innovative residential water saving campaign which transfers the implementation risk to the private sector, and implementation of public-private projects through international bids for new infrastructures and technologies.

Finally, green growth has also enabled job creation and the involvement of the private sector:

- Job creation – water saving awareness campaign, distribution of water saving devices for the tap, upgrading WTP's, eco-innovation industry, traditional water industry jobs
- PPP including foreign investment – desalination plants

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Economic instruments in establishing water security in Australia's Murray Darling Basin

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Type of tool: economic instruments
Issue: agriculture, cities, watersheds
Location: Murray Darling Basin, Australia

Challenges and objectives

The OECD green growth strategy argues water security, defined as ensuring access to adequate quantities of water, of acceptable quality, for human consumption, productive and environmental uses, through effective application of demand and supply policies, can act as an engine for sustainable growth. This case study outlines the role of three economic instruments in this process in Australia's Murray Darling Basin (MDB).

Water is a valuable resource, critical – indeed essential – to economic development. Australia's challenge, one shared by many countries around the world, has been to put in place framework conditions such that water can contribute to economic growth more fully than has been the case in the past, in the context of sustaining environmental outcomes.

Australia's approach to water policy in the MDB in particular is to recognise that water use, be it for human consumption, production or to provide ecosystem services, is a valuable and scarce input that needs to be priced properly and managed actively to be used effectively. In a global context, Australia accounts for only a very small proportion of the world's water resources. And if the FAO data of water availability per capita were used, one would think Australia is well endowed with water resources. And in a sense that is true, but the catch is that most of it is in the tropical north of the country, a long way from the bulk of the population and mid-latitude irrigated farming country. Only around 6% of runoff occurs in the MDB, which accounts for around 40% of Australia's agricultural production.

The key objective under Australia's broad blueprint for water management is a nationally compatible, market, regulatory and planning based system for managing surface and groundwater resources for rural and urban use that optimises economic, social and environmental outcomes. Sustainable water use needs to recognise the importance of the environment *per se*, and its role generating future economic output and services.

This case study examines three economic instruments that are being used to achieve this objective.

Approach one: water markets and water trading

The first instrument I will focus on is the use of water markets and specifically water trading. Water trading is a key feature of water management in the MDB, but not all water rights are traded.

In 2009-10, water markets in the MDB accounted for over 90 per cent of both the entitlement trade and the trade in seasonal allocations (or trade in actual water) nationally. Trading of entitlements in the MDB (around 1800 GL) was equivalent to around 10 per cent

of the stock of entitlements, while trade in allocation water (around 2300 GL) was equivalent to around 40 per cent of the water used in 2009-10. This compares with water entitlement trade of under 100 GL in 2003-04 and trade in allocation water of around 980 GL. The intensity of trading varies across the MDB, with much higher rates of trading in some trading zones than in others – it is most intense in what is known as the 'southern connected system'. Hydrologically, and therefore economically, the main market comprises what is called the southern connected system, and is made up of around half of the 23 river Basins. The overall trade in entitlements was valued at around AUD $2.6 billion, while the trade in allocation water was over $360 million (much lower than in 2008-09 because of the wetter season and greater availability of water in storages (NWC, 2011; MDBA, 2011a,).

Both the markets for allocation water and for water entitlements have grown substantially in recent years, as shown in Charts 1 and 2 below for the southern MDB (Source: NWC, 2011).

Chart 1: Volumes of allocation water traded in the southern MDB

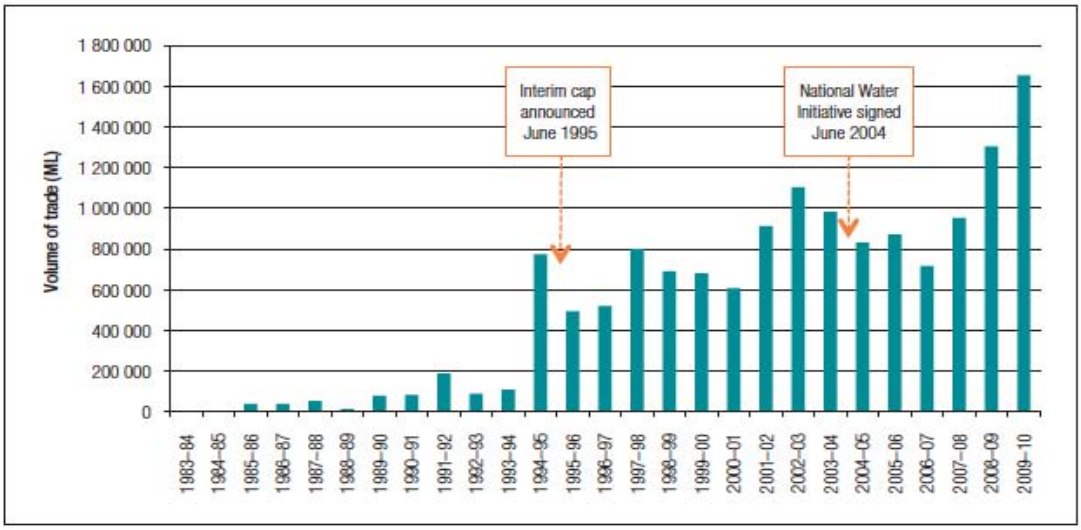
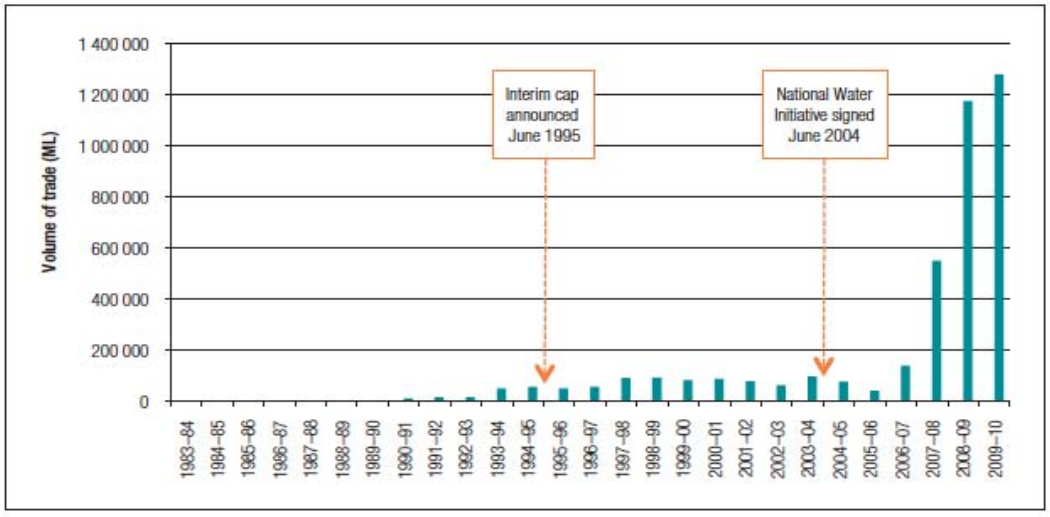


Chart 2: Volume of Entitlements traded in the southern MDB



There are a number of reasons for this growth:

- In the allocation water market, changes to rules on carryover – allowing more to be carried over from one year to the next – provided an incentive to purchase forward to reduce risks around water availability in the following year. Transaction costs also fell progressively. Necessity was probably an additional driver, reflecting the extended and deep drought, but only time will tell how much impact that had.

- In the case of the entitlement market, the Water Act 2007 – a piece of national legislation – gave the impetus to removing some of the key remaining constraints to trade by making separation of land and water a reality in key MDB states. This separation is not yet national: Western Australia, for example, lags behind the progress achieved within MDB notwithstanding commitments to the approach. There are some areas where markets will not make any sense (for example, the so called wild rivers in northern Australia, where use of water for agriculture, industry or communities is a tiny proportion of available water).

Water markets that allow efficient water trading of both water entitlements (the right to use a certain share of available water) and water allocations (the actual water that each year accrues or is allocated to an entitlement, and can be used by the entitlement owner – be they irrigator, urban commercial business or environmental water manager) have made a demonstrably positive impact on economic growth. A 2010 study of water trading in the southern MDB indicated that it increased economic activity by some $370 million in 2008-09, and that economic activity increased in each of the three states where the trading occurred. This study suggests that all major industries – dairying, rice and horticulture – benefited from water trading (NWC, 2011). Previous studies over the past decade all agree on the basic conclusion, that water trading in properly developed markets boosts economic activity and growth.

Of course such markets just do not appear out of nowhere. They reflect the legal and social history of the country or river basin in question. Water markets in the MDB are based on:

- Secure, well-defined property rights for water access entitlements that in essence are just like other real property, i.e. they are transparent, can be mortgaged, and are tradable. This is important for all users – be they farmers, commercial interests or environmental water managers managing water for the environment. These entitlements are fully separated from land, and generally provide access to a share of the consumptive pool each year (that is, the relevant authorities announce allocations as the water year progresses, which are a percentage of a nominal quantity).

- Policy actions that have largely eliminated barriers that impede market activity – in Australia's MDB the market framework reflects a key role played by the 2007 Water Act and by virtue of that legislation, a key role by the competition regulator, and introduction of market and charge rules that address issues which had hitherto stymied market growth. Some barriers to trade (such as the Victorian application of the 4 per cent rule) do remain but the worst of these should be eradicated over the next few years. Transparent access to trading information across the MDB is still work in progress, through the development of a national water market system

(Australian Government, 2011a; Bureau of Meteorology, 2011a; Bureau of Meteorology, 2011b; ACCC, 2010).

Well-developed markets allow market participants to actively manage their water assets and inputs into production, in the same way as they manage other assets and inputs into production. Prices formed in transparent allocation markets will reflect short term scarcity of actual water, while prices for water access entitlements will reflect market views on reliability of products and the relative demand for those products over the foreseeable future.

For example:

- If it is more profitable to sell the water and not grow a crop, potentially keeping other crops such as perennials alive, that can occur.
- If it is more efficient to sell the allocation water and buy fodder to feed dairy cows, rather than growing the fodder on-farm with irrigation, that can occur (water can thus be substituted in some cases).
- Water assets with different reliability characteristics can be put together in a portfolio that can reduce risk, compared with the original product held by the farmer.
- Water assets can become an explicit part of active balance sheet management.

These sorts of actions allow available water to shift to areas of highest return and it enables risk to be reduced. As water in all forms becomes priced in the market it comes to reflect scarcity, thus encouraging water saving innovation.

Markets can be a key tool in sustaining ecosystem services, and provide a transparent way to cost (as distinct from valuing) ecosystem services. They provide a tool that can be used by environmental water managers to make decisions on use of their water portfolio.

One of the biggest developments in recent years has been the setting up of a national Environmental Water Holder, where water entitlements can be held and water accruing to those entitlements used to generate a healthy environment, from a national rather than a state based perspective (which from time to time may be different), adding significantly to the security of water available to the environment.

One of the next steps in water market development is to examine the benefits of setting up a market for capacity sharing of delivery rights. This reflects congestion for delivery of water in peak growing seasons; a market for water delivery will assist in extracting further value out of this scarce resource.

Water trading and the environment

While a cap on overall use was put in place in 1996 ostensibly to halt further deterioration in the environment and ecosystem functions, little action was taken on restoring a sustainable balance between the needs of the environment and other users in the MDB until 2004 when '*The Living Murray*' programme was introduced. It sought to purchase (largely through investments in works and measures) 500 GL of water entitlements for the environment

(MDBA, 2010). Significant results have been achieved, but it was more expensive than direct purchase would have been, and the benefits harder to verify until after the fact.

Economic concepts can also be used to underscore the potential benefits from water trading between irrigators and the environment. 'To achieve maximum social gain, the distribution of water between the environment and irrigators should be set so that the marginal value of water for the environment and marginal value of water to irrigation are equal (Horne, A et al, 2010).

Water purchases by government can be directly from willing sellers. Indeed this is at the heart of a $3 billion water entitlement purchase programme commenced in 2008 by the national government, and over half has already been spent. Water can be purchased at market prices, meaning that existing entitlement holders who choose to sell can be appropriately compensated in a clear and transparent way, and ensures taxpayer funds can be properly accounted for. There has been no shortage of willing sellers. Indeed, prices paid in tenders over the past year have declined, reflecting the state of the market in general (Department of Sustainability, Environment, Water, Population and Communities, 2011a). By purchasing entitlements with the same rights and obligations as irrigators, there can be no question that the environment is not paying its way, and the cost of restoring and maintaining the environment can be made more transparent.

This approach allows large adjustments in the balance of water available to the environment compared with other uses, as envisaged in the MDB Basin Plan processes, can be achieved at least cost and provides significant relative flexibility compared to infrastructure investments.

Environmental water managers can sell water back into the market in years that it is surplus to requirements, potentially generating revenue to purchase water in years when the manager's allocation is less than requirements.

By establishing the Commonwealth Environmental Water Holder (CEWH) as a statutory position in 2007, the national government can ensure Basin-wide environmental interests are looked after, and ensure that water actually gets used as promised. Transparency is at the centre of these arrangements, and the CEWH is required to provide an annual report setting out activity and performance. To repeat the point made above, with water a scarce commodity, with competing uses, it provides governments and society transparent access to the cost of providing ecosystem services. 'Planned' or rules based environmental water, or water set aside for the environment after diversions for agriculture, hitherto has been far from transparently managed, although there is no intrinsic reason why this should be so.

Approach two: government subsidies

The second instrument I will focus on is the use of government subsidies to increase the efficiency of water use, and to promote water security. Programmes with strong public good components may well justify government subsidies.

Three such programmes, which have been progressively implemented over the past 4 years, cover:

- funding of better water information through the Bureau of Meteorology (BOM);

- funding of cutting edge research (CSIRO water availability studies and the Water Information Research and Development Alliance between CSIRO and the BOM); and
- increasing consistency, timeliness and transparency of market information, (including through the National Water Market programme being developed by the Commonwealth and the Australian states and territories).

These programmes are gradually increasing the transparency and availability of market information, enabling better decision-making and risk management, hence enhancing water security.

Governments have also sought to increase the efficiency of the irrigation sector through a suite of programmes that offer varying incentives to change. One such programme rolled out by the national government has supported the funding of irrigation modernisation planning, aimed at getting irrigators to assess the viability of their districts out into the future, in a climate change environment. Questions that have needed answering include: Is it worth upgrading capital investments in the irrigation district? Should particular channels be closed? Irrigators can make decisions against a market background for their water assets.

Some irrigation modernisation studies came to the conclusion that significant parts of existing irrigation networks (in some cases 30 per cent) had no future, and should be closed. A $650 million open tender based government investment programme in NSW is to provide incentives to achieve this and to fund other proposals to improve efficiency in the Macquarie River valley (Department of Sustainability, Environment, Water, Population and Communities (2011). Results thus far are apparently encouraging – with tracts of irrigation channels in Trangie, Tenandra and Marthaguy in NSW being rationalised, and water recovered for environment (held by the Commonwealth Environmental Water Holder) at what appears to be relatively low cost multiples – the cost above the market price for water is the price for securing significant on the ground regional reform.

The case for investments of this sort (other programmes are also operating) rests on their impact on building strong community support for genuine, lasting change. It must be based on cost effectiveness, and net value to the community at large. Many projects to do not pass the test, and governments need to be very clear about expectations. Sometimes that is not the case.

State priority projects

The national government has sought proposals from state governments that might merit national government funding, flowing out of a MDB institutional reform package in 2008. Over AUD $3 billion was originally earmarked for these projects (Australian Government, 2011b). Project proponents were required to develop assessable business cases and much effort was put into testing the viability of projects.

From publicly available information, many projects that were raised by state governments and irrigators alike do not appear to meet the viability test, and there is a persistent (and persisting) attitude at a state level that these funds should simply be handed over without a stringent testing process and without guarantees that lasting reforms would be realised. The original proposed $1 billion investment in Northern Victoria Irrigation Renewal Project (NVIRP) was committed before any serious investigation had been undertaken, and at best only offered modest returns of environmental water at very expensive multiples. In a sense it

was a political commitment of funding to ensure passage of an overall reform programme. Expenditure of this type is fraught with danger, as it encourages rent seeking and decision-making that is not focused on generating long-term sustainability and net benefits to the society. (Following an extended period of negotiation, a contract was signed in October 2011 for a commitment of $953 million for NVIRP stage 2, for a water return to the Commonwealth of 102GL. Separately, a second 102 GL of water savings will be purchased at an additional cost of $219 million.)

There are examples of very good infrastructure projects where government assistance has the potential to produce significant overall public benefits. For example, the NSW government proposed to require all irrigators to upgrade meters to a given standard. The final detailed business case and pilot work indicated substantial benefits from the project, particularly ensuring that irrigators extracted only their allocated water (NSW Office of Water, 2011). Making whole systems subject to consistent metering increases transparency and confidence of all parties in the value of entitlements and access to water.

Equally, there are many projects that have been proposed that do not meet a basic cost benefit test. Making sound investment decisions is critical: governments need to be prepared to invest only in projects that make sound economic sense, rather than make funding available on a 'my share' basis. As a ground rule, investing in infrastructure network projects, or other investments need to have a clear rationale, and a clear understanding of benefits and costs. It will be critical to invest in areas that deliver results rather than provide funding to 'wish list' projects of dubious quality. Water savings are likely to be second best compared with market purchases, as their source will often be determined by the location of the project, not environmental need. Interest groups and the states will continue to make claims for 'their' share of these reforms. This will not always coincide with optimising national outcomes for the MDB as a whole.

Overall (and at the risk of repetition), injection of government funding into water infrastructure, particularly if it can cost effectively result in additional water for the environment as a part of a rebalancing programme, can accelerate the pace of reform, and ensure the support of key sectors. However, poor investments in large projects can lock inefficiencies into the asset network for long periods. These assets will need to be maintained over time, and often this cost burden is shifted back onto the agricultural sector. Insufficient attention being paid to benefit cost analysis can result in poor public investment of scarce resources, and governments and communities not achieving the level of water security and sustainability that was originally sought.

Approach three: legislation and regulations

The third set of economic instruments I focus on cover legislation and regulations.

The 2004 National Water Initiative – an intergovernmental agreement that the Commonwealth and state governments have agreed to pursue – remains the central framework document for water management in Australia. However, in parts it has been strengthened by national legislation, which includes a new institution (the Murray Darling Basin Authority (MDBA)) and additional roles to two existing independent institutions, the BOM and the Australian Competition and Consumer Commission (ACCC).

Getting the MDB back onto a sustainable footing and keeping it there is at the heart of the *Water Act 2007,* which seeks to accelerate the pace of reform. It has been bolstered by a 2008 intergovernmental agreement between MDB states and territory. The *Water Act* seeks to facilitate achieving the objectives of the national water initiative, inter alia, by providing for water planning at a basin level in the MDB, to be undertaken by an independent, expert-based body with a whole-of-Basin focus.

- The activities of the former Murray Darling Basin Commission (MDBC) are now undertaken by the Murray Darling Basin Authority (MDBA) on the basis of a corporate plan, not via the convoluted decision making of the past. This provides the states and the Commonwealth with an initial decision-making role, but then allows the MDBA to get on with implementation.

- The MDBA is also responsible for preparing the Basin Plan. This basin-wide planning document will for the first time set enforceable sustainable diversion limits for every catchment and aquifer in the Basin. The Basin Plan will also include an Environmental Watering Plan, designed to put the environment back on a sustainable footing.

There are two steps in arriving at sustainable diversion limits. First, there is a need to ascertain what the current sustainable diversion limit is and then, second, to understand how future climate might affect this limit. These limits are to be based on 'best available science'. The legislation requires that the MDBA manage the resource at a basin level, 'optimising environmental, economic and social outcomes'.

These sustainable diversion limits have yet to be determined, but from the work done thus far it is clear that the major step in the short to medium term is to get the MDB back onto a sustainable footing, on the basis of the climate we already have. That is a large step in its own right in some catchments, likely involving reductions in water use by industry and agriculture of at least one quarter. The CSIRO water availability studies that have been undertaken have underscored the need for an adaptive management framework in water planning to adjust the rights of all users (irrigators and farmers, urban users and the environment) in a transparent way. Models need to be open, transparent and verifiable, entitlement frameworks clearly defined and the market well functioning important to make best use of the resource in the Australian context.

(The MDBA is currently undertaking extensive consultation with governments, research agencies and affected communities as they go about preparing the proposed Basin Plan. The process has been delayed several times, and is now well over a year behind the original schedule. The latest advice is that proposed plan will be released in late 2011 for comment before being 'made' by the responsible Minister sometime in 2012.)

A key factor underpinning recent growth in entitlement trade in the MDB was the strengthened role of the national competition regulator, the ACCC under the *Water Act 2007*. The ACCC was given the responsibility to develop new water market, charge and trading rules that would reduce or eliminate all major remaining impediments to trade.

- The market rules on transformation and termination fees now allow irrigators to transform their water right into a title that can be freely traded, without needing the approval of an irrigation infrastructure operator, and ensure termination fees do not

create barriers to trade. This overcomes perceived problems relating to stranded assets and control of water assets by other than the ultimate owner even after separation from land (Australian Government, 2009).

- Charge rules relate to fees levied by infrastructure operators for water storage and delivery services and state agencies for the provision of water planning and management services. The rules put in place now prevent these charges from being levied to hinder trade, including interstate trade, and making rules that might favour certain types of users. (ACCC, 2011).

- The new trading rules, yet to be determined (and which will be the responsibility of the MDBA), will address remaining artificial trade barriers. (ACCC, 2010).

The new role given to the BOM also deserves mention. The enhanced emphasis on transparent and reliable water information (in part illustrated by the development of a national water account (BOM, 2011b) will assist market participants address heightened risk and uncertainty. Research being conducted with the CSIRO, to develop new research tools to address user needs over coming decades will facilitate adaptation to climate change and promotion of green growth (BOM, 2011a).

All of the above (and other additional elements that will further contribute to strengthening the water management framework, such as increased compliance to reduce water theft) will need to be implemented in conjunction and cooperatively with state and territory governments. But there is little doubt that the higher national profile federal legislative provides should assist in better using the nation's scarce water resources to achieve green growth outcomes. Overall, the new legislation and regulations that flow from it are making a substantial contribution to a freer, more transparent market, and hence a positive contribution to efficiency and consequent economic growth and environmental sustainability.

Lessons learnt from implementation

Water reform is both iterative and adaptive. Australian experience suggests concerted, sustained action is required over long periods of time. Ongoing political commitment is required to 'finish the job'. This requires government, communities and business to work together. Finishing the task of putting in place the regulatory framework, completing development of information systems and above all 'making the Basin Plan', the overarching regulatory framework for managing the MDB, are all essential for strong effective water markets, for environmental sustainability and water security in coming decades, as climate change or increased climate variability heightens the risk of doing business. Further development of existing water markets will help to secure a sustainable future.

Each of the economic instruments discussed in this paper can contribute to a more effective use of water resources, and better, more sustainable economic and environmental outcomes. Used together the economic instruments can be mutually reinforcing. There is no inevitability about ongoing decline in environmental outcomes as economic growth proceeds. Indeed, looking after the environment will assist in sustaining long-term economic outcomes.

The Australian experience shows that there are substantial benefits for both economic and environmental outcomes from developing strong, transparent water markets, treating water transparently for what it is – a scarce resource. Having a price set for both water entitlements (the long run value for the water asset) and for water in the allocation market (the price reflecting scarcity in a particular year) will help society understand the nature of scarcity and the implicit value of the cost of tradeoffs between the environment and agriculture. Valuation of ecosystem services (an issue not discussed in this paper) is critical to making correct long-run tradeoffs, and is an issue Australia is only now starting to put in the necessary investments. Good information is necessary to undertake this task, and it is only in the past few years that adequate resources are being applied to this task. In many economies this is not the case. Without adequate information, it is almost impossible to make good policy of any sort.

All reform models need to be country specific, though the key elements of framework may well be the same. The Australian 'toolkit' follows closely the TEEB model, but the emphasis placed on each element will differ from country to country (see TEEB, 2009).

Key lessons from the Australian experience in the MDB are:

1. Moving from water management built around an engineering model to a framework with a market-based overlay takes time and persistence.

2. Significant benefits have accrued to rural and regional Australia from introduction of a market based approach, notwithstanding initial reticence. More flexible and adaptable systems have increased innovation and sustainability, and result in higher output in nearly all circumstances, but particularly in years of extreme water shortage.

3. Markets and prices alone will not solve everything and are not suited to all circumstances. A strong clear system of entitlements, and a transparent effective regulatory and compliance framework buttressed by sound, transparent information is important. A holistic (legislative) framework helps to achieve this outcome.

4. Australia's case illustrates how clear separation of land from water allows scarcity to express itself in the market.

5. Strong due diligence is necessary when governments consider subsidising investments to promote efficiencies in water use: it is critical to ensure all investments have a positive benefit cost ratio.

6. In a market based world, environmental managers can actively manage available 'environmental' water. It is important to achieve environmental objectives as efficiently as possible. Water markets allow (perhaps force) managers to think much more strategically about what is trying to be achieved. Used properly it can increase accountability and transparency of environmental objectives.

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Water development in South Africa

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Type of tool: economic instruments
Issue: cities, industry, watersheds
Location: South Africa

> *"The objective of managing the quantity, quality and reliability of the Nation's water resources is to achieve optimum, long-term, environmentally sustainable social and economic benefit for society from their use".*
>
> Principle 7 of the National Water Policy

Challenges and objectives

South Africa's water resources are, in global terms, scarce and extremely limited: average rainfall (450 mm per year) is well below the world average (of about 860 mm), evaporation is comparatively high, no truly large or navigable rivers exist, the combined runoff (of 49 billion cubic metres per year) is less than half of that of the Zambezi River, the closest large river to South Africa. In addition South Africa is also poorly endowed with groundwater and the natural availability of water across the country is highly uneven with more than 60% of the river flow arising from only 20% of the land. Four of South Africa's main rivers are shared with other countries, which together drain about 60% of the country's land area and contribute about 40% of its total surface runoff (river flow).

Most urban and industrial development took place in locations remote from large watercourses, dictated either by the occurrence of mineral riches or influenced by the political dispensation of the past. Some irrigation were also established during times that water was still relatively abundant and little incentive existed for seeking the most beneficial application thereof. As a result, in several river basins the requirements for water already far exceeds its natural availability, and widely-spread and often large-scale transfers of water across catchments have therefore, been implemented.

South Africa depends mainly on surface water resources for most of its urban, industrial and irrigation requirements. The use of water is dominated by irrigation, amounting to over 60% of the total water use in the country, the bulk of which is used consumptively. Water requirements for urban and domestic use account for nearly 30%, with the remainder being used for mining, bulk industries and as cooling water for power generation. Afforestation, which intercepts large quantities of water before it reaches the streams or rivers, is more dominant in the wetter parts of the country.

Water quality has deteriorated in the rivers or river reaches receiving large quantities of effluent. Some rivers with relatively high salinity (brackish) water occur in the dryer parts of the country. Major sources of pollution of surface waters are agricultural drainage and runoff, urban runoff and effluent return flows, industries, mining and rural settlements with insufficient sanitation services. The most important of these currently are insufficiently treated urban effluent and acid mine drainage. Pollution of groundwater mainly results from mining activities and human settlements. Water is also extensively re-used in South Africa, adding nearly 20% to the yield available from the surface water resources.

The water sector (and implicitly also water security) comprises a wide diversity of interests, physical components, authorities, stakeholders, inter-dependencies, externalities and other factors. The situation with respect to water security in South Africa is quite diverse, ranging from high levels of services and security in most of the large metropolitan areas, to severe and immediate risks in less developed and rural areas. The more important aspects with relation to economic growth and environmental sustainability are:

- The larger surface water systems that supply water to the main urban, industrial and mining centres are well managed at a high level of sophistication.[1] However, delays have been experienced with respect to the implementation of some large new water resource developments, which are partly attributable to a lack of sufficient institutional capacity.[2] These delays, if not contained, could have some negative impacts on the potential for economic growth.

- Water quality in many of the country's surface streams has been severely compromised by the inadequate treatment and control of effluent discharges and urban/agricultural runoff. This poses serious environmental, health and economic risks in many places. The situation is largely attributable to a lack of institutional capacity for the monitoring and enforcement of standards, as well an insufficient technical capacity for the operation and maintenance of treatment facilities.

- The general efficiency of water use still leaves much scope for improvements, especially with respect to irrigated agriculture and losses from municipal distribution systems. This results in more water being used than actually needed, with resulting increases in the risk of failure to supply.

- The abstraction of water for irrigation is poorly managed and controlled, largely as a result of insufficient institutional capacity. This has serious impacts on the ability to manage environmental flows and also negatively impacts on the overall efficiency of water resources management.

South Africa, because of its general aridity and high variability of rainfall in space and time, is especially vulnerable to changes in water availability. Indications from global circulation models (GCMs) are that greater variability in rainfall and climatic conditions may be expected. This includes the likelihood of an increase in the duration of dry spells in the interior and north eastern areas of the country, also more intense rainfall and the possibility of more frequent and severe flood events. The probable net effect would be greater variability in runoff and therefore of the usable portion of runoff, together with reduced recharge of groundwater. Specifically, there is growing consensus amongst the scientific community that rainfall over the south western part of the country can be expected to significantly decline and become highly variable over the coming decades.

South Africa has strong and enabling water legislation, well developed infrastructure, leading water resources technologies and management capability, and a sound track record. Given

[1] Many of the smaller surface water schemes and groundwater developments are poorly managed with resultant high risks of failure.

[2] The government tends to under spend available funds due to lack of institutional capacity.

the political commitment together with some strengthening of institutional and technical resources, it undoubtedly has the ability to ensure that sufficient water of appropriate quality will be available in future to sustain a strong and growing economy, high social standards and healthy ecosystems.

Response: improving the allocation of water resources

The National Water Act gives highest priority to water for the 'Reserve', which includes water for basic human needs and for the natural environment. Thereafter international obligations as agreed with neighbouring countries must be respected and honoured. Beyond this, water should be allocated by public authorities and by river basin to ensure that the greatest overall social and economic benefits are achieved. Consideration must not only be given to this primary aim, but also to potential disbenefits to society where water is made available to competing optional uses. This applies both to long-term allocations for water use as well as to short-term curtailments in supply during periods of drought and temporary shortage. Where surplus or unused water exists, prioritisation applies, provided that the water is not used wastefully.

The priorities are listed in the National Water Resource Strategy in descending order of importance, although the order may vary under particular circumstances:

1. Provision for the Reserve;
2. International agreements and obligations;
3. Water for social needs, such as poverty alleviation, primary domestic needs and uses that will contribute to maintaining a social stability and achieving greater racial and gender equity;
4. Water for uses that are strategically important to the national economy (such as power generation),
5. Water for general economic use, which includes commercial irrigation and forestry. In this category, allocation is best dictated by the economic efficiency of use. With the introduction of water trading, demand will automatically adjust over time to reflect the value of water in particular uses; and,
6. Uses of water not measureable in economic terms. This may include convenience uses and some private water uses for recreational purposes, which are likely to be of low priority.

Once these general principles have been established, the overall strategy to cope with water scarcity is to improve the overall efficiency with which water is allocated and used among the different places and activities. Water allocation can be improved between the different economic activities, the overall economic uses and the environment and, finally, between the different places in the territory including opening the displacement of agricultural production to neighbour countries. The potential gains of this strategy have been highlighted by various research projects assessing the value of water.

- Results confirm agriculture as both the main water user and the sector with a higher potential to save water for the environment and for other more productive uses. Nevertheless forward and backward linkages of agriculture as a supplier of raw materials and demanding of labour and inputs need to be properly accounted for.

- Sufficient provision was not made in the past for environmental water requirements and that in many cases water resources have been over allocated. Although the legal and institutional framework for addressing the situation is in place, it will remain a complex and extended process. The reservation of water for environmental purposes obviously reduces the potential availability of water for economic uses, with resultant socio-economic implications. Quantifying the environmental water requirements should therefore not be based on scientific assessment only, but needs to be augmented by assessments of the potential economic and social implications, and subjected to due public involvement.

- South Africa is well known for its extensive network of large scale schemes for the transfer of water from areas of surplus to areas of deficit; and to where the greatest benefits are to be achieved. Water resources over much of the country have been linked through inter-catchment transfers and are managed as large integrated systems, thereby reducing the potential risks of failure through the combined utilisation of resources and the balancing of climatic variability over large geographic areas (Basson and van Rooyen, 2001).

- A concept which could have far reaching mutual benefit for the southern African region, would be to move some of the water intensive and low water efficient production to countries with more favourable climate and soils. An order of 25 million hectares of high potential rain-fed cropping land could be available for this purpose (DWAF, 2010). In comparison, irrigated agriculture in South Africa covers the order of 1 million hectares. Such an initiative should fit well into the agenda of the Southern African Development Community (SADC) towards promoting greater trade and co-operation amongst these countries. It should also lead to the establishment/expansion of local agro-industries as well as other economic linkages, together with related infrastructure and other investments.

The National Water Resource Strategy requires that a range of possible solutions be investigated whenever there is a shortage of water or a need for additional water, taking account of the availability of surface and groundwater and the interactions between them, and the integration of water quantity and water quality issues. The main policy options to be considered include:

- Demand side measures to increase water availability and improve the efficiency of water use.

- Re-allocation of water, including the possibility of moving water from lower to higher benefit uses by trading water use authorisations.

- Supply side measures through the construction of new dams and related infrastructure, including inter-catchment transfers.

The significant impacts of all development options and other interventions need to be assessed. Social and environmental considerations need to be accorded the same attention as those of a technical, financial and economic nature; the aim being to ensure that the overall benefits arising from such actions will exceed the cost and that the benefits and costs will be

distributed equitably. Given the blend of tangible and intangible factors to be considered, public participation forms an important corner stone of the process to be followed.

There are two representative cases of how the growth in water requirements can be met in future:

- One is for an inland area around Johannesburg and the Gauteng Province, which is supplied with water from the Vaal River System, and represents more than half of the economic output of South Africa. For the Vaal River System, the target is to bring new interventions on line to meet the growth in water requirements after having first implemented water conservation and Water Demand Management (WC/WDM) measures. Evidence shows that further inter-catchment transfers still offer the lowest cost options for the augmentation of water resources serving the inland parts of South Africa (Note: The figures have been omitted). This does not imply however, that these would necessarily be the overall best options to be implemented. In particular, due consideration needs to be given to the possible re-allocation of water.

- A second case is the Cape Town area on the coast together with some surrounding developments. A totally different situation applies to the coastal Western Cape area (Note: The figures have been omitted). This area, being more remote from large rivers and not having the same benefits of scale of the Johannesburg/Gauteng area, is totally dependent on the development of modest inland resources (surface and ground water), the re-use of water and desalination of seawater. A rather pronounced drop in the availably of the water resources already developed is expected due to provisions for environmental water requirements (EWR), together with a provision for the possible impacts of climate change.[3]

Conclusions from both cases, together with similar findings for other parts of South Africa, are that water can be made available to meet the future needs in all the major urban and industrial centres in South Africa, although at steeply increasing costs in most cases. Comparisons of the unit reference values (URVs) to the economic value of water indicate that the unit cost of water from some new water resource developments will substantially exceed the economic value of some existing water uses; most notably irrigated agriculture.[4] The re-allocation of water could therefore offer a feasible alternative to some new resource developments and augmentation schemes. It is projected that water resources across the country will become even more inter-connected and inter-dependent in future (Note: The figures have been omitted).

What role for economic instruments?

Water is not freely tradable in South Africa; moreover water use licences or authorisations may be transferred on a temporary basis for one year in the case of water for irrigation, and permission may be granted for an extension of a further year. Permanent transfers may be

[3] Indications are that the Western Cape is likely to be the area in South Africa that may soonest and most severely be affected by climate change.

[4] Although the URVs and economic values are based on different financial and economic approaches and are not intended to be directly comparable, they at least provide a broad indication of the relative costs and economic values/benefits.

affected by one user offering to surrender all or part of an allocation to facilitate a licence application by another prospective user (DWAF, 2004). Transfers of this nature constitute trade in water use authorisations, and require new licence applications, which will be subject to all relevant requirements of the Act relating to applications for licences, including the need for a Reserve determination if one has not already been carried out. Permanent transfers become effective only when the new licence is granted. They may be authorised only by a responsible authority, which may attach different conditions to the new licence than were attached to the surrendered licence. One such condition may be that the new user must pay compensation to the original licence holder, which could be viewed as a form of market related trading. Both the temporary or permanent transfer of water use licences are only permissible when the original and transferred water use are from the same resource.

The price of water in South Africa largely remains an administered item. Prices are mostly seen as a partial cost recovery instrument rather than an incentive to encourage the more efficient use of water, water conservation or a shift from lower to higher value uses. Exceptions are the new stand-alone water resource developments for economic use, such as mining, where the full cost of water from such development is to be carried by the users.

The principle of striving to achieve the overall best utilisation of water which forms one of the corner stones of the National Water Resource Strategy for South Africa, should not be restricted to the geographic confines of the country, but should also be viewed in a regional and more broadly in a global context.

A number of major socio-economic constraints to the exploitation of this potential have been indentified, that would need to be addressed (DWAF, 2010). These include land tenure issues,[5] the high rural population spread presenting a challenge to commercialisation of agriculture, poor or lacking infrastructure and general services (e.g. training and research). As experience shows in other countries, measures would have to be taken to accompany structural adjustment of the South African agricultural sector. A proactive role of the respective governments is needed to bring such regional co-operation to fruition. It would inherently be a long-term initiative to allow time for the gradual introduction of the necessary social and economic adjustments to be made.

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Annex

Economic value of water

Various project related studies have been conducted in South Africa towards assessing the economic value of water. The main approach used was to determine sectoral water utilisation efficiencies by means of a "water multiplier' analysis, to obtain an indication of the relative importance of water in production by some of the water use sectors and sub-sectors of the economy (Basson *et al.*, 2010).

As a broad comparison, national multipliers were determined per million m^3 unit of water used, expressed as employment opportunities and Gross Domestic Product (GDP) supported. Distinction was made between high, mid and low level jobs, based on the skills levels required to produce the output (Table 1).

Table 1. Economic returns from water use, South Africa (per million m^3 water used)

Sector	High-level jobs	Mid-level jobs	Low-level jobs	GDP (ZAR million)[a]
Agriculture (general)[b]	10	30	210	13
Gold Mining	650	2 880	11 900	1 600
General manufacturing	6 800	27 000	28 000	6 700
Pulp and paper	25 000	79 000	81 000	23 000
Beverages	38 000	131 000	158 000	37 000
Glass products	233 000	716 000	836 000	250 000

a) Expressed in 2009 values
b) Least efficient (includes irrigation, rain-fed and livestock farming)
c) Most efficient
Source: Basson *et al.*, 2010

The results show agriculture as the most inefficient user of water. Gold mining and general manufacturing could serve as being representative of water use efficiencies in the mining and manufacturing sectors. It is important to note that the results are based on national statistics, and therefore reflect the average performance of the different sectors.

Wide variations around these averages are bound to occur, but they are unlikely to change the essence of the results, considering the very large difference between agriculture and the following sector in the ranking.

Similar outcomes were obtained with respect to a new water resource development in the Olifants River catchment (Table 2).

Table 2. Economic returns from water use, Olifants River catchment
(per million m³ water used)

Sector	Gross Value Added (GVA) (ZAR million)	Employment
Agriculture (irrigation)	20	200
Mining	370	3 300

Source: Basson *et al* (2010)

Similar results were obtained by comparing the utilisation efficiencies of water in different geographic areas. In this case the economic benefits of allocating the water to the Orange and Fish/Sundays River region, where the economic activity is dominated by irrigated agriculture, were compared with the benefits achievable by applying the same volumes of water to the diversified and industrialised economy of Gauteng, the central industrialised province. The results of the analysis indicated that allocating water for use in the industrialised areas rather than for irrigated agriculture, will, from an economic point of view, render the highest returns (Table 3).

Table 3. Economic returns from water use, Orange River and Gauteng areas
(per million m³ water used)

Factor	Irrigated Agriculture[a]	Diversified Industry[b]	Ratio[c]
Production (ZAR million)	2.1	510	1:240
Employment	24	1 940	1:80

a) Orange River area
b) Gauteng area
c) The ratio refers to diversified industry having 240 (or 80) times greater returns than irrigated agriculture.

Source: Basson *et al* (2010)

Inter catchment transfers

Based on the probalistic assessment of the likelihood and severity of drought in specific areas for example, water is transferred to areas that may be suffering from severe drought conditions, from areas where the prevailing conditions are less critical. A high level of sophistication has been reached in this regard, and substantial greater utility is thus obtained from South Africa's water resources than the sum of the component parts (Box 1).

Box 1. Gains from inter-catchment transfer

A prime example of the benefits of the systems approach for the management of inter-catchment transfers is offered by the Thukela-Vaal Transfer Scheme. In this case an average volume of 530 million m^3/a is transferred from the Thukela River Basin to the Vaal River Basin, at a transfer rate that may vary from zero to a maximum of 630 million m^3/a. By properly managing the storages and times of transfer, a resultant increase in yield in the Vaal River System of 736 million m^3/a is achieved, whilst the residual yield in the Thukela system is reduced by only 377 million m^3/a.

The total quantity of water physically transferred in South Africa from one catchment to another currently amounts to 3 500 million m^3/a. In comparison, the total surface water yield is approximately 110 000 million m^3/a.

Water curtailments during times of severe drought are also incrementally introduced based on probabilistic grounds, and selectively applied to different user groups and economic sectors, in order to minimise the economic and social impacts of such measures.

The same technical, environmental, social and economic considerations as are applicable to any other water resource development and use of water are applicable to inter-catchment transfers of water. Some specific considerations are:

- The allocation of water away from a catchment can only be justified if it results in an overall benefit from a national perspective.

- The inter-catchment transfer of water may have unique impacts on natural ecosystems that extend beyond those associated with in-catchment developments. Specific consideration needs to be given to the possible transfer of organisms/species and changes in habitat conditions. The potential risks and impacts with respect to the transfer of species are more pronounced with the transfer of water between river basins, than between catchments within the same river basin.

- The transfer of water for the express purpose of meeting environmental water requirements in the receiving catchment is not supported.

Given the relative scarcity of water in South Africa, most large scale water resource developments are inherently multipurpose schemes, which also facilitates the better utilisation of the benefits of scale. A recent example is the Olifants River Water Resource Development Project in the north-eastern part of the country.

The project is located in a valley adjacent to a very dry plateau where about 250 000 people live in scattered communities, with totally insufficient availability of water. To construct a single-purpose dam and water supply network for domestic purposes only, would have been exorbitantly expensive and unaffordable to the predominantly poor households on the plateau. By linking the domestic water supplies to some large scale water resource development for mining purposes, almost halved the unit cost of water from the scheme.

A further opportunity was then identified, with the visionary linking of a proposed 1 500 MW pumped storage hydro-electric scheme to the water resource development project, and using the pumped storage scheme to also lift water up the escarpment for domestic use.

The scheme, now under construction, will also serve to stabilise flow downstream for environmental purposes. Specific consideration was given to the potential impacts on the Kruger National Park, (South Africa's premier conservation area which is located further downstream) and also to how the yield from the Massinger Dam in Mozambique would be affected.

2. Green jobs policies and approaches for a fair and well managed transition

Carlos Carrion-Crespo, ILO

The notion of "green jobs" has become something of an emblem of a more sustainable economy and society, that aims to preserve the environment for both present and future generations and to be more equitable and inclusive of all people and all countries. Green jobs hold the promise that humankind will be able to face up to the following two defining challenges of the twenty-first century:

- *Averting dangerous and potentially unmanageable climate change and protecting the natural environment which supports life on earth*
- *Providing decent work and thus the prospect of well-being and dignity for all in the face of rapid population growth worldwide and the current exclusion of over a billion people from economic and social development.*

The above challenges are closely linked and cannot therefore be addressed separately. Green jobs are key to meeting both simultaneously.

Green Jobs Report (2008)

Annandale and Morrison-Saunders (2008) and UNEP (2008) have considered the following definition.

> *"A green job is one which makes minimum negative impacts on the environment relative to the status quo, thereby making enterprises and sectors more sustainable".*

Introduction

It is widely acknowledged that unsustainable use of resources, high levels of pollution and the deterioration of natural capital in general pose severe threats to today's economies and societies across national borders. They threaten the very basis of growth and development and endanger livelihood security for millions of people who are dependent on those resources or potentially affected by climate change. At the same time policy measures aimed at supporting a shift to more sustainable growth and development trajectories have far-reaching implications for employment and labour market dynamics in many countries and economic sectors.

There are four ways in which green economy measures may affect employment. First, they may result in the creation of new jobs, for example in manufacturing pollution-control devices and environmental consulting services. Second, they may result in the substitution of some types of jobs for other types, for example in renewable energy instead of fossil fuels. Third, they may result in the elimination of some jobs without direct replacement, such as when packaging materials are discouraged or banned and their production discontinued. Lastly, they may have an impact on the reorientation and re-skilling of existing jobs, such as in construction.

The International Labour Conference, the ILO's highest body, adopted the Global Jobs Pact in 2010. The Pact recommended "increasing investment in infrastructure, research and development, public services and 'green' production and services as important tools for creating jobs and stimulating sustained economic activity." The major policy challenge is to reconcile the gains of sustainable development with the claims for short-term answers to unemployment and poverty. The Global Jobs Pact seeks to **stimulate and support social dialogue to discuss and agree on pathways for "just transition**". This notion marries the economic, social and environmental dimensions of employment strategies towards a "green" economy.

Challenges

Workers and employers will be affected in different directions – positive and negative – by sustainable development policies. Policies to reduce unsustainable production patterns may contract employment and enterprises in some sectors, while policies to encourage technological change, are likely to expand employment opportunities.

In UNEP's Green Economy Report[6], a global model was developed which compared a green investment scenario (assuming investment sufficient for achieving the water MDG by 2015) to a business-as-usual scenario. Modelling revealed that overall employment and income is greater under the green investment scenario compared to the business-as-usual scenario. However, the number of people working in water-related employment is lower in the green economy scenario, as a result of the efficiency gains achieved in this sector. In this scenario, labour and other resources are freed for use in other sectors. Further, it is suggested that as water is used more efficiently more is available for industry and other sectors, therefore increasing employment in other areas.

Infrastructure and technological investments are a main means of restarting growth and creating jobs. Moreover, investment decisions taken today are going to determine global use of resources and emissions for tomorrow and a good number of years to come. Investments to stem or mitigate the causes of climate change and those needed for adapting to the impacts can be used for creating employment on a large scale. Examples include infrastructure works for sanitation, flood control, irrigation schemes to combat droughts, the improvement of water networks and fittings in buildings.

We must consider that not all water investments and technology changes promote sustainable development. For example, changes in technology can do so if the technology is accompanied with **new skills development programmes**. Neither is there a cut-and-dry distinction between green and non-green jobs; there are several shades of green, according to how they contribute to reduce harmful effects to the environment. For example, a job may contribute to the reduction of water loss but not to the sustainability of agricultural development. Or it may be green in many aspects, but be located in a conflict-ridden environment that will not lead to sustainable development of water resources.

The challenge is to show that efforts to **green the workplace** pay off in terms of **higher productivity and greater competitiveness**. In turn, investments and enterprise

[6] UNEP (2011) *Towards a Green Economy: Pathways to Sustainable Development and Poverty Alleviation.*

development for a greener economy induce the demand for new competencies and a **different kind of entrepreneurship skills**. The structural changes wrought by the transition to green technologies or improved use of water resources **modify the skills** needed in labour markets. New "green collar" occupations will emerge and new types of skills and **competences will need to be incorporated into existing occupational profiles**. **Developing new training curricula** and **launching green entrepreneurship promotion campaigns**, for example among youth, should be grounded on the needs for these new requirements in the labour markets.

The overarching policy challenge is **how best to coordinate employment and skills development policies with environmental and sector policies** for more sustainable development and green economies. **The time-lag** to do so constitutes a supply constraint that in turn, delays the action on sustainability.

Finally, the green economy concept **should very clearly include the social dimension: education, health, social protection, gender equity** and labour as the focus of policies and investments. Alternative adjustment measures should be assessed with the inclusion of the different social benefits accomplished. In terms of investments for the green economy, the needs of the most vulnerable should be considered.

Approaches for a fair and well managed transition

A fair and well-managed transition for workers and entrepreneurs through those rapid changes is required. Getting there requires, in turn, consultation and social dialogue, and active labour market policies, particularly relating to the needs of the most vulnerable. A critical component is governance at all levels.

Improving governance/institutional arrangements

The ILO's forthcoming *Manual: Guidance on Formulating Projects and Research Studies Concerning Labour Issues in Greening the Built Environment* suggests that the Greening Agency will need to explore the issue of institution-building in close collaboration with the local authority (or over a sub-region several local authorities) and relevant members organisations of the Greening Agency itself. **Effective institutional arrangements** should be brought into being in parallel with pilot projects that demonstrate the possibilities.

One recent example is the remunicipalisation of water supply in Paris, which will include a **citizen's water control board** that will enable users to evaluate water quality. Money previously used to pay dividends will be reinvested into the water services.

A similar scheme was implemented in Buenos Aires, Argentina, in which public management of water services was restored in 2001. Trade unions and government agreed to provide 10% worker participation in the government utility company. This partnership has led to **better productivity** and water provision.

Enhance Social Dialogue and collaboration

The importance of concerted efforts and joint actions to address such challenges is well recognised by governments, trade unions and employers organisations, and has been reiterated in several forums, including discussions during the ILO Working Party on the

Social Dimension of Globalisation in November 2007. As part of these efforts, the International Labour Organization, the United Nations Environment Programme, the International Trade Union Confederation and the International Organization of Employers came together in the Green Jobs initiative with the goal of promoting environmentally sustainable jobs in a climate-challenged world. The initiative seeks to **enhance dialogue and strengthen collaborations,** build the capacity of ILO constituents, fill knowledge gaps, facilitate a 'just' transition to environmentally sound economies, and support policies to achieve the sustainability of jobs and enterprises.

Create opportunities for productive employment and decent jobs for all

Social transfers alone cannot support long term development: we also need policies that create opportunities for productive employment and decent work for all. Relevant reports and country experiences show that a transition to a green economy can lead to net gains in employment and particularly benefit the poor, youth and women. For this paper, we adopt the ILO's definition of a job and for the purposes of the international Standard Classification of Occupations to mean "a set of tasks and duties performed or meant to be performed, by one person, including for an employer or in self employment".

Investing in skills

In both the North and South, the implementation of sustainable sanitation may generate substantial employment. To some extent this will be 'conventional' kinds of work at both design and implementation levels. However, the new approach generally will require a reorientation of attitudes and in some cases skills with knowledge of the health implications of what is being done. Relevant awareness-raising and training programmes will be necessary (see ILO's forthcoming *Manual: Guidance on Formulating Projects and Research Studies Concerning Labour Issues in Greening the Built Environment).*

Investment in skills development is vital to this sustainability. In the 21-country study "Skills for Green Jobs: A global view" (2010), the ILO found that skills shortages hinder the potential to unlock the employment potential of green growth. The report recommends that countries devise strategies based on well-informed policy decisions, social dialogue, and coordination among ministries and between employers and training providers. We must bear in mind that new technology creates new needs in this regard.

Improving management practices

Improving responsible management practices at and around the workplace can greatly contribute to cleaner, greener and safer practices, reducing emissions and preventing health care costs of occupationally related accidents and illness.

Social Dialogue for decent jobs

Green jobs must also provide workers a say in the decisions which will affect their lives and the development of necessary reforms. The ILO's *Declaration on Social Justice for a Fair Globalization (2008)* asserted that "Social dialogue and tripartism [are] the most appropriate methods for translating economic development into social progress, and social progress into economic development; [and] facilitating consensus building on relevant national and international policies that impact on employment and decent work strategies and programmes."

Social dialogue seeks to build consensus and prevent conflict. The ILO promotes social dialogue in water utilities through an action programme that builds the capacity of the workers, employers and government ministries, as well as funding baseline studies on the state of social dialogue in the utilities and facilitating the development of Action Plans to develop sustainable mechanisms for social dialogue.

A leading example is the Maynilad Water District, which has developed inclusive mechanisms for social dialogue that has enabled workers in the utility to help develop systems to reduce the loss of water, thereby increasing productivity. The ILO has also developed activities to increase the participation of indigenous communities in the design and construction of water supply infrastructure and in the management of water resources. The main impact of this programme has been an increase in hygiene and sanitation education in the communities, and their entrepreneurship to make the service more efficient.

Similarly, the Namibian government has developed a programme to establish conservancies within communal lands. This programme has sought to decentralise natural resource management through devolving user rights over wildlife within the conservancy boundaries to elected committees of local people. It has benefitted as many as 95,000 Namibians, and provided incentives to manage wildlife populations in a sustainable manner.

Participatory approaches and empowerment for managing change

Organisational change or reforms which are undertaken from the bottom to the top, by empowering workers and employers through consensus-building and participatory approaches, are more likely to change the culture of the organisation, not only the behaviour and the attitudes of its workers.

The Pepoo project in Kenya is a case in mind, which developed a single-use, hygienic toilet bag that can be knotted and buried. Once buried, it breaks down the contents into fertilizer. The program includes distribution and collection services which are expected to create 1000 jobs, which will focus on empowering women. Currently, the product is being sold mostly by women micro-entrepreneurs.

For example, improving water supply has been shown to reduce the burden of the water supply chain on women and children, allowing them to participate in agricultural activities and to attend school. One way to increase water supply was developed by the Working for Water programme in South Africa. This invasive species management programme employs members of the local communities to clear thirsty alien tree and plant species which preclude the free flow of water. At the same time, like the Panama initiative, it increases the participation of marginalised peoples in the water supply chain.

We can define organisational culture as: “the pattern of basic assumptions that a given group has invented, discovered or developed, in learning to cope with its problems of external adaptation and internal integration. These have worked well enough to be considered valid

and are therefore taught to new members as the correct way to perceive, think and feel in relation to these problems."[7]

Legge suggested a strategy to approach organisational cultures: Managing culture can be likened to 'riding a wave' – the best a surfer can do is understand the pattern of currents and winds that shape and direct the waves, then use these to stay afloat and steer the desired path. Clearly, this is not the same as changing the basic rhythms of the ocean.[8] Essentially, this means that lasting organisational change can happen if the organisation identifies the forces that move its employees to act; if employees are involved and consulted in identifying and resolving the problems of the organisations, the chances of instituting successful reforms increase.

Social protection

Green jobs must also offer workers adequate income, social protection and respect for their rights. Stable incomes and decent employment support sustainable development. The current economic crisis has shown the need for sound social protection policies to sustain livelihoods and lessen long-term economic and social scarring which result from market disruptions. These protections will contribute to sustainable water utilities through lower worker turnover, increased productivity, reduced corruption, and an increase in worker participation in environmental protection efforts.

[7] Schein, E. H. *Organizational Culture and Leadership* (Jossey-Bass, 1985), p. 18

[8] Legge, K. *Human Resource Management: Rhetoric and Realities* (Macmillan, London, 1995).

Maynilad Water District, Philippines

Roel Espiritu, Head of Labour Relations of Maynilad Water Services, Inc

Type of tool: green jobs
Issue: cities
Location: the Philippines, Asia

Challenges and objectives

Currently, Maynilad has a service area of 540 square kilometres with a population of 9.5 million, 89.2% of whom are customers of Maynilad or a total of 937,578 water service connections. Of these customers, 82% have access to 24-hour piped water services and 92% receive water at a pressure of 7 pounds per square inch (psi). The company produces 2,149 million litres of water per day (MLD) through its three treatment plants, 17 pumping stations and 35 distribution lines. The company also has 12 Business Areas, 35 Hydraulic Areas and 761 District Metered Areas. The company is currently manned with 2,123 full time employees.

Institutional challenges

The corporate history of Maynilad began with the successful privatisation of the Metropolitan Waterworks and Sewerage System (MWSS) in 1997; the oldest water system in Asia. This former state-owned corporation was in charge of providing water supply and sewerage disposal services in the greater Metro Manila area. With privatisation, MWSS handed over the operation of the water utility to two concessionaires; *Maynilad Water Services, Inc. (MWSI),* which was awarded the right to operate the waterworks and sewerage system in the 17 cities and municipalities in the West Zone areas of Metro Manila, home to then 7.3 million people; and *Manila Water Company, Inc. (MWCI)*, to serve the East Zone area comprised of eight cities and municipalities with a then population of 4 million people. In this highly anticipated bidding that drew the attention of the global water community, the partnership of Benpres Holdings Corporation (Benpres) and Ondeo Water Services, Inc. (formerly Suez Lyonnaise de Eaux), was awarded by the government a 25-year exclusive concession to run the water and wastewater operations of Maynilad.

After a decade with many financial, legal, and regulatory disputes and after being reclaimed by the government due to bankruptcy, Maynilad went through a change of ownership. The consortium DMCI-MPIC Water Company Inc., formed by Metro Pacific Investments Corporation (MPIC) and DMCI Holdings, Inc. (DMCI), acquired 83.96% of the water company's shares. Lyonnaise Asia Water Limited (LAWL) held a 16% share. The MPIC-DMCI consortium took over the reins of managing Maynilad on 24 January 2007 and immediately started working on the financial and operational rehabilitation of the company. In August 2007, the consortium signed a prepayment and settlement agreement with Maynilad's creditors and MWSS. The new owners of Maynilad had paid off the company's outstanding debts, which would have reached 240 million by January 2008. An aggressive catch-up plan was also implemented to increase company revenue, improve water service operations, and drastically cut commercial losses.

The challenge of reducing non-revenue water

One of the top priority programmes of Maynilad is focused on ensuring business viability and sustainability by reducing chronic water losses or Non-Revenue Water (NRW). NRW is defined as the difference between the amount of water put into the distribution system and the amount of water billed to consumers. NRW, which is often defined in terms of percentages, is considered as the best over-all indicator of the quality of the water utility management; high levels of NRW lead to low levels of efficiency.

In 2007, the NRW of Maynilad reached 66% - a very high rate. This means that 1,500 million litres of water per day were wasted. To illustrate the enormity of this water loss; NRW at a volume of 1,500 MLD could flood a 16.95 KM road with 2.0 meters of water or could supply Ho Chi Minh City, Vietnam with water 1 ½ times. Furthermore, water of this quantity, if not lost, could supply an additional 1,250,000 households with potable water. When lost, this volume of treated water remains unaccounted for and does not translate to revenue for the company and adversely impacts water supply.

NRW may be categorised into physical or real loss; commercial or apparent loss and loss of water for operational purposes. High *physical losses or real losses* refer to the loss of actual water as a result of leakages in pipes, joints and fittings, overflow at the utility's reservoirs caused by poor operations and system maintenance. Significant *commercial losses or apparent losses*, on the other hand, refer to loss of revenue exemplified by unbilled water due to data or meter errors and system flushing and theft. Another cause of water loss is for *operational purposes*; for example due to the fact that the distribution lines of the company were inherited and date back to when the company was established and was poor maintenance of the network

The drivers of change and the barriers for addressing NRW

Management changes

Before the new management arrived, there was no programme that focused on combating the NRW problem, primarily because the threat and the impacts of NRW to the business were not fully understood. The management also did not support the elimination of the NRW problem. Under the directive of the new management, Maynilad has been more aggressive in its efforts to combat NRW.

Customer dissatisfaction

Customer dissatisfaction is another repercussion of intermittent water supply. If the customer demands are not satisfied, their willingness to pay for improved service decreases. The customers also suffer because of unnecessarily high tariffs to cover the cost of the NRW. In Maynilad's case, because it inherited 66% NRW, NRW is factored into the fixing of the tariff. The reduction in NRW benefits the customers. The tariff is computed based on targeted volumes which assume a certain NRW. If actual NRW is lower than the target, then volume is higher than forecasted. This means in the next rebasing the tariff should be adjusted downwards. The regulator, Metropolitan Waterworks and Sewerage System-Regulatory Office (MWSS-RO) can choose to only partly adjust the tariff.

How the barriers were overcome through a green jobs approach: Maynilad's approach to addressing NRW

Institutional will and new recruitment

The new owners of the management of Maynilad were determined to combat the high level of NRW in order to provide quality service to the customers, to increase the revenue and to comply with the MWSS-Regulatory Office requisite of reducing NRW to 40% by the year 2012. To achieve these goals, the company devised, implemented and invested in various measures, including the acquisition of modern equipment and technology to localise and detect leaks.

At the onset of 2008, a Central Non-Revenue Water (CNRW) Division was created to show the management's full support and commitment in managing the NRW. To ensure the proper implementation of the projects, manpower resources were also reinforced; new young engineers were hired and placed in this newly created division.

Investments

Another drastic measure taken by the new management was the massive investment in capital expenditure (CAPEX) projects to address NRW. The MPIC-DMCI management has earmarked 38 billion pesos for CAPEX for the years 2008 through 2012, primarily for the rehabilitation and/or replacement of old and deteriorated network and lines. In fact, 51% of the CAPEX budget is allotted for the management of NRW.

Establishment of network management improvements: District Metered Areas

The establishment of District Metered Areas (DMAs) is another measure implemented to manage NRW. Since Maynilad has a very vast distribution network with poor pipe conditions, the system could not easily be managed as a whole. Therefore, the system was broken down into smaller sub-systems. DMAs are small hydraulically discrete zones where water flowing can be precisely measured and compared with metered water use. This step localises and diagnoses the specific problems in each area and helps to determine the most efficient solutions.

Restructuring of departments

To further actualise an efficient management of NRW, the Metering Department was restructured and incorporated as one of the core departments of the CNRW Division. This reorganised department aims to re-evaluate meter performance, focus on correct sizing of meters, and meter replacement programmes with a quality service benchmarked on others. The department was staffed with new young engineers who will use new technologies and will be guided by meter experts.

Investments in new technologies to increase effectiveness and efficiency of management

The Central NRW Division is engaged in active leak control activities to detect and repair leaks, since they are the primary causes of physical losses. The company invested in modern and sophisticated technologies for *aggressive leak detection*. It called in the services of Pressure Pipe Inspection Company (PPIC) to train Maynilad engineers in the use of

Sahara®- a state-of-the-art technology, which accurately detects leaks, pockets of trapped gas, and structural defects in water main lines.

With the help of these technologies, *pipe inspection* can be undertaken without water service interruptions and the company can intensify its leak detection efforts without affecting water delivery services to its customers. Furthermore, accurate detection of leaks using the latest technologies allowed for an efficient execution of repair works, especially in main thoroughfares. This reduces traffic jams that contribute to already high carbon emissions in Metro Manila.

Pipe replacement is another step taken by Maynilad to reduce NRW. Maynilad's network is 80 years old and most of the pipes are fractured, corroded and too deep in the ground, so they already need to be replaced. However, total pipe replacement would be a very costly way of solving leakage problems. Therefore, the company has resorted to selective pipe replacement rather than total pipe replacement.

Furthermore, Maynilad also invested in equipment known as *pressure-reducing valves (PRVs)* which reduce and maintain pressure at a set level. With these PRVs, NRW personnel are able to manage leaks more efficiently.

Another function involved in NRW reduction is *Hydraulic Modelling*. Hydraulic Modelling is implemented in partnership with the Water Network. Hydraulic modelling enables the company to correctly predict how the system will function under certain conditions, without affecting the supply of water to customers. After a hydraulic model of Maynilad's network was built, actual flow and pressure data were checked in the field to calibrate the model and ensure its accuracy.

The reduction of NRW is a very data-driven project, so the company also focused on *data management*. To correctly manage NRW, data on DMA flow and pressure, leakage complaints, leak repair, and Geographic Information System (GIS) data of pipes and laterals were regularly collected. For this, Maynilad maintains a netbase programme, which is an automatic system integrating network data from different sources and also allows for multiple function analysis. The netbase programme plays a very important role in NRW management.

Training and new jobs

To reinforce the implementation of leak detection strategies, the company trained competent leak finders for leaks that are hardly visible and require special equipment to be detected. These leak finders use sensitive microphones to detect leak noises and pinpoint their locations. This is usually done at night when it is quieter. It is a race against time for the leak detection team, because the longer the leak duration; the higher the water losses. Due to the improvements in the leak detection strategies, the number of resolved leak-related issues has increased up to 99% by the last quarter of 2010. Furthermore, the resolution time was also reduced by more than half. In 2009, reported leaks were repaired in 15-39 days and now they are repaired in 10 days.

NRW reduction programme would not be successful without *continuous comprehensive trainings,* undertaken in partnership with the Corporate Human Capital and Organization Development (CHCOD) Division of the company.

Social Dialogue and partnering with the unions

There are two labour unions which co-existed when privatisation took place. These unions are recognised by the management and encouraged to take up any issue affecting the rights and welfare of their members. The management has consistently respected the employees' right to organise and to collectively bargain, among others. On the other hand, the unions, while remaining vigilant in protecting the rights and welfare of its members, have shown vital support for the management in delivering its commitment to the government, its customers and stakeholders.

The Maynilad Water and Sewerage Union-Philippine Transport and General Workers Union (MWSU-PTGWO) is the sole and exclusive bargaining agent of all rank-and-file employees in the agreed bargaining unit. Meanwhile, the Maynilad Water Supervisors' Association (MWSA) is the sole and exclusive bargaining agent of supervisory employees in the agreed bargaining unit.

Since 2007, when DMCI-MPIC Water Company, Inc. took over the reins of Maynilad, the management has effectively partnered with the unions in accomplishing its mission and goals while at the same time taking care of the welfare of the employees. A number of significant issues have been amicably settled between Maynilad and the unions through the responsible utilisation of the grievance machinery and labour management committee provisions of the CBA. Furthermore, the management, MWSU-PGTWO and MWSA are very active partners of the United Nations' International Labour Organization (ILO) in espousing social dialogue in the work place.

In compliance with statutes, our collective bargaining agreements contained two provisions that formalised social dialogue in Maynilad. The first one pertains to the Labour-Management Committee (LMC) and the second one covers Grievance Machinery. The former convenes to discuss and resolve work-related matters and problems affecting operations and the latter provides the procedure for adjusting grievances and disputes between the management and the unions. In practice, however, most the work-related problems, grievances and disputes are settled outside of these formal mechanisms. The leadership of the unions and Management's Labour Relations officials have adopted an open-door and informal attitude in addressing the concerns of employees. Management can at any time visit the union office and vice-versa. They have open and candid discussions on pressing daily issues as well as future concerns. Solutions are made by consensus and both sides trust each other to deliver on commitments. Only when both sides are determined that reaching an acceptable solution is not possible, the formal mechanism of LMC or the Grievance Machinery is set in motion. They document the disagreement and report this to the proper government agency, either for mediation or arbitration. In our experience, this process has abolished confrontation and animosity and contributed to respect and trust between the parties involved.

Examples of issues resolved by the management and the unions are:

1. Most of the leak detection work is executed during night-time when noise from vehicles is minimal. In this regard, the management and unions have partnered to ensure the safety and well-being of the employees. Maynilad coordinates through its Security Department with authorities in areas where leak detection operations are being conducted.

2. Maynilad also provided marked service vehicles and medical and legal services to employees in the event of accidents.
3. Employees are provided with the proper personal protective equipments.
4. Issues on compensation and benefits.

Additionally, as a direct result of the trust and confidence developed between the parties, our recent collective bargaining agreement with the rank and file union was forged in just one month after four formal negotiations. And our collective bargaining agreement with the supervisory union, while we needed the mediation of the government, was forged in just two months.

Our collective bargaining agreement with the rank and file union embodied the management and the unions' commitment to protect the environment. The pertinent provisions of our CBA read as follows:

Article XIV

Environment, Safety and Health Care

Section. 1 The Company as a whole the Company will create and maintain a work culture that will encourage all employees, contractors, suppliers and shareholders to support this commitment. Both the management and the union agree to:

a) Protect the environment by minimising and managing the impact of company operations on the environment, optimising the use of resources and increasing operation efficiencies;
b) Establish an environment management system to ensure that protection and sustainability is an integral part of the Company's business management;
c) Design and execute systematic programs that eliminate all hazardous acts and conditions to prevent work-related injuries, illness and accidents at the workplace. Both the management and the union shall pursue the establishment of high standard of safety and occupational health awareness, practice and discipline.

In keeping with this policy, the Company and the Union will comply with all the regulatory requirements and international standards on environment, health, and safety. This will be achieved through the use of appropriate technology and the best practice in the pursuit in the pursuit of growth and viability

The investment in water technology for resolving NRW is one of the fruits of the partnership and commitment of the management and the unions to protect the environment. Moreover, this commitment for the protection of the environment and occupational health safety led to the IMS (Quality Management (ISO 9001:2000),Environmental Management (ISO 14001:2004) Occupational Safety and Health Management (OHSAS 18001:2007)) certification of the following Maynilad facilities:

1. Dagatan-Dagatan Sewage and Septic Treatment Plant
2. Tondo Sewerage Treatment Plants
3. La Mesa Treatment Plant 1 – a conventional-type plant with a maximum design capacity of 1500 MLD

4. La Mesa Treatment Plant 2 – a plant of the pulsator-type that has a design capacity of 900 MLD with an allowable overload of 990 MLD.

Additionally, Maynilad is ISO 14064:2006 certified for the verification of its greenhouse gas or carbon footprint quantification and reporting initiative.

Lessons learnt from implementation

Since the new management started a head-on approach to addressing NRW, the level of NRW has been reduced from 66% in 2007 to 47.8% at present. These considerable efforts resulted in 33% more billed volume and 29% more total revenue. Maynilad's total revenues increased from P8.1 billion to P10.6 billion. The company's success is also attributed to strong support from the management, sufficient funding, manpower, equipment and world class advisors.

The existence of unions is not incompatible with the success of an enterprise. A strong partnership between the management, the unions and the employees through active and effective social dialogue contributed immensely to the success of the business. The respect and transparency between the management and the unions and the willingness to negotiate, discuss, and even compromise on many issues has resulted in industrial peace within the company. Therefore, energy and resources could be directed to attaining the company's mission: providing excellent services to its customers and value to the shareholders, and improving the employment conditions of the workers. Truly it can be said that "*Sa bagong Maynilad, gumadaloy ang ginhawa*!" (In the new Maynilad, comfort/good life is flowing-freely.).

The management and the unions are now teaching the unions of local water utilities about the success of their partnership and showcasing that successful privatisation, one that strongly respect the rights and welfare of the employees, is achievable.

Scaling up and relevance for developing and transition countries

CHCOD and CNRW have started a standardised NRW management training programme that aims to produce competitive and world-class NRW experts from Maynilad. In fact, the company has recently amended the primary purpose of its Article of Incorporation to allow it to be able to offer NRW expertise to other water utilities both in the Philippines and overseas. Furthermore, we expect that new green jobs will be created as a result of the expansion of our sewage treatment services.

Evaluation: economic, environmental and social benefits

Impact of NRW and management changes on employment and business productivity and efficiency

The CNRW started with just five personnel but at present, Central NRW is already manned with more than 258 full time employees. In general, since DMCI-MPIC Water Company, Inc. took over the ownership of Maynilad in 2007, the company has already generated and employed 87,000 people, including those hired by contractors and suppliers that rely on Maynilad as their major client.

High levels of NRW translate to high inefficiency of a water utility. The loss of treated water – in which the company has invested considerable amount of money – increases the treatment and distribution costs and decreases revenue. Also, more investment in capital expenditure programme is needed to meet the increasing demand. Furthermore, poor financial performance of a water utility company makes it difficult to invest more in expansion of its distribution network as financing institutions review the financial performance of its borrowers to determine the latter's ability to repay its loans.

In Maynilad's case, due to the effective reduction of NRW and determination to grow the business, financing institutions have shown confidence in Maynilad's ability to repay its obligations. In the first quarter of this year the company has secured a Php7B loan to partly fund its capital expenditure programmes for 2011 and 2012 to improve operational and network efficiency, to meet the company's service obligations and support growth. Moreover, in June of this year Maynilad has secured US$137.5 million loan from the World Bank which will be used to fund its wastewater treatment projects.

Social impact of NRW

When a water utility company experiences a high level of water losses, it cannot achieve its primary goal of satisfying the needs and demands of its customers. NRW caused by physical losses often lead to intermittent water supply and reduced supply hours and volume for the customers. Intermittent water supply also causes health risks as contaminated groundwater, or even sewage enters leaking pipes when there are supply interruptions or very low pressure periods.

Customer dissatisfaction is another repercussion of intermittent water supply. If the customer demands are not satisfied, their willingness to pay for improved service also decreases. The customers also suffer from unnecessarily high tariffs, because they have to bear the costs of the NRW.

Moreover, the amount of lost water lost could have supplied additional unserved customers or customers who do not have access to piped, clean and potable water yet. The reduction of physical losses of treated water can make more piped water available and increase the coverage of water utilities, especially in poor communities[9].

Participation is a basic principle in the policies of the management and the unions. The Preamble of our collective bargaining agreement states that:

> "*Maynilad's goals (including reduction of NRW) can be attained only through our (Management and Union) partnership, unity and discipline, recognising each other's right and responsibilities and the role each plays in increasing Maynilad's productivity, level of efficiency, and committing ourselves to service excellence, … in improving the quality of life of the Filipino…*"

A participatory approach has hastened the reduction of NRW as it has fostered a stronger relationship between the management and the employees by creating a sense of ownership. In fact, one of the anchors for determining the performance rewards for employees in 2011 is

[9] Asian Development Bank (2010) The Issues and Challenges of Reducing Non-Revenue Water

the reduction of NRW. Mid-year results showed that we are well on our way to achieving, if not surpassing, the target of 48% NRW.

Additionally, the company acknowledges the importance of a participatory approach in delivering its services and reducing NRW. In this regard, as part of Maynilad's corporate social responsibility, Maynilad has set up the Samahang Tubig Maynilad and Bayanihan Bayan Tubig programmes/projects. These programmes are designed to address the problems of water inaccessibility and irresponsible water use in Maynilad's concession. In the Samahang Tubig Maynilad project, residents of urban poor communities are organised and trained to enhance their capability of sustaining the water management programmes in their communities. On the other hand, in the Bayanihan Bayan Tubig project beneficiaries help themselves and one another by contributing time and physical labour to the programme. Under supervision of Maynilad engineers, the beneficiaries install the pipes that will bring water to their communities. This not only cuts the cost of the pipe installation project, but also fosters a stronger relationship within the community, while creating a sense of ownership of the project among the recipients.

Environmental impact of NRW

Addressing NRW does not only concern the company's stakeholders and its customers; it also avoids that water, a scarce and precious resource, from being wasted. The high level of NRW adversely affects climate change mitigation efforts. Climate change impacts were felt in 2010, when El Nino occurred in the Philippines. A high rate of NRW also implies a high consumption of energy by the company used in the treatment and distribution of water.

At 66% NRW in 2007, we had to produce 4,500 litres per day for each individual service connection. Now at 48% NRW, we only have to produce 2,500 litres per day. This represents a reduction of 44% in Maynilad's water demand. Additionally, every 1% reduction in NRW is equivalent to more than 20 million litres of water saved. Hence a reduction of 28% in NRW (from 66% in 2007 to 48% in 2011) is equivalent to 560 million litres of treated water saved and redistributed.

Programa de Inversiones Intensivas en Empleo (PIIE), Panamá

Julio Pérez, ILO

Tipo de herramienta: Empleo Verde
Localización: Panamá, América Latina

Retos y objetivos

La experiencia se desarrolla para el fortalecimiento de la equidad para reducir las brechas en los servicios públicos de agua segura y saneamiento mediante el empoderamiento ciudadano en áreas rurales e indígenas excluidas.

Objetivos:

- La salud de la población debe mejorar con el desarrollo de estrategias de promoción de la salud, prevención de enfermedades, ampliación de la cobertura y acceso a los servicios (ODM 1, 3, 4, 5, 6).
- La sostenibilidad ambiental (recursos hídricos, biodiversidad, desarrollo forestal, estabilización del cambio climático, prevención de desastres) se debe fortalecer con el apoyo de marcos normativos, estrategias nacionales y acciones locales (ODM 7).

Los motores del cambio

En este proyecto participan la UNICEF, la Organización Panamericana de la Salud (OPS/OMS), PNUD y la OIT, además de los Ministerios de Salud y Educación, ANAM, los Municipios, los Representantes de Corregimiento, las autoridades indígenas tradicionales y las organizaciones comunitarias. El Ministerio de Salud, por ejemplo, ha logrado visualizar no sólo los beneficios que implica la construcción de los sistemas de suministro de agua, sino también la participación de las mismas comunidades en el proceso de diseño y construcción. El establecimiento de instancias de coordinación nacional (instituciones y agencias) y local (en cada cuenca) entre los diferentes actores (Comités de Coordinación Local, Unidades de Coordinación distrital, Unidades de coordinación Técnica Regional) ha sido un elemento clave para la sostenibilidad de las iniciativas de ambos programas. La colaboración de las diversas instituciones facilitó la comprensión del concepto de programa conjunto articulado, lo cual fue bien valorado por los actores locales y facilitó el diálogo. Acá también es fundamental el perfil del Coordinador/a para ayudar a construir hilos conductores que unen el trabajo de las agencias y contrapartes.

Cómo se superaron las barreras: la aproximación del programa de inversiones intensivas en el empleo

Empoderamiento de los actores tradicionales

Se utilizaron marcos de referencia, por ejemplo memorandos de entendimiento o el documento marco del programa, para empoderar a los actores tradicionales y convertirlos en socios de los programas y no simplemente beneficiarios. La integración de los actores claves en el proceso de ejecución de los programas como socios y no meramente beneficiarios es fundamental para la apropiación nacional de las actividades mismas y los resultados esperados. Además, un documento formalizado y por escrito ayuda a manejar las

expectativas de los diferentes actores, sus responsabilidades, aportes para la ejecución del programa conjunto, etc., y fortalecen el rol de las autoridades tradicionales.

Se fomentó el desarrollo comunitario participativo, no solamente asistencialista. En el caso del programa conjunto de gobernanza económica, una importante lección aprendida fue el reconocimiento de que el concepto de "proyecto" para la cosmovisión Ngäbe Bugle lleva implícito el pago por servicio y no participación, por lo que recomendaron el concepto de "programa" porque lo comprenden como desarrollo comunitario. Por ende, en las zonas de intervención se utiliza Programa Conjunto, tal como está en el documento marco.

Diálogo con las comunidades

Se estableció un diálogo continuo con las comunidades mediante la presencia de los programas en los congresos indígenas generales, regionales y locales, brindando informes de avances de las actividades a las autoridades tradicionales y comunidades con el objetivo de sensibilizar y divulgar los programas en general, así como temas específicos de cambio climático y manejo de los recursos naturales, saneamiento de agua y gobernanza. Este dialogo y la lectura permanente de escenarios de cambio también ayudó a crear espacios de transición con autoridades tradicionales.

Ampliar la coordinación a otros aspectos de importancia local

Para aumentar la relevancia y probabilidades de continuidad de algunos mecanismos de coordinación local, se ha visto la necesidad de abarcar temas generales que van más allá de las actividades de los programas mismos. Los programas conjuntos, tanto en el nivel central como nivel regional/local, han creado una oportunidad para construir un puente de comunicación entre instituciones del estado que trabajan en temas similares, pero sin ninguna coordinación formal. Apoyan el trabajo de una coordinación interinstitucional "armónica". El Ministerio de Salud ha adoptado un enfoque integral en temas de Agua y Gobernanza y su relación con las necesidades de salud.

Desarrollo y fortalecimiento institucional

Además, el programa ha logrado reactivar las Juntas Administradoras de Agua Rural (JAARs), instancias poco activas antes de la llegada del Programa. La reactivación y fortalecimiento de estos grupos fortalece una gestión articulada en el nivel regional con base en las estructuras existentes.

Procesos participativos

La identificación de los actores locales y su posterior incorporación en procesos participativos ayudó a lograr los diferentes productos de los programas, como clave de la apropiación nacional y la sostenibilidad. Estos actores incluyeron las autoridades, organizaciones comunitarias, docentes, niños y juventud, empresas indígenas, médicos, instituciones académicas, etc. Por primera vez la empresa constructora reconoce la necesidad de tener por delante una trabajadora social frente al proyecto antes de "enterrar tuberías" (se entiende esto como la construcción o manejo e implementación completa de los acueductos rurales.

Acompañamiento técnico en apoyo al empoderamiento

OIT a través del Programa de Inversiones Intensivas en Empleo (PIIE) viene realizando el acompañamiento técnico a los Proyectos de Agua y Saneamiento de Nicaragua, Panamá y Paraguay, financiados por el Programa Conjunto PC-ODM de las Naciones Unidas. Este programa procura el mejoramiento de la salud mediante el empoderamiento de la población beneficiaria para lograr ampliar la cobertura y el acceso a servicios de agua y saneamiento; fortalecimiento de la sostenibilidad del recurso hídrico mediante acciones locales e institucionales.

En tal sentido, la OIT ha desarrollado la pericia de los usuarios en las diversas fases del proyecto y específicamente sobre el tema de gestión comunitaria del agua, Panamá tiene una experiencia exitosa de gestión de servicios de agua con enfoque inclusivo e intercultural con comunidades Ngoblé. Producto de dicho proceso las mujeres indígenas integran estos comités, administrando eficientemente los recursos que se recaudan por los servicios generando inclusive un margen de ahorro para el mantenimiento de los sistemas.

Talleres de capacitación y desarrollo de materiales

- Talleres de capacitación para hogares, in situ, sobre la importancia y manejo del agua potable, saneamiento y disposición de residuos sólidos para los cuatro distritos seleccionados, con enfoque multicultural y de género.
- Talleres de capacitación para las organizaciones comunitarias, como las Juntas Administradoras de Acueductos Rurales (JAAR), empleando herramientas participativas como la Planificación Integrada de Acceso Rural (PIAR) para lograr la priorización participativa de intervenciones en el sector.
- Adecuación de la metodología de instrucción mediante la actualización y/o producción de manuales y materiales informativos multilingües sobre educación sanitaria y gestión de agua y saneamiento.
- Talleres de capacitación para las JAAR sobre procesos participativos de planificación y toma de decisiones para la generación de recursos a través de actividades productivas sostenibles.
- Capacitación técnica del personal del MINSA y autoridades locales para acompañar a las comunidades en la gestión, supervisión, seguimiento y evaluación del programa. (OPS/OMS, UNICEF, PNUD)

Realización de procesos participativos y empoderamiento

- Realización de diagnósticos rápidos participativos sobre la situación de agua, saneamiento y manejo de residuos sólidos en los distritos del programa realizados.
- Elaboración de planes participativos municipales para el desarrollo de infraestructura de agua, saneamiento y disposición de residuos sólidos, por distritos.
- Desarrollo de mecanismos para la participación de los pobladores en el desarrollo de las obras. (UNICEF, OPS/OMS, PNUD).
- Creación de un programa comunitario de vigilancia y protección de fuentes de agua con enfoque de género y juventud. (UNICEF, OPS/OMS, PNUD).

Desarrollo de soluciones apropiadas en cooperación

Desarrollo, a través de los gobiernos locales y autoridades tradicionales, de acueductos y equipamiento para soluciones sanitarias, incluyendo rellenos sanitarios manuales aplicando tecnologías apropiadas a las condiciones físicas y socioculturales, y aceptadas por las comunidades en los distritos de Müna, Kankintú, Besiko y Kusapín, ubicados en la Comarca Ngöbe-Buglé. OPS/OMS (UNICEF).

Lecciones para el futuro y para otras experiencias

Esta experiencia fue presentada a inicios de este mes (1 y 2 de agosto) en el Seminario-Taller "Cooperación Sur-Sur sobre la gestión de agua y saneamiento en poblaciones indígenas y rurales dispersas, desde la perspectiva de género y enfoque intercultural" en el Chaco Paraguayo. En el evento participaron líderes indígenas mbya, guarani, nivaklée y ayoreo quienes escucharon de sus pares indígenas ngoblé el proceso desarrollado para el logro de una gestión del agua más equitativa.

La lideresa Vicenta Trotman, integrante de una de las Juntas de Agua y saneamiento de la Comarca Ngoblé, expuso acerca del proceso de sensibilización, capacitación y empoderamiento desarrollado a través del PC. Así mismo informó de como la mesa técnica está integrada por el médico tradicional y el médico del centro de salud; el cacique y el alcalde y todos se sienta en una mesa de diálogo para definir el alcance y mejorar el manejo de la gestión del agua.

Es importante tomar en cuenta y respetar los tiempos y procesos tradicionales de consulta y de diálogo. Hay que ajustar los planes de trabajo para incorporar estos tiempos para que no se mal interprete como "baja ejecución" o retrasos en la implementación de los programas. Al final estos "retrasos" iniciales se convierten en ganancia para la sostenibilidad. Una importante lección aprendida ha sido el respeto muto de la interculturalidad – hacia las comunidades y también de las comunidades hacia las agencias, las contrapartes y el PC mismo.

Evaluación económica y social

Hasta ahora hay 4 microempresas comunitarias formadas en construcción, diseño, con visión empresarial. El programa busca que obtengan personería jurídica y que sean estas empresas las que ejecuten las construcciones en los próximos proyectos. Toda la mano de obra es local y muchos emprendedores son contratados por la empresa. (Albañiles, artesanos, plomeros). La comunidad exigió la contratación de una trabajadora social de parte de la empresa. Además las empresas comunitarias, formadas en su mayoría por jóvenes, han sido capacitadas en Módulos en emprendimiento indígena de parte de los experimentados peruanos Rene Apaza y su esposa y se ha formado una red de Facilitadores indígenas en emprendimiento en Panamá.

3. Water cost recovery and financing to support the transition to a green economy

Diego Rodriguez and Julia Bucknall, World Bank

A green economy is one that results in improved human wellbeing and social equity, while significantly reducing environmental risks and ecological scarcities. (UNEP)

To function properly and sustainably, all parts of water resources management and the supply of water related services must be fully funded. This includes not merely the creation and maintenance of physical infrastructure, but also water resource management, environmental protection and pollution abatement measures, as well as the less visible functions such as policy development, research, monitoring, administration, legislation enforcement, provision of public information, and involvement of public stakeholders. (World Bank)

Financing the green economy

The water development agenda overlaps with that of the green economy in areas of pollution mitigation, wastewater treatment, energy efficiency in water and wastewater treatment, distribution and reuse, irrigation, hydropower, and management of natural water ecosystems (including wetlands). Many of these projects could target several objectives simultaneously and therefore, can generate an array of benefits. The financing of such initiatives is attractive. However, designing and implementing projects and programmes with multiple objectives (cross sectoral) is challenging and complex.

UNEP has made an assessment that under a green investment scenario the additional investment needed in the water sector would be US$ 191 billion per year until 2030 and US$ 311 billion per year until 2050 (mainly to supply water and sanitation services and meet MDGs and universal coverage). “The Africa Infrastructure Country Diagnostics” (AICD) estimates that US$ 22 billion per year (approximately 3.3% of Africa's GDP) is the amount required to attain the water and sanitation MDG targets. These estimates, which are based on minimum acceptable asset standards, include an annual capital expenditure of US$ 15 billion and operating expenditures of around US$ 7 million. These figures do not include the cost of investment in hydropower or irrigation.

Investment in water infrastructure, in both its physical and natural assets, can be a driver of growth and the key to poverty reduction (UNEP 2011). Although the recent global economic crisis set back investment in water in many countries (Winpenny et al. 2009), the impacts have been varied, and some governments have made determined efforts to compensate through counter-cyclical fiscal measures. Approximately 20% of the $2 trillion of economic stimulus packages announced since 2008 is estimated to have been in “green” investment in renewable energy, energy efficiency, more efficient use of materials, clean technology, waste mitigation, and sustainable use and restoration of ecosystems and biodiversity. Water is one of the beneficiaries of these programmes, although its full importance has not been recognised.

The challenges for financing water in the green economy

There are a number of identified barriers to investment that have limited the scale up of investments required to transition to a green economy. These include existing market failures such as access to finance, especially for small and medium enterprises (SMEs) and communities; political interests; limited credit availability and risk-aversion; lack of transparent and enforceable legal and regulatory frameworks (the enabling environment); knowledge externalities; information asymmetries; and policy-induced distortions.

The current financial climate has decreased the availability of liquid financial resources, affecting the supply of risk capital (e.g. equity) and financing for loans and concessional instruments. Many innovative instruments, developed with technical assistance and risk-sharing from donor agencies, are at risk. Low access to financial resources can have a serious effect on the already low level of investments and operation and maintenance faced in most developing countries resulting in deterioration in the infrastructure providing services, and a lack of infrastructure to cope with succession of droughts and floods worsened by climate change (Winpenny et al. 2009).

Achieving the MDGs requires large investments to increase access to safe and sustainable water services in many countries. Yet in itself increased investments in the water sector do not result in improved access to sustainable water services. When large flows of resources in the sector are managed by the government, the efficiency and effectiveness with which these resources are managed becomes a critical factor to ensure the sustainability of the services and the systems. If calls for increased spending on infrastructure are to translate into better services in the developing countries, then it is paramount that the efficiency of public resources and using it to better leverage private sources is improved.

Approaches to financing a greener economy

Closing the financing gap in the water sector and advancing towards implementing the principles of a green economy requires a range of instruments including higher user charges and environmental charges, higher collection rates, more efficient service provision resulting in lower costs, and more targeted subsidies.

The financing report of UNEP proposes a range of potential ways of financing these investments. This includes institutional investors such as pension funds and insurance companies, public financing (from taxation and government borrowing from capital markets), global development institutions (e.g. the IMF, World Bank and other multilateral institutions), and stable and resilient capital markets. It is likely to be a longer-term process in which the appropriate mix of instruments will change over time.

Generating finance for water infrastructure and services

The green economy agenda has serious implications for water infrastructure, adding more weight to the search for greater efficiency in the use of resources, and a reduction in waste and greenhouse gas emissions, all aimed at shifting investment and consumption towards patterns that reduce depletion of natural capital.

All countries, at every level of development, face heavy costs in creating a water infrastructure that is “fit for purpose”. According to a recent World Bank Study (2010b), progress towards fulfilling the Millennium Development Goals (MDGs**)** has been challenged

by the global financial crisis**.** The crisis will potentially magnify the already large investment needs. According to one of those projections for 2015, 100 million more people will lose access to safe drinking water. A rethinking in financing strategies is required as additional resources will need to be captured from improvement in the efficiency of public expenditures.

Approaches for financing water infrastructure and services

To raise the sums needed for water and sanitation infrastructure, a pragmatic and eclectic approach is required, including the reduction, mitigation and sharing of water financing risks, which are by now widely appreciated[10]. National and international public agencies are the predominant sources of finance for water infrastructure.

National governments may be constrained by their fiscal position, but some of them have greatly benefited from strong commodity prices and have used their fiscal resources to invest in infrastructure, including water.

External Official Development Assistance (ODA) is now on a rising trend. In 2007-8, DAC countries' bilateral annual aid commitments to water and sanitation rose to US$5.3 billion. Adding to that the concessional outflows of multilateral agencies, the total ODA for water and sanitation was $7.2 billion in that year[11] (compared with $5.6 bn. in 2006). ODA takes place predominantly in the form of grants. Public international development banks (World Bank, the regional development banks, European Investment Bank, offering loans on attractive terms, are well placed to regain market share for infrastructure finance and are gearing up for this purpose.[12]

The Asian and Middle Eastern **sovereign wealth funds and publicly sponsored companies** are an additional and increasingly important source of money for the development of natural resources and infrastructure[13].

Hedging against devaluation risk is not a practical proposition. The more sustainable long term solution is to **generate more internal revenues from tariffs**, and to rely as much as possible on local financial and capital markets.

A number of donors and IFIs offer **risk sharing products** to encourage the growth of local currency finance for water and other infrastructure.

The food crisis, driven by population growth, higher food production and a surge in energy prices leading to higher food prices, brought an estimated 44 million additional people below the poverty line and contributed to the economic woes of most developing nations. Food security is contingent upon a sustainable and efficient water management system. Preventing the food crisis from reaching alarming proportions requires improved water management and the expansion of water access for the worlds' poor. New investments in irrigation infrastructure and improved water management can minimise the impact of water scarcity and partially meet water demands for food production (Falkenmark and Molden 2008). More importantly, sustainable water uses need to be assured through more efficient irrigation technologies and effective water pricing models.

[10] Amongst many references, v. the *Camdessus Report* (2003) and OECD (2010)
[11] OECD/DAC June 2010. www.oecd.org/dac/stats/water.
[12] E.g. World Bank 2010a
[13] ICA 2007

Funding in response to climate change and growing water scarcity

Projections reveal that an annual cost of climate change adaptation in developing countries in the industrial and municipal raw water supply sector would be between $9.9– $10.9 billion (net), and $18.5–$19.3 billion (gross), while costs for riverine flood protection is projected at between $3.5–$5.9 billion (net), and $5.2–$7.0 billion (gross). A large and challenging agenda stretches ahead for water infrastructure to cope with greater variability and uncertainty caused by climate change and other change forces.

Approaches for financing responses to climate change and water scarcity

The investments required will pose high financing demands from governments, public agencies and international research institutes. Their efforts will need to be supplemented with those of private, non-governmental bodies of all kinds, who can add value though extra resources, different ways of working, new approaches and innovative products. Adaptation and mitigation projects implemented by public agencies can draw on:

- **A range of development funds, including new adaptation funds** created for this specific purpose, to which public agencies have access. There are currently over around a dozen funds available for adaptation for water, amongst other sectors. Particularly relevant is the funding provided by the Pilot Program for Climate Resilience (PPCR), sponsored by the World Bank and other major IFIs. "The pilot programs and projects implemented under the PPCR are country-led, build on National Adaptation \programs of Action (NAPAs) and other relevant country studies and strategies. They are strategically aligned with other donor-funded activities to provide financing for projects that will produce experience and knowledge useful to designing scale-up adaptation measures." (www.cif/ppcr.org).
- For sub-sovereign agencies who cannot tap into development funds, **commercial financial sources** are critical.
- Much of the adaptation/mitigation efforts will fall to private companies, farmers and households. A different kind of finance is required for adaptation carried out by commercial entities (including farmers) or other water users.
- **Microfinanc**e is particularly suitable for improving irrigation efficiency for small farmers.
- Certain forms of contract can also be funded by ***quasi-equity,*** in which rewards depend on the successful achievement of project aims, e.g. **performance-related contracts** for water leakage reduction.

Funding diversification and demand management

Diversifying the sources of water by increasing the use of technologies, such as desalination and reclaimed water and promoting self-supply by users (farmers, households and companies) can reduce and distribute risk by relying on different sources of water. Funding for these activities follow more of the traditional financing approaches.

Improvements in resource and eco-efficiency, especially in the manufacturing industry, offer huge potentials for improving competitiveness in local, regional and global markets, as well as achieving more sustainable solutions. Increasing resource efficiency can achieve

cost reductions and decrease the environmental impact of industrial activities from enhanced resource and energy use. These actions are increasingly necessary to deliver sustainable growth and jobs and to gain competitive advantage in response to increasing global competition for resource and environmental constraints.

Approaches for financing diversification and demand management

Desalination plants and some projects for the **use of reclaimed water** (entailing sizeable investment in wastewater treatment plants – WWTPs) lend themselves to stand-alone commercial ventures funded from equity and commercial finance, typically under a concession form of contract. The main challenge lies in the financial sustainability of these schemes and more efforts should be devoted to devising sustainable solutions.

Demand management needs a different approach to financing. Much of the cost of demand management falls on and is financed by consumers – households, farmers and industries –, though governments can help with subsidies and tax breaks (McKinsey & Co. 2009).

Funding governance, institutional reform, management and information

Adequately funded water governance is essential for reducing uncertainty and managing risks. Generating data for policymakers and managers (observations, analysis, modelling, scenario building) will help inform decision makers and hence reduce decision-making uncertainty. Effective governance in areas such as environmental controls, groundwater monitoring and abstraction licensing, and monitoring and policing of pollution can reduce the risk of overexploitation of water resources or of surface water pollution and irreversible contamination of aquifers. Many water governance problems arise at the transboundary level, which is fraught with potential risks and conflicts. Capacity building and management support for transboundary water institutions needs proper funding.

Investment in strengthening the information base and data collection of hydrological information will result in positive returns but it is an area currently underfunded. Furthermore, transboundary cooperation is influenced by political and sovereign issues that affect cooperation. The attribution of benefits to the different partner countries is difficult, hence sharing costs is problematic, and hampers setting realistic budgets and funding modalities.

Approaches to financing governance

Some of these governance functions can be self-financed through abstraction and pollution charges. Other sources would be from multilateral and bilateral agencies, local governments, usually in combination.

Supporting technology development and adaptation

Specific enabling technologies that have substantial potential have been identified in various sectors. However, many of these technologies are still very costly or are at an early stage of development. Furthermore, the transfer of technology is a complex issue that is constrained by regulatory factors, technical capacities and political interests. ICT should be in the list of the sectors that are likely to play a leading role in a green economy. At a global level there is a

need to increase environmental research and development (R&D) and encourage the international transfer of cleaner technologies.

Approaches to financing technology

- Governments should invest in ICT infrastructure, foster broadband deployment and try to accelerate the digital economy.
- Public funds should be made available for investment in technology adaptation and adoption.
- There is a need for different types of patent franchise and access mechanisms for developing countries.

Investing in environmental assets and pollution reduction

Investing in environmental assets and the management of those assets can help achieve national goals for relief from poverty, hunger, and disease. Investments in improved agricultural practices to reduce water pollution can boost coastal fishing industry. Wetlands protection can help meet needs of rural communities, while avoiding costs of expensive flood control infrastructure. Both the UN Millennium Project and Millennium Ecosystem Assessment (MA) highlight the interdependencies between economic development and environmental management for poverty reduction and general wellbeing. Due to a combination of poverty, vulnerability to drought and crop failure, lack of safe drinking water, and other environment-related ills, millions of people die each year. Over a billion people suffer from diseases due to the lack of clean water, resulting in losses in productivity that affects growth.

Approaches for investing in environmental assets and reducing pollution

- Public policies should give incentives for private sector decisions regarding investment, production and consumption patterns that reflect the social benefits of environmental sustainability and the costs of various forms of environmental protection.
- Payment for environmental services to protect upper watersheds and preserve ecosystems services downstream.
- Unitary tax over agrochemicals.
- Pollution fees as a mean to finance effluent collection systems and water treatment plants.
- Mark-ups over water prices to finance river restoration programmes or to create water protection funds.
- Trust funds formed with voluntary contributions from firms and individuals.
- Reductions of risk premiums over loans to finance water infrastructure by means of loan guaranties to help the projects tap debt markets in local currency.
- Performance based price rebates (provided water users demonstrate a sizeable reduction in pollution loads or water consumption).

Approaches for addressing the challenges of financing

Improving efficiency in public spending

Much can be done to reduce the financing gap in the sector, while at the same time ensuring that the funds that come from government are efficiently used. Sector authorities will have to prioritise their efforts, but also be aware that in the absence of full cost recovery for water service delivery, implicit trade-offs are made between current and future users, and current and future taxpayers. Public Expenditure Reviews are a promising tool to shed light on how public resources are utilised in the sector. Also, results-based financing could prove an essential mechanism to improving efficiencies in a resource-constrained, inefficient sector. Ensuring that institutional capacities are strengthened to implement some of the new methods and tools becomes a priority. The challenge of scaling up in countries with weak institutional capacities is enormous but a transformation is required in the sector to accelerate progress. Making these trade-offs more explicit might be an important tool to increase accountability and transparency in the sector. They may also provide an incentive to create support for the necessary changes that are still needed in large parts of the sector.

A proactive role of government in major infrastructures

A proactive role for government is necessary in the context of relatively higher start-up costs compared to the longer-term benefit stream, positive externalities, and the commercial risks related to green investments and new technologies. This is particularly relevant to achieving a competitive outcome. Utilised with care, some state or public intervention may have a positive effect, for instance in supporting agri-environmental measures, development of renewable energies for desalinisation or other necessary infrastructure.

Reducing costs

A major source that needs to be tapped to close the financing gap is reducing the cost of the service providers. The most common factor of operational inefficiencies in utilities that can have important environmental impacts is non-revenue water (NRW) losses. Measures to address NRW should aim at reducing losses due to metering inaccuracies and unauthorised consumption and leakages in the network and in the household. Such a strategy needs to be based on an understanding of the full scope of the problem. In addition to taking the critical step of understanding the baseline situation, building capacity including use of appropriate technologies are also fundamental to an effective reduction programme. More importantly, implementing a reduction programme requires consideration of NRW within the broader context of utility reform. Thus the NRW reduction programmes must ensure an alignment of all objectives of developing an efficient and effective utility that meets the needs of its customers.

Approaches to NRW reduction could involve the private sector which can assist with providing services such as new technology development, investment, and incentives for project performance. Options for private sector involvement range from delegated management under Public Private Partnership (PPP) contract, to outsourcing of NRW reduction activities, and technical assistance contracts (Kingdom et al. 2006).

A good example of a well designed performance based contract is the **Manila Water Company in Philippines** which received a concessionary contract from the Manila's Metropolitan Waterworks and Sewerage System (MWSS) in 1997 and successfully reduced NRW from 63% to about 15% by 2009. This was accomplished through the implementation of efficient NRW management programmes that combined technical and social interventions. Illegal connections and meter tampering were addressed through community dialogues and "Water for the Poor" programmes.

Source: Kingdom et al. (2006)

Technology selection

Technology selection also plays an important role in reducing the cost of services. Technology choice will affect initial investment costs and hence the capital costs of the service, but also the operation and maintenance cost of the service over time. Both of these costs need to be taken into account when selecting technologies as lower capital costs may not necessarily go hand in hand with low operation and maintenance costs. Also important is the need to standardise the use of technologies in a country. The wide dispersion of technologies poses costs in terms of availability of spare parts and the local knowledge to deal with the different technologies. Standardising technologies and setting minimum standards, such as hand pumps should be considered.

Pro-poor tariffs and financing of water utilities

Local governments and service providers can consider increasing the design and implementation of successful policy instruments such as Social Safety Nets (SSN). SSNs are part of a broader poverty reduction strategy and are used as social tools to help facilitate productivity, redistribute resources to the poorest and most vulnerable, and protect low-income households from the effects of economic shocks or inequities. SSNs tend to have a better targeting performance than consumption or connection subsidies and they are offered through cash or non-cash instruments. Cash instruments include programmes that provide transfers in cash such as income support programs, non-contributory pensions, and disability benefits. Non-cash programmes on the other hand include food transfers, training opportunities for beneficiaries, and subsidies. Public-works and micro credit are other forms of SSN instruments. Public works typically provide low skills employment opportunities (for example, construction or rehabilitation of much needed public infrastructures) to the poor willing to work for a low wage payment in cash or in-kind (Milazzo and Grosh 2008).

Lessons learnt from the application of Social Safety Nets and investments for poor communities

The World Bank has actively incorporated SSN components into its lending and analytical work activities. In its water lending operations, SSN interventions have ranged from conditional cash transfers to grants and training opportunities. For example in the Indonesia Third Water Supply and Sanitation for Low Income Communities project, the World Bank is supporting the Government of Indonesia's commitment to achieving the water MDGs, by providing community block grants to deliver water supply and sanitation infrastructure, community empowerment and local institutional development including incentive grants which would increase the number of low-income rural and peri-urban residents with access to improved water and sanitation facilities. The project is being implemented on a

programmatic basis to provide assistance to selected villages that meet the project's targeting and section criteria. Through this mode of delivery, project funds are directly allocated to the participating villages.

Quantity-based subsidies are, however, not the only type of subsidies that are being provided in the residential water sector. Many utilities offer connection subsidies, targeted by geographic or proxy means-test criteria. In addition, self-selection is used to target subsidies for lower-quality services such as public standpipes. These schemes perform somewhat better than quantity-based ones. The geographic schemes examined present an almost neutral distribution, while proxy means-testing and self-selection present relatively progressive distributions. Still, these schemes exclude a substantial proportion of poor people – due to low utility coverage for this group. In irrigation, subsidies are delivered either through area-based pricing or volumetric pricing. Area pricing tends to promote little conservation, whereas volumetric pricing helps to limit water use but has high transaction costs.

Results Based Financing

In Results Based Financing (RBF), resources are disbursed not against individual expenditures or contracts on the input side (as traditionally done), but against demonstrated and independently verified results that are largely within the control of the recipient.

Examples of RBF structures:

- **Output-based Aid (OBA).** Typically OBA involves payment of a subsidy to cover a funding gap to access basic services by the poor. OBA can also be used for more efficient delivery of services that exhibit positive externalities. Service delivery is contracted out by the entity providing the public funds to a service provider (a private enterprise, a public utility, NGO, community-based organisation), with payments tied to achievement of specified service performance or outputs. OBA subsidies can either buy down the capital cost of investments required to deliver the service or can cover the difference between an affordable user fee and a cost-recovery user fee, for example a consumption subsidy.

- **Output-Based Disbursement (OBD).** OBD involves payment of a subsidy to a service provider or a contractor for improvements in the efficiency of service-related assets, systems, or recurrent government activities.

- **Performance-Based Financing for Health (PBFH).** PBFH involves payments to a provider, payer (e.g. government entity) or consumer when measurable actions are taken or defined performance targets are achieved.

- **Conditional Cash Transfers (CCT).** CCT programmes provide cash payments to poor households that meet certain behavioural requirements, generally related to children's health care and education.

- **Cash-on-delivery Aid (COD).** Proposed by the Centre for Global Development, COD involves payments to the recipient government after measurable progress, only for as much as is verifiably achieved (e.g. a fixed amount for every student that takes a

standardised competency test in their last year of primary school, or for each additional child over an enrolment baseline who takes the standardised competency test).

- **Advance Market Commitments (AMCs).** AMCs are a range of mechanisms which aim to create sustainable markets by providing a guarantee of future revenues to service providers for a limited period of time. AMCs act by guaranteeing service providers a price on delivery of a pre-defined output and/or that they will be able to sell a minimum number of units for a limited period of time.

- **Carbon Finance (CF).** CF is an instrument for leveraging private and public investment into projects that reduce greenhouse gas emissions. It involves contracts to purchase emission reductions similar to a commercial transaction, paying for them annually or periodically once they have been verified by a third party auditor (World Bank 2010c).

RBF mechanisms such as OBA, OBD, AMCs, and some types of PBFH link service outputs with associated unit costs and disbursements reflect the actual cost of service. Other RBF mechanisms such as COD, PBFH, CCT, and CF, where the costs cannot easily be predetermined (e.g. school enrolment numbers), consider output delivery or achievement of specific milestones or measured outcomes as a condition for funding without the unit cost linkage.

Lessons from implementation of Results Based Financing of water projects

The application of RBFs in the water sector has been quite limited, but in recent years, these instruments have emerged as an important new way of financing basic services. Output-Based Aid (OBA) is one of the mechanisms that have been used in the water supply and sanitation sector in the last few years with promising results. Most of the financing has been channelled through the Global Partnership on Output-Based Aid (GPOBA), a partnership of donors and international organisations working to promote the concept of OBA. There are currently 22 projects with World Bank participation with approximately US$ 140 million allocated to subsidies: 15 water supply schemes, three sanitation schemes, and four providing both water and sanitation (Kumar and Mugabi 2010). Many of these projects are already showing promising results: in a span of less than a year 6,700 connections were made in Cameroon (project target at completion is 40,000); in India 77,000 connections in rural communities in Andhra Pradesh were completed. In most of the schemes a one-time subsidy is provided for access to service. Most cases financed so far involve piped-water schemes, with access defined as the delivery of a working connection to the network.

In an evaluation of the implementation of OBA projects in the water sector, Kumar and Mugabi (2010) draw some key elements for success necessary early in the process: i) market structure and experience with competitive processes to encourage efficiency; ii) regulatory or legal and contractual framework, including policies for setting and adjusting tariffs; iii) capacity of implementing agencies – for example, to handle transaction processes, monitoring and verification, and the flow of funds as well as an understanding of and willingness to work with performance-based arrangements, and iv) extent of experience with the private sector in service provision, where relevant.

The formulation of clearly defined incentives requires reporting systems that generate systematic and reliable information to benchmark and monitor the efficiency with which

resources are being used in terms of outputs and outcomes. Governments must understand the benefits of being able to clearly monitor and measure the impact of its investments.

Lessons learnt from specific cases

Lessons learnt from 'Output-based Aid: extending water and sanitation services to the poor in peri-urban Morocco':

- The use of performance-based subsidies helped refocus service provision on household demand, which increased accountability, strengthened partnerships between local authorities and operators, and made monitoring of service delivery a priority.

- The OBA approach proved an efficient and powerful tool to extend services to poor peri-urban areas in a cost-efficient and sustainable manner.

- Participation was strictly demand-driven. This created an incentive for the operators to carefully assess demand from targeted beneficiaries during preparation and work with local authorities and partners during implementation to raise awareness and promote the programme.

- Operators reached potential customers by sending dedicated teams to marketplaces or the centre of targeted neighbourhoods to record demand from beneficiaries who might not easily travel to one of the operator's agencies.

- The OBA approach was seen to play an important role in overcoming financing blockages, mobilising stakeholders, and making sure funding reached the targeted people.

- The quarterly inspections by an independent technical reviewer helped improve the operators' progress reporting requirements and implementation methods.

- The OBA is seen as strategically relevant to Morocco, given the lack of targeted subsidy mechanisms for poor households, especially in informal urban settings. Despite the maximum number of connections being made through the pilot project, the need for additional connection remains great. The operators continue to deliver connections under the same conditions, but without the subsidy; there is an immediate need for concrete action from the government to implement a programme which continues to address the persistent service deficit in low-income peri-urban settlements throughout Morocco.

- The Government of Morocco has expressed interest in replicating the OBA approach on a citywide or nationwide scale. The World Bank is now working with the government to plan a scale-up programme that could be adapted to address the needs of several large municipalities. Such a programme would also aim to strengthen coordination between institutions in charge of the different aspects of peri-urban utility service, and reform tariff and connection fee structures, so as to prevent an expansion of unserved peri-urban neighbourhoods.

Lessons learnt from 'Social contract formulas in rural areas: the India Naandi Foundation water treatment plants':

- An OBA approach has promoted participatory community involvement and capacity building in the villages for managing and delivering efficient services. A grassroots fee-for-service model coupled with a sense of community engagement and ownership will help ensure the long-term sustainability of the water supply schemes.

- Rural households are willing and able to pay for clean drinking water; however, in most cases this demand has to be created through community awareness campaigns. In this case, a cost recovery tariff was a new concept for the beneficiaries and willingness to pay had to be generated. This was made possible by the community awareness and social marketing campaigns carried out by the implementing agencies, and a high level of transparency and accountability ensured through the OBA approach.

- A win-win strategic partnership between the grant recipient and the technology provider/operator is critical to success. The partnership resulted in a win-win situation whereby WHI (the technology provider) benefited from increased demand generated by Naandi's safe-water education campaigns, and Naandi benefited from linking its traditional health education work to new and reliable clean water supplies. However, as operators increase their capacity in using the community approach, a direct contractual agreement between the Panchayat and the operator is likely to be more efficient.

- Small grant-financed pilot projects can stimulate discussion amongst government agencies on wider sector issues (e.g. appropriate water treatment technology for rural water supply, institutional arrangements for O&M, and improving accountability and transparency in service delivery). But project implementers must be flexible enough to respond quickly and appropriately to take advantage of opportunities.

- Paying on outputs effectively transfers procurement and financial management-related risks to service providers.

Lessons learnt from 'Pro-poor financing and tariffs in Medellin, Colombia':

- Know your target population well. Programmes addressed to the poor must be built on a thorough analysis of the target beneficiaries' conditions and their local particularities in order to structure flexible and custom-made options for social improvement. This requires interdisciplinary study of economic, social and psychology behaviour, as well as the rules, regulations and institutions that affect social behaviour.

- A successful programme in one particular context does not necessarily guarantee success when the practice is transferred to a similar context. As initiatives are designed to solve a specific situation, what can be transferred is not the practice itself but the building and conceptualising processes involved in its design and initiation.

- Do not think the target has been already met. Constant monitoring and evaluation is essential to identify changes or deviations from the expected outcomes or to introduce improvements leading to increased efficiency and effectiveness of measures.

- Investment in social capital in the community contributes to economic development and generates positive externalities.

- Credit is not the solution when it does not contribute to income generation or savings for consumers. Thus, credit options for delinquent accounts must be considered just as temporary measures in order to avoid consumers' dependency or poverty traps.

- Joint efforts generate high impact. Collaboration and cooperation between governments (both municipal and national), private and public entities is the best way to support the expansion of water and sanitation services and invest in social welfare, through joint commitment to the achievement of a common target. The responsibilities and roles of each actor should be identified.

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Social contract formulas in rural areas: the India Naandi Foundation water treatment plants

Cledan Mandri-Perrott, World Bank

Type of tool: cost recovery and sustainable financing of water services
Location: Andhra Pradesh State, India, Asia

Challenges

The provision of safe drinking water is a key development issue in India, where only 18 percent of rural households have access to clean water and 21 percent of communicable diseases are water-related. Andhra Pradesh is the fifth most populated state in India with 80 million people. Nearly 65 percent of its population has access to water; however, 17 million people (over 22 percent) routinely experience bacteriological contamination of water. Rural households in the coastal districts suffer frequent outbreaks of jaundice, diarrhea, and gastroenteritis. Some of the challenges in providing clean water in rural areas include geographic remoteness, poor maintenance of existing systems, and a paucity of public funds. Social factors also contribute to poor service levels in rural areas, notably the caste system and high rates of illiteracy. Providing safe drinking water to poor families in the coastal area of Andhra Pradesh is critical for the economic development of the region as well as for improving health and living conditions.

Drivers of change and objectives

In 2006 the Naandi Foundation was founded, an Indian non-governmental organisation which describes itself as "one of the largest and fastest growing social sector organisations in India working to make poverty history." Started by an extremely successful businessman, the foundation bases its approach to poverty on using public-private partnerships to create sustainable models for delivering critical services. Safe drinking water is a core programme. Naandi formed a relationship with Water Health India (WH India), a subsidiary of Water Health International (WHI), a disinfection technology provider, and approached Global Partnership on Output-Based Aid (GPOBA) to request funding to pilot rural village water schemes in coastal Andhra Pradesh that combine cost-effective water purification technology with a community-driven and performance-based approach.

The proposal was accepted by GPOBA and, in May 2007, Naandi and GPOBA signed a grant agreement for an output-based aid (OBA) project to improve rural water services in three coastal districts of Andhra Pradesh: Guntur, Krishna, and West Godavari. The Naandi Foundation manages the project and runs programmes to generate awareness about the need for clean water through health educators. These educators work with the community through women's self-help groups and schools, targeting women as they are the decision-makers for domestic water use. WHI installs and maintains the treatment plants, with the water meeting the quality standards specified by the Bureau of Indian Standards. Given the remoteness of the locations and the lack of technical support, the objective has always been to ensure sustainable delivery of services. Apart from setting up each plant, WHI hired and trained plant operators in each village. The water tariff pays for the ongoing operation and maintenance of the water plants.

The project aimed to establish Community Safe Water Schemes (CSWS) in 25 coastal villages that currently lack access to clean drinking water, benefiting around 12,500 poor households (earning less than $20 per month). It was estimated that each CSWS would benefit a minimum of 500 poor households. Each CSWS has a water treatment plant connected to a water distribution point from which users will purchase water in jerry cans. Although this project does not envisage domestic connections, it is a first step in providing safe and affordable drinking water in areas where typically the existing water source is of poor quality.

The approach: how the financing tool helped overcome barriers to providing safe drinking water for the rural poor

Public-private partnership

The community water project employs a community-based public-private partnership model involving the village *Panchayat* (local council), Naandi, and WHI, each with the following roles:

- The village *Panchayat* is required to provide land for the plant to be built on, a treatable water source for the plants, the community financial contribution, and electricity at a pre-agreed tariff for the CSWS.

- Naandi acts as project manager and secures pre-finance for the plant's construction through commercial borrowing. It mobilises the community to raise the necessary community financial contribution and collects water user fees. It trains Safe Water Promoters and Village Health Workers, and develops a communication and awareness campaign to change the behavioural practices of poor families regarding water. Naandi also undertakes monitoring and evaluations to measure outputs and the impact of the scheme.

- WHI is the project operator. It builds and installs the ultraviolet (UV) filter water purification plants and the basic infrastructure needed to operate them (i.e. pumping system, storage tank and shelter); hires and trains a plant operator for each of the 25 villages; and shares project implementation risks by providing Naandi with operational performance guarantees.

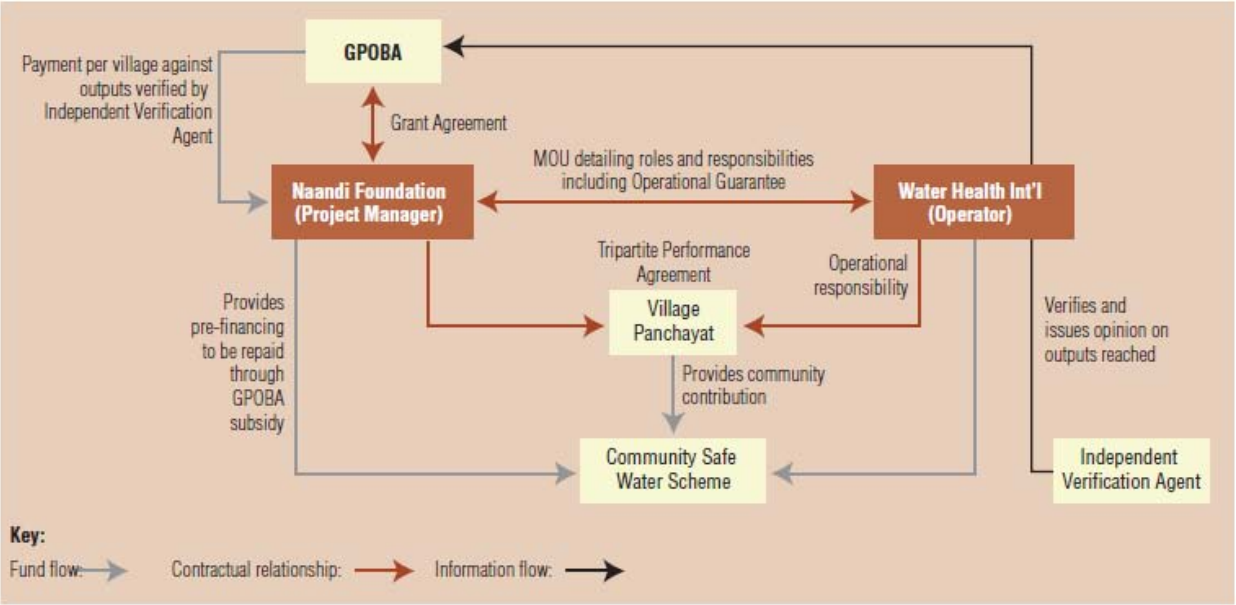

Figure 1. Project arrangements

Output-based aid approach

Enhancing the sustainability of the pilot water schemes through an output-based approach has been a key part of the project design. GPOBA subsidizes the cost of setting up the water treatment plants with ultraviolet (UV) purification technology 25 villages through a US$800,000 grant. This subsidy is performance-based and linked to the delivery of pre-agreed outputs which include three months of billed water services (see Table 1). The output-based approach requires that tariffs paid by users for consumption cover the costs of operation and maintenance, user-fee collection, and education and communication activities with key stakeholders and vulnerable groups such as young mothers, infants, and families living below the poverty line. Tariffs also cover loan repayment, thus helping to ensure the long-term sustainability of the services.

The GPOBA subsidy is paid to Naandi in instalments after independent verification of three pre-agreed outputs which Naandi pre-finances through commercial borrowing. Notably, a significant part of the subsidy is payable only after each CSWS proves it has provided reliable water services for at least three months after becoming operational. Together with an independent verification agent, the World Bank's Water and Sanitation Program (WSP) will conduct ex post reviews of the completeness, accuracy, and authenticity of the documentation provided for each village, and undertake ex post physical spot checks of the outputs. Payments by GPOBA are made only after these conditions have been met.

As the subsidy is mainly linked to service delivery (rather than constructs, as input-based schemes), if WHI does not perform, Naandi will not receive the subsidy from GPOBA and therefore will be unable to repay the loans it take acquired to pre-finance the schemes. Naandi relies upon the operational guarantee provided by WHI to protect itself against this risk.

Indicator	Output Item	Description of the Output	Means of Verification	%Disbursed
1	25 UV water purification plants/CSWSs installed	Construction and installation of the complete CSWS	Completion report for each plant available from the Independent Verification Agent	20
2	Registration of the households	Paid subscription fees	Minimum 500 Below Poverty Line households registered for paid usage of water; subscription fee available from such households	60
3	Three months of billed user free consumption	m^3 of water sold	Continued usage of paid water by a minimum of 500 households; billing records.	20

Table 1. Schedule of outputs and disbursements

Selecting eligible households

The project uses various techniques to target the poorest households. The three project districts were chosen because of their high poverty rate and lack of access to quality water services. Within this geographical area, villages were selected based on the presence of a water source that could be purified by ultraviolet technology, and the willingness and ability of the village to adopt a fee-for-service scheme. To target individual beneficiaries in the villages, the project uses the government's 'white ration card', a system that entitles low-income individuals to obtain basic commodities (e.g. rice, flour) at a reduced price. Other indicators considered include family size, construction of a house from low-cost material, limited or no possession of durable goods such as a TV, and time spent by women and children of a given household in fetching water. As project manager, Naandi does the targeting in close collaboration with the village *Panchayat*. The process is verified by the independent verification agent.

Sharing the investment costs

The total project cost is US$1.25 million. The cost per CSWS (US$50,000) covers investment, community awareness, and running costs. Tariffs are set at an affordable rate and cover the initial investment (net of subsidy) and operation and maintenance costs. Sustainability of the service is thus ensured through user fees which average US$0.03 for a consumption of 20 litres. Since the three project districts are contiguous, the cost per CSWS is almost the same across all the project villages.

The share of investment costs is shown in Table 2. The community contribution (which is at least 20 percent of the total capital cost) may come from user fees, and/or from local

government funds, and/or from donations from philanthropists and charitable organizations. The commercial loan sourced by Naandi is payable over a period of approximately seven years. During this period the assets remain with the community and Naandi, and WHI has full operational responsibility. After the loan is re-paid, the *Panchayat* may choose to renew the operation and maintenance agreement with Naandi and WHI. The life of the plant system is expected to be at least 15 years.

Source of funds	Per village (US$)	Total project (US$)	Share of total (%)
Community contribution	10,000	250,000	20
GPOBA subsidy	32,000	800,000	64
Long-term commercial loans	8,000	200,00	16
Total	50,000	1,250,000	100

Table 2. Share of overall investment

Evaluation

The project provided access to safe water through the construction and installation of 25 UV water purification plants in 25 villages in Guntur, Krishna and West Godavari districts. By grant closure, all water plants were fully operational and serving a total of 16,104 poor households (or 77,878 people), which is 29 percent higher than the original target of 12,500 households. Household surveys conducted after grant closure found that 98 percent of the households reached by the project still continue to use water from the new plants for drinking purposes (i.e. they have not reverted back to existing contaminated sources). This implies a high community awareness of the health risks of contaminated water, and evidence of the effectiveness of the awareness campaign which complemented the hardware component.

Evidence from household surveys also suggests that the project has led to health and economic outcomes (see Table 3), which can be reasonably and directly linked to the project outputs.

Before the project	After the project
• Average time spent collecting water was estimated at 61 minutes. • Incidence of water borne diseases in children and adults was 68 percent and 84 percent respectively. • On an average a family was spending around Rs.300-400 for treatment on	• Average time spent collecting water estimated at 20-22 minutes which shows that there was a time saving of around 40 minutes per trip of fetching of water. • Overall, the incidence of water borne diseases has dropped by 85 percent (figure collaborated by

these diseases for a single visit.	health workers in the village health centres). • Household savings on medical expenses alone was Rs 650-750 a year.

Table 3. Evidence of economic and health benefits from household surveys

Economic analysis

The project provided significant short and long-term benefits with many positive spillover social and economic impacts at the individual and community levels. Health and environmental benefits and cost saving from medical and health related expenses are the largest benefits of any water supply and sanitation project, but they are difficult to quantify in entirety.

A benefit-cost framework using a 'with' and 'without' project methodology has been used to calculate the Economic Rate of Return and the Net Present Value (NPV) of the project, ex post. The economic analysis covers a project life of 15 years. Cash flow is discounted at 12%, which is the estimated cost of capital. A conservative inflation rate of 6% per annum is assumed for cash flow analysis. Without project situation is what would have been prevailed without the project vis-a-vis factors such as population increase, continued exposure to contaminated water, and economic growth. The quantifiable economic benefits include: (i) water sold at flat tariff rate established by the operator which comprise of economic value of incremental water consumptions by households with access to safe water; (ii) health benefit of the project for the beneficiaries; and (iii) potential time cost saving for collecting water from distance. The economic value of cost of time saved is estimated using the opportunity cost of labour or the income foregone in other income generating activities; which is considered benefits to the households and the society.

The ex post economic analysis yield a positive and significant NPV of Rs.199 million (or US$4.4 million) and an overall Internal Rate of Return (IRR) of 71% (against IRR of 73% for ex ante economic analysis at appraisal). The economic benefit of the revenue generated from water sold alone at the established tariff rate is also significant with NPV of R.113.9 million (or US$2.5 million) and an Intern IRR of 38% (against 31% at appraisal). When the net benefits (over and above their willingness to pay) of time cost saved to fetch water are added, the IRR increases to 49% and with added net benefits from improved health, the overall IRR reaches to 71%.

Financial analysis

The ex ante financial analysis at appraisal revealed that project was financially sustainable from the operator's perspective. The ex post financial analysis reveals that the operators will be able to cover its operating costs and with a profit margin only starting year 2012. The reasons are: (i) of the 25 schemes constructed 23 are operated and maintained by the operator (2 are operated by the communities); (ii) of the 23 schemes in operations at the project closing in 2010, only 11 covered direct O&M costs and remaining sites did not generate enough revenue to cover operating costs; (iii) plant constructed were in operation only 8 hours a day; (iii) consumption in 9 sites was low due to bad taste of water; and (iv) in 3 sites community is small and therefore insufficient volume of water produced and

consumed. All these issues are being addressed, schemes are being upgraded to be operated more efficiently with better quality water, and operational hours of the schemes are being increased to cater increasing demand. With available data on revenue generation and O&M costs as of 2010, the measures being taken to improve consumption and revenue, as well as other relevant information, all 23 schemes are expected to generate enough revenue to cover the cost with a profit margin starting 2012 and in the 15 year of its useful life. The Financial Rate of Return (FRR) is estimated at 23% (against 64% at appraisal) when taking into account the subsidy from the grant; and it is estimated at 3.5% (against 6% at appraisal) without the subsidy.

Lessons learnt from implementation

The design and implementation of the project offers the following key lessons that might be useful in shaping future similar projects:

- ***Rural households are willing and able to pay for clean drinking water.*** This has been a consistent lesson emerging from many World Bank-supported rural water supply and sanitation projects in India. However, in most cases this demand has to be created through community awareness campaigns. In this project, paying a cost recovery tariff was a new concept for the beneficiaries, which for decades have been accustomed to expecting free service delivery from the government. The shift in payment behaviour was made possible by the community awareness and social marketing campaigns carried out by the implementing agencies, and a high level of transparency and accountability ensured through the OBA approach.

- ***A win-win strategic partnership between the grant recipient and the technology provider/operator is critical to success.*** The role of the Naandi Foundation as grant recipient, administering the project and interfacing with the implementing agency and the Panchayat through a tripartite agreement, has been instrumental for the success of the project. Naandi provided support in selecting communities and in targeting beneficiaries. Throughout the project Naandi conducted visits to beneficiary communities, trained and facilitated community-based health promoters, managed awareness campaigns and helped clarify issues relating to project implementation with the implementing agency. The partnership resulted in a win-win situation whereby WHI benefited from increased demand generated by Naandi's safe-water education campaigns, and Naandi benefited from linking its traditional health education work to new and reliable clean water supplies. However, as operators increase their capacity in using the community approach, the need for tripartite agreements between the operator, an NGO and the village Panchayat becomes less necessary. In such a case a direct contractual agreement between the Panchayat and the operator is likely to be more efficient.

- ***Small grant-financed pilot projects can stimulate discussion on wider sector issues, but Bank teams must be flexible enough to respond quickly and appropriately.*** This project partially contributed to stimulating a wider sector discussion on issues related to appropriate water treatment technology for rural water supply, institutional arrangements for O&M, and improving accountability and transparency in service delivery. However, the Bank team missed an opportunity to engage with the State government agencies (such as the Rural Water Supply and

Sanitation Division) regarding the potential benefits of the OBA approach in general and the potential for wider application.

- ***Appropriate application of the Bank's fiduciary procedures to an output-based arrangement minimised the fiduciary risk to the Bank without encroaching on the implementers' freedom to use its own systems to deliver outputs***. The project has confirmed that paying on outputs effectively transfers procurement and financial management-related risks to service providers.

Scaling up

The GPOBA subsidy has made it easier for Naandi to borrow funds from commercial banks. The OBA approach is promoting participatory community involvement and building capacity in the villages for managing and delivering efficient services. The grassroots fee-for-service model coupled with a sense of community engagement and ownership will help ensure the long-term sustainability of the water supply schemes.

It is anticipated that the CSWS model can readily be applied to other villages in the State of Andhra Pradesh and ultimately in other parts of India. GPOBA, Naandi, and WHI believe that scaling up is possible, as the impacts of each pilot will motivate adjoining villages to engage in similar projects, accelerating demand and willingness to pay for clean water through user fees. Lessons from this project may also assist in the design of national programs aimed at achieving the Millennium Development Goals for water and sanitation.

WaterHealth International has entered into similar public-private partnerships in Ghana, the Philippines and India. Naandi is now introducing rural private operators into its schemes in central Vietnam with the aim of improving the financial and technical sustainability of its schemes.

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Output-based Aid: extending water and sanitation services to the poor in peri-urban Morocco

Xavier Chauvot de Beauchêne, World Bank

Type of tool: Output-Based Aid
Issue: cities
Location: Casablanca, Tangier and Meknes in Morocco, Northern Africa

Challenges

Morocco is a middle-income country and access to potable water and improved sanitation has seen significant improvements in the last decade, reaching 94 and 81 percent respectively in urban areas. However, infrastructure is lagging in slums and illegal settlements in urban and peri-urban areas, where the poor are deprived of access, particularly to the sewerage collection networks. In some cases, these settlements constitute a substantial portion of metropolitan areas. For example, in Casablanca, 1.2 million, or 30 per cent of the population, live in such illegal settlements.

The inhabitants of urban and peri-urban areas without access to adequate services must rely on contaminated water from shallow wells, water providers who charge relatively high unit price, or standpipes which may require women or children to queue for hours. The majority of households uses cesspits and poorly designed septic tanks, which risk further contamination of groundwater, and many of the poorest people have no form of sanitation at all. These deficiencies have serious and direct impacts on people's health, their ability to engage in economic activities, and children's school attendance. They also harm the finances of water utilities, which generally attain very low cost recovery from public standpipes.

Barriers

There are a number of barriers to extending water and sanitation services to the poor in these areas:

1. Unplanned growth of peri-urban areas has systematically excluded them from the service areas of water and sanitation operators.

2. Technical and administrative hurdles made it difficult for operators to intervene in illegal settlements, mostly because of a lack of basic access roads.

3. Operators have difficulty financing infrastructure for households perceived to be in the loss-making lowest brackets of existing water tariffs.

4. Connection fees are priced at marginal cost, topped with a 'first settlement fee,' thereby driving costs of access to unaffordable levels for many households, even when the option of payment by instalments is available through 'social connection' programmes.

Drivers of change

In response to these challenges, the National Initiative for Human Development (INDH) was launched in May 2005. One of the focuses of this initiative was on upgrading infrastructure, public utilities and social services in poor neighbourhoods, particularly in urban and peri-

urban areas. The initiative addressed a critical barrier by recognizing and addressing informal settlements which were previously considered illegal and therefore ineligible for services. This provided a strong momentum for municipalities and utilities to explore the best mechanism to expand access to basic infrastructure among the poorest. Local governments and operators were encouraged to reduce connection fees for their inhabitants to meet the needs of the poor. The lack of financing to develop connections for onsite upgrading of services remained a key challenge faced by the INDH.

The government and operators of water utilities in Casablanca, Meknes and Tangiers requested a grant from the Global Partnership on Output-Based Aid (GPOBA) – a World Bank-administered programme – to pilot an innovative Output-Based Aid (OBA) approach with the objective of expanding access to water and sanitation service among the poor living in peri-urban settlements with a recognized right to access services through the INDH programme. The tool employed in the project was the introduction of an OBA approach, which are performance-based subsidies to encourage service expansion, but disbursed on the basis of realized and independently verified outputs.

How the tool overcame barriers to extending service coverage

The project was launched in 2007 and implemented by the two private sector incumbents in Tangier and Casablanca, Amendis-Tanger and Lyonnaise des Eaux de Casablanca (LYDEC), and the Regie Autonome de Distribution d'Eau et d'Electricite de Meknes (RADEM), a public utility. The Government of Morocco also played an oversight and monitoring role. The pilots were funded through a US$7 million grant from GPOBA and aimed to connect 11,300 households (approximately 56,000 people) to piped water and sanitation services in poor peri-urban neighbourhoods in the three cities.

The utilities that serve Tangier, Meknes and Casablanca arranged pre-financing for expansion of water and sanitation facilities to pre-selected communities. Targeting was geographical and identified neighbourhoods in the INDH's shortlist of most disadvantaged urban and peri-urban communities. Water and sewerage connection networks were constructed on land belonging to the municipality and once the connections were made, an OBA subsidy would be disbursed to supplement reduced connection fees by households. The pre-agreed subsidy was designed to bridge the gap between capacity to pay and the real cost of connection. All households located in selected areas were eligible for a subsidized connection fee, in addition to the fee waivers granted for INDH areas and payment facilities offered by 'social connection' programmes.

The outputs for which the subsidies were disbursed were simultaneous network connections to water supply and sewerage services for individual households, or in the case of Meknes, the connection to either service. The subsidy was operator- and service-specific (see Table 1) and paid in local currency in two steps: 60 percent upon certification by an Independent Technical Reviewer of a working water and sewerage connection to an eligible household; and 40 percent upon verification by the Independent Technical Reviewer of at least six months of sustained service.

City	Operator	Subsidy levels per connection (MAD/US$ eq.)		Subsidy levels per connection (MAD/US$ eq.)	Minimum household monthly installment for connection fee*
		To water supply	To sanitation		
Casablanca	LYDEC	MAD 1,458 (US$170)	MAD 3,609 (US$421)	28%	MAD 60 (US$7)
Tangiers	Amendis	MAD 1,467 (US$171)	MAD 4,158 (US$485)	24%	MAD 100 (US$11.7)
Meknès urban areas (Ouislane, Meknès)	RADEM	MAD 1,422 (US$166)	MAD 7,821 (US$913)	53%	MAD 110 (US$12.8)
Meknès rural areas (Dkhissa, Ait Ouallal, etc.)	RADEM	MAD 5,319 (US$621)	Ineligible to OBA funding	74%	MAD 55 (US$6.4)

MAD-Moroccan dirhams (U.S> dollar equivalent in parentheses), exchange rate of as March 2009
*For households choosing to pay their connection fees in instalments over time.
Source: GPOBA/Infrastructure Développement Consultants
Table 1. Operator- and service-specific unit subsidy amounts per connection

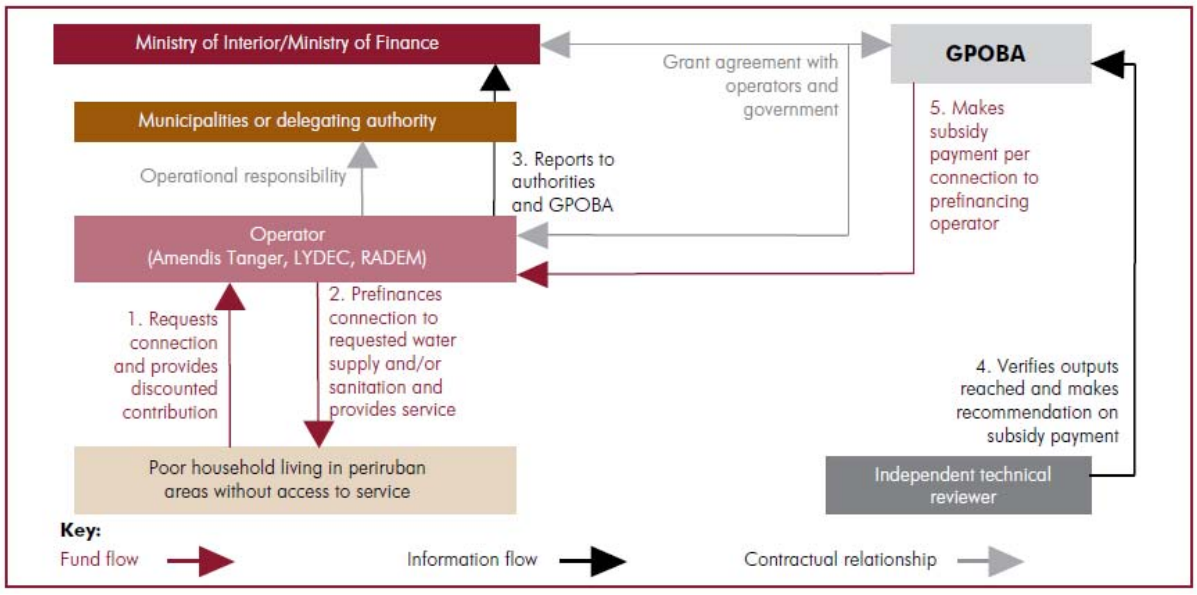

Figure 1. Project arrangements

The built-in incentives of the OBA approach are specifically designed to overcome traditional barriers of expanding services in marginal neighbourhoods, namely: inability to afford connection costs; operators' unsustainable financing for service expansion programmes to poor areas; complex technical and administrative obstacles to infrastructure development in

poor unzoned areas; and reluctance of national and local governments to fund subsidy programmes with no accountability or guarantee for results.

Evaluation and lessons learnt from implementation

The pilots experienced a slow start, with about 2,000 connections (15 percent of the programme's three year objective) in the first year, but connection rates accelerated significantly thereafter. Demand exceeded expectations. An independent midterm review of the pilots showed that the delay was due to implementation difficulties unrelated to the OBA approach: World Bank procurement procedures, upstream investment delays, and lack of clarity over land tenure. By 2011, the grant made available by GPOBA was fully committed and subsidies allocated. The pilot provided subsidized access to water supply to a total of 10,504 households and sanitation services to a total of 9,036 households, benefitting more than 52,500 people. Households that were simultaneously connected to water supply and sanitation services totalled 5,593 in Casablanca and 2,909 in Tangiers. In Meknes, 2002 households acquired access to water supply services and 534 to sanitation services. The collection rates achieved were equal or superior to the average in each operator's service area.

The project has resulted in important direct benefits to households in terms of time savings, reduced health costs and improved hygiene practices. Beneficiary households report high satisfaction with the service provided, and operators and government are also satisfied with the pilot.

Lesson learnt

- The use of performance-based subsidies helped refocus service provision on household demand, which has increased accountability, strengthened partnerships between local authorities and operators, and made monitoring of service delivery a priority.

- All parties agree that the OBA approach has proven an efficient and powerful tool to extend services to poor peri-urban areas in a cost-efficient and sustainable manner.

- Participation is strictly demand-driven. This creates an incentive for the operators to carefully assess demand from targeted beneficiaries during preparation and work with local authorities and partners during implementation to raise awareness and promote the programme.

- Operators developed proactive and dynamic approaches to integrate their new customers. E.g. they reached potential customers by sending dedicated teams to marketplaces or the centre of targeted neighbourhoods to record demand from beneficiaries who might not easily travel to one of the operator's agencies.

- The OBA approach was seen to play an important role in overcoming financing blockages, mobilizing stakeholders, and making sure funding reached the targeted people.

- The quarterly inspections by the Independent Technical Reviewer helped improve the operators' progress reporting requirements and implementation methods.

The World Bank will prepare an implementation completion and results report on the project in the coming months, to give a full account of results and disseminate final lessons.

Scaling up and relevance for developing and transition countries

The OBA approach is seen as strategically relevant to Morocco, given the lack of targeted subsidy mechanisms for poor households, especially in informal urban settings. Despite the maximum number of connections being made through the pilot project, the need for additional connection remains great. The operators continue to deliver connections under the same conditions, but without the subsidy; there is an immediate need for concrete action from the government to implement a programme which continues to address the persistent service deficit in low-income peri-urban settlements throughout Morocco.

The Government of Morocco has expressed interest in replicating the OBA approach on a citywide or nationwide scale. The World Bank is now working with the government to plan a scale-up programme that could be adapted to address the needs of several large municipalities. Such a programme would also aim to strengthen coordination between institutions in charge of the different aspects of peri-urban utility service, and reform tariff and connection fee structures, so as to prevent an expansion of unserved peri-urban neighbourhoods.

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Pro-poor financing and tariffs in Medellín, Colombia

Rubén D. Avendaño, Empresas Públicas de Medellín

Type of tool: cost recovery and sustainable financing of water services
Issue: cities
Location: Medellin, Colombia, Latin America

Challenges and objectives

Colombia, as is the case of many Latin-American countries, has implemented different economic reforms to improve the living standards of its population. In the utilities arena, some measures have been taken in terms of tariff structure and changes in the institutional framework. However, there exist economic, social and legal entry barriers for a significant proportion of people that remain without guarantees, living in an informal world where rights depend on income.

People living in poverty face innumerable access problems related to the lack of financial capacity to afford to a minimum water service allowance, and the inability to save enough money to pay for the consumption. This has been a crucial issue in the water sector in the developing world for years. In addition, experience shows that low or no income is not the only barrier inhibiting access to water services. Other conditions associated with poverty in these areas, such as social unrest, violence, unemployment and underemployment, urban displacement, and other related factors, threaten to undermine economic efforts to guarantee service access. In many cities in the developing world, as in Medellín, the poor peri-urban population not only live under 'border' economic conditions, entering and exiting to and from the formal world, but also under border social, legal, and institutional conditions. This interception of multiple geographical, economic and social stressors constitutes a major challenge to extending water services coverage to these areas. Moreover, this population is more vulnerable to external social and economic shocks (unemployment, sickness or death of members in close social networks, etc.)

Governments in association with utilities in the developing world have a responsibility to address these challenges in services provision. The experience of Empresas Públicas de Medellín (EPM) as water services provider for Medellín and the Aburrá Valley[14] in Colombia, consists of joining formal public policies of local and national government with EPM's corporate social responsibility policies to create shared value in the weakest segment of the population. A portfolio of initiatives has been specifically designed with the aim of guaranteeing universal access to public services, and to prevent this vulnerable population from falling into a poverty trap that impedes the possibility of connection and consumption. Based on an understanding of users both as households and as people that make part of a community, by considering their symbolic and social capital, EPM is addressing with success this challenge.

[14] The Aburrá Valley (in Spanish Valle de Aburrá), is the natural basin of the Medellín River and one of the most populous valleys of Colombia in its Andean Region with more than 3 million inhabitants. The Aburrá Valley is home to ten cities: Medellín, Barbosa, Bello, Caldas, Copacabana, Envigado, Girardota, Itagüí, La Estrella and Sabaneta.

About EPM

Empresas Públicas de Medellín is a Colombian company owned by the Municipality of Medellin. EPM is a utilities provider (water, electricity, gas, and telecommunications), and its main market is the metropolitan area of Medellin and the Department of Antioquia, comprising of 5.2 million people. It is the second largest water and sanitation utility in Colombia and currently its profits transferred to the municipality represent around the third part of the latter annual budget.

EPM is recognised nationally and internationally for its efficiency and quality operations. Some of the facts that demonstrate EPM's success are: good financial results, high quality standards of its services, high credit ratings[15] by national and foreign financial agents and the social acknowledgment[16] for its performance and commitment to improve the quality of life of the population it serves, especially the poor.

EPM projects are developed in accordance with strict financial, technical and legal principles, and all its procedures and controls for the acquisition of goods and services guarantee transparency in all contractual processes. Its management and directors are independent of any political influence. In addition, EPM's corporate governance model made of formal and informal mechanisms and its Corporate Social Responsibility Policy have become important drivers for the growth and sustainability of the company.

How have cost recovery and financing mechanisms helped overcome barriers?

Understanding that the access problem is critical in Medellin, EPM has designed and implemented a variety of solutions tailored to target people with different needs.

A key issue regarding how to overcome the barriers to the poor is the institutional capacity to understand the problem and to design and implement effective solutions. EPM has the institutional capacity for managing the entire process from problem identification to the implementation and evaluation of the programs. This process requires first of all, a clear understanding of the initial situation to enable the formulation of appropriate and comprehensive strategies. At EPM a conceptual framework is first developed, based on interdisciplinary studies and an in-depth analysis of the economic, social and psychological users' behaviour that is affected by rules, regulations and institutions. The next step is the planning of the intervention, identifying the roles and responsibilities of actors involved (national government, local government, ONG's, third parties, and EPM), followed by the design of mechanisms that better respond to the main objective – *service universalisation*. Finally, during and after implementation, the development and application of permanent monitoring and evaluation techniques is essential.

In the pursuit of its goals as public services provider, and in response to the challenges faced in its service area, EPM has designed the following strategies to increase access to water and

[15] Fitch Ratings: International rating for EPM's foreign currency debt BBB-. Bonds rating: AAA. (September 2010) Moody's rating Baa3. January 2011.

[16] The survey "Medellín cómo vamos", is a civil initiative created in 2006 to evaluate the quality of life changes in the city of Medellin. In 2010, EPM shows high satisfaction levels with the utilities services was of 4.5 over 5 points. For more information see www.medellincomovamos.org/

sanitation services, prevent services disconnection and to improve the quality of life of its customers:

Network Connection Financing Program (NCFP)

The NCFP is an EPM initiative designed to provide access to water services to low-income households in peri-urban areas of the Aburrá Valley. The program offers long-term credit facilities at low rates to people who have no access to credit. Beneficiaries of the program are then able to finance the construction or improvement of in-house and external water and sanitation infrastructure in order to gain access to public utilities. EPM offer this service based on household demand and credit is payable over ten years at DTF rate (average market interest rate for deposits). The credit component of the program is accompanied by infrastructure contracts that are awarded to formally organised community entities, helping to strengthen local technical and business capacity.

Financing and Re-financing Consumption (RFWC)

The purpose of this EPM initiative is to help households with low capacity to pay (strata 1,2 or 3[17]) and debts in their water, sanitation and energy bills, to access to low cost financing with minimum guarantees to prevent delinquent accounts and service disconnection. Before service suspension, clients have option of paying 80 percent of their debt within their current bill and the remaining 20 percent the following month without charges. Disconnected clients with over two months of bill debts are offered reconnection agreements and the financing of the debt for up to five years at DTF rate. In the case of clients that have been affected by displacement or natural disasters, the debt can be refinanced for up to ten years with no interest charged.

Prepaid Program (PP)

PP is an EPM initiative targeted at customers with delinquent accounts or that are at risk of having an illegal connection. The program allows reconnection of services (which are prepaid) and debt payment over 120 months charged at DTF interest. The customer purchases a PIN number from a local store and introduces the PIN in their meter at home to use the energy services purchased. Of the payment made through the PIN, 90 percent is for the purchase of energy and the remaining 10 percent contributes to repayment of the debt with EPM. Thus far, EPM has only implemented this program for energy services but offering a prepaid option for water services is being piloted.

Social Financing Program (SPF)

The Social Financing Program (SFP) / Grupo EPM card offers households in the Antioquia Region credit at competitive rates that vary according to the type of product or activity financed. Priority is given to strata 1 to 4 households which constitute 96 percent of cardholders. The credit is intended for use in financing home improvements and energy and

[17] **Colombian socioeconomic classification system:** Colombian legislation has established a household classification system with six socio-economic categories (strata 1 to 6) according to location, income level and public services provision. This classification determines people's taxes, public services tariffs, modalities of access to health service, among others. Strata 1, 2 and 3 are preferential to receive subsidies and benefits from the government due to their low socio-economic conditions.

water appliances, with the objective of improving efficiencies and the quality of life of customers. The credit is billed with the utilities and customers pay in monthly instalments incorporated into their utility bills.

Community Organisation Contracts

The objective of this social program of EPM is to contract community-based organisations and associations located in areas in the Aburrá Valley where EPM has projects on network expansion, operation and maintenance in water and sanitation services provision. EPM hires these organisations to build local infrastructure and the procurement requirements are specifically designed to enable them to enter contracts.

Water services provision peri-urban areas

This initiative is implemented by EPM in conjunction with the Municipality of Medellin and seeks to legalise and allow access to public water services for people in peri-urban areas in Medellin. The aim is to reduce risks derived from illegal or irregular use of public services and protect private and public goods. The charge is applied according to the average user's socioeconomic level without using individual meters. Although this is not ideal, it is one of the few coverage options for areas where regulations prohibit the provision of conventional public utilities.

Minimum Potable Water Consumption Amount for Life

The World Health Organization estimates that the average quantity of potable water needed per person to meet basic human needs is 2.5m^3 per month. 'Minimum Potable Water Consumption Amount for Life' is a Municipality of Medellin initiative launched in 2009 providing subsidies paid by the municipality to cover the cost of 2.5m^3 /month per person. Households targeted by the program are those in the rural or urban jurisdiction of Medellin that have been previously identified as potential beneficiaries of social programs due to unmet basic needs, as identified by the government. EPM applies the respective discount in the customers' bills. The program also includes information campaigns to promote the rational use of water.

National demand-side and supply-side subsidies

The national demand-side subsidies scheme offers users with low payment capacity (strata 1,2 and 3) subsidies financed by an overquote in the bill of users with the best payment capacity (strata 5 and 6), industrial and commercial users, and with municipality funds. The level of subsidy depends on the strata of the municipality: strata 1 receives a 50-60 percent subsidy on consumption; strata 2 receives a 30-40% subsidy on consumption; and strata 3 receives a 10-13% subsidy on consumption.

The national government also provides supply-side subsidies, investing in public services infrastructure so that public service enterprises can improve service delivery without passing on the additional cost to users.

Evaluation: economic, environmental and social benefits

Initiatives offered by EPM have resulted in significant improvements in the life conditions of the population it serves. Some verifiable impacts are:

Network Connection Financing Program

Economic: During 1999-2011, US$45 million was invested in water and sanitation services through the NCFP. The program has resulted in a total of US$5 million in interest rate savings for consumers compared to conventional financing. Indirect benefits of the program include the creation of 10,732 jobs in the water and sanitation services sector. The component on infrastructure contracts has resulted in 197 contracts with 214 community organisations in the Aburrá Valley.

Environmental: EPM has wastewater treatment plants that clean residual water before its flows into the Medellin River. As the river goes through the entire Aburrá Valley, the NCFP reduces environmental contamination by connecting users to the main sewage system.

Social: Direct impacts on water and sanitation provision during 1998-2010 include: 10,163 households connections to water services and 13,917 sewerage connections, benefitting 55,670 people. During 2008-2010, the aqueduct network was expanded by 50.7 km and the sewage network by 55.1 km. The program has also involved a total of 23,390 hours of community training and has contributed to poverty alleviation through job creation.

Financing and Re-financing Consumption

Economic: The RFWC financed 326,128 customers a total of US$95 million during 2008-2010 (constant 2008 prices). This has resulted in consumer savings of US$10.58 compared to the conventional financial system.

Social: Of the beneficiaries reached by the program, 92% are low-income households (strata 1, 2 and 3). The scheme has therefore addresses inequities and contributes to the improvement of quality of life of its beneficiaries.

Prepaid Program (PP)

As the PP initiative is only currently being trialled for water services, only the energy program has been fully evaluated, with the following results:

Economic: During 2008-2010, the program saw investments of US$9.3 million. Importantly, the program allows customers to consume public services according to their economic capacity without incurring any payment risk and preventing disconnection.

Environmental: The program includes education in rational energy use, which has resulted in a reduction in consumption of 60kW-h per family as compared to a representative sample of post paid families in 2010.

Social: A total of 70,930 network connections have been made in the last three years, benefitting 201,779 people (with 7% from strata 1, 2 and 3). The program will enable 88,000 disconnected clients to regain access to energy services by 2014. The program contributes to the improvement of quality of life and provides a mechanism to avoid illegal connection to public services.

Social Financing Program

Economic: US$28 million has been financed in three years through the SPF, representing savings of US$13 million for consumers. The program promotes credit channels for people

who otherwise would not be eligible for financial services, with low interest rates and repayment flexibility. The program stimulates local, regional and national economies.

Environment: The SFP has facilitated the adoption of a new generation of efficient appliances, contributing to significant energy, water and gas savings, with corresponding environmental benefits from reduced resource use.

Social: As of August 2011, the Grupo EPM Card has financed 63,000 households in 17 municipalities. The scheme has issued 39,276 cards in three years. Participants benefit from reductions in bills due to the use of more efficient appliances.

Community Organisation Contracts

Economic: During 2008-2010, 31 contracts with organisations in Aburrá Valley were made, totalling US$10 million. The initiative has generating 376 jobs in the water and sanitation services sector. This has enhanced the income of communities and contributed to the distribution of wealth, stimulating local, regional and national economies.

Environmental: The community organisation contracts include environmental protection clauses complemented with auditor procedures to verify compliance.

Social: The initiative has contributed to poverty reduction as a result of job generation; strengthened skills in management, operation and procurement; and successfully promoted community-based schemes.

Water services provision in peri-urban areas

Economic: During 2008-2010 US$126,000 was invested in water services provision for peri-urban areas.

Environmental: EPM has wastewater treatment plants that clean residual water before its flows into the Medellin River. As the river goes through the entire Aburrá Valley, the NCFP reduces environmental contamination by connecting users to the main sewage system.

Social: The peri-urban scheme contributes to the universalisation of public services, risk reduction and life quality improvement for peri-urban populations. A total of 67 meters have been connected during 2008-2010, benefitting 6,417 people. Customer education programs have been implemented to encourage sustainable and rational water use.

Minimum Potable Water Consumption Amount for Life

Economic: The Municipality of Medellin has invested a total of US$1.21 million in 2010. In that year, the total savings achieved were US$269,444, equivalent to a 12 percent in monthly savings per family which represents approximately US$5 – resources that vulnerable families can invest in meeting other needs.

Environmental: 92 percent of beneficiary households practice rational water consumption, with corresponding environmental benefits.

Social: The program provides a definite quantity of potable water at no cost to vulnerable families in Medellín. It has brought positive results and proven improvements in social conditions. In 2010, 26,079 households benefitted from the program and for 2011, this is

expected to rise by 72 percent (reaching 45,000 households). By guaranteeing vulnerable families' access to water, the municipality is improving economic, social and health conditions of Medellin's population. The incidence of illness is reduced as a result of the increased availability of potable water.

National demand-side and supply-side subsidies

Economic: During 2008-2010, US$140.53 million in water and sanitation subsidies were provided to lower income population (strata 1, 2, 3) of 17 municipalities (where EPM provides water services). This has reduced the cost of water and sanitation services for users. On the supply side, EPM has received US$19.82 million in public investment for water service provision, lowering the cost of water and sanitation services infrastructure.

Social: The initiative has benefitted 699,000 users (strata 1,2,3) in Aburrá Valley and addressed social inequities in the region.

Scaling up and relevance for developing and transition countries

To address the access problem, most developing countries have copied models from elsewhere in the pursuit of higher standards of living. But experience shows that due to varying social, economic, legal and cultural conditions between countries, models cannot simply be transferred with success guaranteed. It is therefore necessary to identify shared factors from which the transferability of an approach can be inferred.

After a long learning process of more than 50 years, EPM pro-poor initiatives have played an important role in the characterisation of the population it serves in terms of their life conditions and motivations (including neuropsychological factors that influence their decision making). In this respect, EPM is eager to share its experience about how its initiatives have been designed to meet the needs of its population and its permanent efforts to improve its operations.

Opportunities for the future

Recently (2011), EPM hired a consulting service to assess delinquent accounts and effectiveness of EPM tools in improving public services universalisation. The main conclusion of the study was that current initiatives offered by EPM to vulnerable users are achieving good results, but in order to help people living under border conditions (less than 5% of EPM target population) move up in the social scale, the following changes were recommended: i) restructuring existing initiatives and creating new and complementary tools (such as insurance mechanisms against shocks like death, illness or accident); ii) focalisation strategies leading to the development of differentiated options according to users' vulnerability levels (measured by poverty level and delinquent account risk); and, iii) collaboration in efforts with other actors concerned with situation of vulnerable populations. In addition to local and national governments who bring support on legislation and public policies, there are international organisations, NGOs and private entities that allocate resources and are interested in implementing programs to improve social welfare. Furthermore, more efforts must be made to link EPM actions to local and national policies for poverty reduction in order to concentrate focalisation strategies in the same population and improve effectiveness.

Lessons learnt from implementation

- Know your target population well. Programs targeted to the poor must be built on a thorough analysis of the target beneficiaries' conditions and their local particularities in order to structure flexible and custom-made options for social improvement. This requires interdisciplinary study of economic, social and psychology behaviour, as well as the rules, regulations and institutions that affect social behaviour.

- A successful program in one particular context does not necessarily guarantee success when the practice is transferred to a similar context. As initiatives are designed to solve a specific situation, what can be transferred is not the practice itself but the building and conceptualising processes involved in its design and initiation.

- Do not think the target has been already met. Constant monitoring and evaluation is essential to identify changes or deviations from the expected outcomes or to introduce improvements leading to increased efficiency and effectiveness of measures.

- Investment in social capital in the community contributes to economic development and generates positive externalities.

- Credit is not the solution when it does not contribute to income generation or savings for consumers. Thus, credit options for delinquent accounts must be considered just as temporary measures in order to avoid consumers' dependency or poverty traps.

- Joint efforts generate high impact. Collaboration and cooperation between governments (both municipal and national), private and public entities is the best way to support the expansion of water and sanitation services and invest in social welfare, through joint commitment to the achievement of a common target. The responsibilities and roles of each actor should be identified.

4. Investments and fiscal measures for the protection and improvement of biodiversity and ecosystem services

Thomas Chiramba, Silas Mogoi and Isabel Martinez (UNEP), Tim Jones (DJEnvironmental)

Challenges

UNEP's Water Investing in Natural Capital (2011) highlights the importance of investing and conserving biodiversity and ecosystem services. The report points that in terms of ecosystem health and function, global assessments of the health of the world's water river systems and aquifers suggests that the aggregate trend is one of decline (Millennium Ecosystem Assessment Report 2005; WWF's Living Planet Report 2010; the UN World Water Development Report 2010).

Examples of the decline included in the report are:

- Barriers have been laid across China's Taihu Lake to stop regular algal blooms reaching the water treatment plant that supplies water to over 2 million people (Guo 2007);
- From October 2002 until October 2010, the absence of flow has meant that dredges have been used to keep the mouth of the Australia's River Murray open to the sea;
- In Manila, the Philippines, groundwater extraction, primarily for industrial purposes, is lowering the water table at a rate of between 6 metres and12 metres per year (Tropp 2010);
- In 1997, China's Yellow River flowed all the way to the sea only for 35 days and for much of the year this river's last 400-plus miles were dry (Fu 2004).

Ecosystem services – for example the regulation of water quality and quantity – have enormous economic value, yet the linkage between degradation of ecosystem services, growing resource scarcity and the rising costs of providing those services artificially (e.g. through costly water treatment plants) have been widely neglected until relatively recently. Indeed it is only in the last decade or so, particularly since publication of a seminal journal article by Daily et. al (1997) that 'ecosystem services' is a phrase in regular usage.

Ecosystem services provided by watersheds

Smith *et al.* (2006) provide the following categorisation of the ecosystem services provided by a typical watershed:

1. *Provisioning services* – i.e. services focused on directly supplying food and non-food products from water flows: freshwater supply, crop and fruit production, livestock production, fish production, timber and building materials supply, medicines, hydroelectric power.

2. *Supporting services* – i.e. services provided to support habitats and ecosystem functioning: wildlife habitat (i.e. biodiversity conservation), flow regime required to

maintain downstream habitat and uses.

3. *Cultural and amenity services* – i.e. services related to recreation and human inspiration: aquatic recreation, landscape aesthetics, cultural heritage and identity, artistic and spiritual inspiration.

4. *Regulating services* – i.e. services related to regulating flows or reducing hazards related to water flows: regulation of hydrological flows (buffer runoff, soil water infiltration, groundwater recharge, maintenance of base flows), natural hazard mitigation (e.g. flood prevention, peak flow reduction, landslide reduction), soil protection and control of erosion and sedimentation, control of surface and groundwater quality.

The way in which management of the upstream part of a river basin or watershed influences the quantity, timing and quality of water available for downstream economic uses is among the easier ecosystem service linkages to convey (in principle at least) to non-specialist stakeholders.

The importance of maintaining intact vegetation cover – especially forest cover – in the upstream parts of river basins as a means of regulating infiltration, runoff, erosion and sedimentation, and the significance of healthy forest and freshwater ecosystems for maintaining biodiversity means that water managers and conservationists often have a common interest in the protection and/or enhancement, rehabilitation, or restoration of these ecosystems. This linkage is even more significant if the potential for additional 'wins' through the role of forests in limiting carbon emissions is taken into account (though the latter is largely beyond the scope of this session).

UNEP (2011) report considers that "*there is a new recognition of the positive synergy that emerges between healthy environments and healthy communities*". When astute investments in the restoration of ecosystems are made, internal rates of return in excess of 10 per cent are attainable.

Biome/ecosystem	Typical cost of restoration (high-cost scenario)	Estimated annual benefits from restoration (avg. cost scenario)	Net present value of benefits over 40 years	Internal rate of return	Benefit/cost ratio
		US$/ha	US$/ha	%	Ratio
Coastal	232,700	73,900	935,400	11%	4.4
Mangroves	2,880	4,290	86,900	40%	26.4
Inland wetlands	33,000	14,200	171,300	12%	5.4
Lake/rivers	4,000	3,800	69,700	27%	15.5

Table 1: Examples of the estimated costs and benefits of restoration projects in different biomes
Source: Adapted from TEEB (2009a)

Approaches

Restoration of degraded river systems

As documented by Le Quesne et al. (2010), some countries are now investing large amounts of money in the restoration of degraded river systems and the development of policies and administrative arrangements designed to prevent degradation of these systems.

Two examples of governments investing in river restoration

Korea

In July 2009, the Republic of Korea announced a Five-Year Plan for Green Growth in order to implement the National Strategy for Green Growth over the period 2009-2013. This includes a 22.2 trillion Korean won (US$ 17.3 billion) investment in a Four Major Rivers Restoration Project. The five key objectives of the project are as follows: (1) securing sufficient water resources against water scarcity, (2) implementing comprehensive flood control measures, (3) improving water quality whilst restoring the river-basin ecosystems, (4) developing the local regions around major rivers, and (5) developing the cultural and leisure space at rivers. Overall, it is expected that the project will create 340,000 jobs and generate an estimated 40 trillion won (US$ 31.1 billion) of positive economic effects as rivers are restored to health.

Australia

In January 2007, the Australian government announced a A$10 billion (US$10 billion) commitment to restore health to the seriously over-allocated Australia's Murray Darling basin and appoint an independent authority to prepare a new plan for the basin using the best available science. Some A$3.1 billion is being spent on the purchase of irrigation entitlements from irrigators and the transfer of these entitlements to a Commonwealth Environmental Water Holder, A$5.9 billion on the upgrade of infrastructure with half the water savings going to the environment and A$1 billion on the collection of the information necessary to plan properly.

Sources: Office of National River Restoration (under the Ministry of Land, Transport and Maritime Affairs) (2009); Korean Ministry of Environment and Korea Environment Institute (2009) and Murray Darling Basin Authority (2010).

Recognising and valuing the services provided by ecosystems

A central requirement for greening of economic growth is the proper recognition and valuing of the services provided by ecosystems, as highlighted in the Synthesis Reports of the Millennium Ecosystem Assessment. By finding means of incorporating these values into market-based mechanisms, not only can they be properly taken into account in conventional economic decision-making processes, but also market-based financial incentives can be established to support and maintain ecosystem services.

Payment for Ecosystem Services

One of the key ways that water managers and those interested in conserving biodiversity have come together is through the setting up of fiscal measures that provide incentives for the sustainable management of ecosystems. Such measures may take a range of different forms – they may, for example:

- be public or private
- involve cap-and-trade schemes
- involve direct or indirect payments
- involve downstream users explicitly paying for services supplied by upstream land/water managers
- be aimed at generating multiple economic, social and environmental benefits (rather than purely environmental benefits)

One of the most widely implemented approaches during the last five to ten years (although its use is still in relative infancy in many countries) is commonly referred to under the umbrella of 'Payment for Ecosystem Services' (PES), although some confusion surrounds the use of this term.

Indeed, Greiber (2009) states that:

"*PES sometimes appears to have become a 'catch phrase' which needs further clarification on what it actually embodies – virtually all financial and legal incentive mechanisms for promoting conservation and good environmental citizenship, or only specific ones. Depending on the concrete definition of a PES mechanism, its legislative and practical requirements will differ considerably.*"

Greiber further concludes that:

"*What makes a PES a PES is that in any payment arrangement those who pay are aware that they are paying for an ecosystem service that is valuable to them or to their constituencies – and those who receive the payments engage in meaningful and measurable activities to secure the sustainable supply of the ecosystem services in question.*"

Some environmentalists have expressed fears that direct payments for ecosystem services may do more harm than good for the conservation of biodiversity (see Wunder, 2006 for a discussion of some of the key issues in this debate). A key constraint (see Wertz-Kanounnikoff, 2006) is that *payment* for ecosystem services presupposes that the services supplied by a particular ecosystem are understood in a real 'on the ground' (rather than purely theoretical context) and that means of valuing these economically are available. This is by no means always the case and while experience and know-how are expanding rapidly in all regions of the world, the necessary scientific/technical and socio-economic background studies required to prepare a successful PES scheme are inevitably costly and time-consuming.

In spite of such constraints, leading global conservation NGOs such as Conservation International, The Nature Conservancy, and WWF, are all actively implementing PES projects and PES is recognised as an important tool by the Conservation on Biological Diversity (CBD). Goal 4 of the CBD's Strategy for Resource Mobilization seeks to: *"Explore new and innovative financial mechanisms at all levels…"*. The first of six strategic objectives under this goal is *"To promote, where applicable, schemes for payment for ecosystem*

services, consistent and in harmony with the Convention and other relevant international obligations."

The TEEB/Bank of Natural Capital considers that PES "*offers a real opportunity to bring nature into our markets with a visible value*" and highlights PES as "*a key strategy for governments at international, national and local levels because [PES] rewards those who have the most immediate relationship with natural capital, but who usually lose out most in the trade and conversion of natural resources – namely the poor."* Alleviation of poverty as a driver of natural resource degradation is recognised by biodiversity conservationists and water managers alike as one of the most valuable potential contributions of effective PES schemes.

Lessons learnt from PES in practice

Different PES approaches have been reviewed including three from Africa, three from Asia and three from Latin America and the Caribbean (LAC). They cover a broad range of scenarios, from initial valuation of ecosystem services in the Sourou River Valley (Burkina Faso), to implementation of pilot PES schemes in Lam Dong Province (Vietnam), Lake Naivasha basin (Kenya) and the Maloti-Drakensberg region (South Africa), through efforts to solve specific water management challenges in Fukuoka City (Japan) and Pingwu County (China), to relatively mature PES programmes in Costa Rica, Ecuador and Mexico, which have already served as models for replication and scaling up elsewhere in the LAC region (see compendium table). .

Below is summary of some of the common themes and key points emerging from the case studies of PES as a whole.

1. On the design

Payment for Ecosystem Services (PES) schemes need to be carefully designed and targeted to:

- be appropriate for the relevant legislative and institutional/governance framework (this is clearly most important for public PES schemes – see Greiber 2009).
- have clear predefined objectives, targets and indicators of success (and failure);
- apply to specified geographical (or hydrographical) limits.

As such mechanisms are being newly applied in many countries or individual river basins/watersheds, pilot projects provide a valuable means of testing and adapting internationally or nationally proven approaches to local conditions.

2. Set up baseline scenario and monitoring

- It is vital to have a baseline scenario against which to measure changes in economic, social and environmental factors during implementation. This can easily be forgotten in the midst of complex negotiations to establish workable financial mechanisms.
- A programme of monitoring of economic, social and environmental factors needs to be designed in advance as an integral component of implementation.

3. Public awareness campaign

A programme of public awareness can be important in sensitising stakeholders to upstream–downstream environmental linkages and the economic significance of the ecosystem services management carried out by watershed owners/managers. This can enhance willingness to pay on the part of users, and willingness to adapt land/water management practices by service 'suppliers' – or at least willingness by both groups of stakeholders to engage in dialogue.

4. Start small and scale up

Experience shows that it may be better to 'start small' and to 'scale up' rather than to try to implement a fully fledged financial mechanism from the beginning. This can be done, for example, by targeting a specific land/water management practice – and the driver(s) underlying it – that influences a specific ecosystem service (e.g. deforestation driven by the need for fuel wood, causing increased runoff, erosion and sedimentation of water courses). Trying to address multiple management practices, drivers and ecosystem services simultaneously from the start is liable to overwhelm the programme managers as well as stakeholders.

5. Identify beneficiaries and suppliers of ecosystem services

It s important to identify 'beneficiaries' and 'suppliers' of ecosystem services and representatives of each group who are able and willing to participate in discussions/negotiations on behalf of others.

Stakeholders may include all or some of the following categories of 'actor', only some of whom are direct suppliers/sellers or users/buyers:

- government ministries/departments
- government agencies
- local authorities
- river basin management authorities
- public corporations
- private corporations
- individual consumers
- individual landowner/managers
- community groups
- water users' associations
- national or international NGOs
- development assistance agencies
- other external donors

6. The elements

Sustainable provision of ecosystem services can be achieved through changes in land-use practices and incentives to farmers that are both equitable and targeted at maintaining or enhancing livelihoods.

7. Continuous adaptation to deal with key challenges

PES is not a panacea. All of the case studies included in the documentation for this session confronted a range of challenges, requiring continual adaptation.

8. Tips for successful PES

Building trust:

- Building trust and a spirit of partnership or mutual 'buy-in' among stakeholders.

Financial mechanisms:

- Ensuring that any financial mechanism proposed is in line with the provisions of applicable policy and legislation (recognising that if not, further lengthy preparatory work may be needed to lobby for and secure the necessary changes).

- Counterpart/additional contributions may be leveraged by the successful operation of an investment scheme. This can dramatically increase the overall funding mobilised and – more importantly – the beneficial environmental impacts of that funding.

Financing/payment:

- Convincing downstream water users that they should contribute financially to protection, maintenance or restoration/rehabilitation of ecosystem services by upstream landowners/managers.

- Addressing the contention that downstream water users, who already pay fees or taxes for their water consumption, may be 'forced to pay twice' by any additional levy or charge for ecosystem services.

PES Charges and sustainability

- Setting the charges paid by water users at a level that is acceptable to the water users but which still generates sufficient income to finance planned investments in upstream environmental protection measures.

Equity and fairness

- Setting levels of payments to upstream land/water managers that are equitable and which are sufficient to act as an incentive in themselves to conserve natural resources (regardless of the stipulations of any contract or sanctions for non-compliance) rather than to continue exploiting them unsustainably.

Lessons learnt from selected PES cases

Case	Lessons learnt
Fund for the Protection of Water (Fondo para la Protección del Agua – FONAG)	Governments, NGOs (including international NGOs), development assistance agencies, the corporate sector and local communities can work effectively together on PES schemes if the benefits for all stakeholders are clear. Relatively modest expenditure can leverage much bigger overall investment through counterpart contributions. Restricting use of the fund to yields from interest and investments – NOT capital – means that the fund grew slowly but sustainably. Strong capacity building and communications/ awareness-raising components have been vital to FONAG's success.
PROCUENCAS Payment for Ecosystem Services scheme, Costa Rica	Upstream environmental services are linked to downstream beneficiaries through a direct and earmarked monthly financial charge to all city water end-users. The case is a good example of a small, independent PES scheme that has successfully addressed 'willingness-to-pay' (WTP) issues through clear articulation of the linkages between watershed conservation, quality (and cost) of water supply management and public health objectives.
Programme for Payment of Hydrological Environmental Services (Programa de Pago por Servicios. Ambientales-Hidrológicos – PSAH), Mexico	Scheme identified those benefiting from ecosystem services and found a mechanism through federal law for charging for 'natural capital'. Contracts with landowners were based on meeting conditions/ indicators that could actually be monitored (e.g. rates of deforestation via satellite photos) against a baseline scenario. Criteria used to set geographical priorities so that over-subscription of the scheme could be dealt with. In this case a points system was used to prioritise areas according to the value of environmental service, as well as the level of poverty and risk of deforestation.
Economic value of the Sourou valley, Burkina Faso – a preliminary evaluation	Apparent economic benefits accruing from a particular use (in this case agriculture) of a region's land and water resources may in fact be relatively insignificant if a comprehensive economic valuation of ecosystem services is conducted.

Payment for Environmental Services pilot project in Lake Naivasha basin, Kenya	Sustainable provision of ecosystem services can be achieved through changes in land-use practices and incentives to farmers that are both equitable and targeted at maintaining or enhancing livelihoods. Strong stakeholder partnership leads to more successful implementation. Necessary preconditions include: availability of baseline hydrological data; establishment of a strong business case; building of trust and commitment among stakeholders establishing a market mechanism – that stakeholders are easily able to engage with – for the selling and buying of ecosystem services. Appropriate and adequate capacity building of ecosystem service providers and beneficiaries strengthens implementation of PES projects.
Payment for Ecosystem Services (PES): Feasibility and Implementation in the Maloti-Drakensberg Transfrontier Project Area, South Africa	Improved management can shift destructive summer flows in periods of water abundance or excess, to the winter months when water is scarce and when value can be added. Management results in significant reductions in soil erosion, reducing the sedimentation of water infrastructure, improving productivity and increasing carbon sequestration. Watershed management may be one of the cheapest and socially equitable water augmentation options available to South Africa. Management costs vary – some catchments show that restoration and management is financially feasible with only baseflow enhancement being marketed, while other catchments require three services to be traded before management is financially feasible. Catchment management becomes increasingly feasible when more than one of the services is traded. Rural people can farm water, carbon sequestration and sediment yield reduction as complementary services to sound cattle farming.
Payment for Forest Environmental services (PFES): pilot implementation in Lam Dong Province, Vietnam	The identification and emergence of champions at all levels of the implementation process (national, provincial, district, and commune) was a key factor for success. The limited number of environmental services implemented under the pilot policy (water regulation, soil conservation, and landscape visual quality) reduced the risk of implementation failure. Despite the fact that extensive scientific/technical studies

	were carried out to value ecosystem services, the final payment structure also took into consideration the socioeconomic and socio-political context of the communities in question. Strictly adhering to the valuation studies, while scientifically robust, would not have guaranteed the uptake of the project and the backing of the community and payers. The development of the management mechanism was greatly assisted by local household participation in its design, implementation, and evaluation. The proper and equitable distribution of payments is contingent on the equitable and precise allocation of forest parcels to households. However, lacking a private land tenure system and integrated land-use planning system, the process of forest demarcation, allocation, filing, and approval in Lam Dong Province required significant time and money, at times impeding the proper and timely disbursement of payments to households. There was an issue of whether payments under PFES should be considered as being made from the state budget or whether they replaced the water-resource tax that hydropower plants had to pay. These and many other issues, connected to the innovative concept of PES, took time to resolve among various stakeholders. Establishing automated gauging stations in a relatively remote provincial river basin was a great challenge.
Conserving and managing forests as source of water for Fukuoka City, Japan	Good use of education and exchange programmes to foster interaction between beneficiaries and service providers.
Payment for Ecosystem Services and alternative livelihoods in rural China	The effectiveness of the scheme was increased by providing training and capital for villagers to pursue new (environmentally-friendly) sources of income

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FONAG – The Fund for the Protection of Water, Ecuador

Thomas Chiramba, Silas Mogoi and Isabel Martinez (UNEP), Tim Jones (DJEnvironmental)

Type of tool: investments and fiscal measures for biodiversity protection
Issue: watersheds
Location: Ecuador, LAC

Introduction

The Fund for the Protection of Water (Fondo para la protección del Agua – FONAG) is a private trust fund established in 2000 for a period of 80 years and regulated under Ecuador's stock market law. In essence, the Fund is an example of payment for the environmental services provided by ecosystems (commonly referred to as Payment for Ecosystem Services or PES).

Challenge and objectives

FONAG works to ensure the provision of a *sufficient quantity* of water of *good quality* by supporting actions directed at protecting water resources, based on the principles of long-term natural sustainability.

FONAG focuses on the Upper Guayallabamba river basin, the Antisana river basin, the Oyacachi river basin and the Papallacta river basin which are crucial for maintaining the water supply to the Metropolitan District of Quito and its surrounding area. FONAG's area of operation covers some 5,025 km² and held 1.96 million inhabitants at the time of the 2001 census.

Oyacachi and Papallacta river basins

In order to avoid the degradation of these river basins, FONAG is supporting actions directed making the activities of local communities more sustainable but also more productive.

Antisana River Basin

Activities in the Antisana River basin are directed towards protecting the quality of water entering the Mica Quito Sur reservoir, part of the system that provides potable water to the city of Quito. The main problem in this basin is related to poor livestock management practices in surrounding properties, which cause water pollution, soil erosion and adversely impact nature conservation in the Antisana Ecological Reserve. Preparatory studies at an estimated cost of USD 22,000 are currently underway, with equal contributions by FONAG and TNC, and additional counterpart funding from the implementing institution.

The approach: how did PES help overcome barriers to dealing with the challenge?

Establishing a fund

A pilot project was set up in 1998, payments to FONAG began in January 2000 and financing of watershed protection projects was initiated in January 2002. The trust provides a stable, long-term financial mechanism, using revenues (interest and investments) derived from its equity to co-finance activities aimed at maintaining the hydrographic basins that supply the water needs of Quito Metropolitan District and its surrounding area of influence.

Establishing a clear mission, and vision

FONAG's Mission was established as: FONAG rehabilitates, cares for and protects water basins that supply water to the Metropolitan District of Quito and surrounding areas.

Vision: to be the mobilising agent that involves all actors in exercising their citizenship responsibly on behalf of nature, especially water resources.

A consensus and dialogue participatory approach

To lead processes and consensus through dialogue, proper decision-making, strengthening research and the appropriate use of technology to achieve integrated management of water resources in which active, responsible participation based on solidarity leads to sustainable water management.

FONAG implements programmes and projects that meet the institutional challenges of building a new 'water culture' (where the active and responsible participation of all stakeholders and actors creates a more just, shared and sustainable use of water resources with improved health and development outcomes) and achieving integrated water resource management.

Communities particularly targeted by FONAG programmes and projects include:

- Communities in the Cayambe-Coca Ecological Reserve (Oyacachi river basin)
- Communities in the Antisana Ecological Reserve (Papallacta river basin and La Mica Lagoon)
- Communities in the Cotopaxi National Park (Pita sub-basin of the Upper Guayallabamba)
- Communities in the Los Ilinizas Ecological Reserve (San Pedro sub-basin of the Guayallabamba)

The activities implemented by FONAG are the result of various consensus-based processes carried out among the participating institutions.

Collaborate with institutions

Through the Ecuadorian Centre for Agricultural Services (CESA), FONAG is seeking to conserve water resources, improve animal husbandry and agricultural practices, strengthen local resource management and provide access to financial services. All these components will be developed during an initial implementation phase lasting fifteen months, at an estimated cost of USD 78,000, with part-funding provided by FONAG and co-financing from The Nature Conservancy and CESA.

Among other practical actions, work is being done to genetically improve livestock herds living around the Oyacachi basins, through a campaign to vaccinate, identify and execute a programme to provide these herds with vitamins and rid them of parasites.

Implementing specific programmes and projects

These programmes and projects are carried out in FONAG's geographical area of operation (see below) with the participation of various community actors, local authorities, governmental bodies, non-governmental organisations, and educational institutions.

FONAG implements its programmes directly, conceiving them as a way of building processes that are capable of changing people's attitudes toward nature and encouraging responsible water management.

The *programmes* have a minimum time scale of 20 years and cover all six key areas of FONAG's activities:

- Water Management
- Site surveillance and monitoring
- Restoration of vegetation cover
- Environmental education
- Training in Integrated Water Resource Management (IWRM)
- Communication

The Water Management Programme has two parts: technical and social. The first aims to develop water management tools, while the second seeks to achieve better governance and administration of water resources. The technical work is being implemented by IUCN and the social component is led by the Fundación Futuro Latinoamerica with the support of the Tinker Foundation.

The *projects* are interventions undertaken by supporting institutions, communities, educational organisations and local governments. They are short-term, with a maximum duration of two years. There are currently 20 such projects covering all of the sub-basins within FONAG's area of operation. Of the institutional budget, 20% is assigned to these projects.

Financing and financial approach

The capital assets of the FONAG are composed of contributions from local businesses, private and international institutions.

Concerned with the conservation of water resources and committed to finding solutions for the problems resulting from inadequate management of these resources, the Metropolitan Water and Sewerage Company of Quito (EMAAP-Q) and the international environmental NGO The Nature Conservancy (TNC) entered into a contract establishing the Fund in January 2000. The Electric Power Company of Quito (EEQ) joined in May 2001; the private brewery company Cervecería Andina S.A. (now Cervecería Nacional S.A.) participated with effect from March 2003; Swiss Development Cooperation (SDC/COSUDE) from January 2005; and The Tesalia Springs Co. from April 2007.

Of FONAG's investments, 80% are allocated to developing and strengthening these programmes.

Specific projects are an integral part of FONAG's six programmes, which are led by like-minded institutions with co-financing provided by FONAG.

FONAG's financial development is illustrated in Figures 1 to 3 below. FONAG's success is based in large part on:

- A philosophy of modest but steady growth
- Limiting its financial support for programmes/projects to the revenue (interest and income on investments) derived from its equity capital
- Attraction of increasingly significant counterpart funding

By 2009 FONAG was making financial contributions of almost one million USD per year and leveraging counterpart funding to fund programmes and projects with total expenditure of nearly four times this amount.

Evaluation: economic, social and environmental benefits

FONAG is contributing to securing present and future water supplies for Quito. Through the fund, more than 65,000 ha of watersheds are now under improved management. Upstream farmers receive support for watershed protection programmes, as opposed to cash payments. More than 1800 people are estimated to have received increased economic benefits associated with watershed management and conservation.

Scaling up and lessons learnt from implementation

FONAG has served to inspire the development of similar schemes elsewhere in Latin America and beyond.

Lessons learnt

- Governments, NGOs (including international NGOs), development assistance agencies, the corporate sector and local communities can work effectively together on PES schemes if the benefits for all stakeholders are clear.
- Relatively modest expenditure can leverage much bigger overall investment through counterpart contributions.
- Restricting use of the fund to yields from interest and investments – NOT capital – means that the fund grew slowly but sustainably.
- Strong capacity building and communications/ awareness-raising components have been vital to FONAG's success.
- A stable, long-term financial mechanism provides the security, stability and sustainability needed for partners to feel confidence in participating in FONAG and enables FONAG to operate.

Reference

http://www.fonag.org.ec/portal/ downloaded 1 September 2011

Figure 1. FONAG equity yield 2000-2009 (USD)

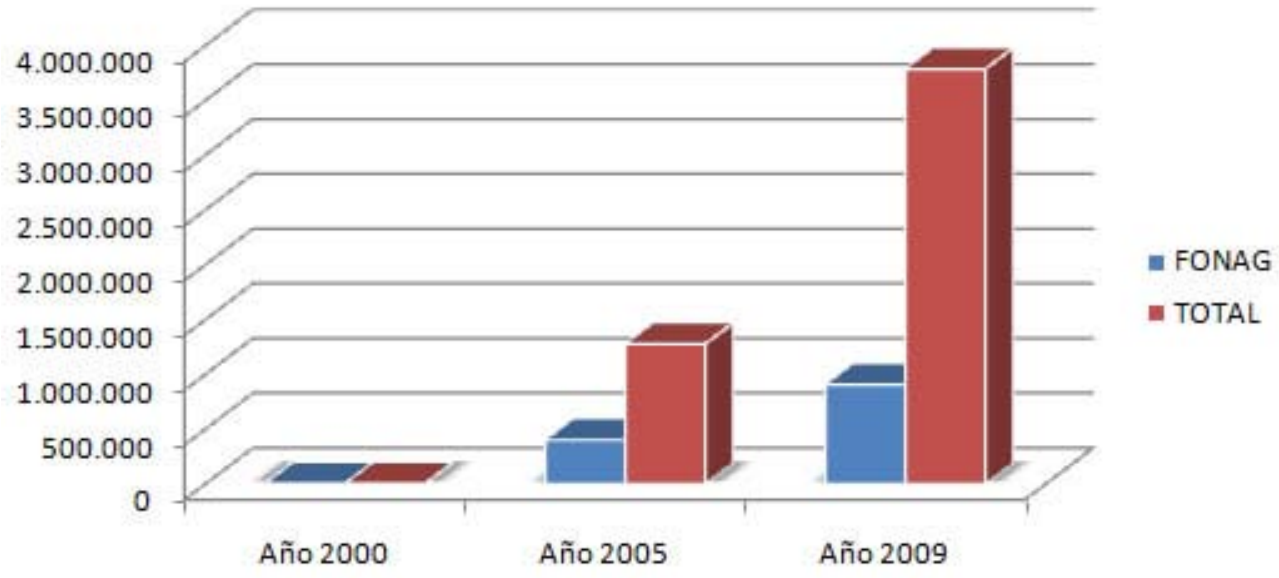
Year	Total equity	Revenue from equity (interest & investments)	Reserve fund	Total available	Yield (%)
2000	164.046	5.990	Not yet established	5990	3.65
2001	443.502	20.306	Not yet established	20306	4.58
2002	837.111	56.059	3.433	59492	7.11
2003	1.450.053	82.605	84.594	167199	11.53
2004	2.112.553	133.774	377.716	511490	24.21
2005	2.693.452	281.980	251.784	533764	19.82
2006	3.588.514	540.456	599.220	1139676	31.76
2007	4.193.784	467.123	96.434	563557	13.44
2008	5.162.206	1.014.447	26.480	1040927	20.16
2009	6.437.743	1.140.345		1140345	17.71

*A reserve was established in 2002 so that FONAG could be in a position to cover unforeseen but legitimate cost increases for projects already underway.

Figure 2. Programmes and projects funded (USD) – comparison of 2000, 2005 and 2009

Programmes & Projects	2000		2005		2009*	
FONAG Programmes	TOTAL	FONAG contribution	TOTAL	FONAG contribution	TOTAL	FONAG contribution
Water management	–	–	98,931	28,931	576,677	58,977
Site surveillance and monitoring	–	–	78,809	23,809	324,564	95,719
Restoration of vegetation cover	–	–	351,952	109,952	774,149	248,649
Environmental education	–	–	35,757	20,757	311,257	79,016
Training in IWRM	–	–	350,000		50,276	32,776
Communication	–	–	25,832	5,832	83,290	55,370
Programme support	–	–	36,091	16,091	1,082,266	49,728
FONAG Programmes subtotal	–	–	977,372	205,372	3,202,479	620,235
Community Projects	–	–	113,108	69,108	369,186	152,394
Operational management	690	690	136,560	76,560	119,026	52,318
FONAG administrative costs	5,078	5,078	51,770	51,770	97,350	83,350
Overall total	**5,768**	**5,768**	**1,278,810**	**402,810**	**3,788,041**	**908,297**

Figure 3. Steady growth in FONAG's investment in programmes and projects and the more rapid growth in counterpart funding leveraged (vertical axis, USD), comparing the situation in 2000, 2005 and 2009 (horizontal axis).



Payment for Environmental Services pilot project in Lake Naivasha basin, Kenya – a viable mechanism for watershed services that delivers sustainable natural resource management and improved livelihoods

Thomas Chiramba, Silas Mogoi and Isabel Martinez (UNEP), Tim Jones (DJEnvironmental)

Type of tool: investments and fiscal measures for biodiversity protection
Issue: watersheds
Location: Kenya, Africa

Challenge and objectives

Lake Naivasha is located in the Kenyan portion of the Great Rift Valley and has been recognised as a 'wetland of international importance' under the Ramsar Convention on Wetlands. The project is being implemented in the Malewa River basin (a sub-catchment of Lake Naivasha basin) situated in the Rift Valley and Central Provinces of Kenya. The project has consisted of three phases, beginning in 2006 with the project initiation phase (scoping and feasibility studies including hydrological survey, cost-benefit analyses, livelihood analysis, business case analysis, legal policy framework analysis). The implementation phases commenced in 2008, while the project has now entered its third and final phase – scaling up. The catchment of Lake Naivasha covers an area of approximately 3,400 km^2 and ranges in altitude from approximately 1,900 m to about 3,900 m above sea level. The project area covers the Turasha-Kinja and Wanjohi Rivers. Both are major tributaries of the River Malewa, which contributes 80% of the water that flows into Lake Naivasha.

Economic activities around Lake Naivasha include small-scale and large-scale agriculture, horticulture, ranching, tourism, fishing and geothermal power production, and pastoralism. Over 50 square kilometres of land around the lake is under intensive, commercial horticulture and flower farming. These activities provide livelihoods for over 500,000 people living within the basin.

Significant environmental threats emanate from poor land-use practices within the watershed, unregulated and excessive water abstraction for domestic and agricultural/horticultural use, weak policy enforcement, and population pressure on natural resources, water pollution and climate change. These have resulted in degradation of ecosystem services, economic losses, worsening poverty and reduction of biodiversity.

The approach: how did PES help overcome barriers to dealing with the challenge?

The goal was to develop a viable financial mechanism for payments for watershed services that delivers sustainable natural resource management and improved livelihoods and serves as a pilot and learning model for further expansion and replication.

Payment for Environmental Services (PES) is a market-based mechanism where land owners are rewarded by service beneficiaries. It is based on the premise that land owners undertake land use transformations that provide agreed ecosystem services. For these services, they are rewarded financially by the beneficiaries.

The role of intermediary institutions

WWF (WWF-Kenya) and CARE-Kenya are providing funding and coordination as intermediary institutions to develop Payment for Ecosystem Services – PES (the ecosystem service in this case being water) – as a market-based scheme for delivery of sustainable natural resource management and improved livelihoods.

Engaging partners

- Lake Naivasha Water Resource Users Association (downstream buyers)
- Lake Naivasha Growers Group (downstream buyers – the principal participant in the project among the buyers)
- Upper Turasha-Kinja Water Resource Users Associations (upstream sellers)
- Wanjohi Water Resource Users Associations (upstream sellers)
- Ministry of Agriculture
- Water Resources Management Authority
- Kenya Forest Services
- Provincial Administration

The partners therefore include ecosystem service 'sellers/providers' and 'buyers/users', as well as the principal national and local agencies involved in the regulation of these services.

Piloting and scale up

The project is designed to serve as a pilot and learning model for further expansion and replication.

Contractual benefit sharing

This linkage requires contractual agreements negotiated between the ecosystem stewards and ecosystem beneficiaries, making PES a unique benefit-sharing mechanism.

In this case, Lake Naivasha Water Resource Users Association (LANAWRUA – Lake Naivasha Growers Group currently being the major contributor to the Association) – on behalf of ecosystem service beneficiaries, notably the major floricultural/horticultural industry based around the lake – agreed to compensate small-scale landowners/farmers represented by the Upper Turasha-Kinja and Wanjohi Water Resource Users Associations (WRUAs) who forego some potential income to manage their land to provide good quality water to downstream users. The two WRUAs were provided with an initial financial incentive of USD 10,000, followed by a second payment of USD 10,000. The first incentive rewarded 470 farmers and second reward benefited 504 farmers.

Pilot site selection

Initial hydrological studies identified five degradation hot-spots. Two PES pilot sites were identified by considering a range of relevant factors for the Wanjohi and Turasha sub-basins.

Both pilot sites were regarded as highly degraded and of critical importance for biodiversity conservation. The Soil Water Assessment Tool (SWAT) model was applied to predict the impact of land-management practices on water over long periods of time. Other important elements of the selection process were livelihood assessment, cost-benefit analysis, marking and mapping of hot-spot farms (see below) and completion of an Environmental Impact Assessment. Potential buyers identified downstream were: Nakuru Rural Water and Sewerage Company, Naivasha Water and Sewerage Company, commercial horticultural growers (LNGG), Kengen geothermal electricity generation plant, Kenya Wildlife Service, the tourism industry in Naivasha and the Lake Naivasha Riparian Association.

Community sensitisation

Intensive awareness and sensitisation were conducted on-farm, in grass-roots meetings, seminars, workshops, field days, and public meetings (barazas) to enhance understanding and buy-in by the community and all stakeholders.

Hot-spot farm selection

Hot-spot farms were selected from target areas (i.e. areas of the two sub-basins where water quality/quantity problems had been identified) where initial sensitisation work on the concept, operation and benefits of PES had been conducted. From a technical viewpoint the farms selected as 'hot spot farms' were those on steep slopes where no soil/water conservation measures were already in place. To enhance buy-in from farmers, members of the Water Resource Users' Associations and opinion leaders guided the selection of target farms. All 565 farms in the selected pilot areas were mapped and marked.

Land management changes aimed at improving downstream water quality and quantity

- Rehabilitation and maintenance of riparian zones
- Establishment of grass strips/terraces to reduce runoff and erosion on steep slopes
- Reduced use of fertilizers and pesticides e.g. through integrated crop/pest management, use of new/improved crop varieties
- Agroforestry/tree planting – planting native trees and high-yielding fruit trees and cover crops for improved farm productivity, reduced runoff/erosion and increased biodiversity
- Training for livelihoods enhancement – training provided to farmers by Ministry of Agriculture and Horticultural Crops Development Authority on issues such as: (a) soil and water conservation techniques to boost farm productivity; (b) use of improved fodder storage techniques; and (c) use of new/higher-value crops such as improved potato varieties, tree tomatoes and apples.

Assessment and monitoring

Four river gauges were installed. On-farm monitoring and training in good agricultural practices aimed to ensure that the correct practices are being followed; on-farm follow up has been intensified on all farms.

Evaluation: economic, social and environmental benefits

- **Land management changes.** These were implemented at all participating sites.

- **Water quality.** Farmers along the target tributaries are reporting positive changes in water clarity though there is not yet empirical evidence for this (hydrological data collection is on-going).

- **Livelihood improvement.** Napier grass (*Pennisetum purpureum*), cock's foot (*Dactylis glomerata*) and Elmba Rhodes grass (*Chloris gayana*) used for conservation have increased fodder supply resulting in increased milk production and reduced pressure on forests from grazing. Planting of fruit trees and use of higher quality material for potato planting bring in additional income.

- **Soil and water conservation.** The structures introduced in the farms have dramatically reduced soil erosion and surface water run-off. Soil fertility has been enhanced by on-farm planting of appropriate trees.

- **Forest cover.** Apart from napier grass, the project focuses on planting trees on farm and along riparian areas. This has increased tree cover in the pilot areas with anticipated timber and non-timber products in future.

- **Buyer's continued support.** The project has continued to receive overwhelming support from Lake Naivasha Water Resources Users Association (mainly through LNGG).

Lessons learnt

- Sustainable provision of ecosystem services can be achieved through:
    - changes in land-use practices
    - incentives to farmers that are both equitable and targeted at maintaining or enhancing livelihoods
- Strong stakeholder partnership leads to more successful implementation
- Necessary preconditions include:
    - availability of baseline hydrological data
    - establishment of a strong business case
    - building of trust and commitment among stakeholders
    - establishing a market mechanism – that stakeholders are easily able to engage with – for the selling and buying of ecosystem services
- Appropriate and adequate capacity building of ecosystem service providers and beneficiaries strengthens implementation of PES projects

Present challenges and future plans

Present challenges

- **Very high demand for change.** The pilot farmers' on-farm benefits have triggered very high demand for change in the region. More than 300 additional farmers have joined the projects stretching the project resources.

- **Unpredictable weather pattern.** Climate change has disrupted the seasons resulting in adverse effects within the pilot area. Prolonged drought destroyed most of the conservation plants. This was followed by heavy rainfall and soil erosion.

- **Degraded public lands.** Non-point source sedimentation from degraded public land may threaten efforts to prove a business case for PES through water quality monitoring since such sedimentation may obscure the hydrological benefits arising from land-management improvements on the targeted hot-spot farms.

- **Complex land ownership.** There is much dynamic of land ownership in the pilot area due to inheritance, subdivision and use changes. These threaten the main pillar of the project, namely farm ownership.

- **Low buy-in from buyers.** Like other PES schemes around the world, especially those relating to watershed services, securing commitment from direct beneficiaries of those services is a challenge; especially in a situation where they are already paying a statutory water fee to the regulating body and therefore payment for PES appears as if it is a "double" payment.

Future plans

- **Up-scale the scheme internally and externally.** Significant long-term improvements at a sub-basin or whole-basin scale will only be achieved if all (or at least a large majority) of service providers are undertaking sustainable land- / water- use practices. This in turns implies the participation of a majority of water users to fund the provision of environmental services. Internally more sellers/ farmers will be engaged and already there is high demand from farmers who are not currently implementing the scheme. Externally, three other WRUAs will be considered for inclusion in the PES scheme following the results of feasibility studies.

- **Engage more buyers and sellers.** Consultative meetings will be organised to discuss with potential buyers their participation in the scheme. The selling point will be the opportunity to improve their business through investment in PES scheme, notably through reducing the cost of water treatment. It is anticipated that with improvement in quality, increased quantity will also be available to support business growth. Ecosystem service sellers will be mobilised through community sensitisation meetings involving the provincial administration. The selling point for them of PES will be the opportunity for improved livelihoods.

- **Link to Reducing Emissions from Deforestation and Degradation (REDD).** Through the PES scheme SMART approaches are/will be promoted to reduce emissions. For instance by promoting alternative renewable fuel sources (e.g. biogas, woodlots) and

energy-efficient stoves, these will reduce pressure on forest ecosystems. Payment for watershed services will be combined with a carbon finance scheme to generate multiple benefits.

- **Institutionalise PES in the policy framework.** Relevant policymakers will be engaged through dialogue and advocacy with the goal of PES schemes being integrated into natural resource management policies. The Water Resource Management Authority –WRMA is already engaged in the current project.

- **Link the pilot farmers to markets.** This will be done through facilitation of farmers to form producer and marketing groups. This will increase their bargaining power, market competitiveness, reduce transaction costs and therefore increase return on investment.

Conclusion

This case study demonstrates clearly how economic incentives for both ecosystem service buyers and sellers can be used to achieve significant land- and water-management improvements.

This is a pilot project, still at a relatively early stage of implementation and it is still too early to be able to quantify the gains in water quality/quantity or livelihood improvements achieved as a result of these management changes. However, the overall approach is one that can serve as a model for elsewhere in Africa and other developing country contexts, where conservation of soil, water and biodiversity must be seen to be delivering tangible livelihood benefits.

Rewards for watershed services in Sumberjaya, Indonesia

Delia Catacutan, World Agroforestry Centre

Type of tool: economic instruments in water management / investments in the protection and improvement of biodiversity
Issue: watershed management
Location: Sumberjaya, Lampung province, Indonesia, Southeast Asia

Introduction

Government's perception that uncontrolled deforestation and conversion to coffee farming on the slopes of Sumberjaya has led to increased soil erosion, threathening the operation of the newly constructed Way Besai hydropower dam and reducing water availability for irrigated paddy rice downstream has resulted in the eviction of thousands of farmers in the Sumberjaya forest between 1991 to 1996. On the contrary, studies by the World Agroforestry Centre (ICRAF) since 1998 in the area show that multi-strata coffee farms provide livelihoods to farmers and also control erosion in a way similar to that of natural forest. Therefore, coffee farming and forest protection should not be viewed as antagonistic practices. Multiple stakeholders have different knowledge and perceptions on forest and watershed functions which they use to justify their actions, but through negotiations, these differences have led to a new discovery of what stakeholders can do together to reduce conflict on the way the watershed should be managed. Rather than 'eviction', rewards schemes for watershed service provision was used to meet the multiple goals of coffee farmers, local government, district foresty, and the hydropower company.

Drivers of change

Since 2002, the World Agroforestry Centre (ICRAF) has been implementing the **'Rewards for Use of, and shared investment in Pro-poor Environmental Services'** or RUPES project in Asia, covering China, Indonesia, Nepal, Vietnam, Philippines and India. RUPES is dedicated to developing practical environmental services schemes that can be adapted in different countries with different circumstances. It aims to integrate rewards for environmental services into development programs to alleviate rural poverty and protect the natural environment.

The environmental services (ES) discourse in Indonesia gained more attention after the RUPES Project organised a national ES seminar in February 2004. At the office of the Indonesian National Development Planning Agency (BAPPENAS), a seminar was conducted with participants from ES practitioners around the country. At the end of the seminar, the participants agreed to form a national level network, named 'COMMITTEES' to advance the thinking and application of ES rewards schemes to protect the environment and improve the welfare of poor farmers in upstream areas. Members of the COMMITTEES are currently working hand in hand with a number of partners to pass an ES policy in Indonesia.

At the field level, the Sumberjaya ES program is one amongst a number of pilot ES rewards schemes carried out by NGOs. Today, ES in Indonesia finds an increasingly significant place at the national discourse as evidenced by the increasing number of collaborative programs in both pilot and implementation levels involving various stakeholders including the government (especially the Ministry of Forestry), local NGOs, national and international research and development agencies.

About 40% of the 45,000 ha Sumberjaya watershed is protected forest. It has a history of conflict, including forced eviction which rooted distrust and tension between local people and various levels of government. From 1991 to 1996, thousands of farmers in the Sumberjaya forest were evicted by government based on their perception that coffee farming in the slopes has increased soil erosion, thereby putting the operations of the Way Besai hydropower dam at risk of sedimentation and low water levels. In 1998, ICRAF began its research to assess the impacts of multi-strata coffee farming on watershed functions, and found that this farming system provides good income for farmers and can control soil erosion in a way similar to that of natural forest.

In 2004, the RUPES project started facilitating local communities in understanding their important role in managing the watershed. Dialogues with local government officials, district foresters, local people and the Way Besai hydropower company were facilitated by RUPES staff. Using ICRAF's results from land use and hydrological studies, stakeholders understood that eviction and soil erosion should not be a consequence of multi-strata coffee farming – in that, watershed protection and coffee farming can be combined in a way that is not detrimental to the hydropower dam. Clearly, different stakeholders have different understanding about watershed functions, as well as different interests on watershed services and on the management of the watershed. Coffee farmers would want to continue cultivating the hillsides for their livelihood, whilst the Forestry Department and the Local Government wants control over the area and the hydropower company wants more water in the dam. The lack of secure land tenure by local people in the area was the basis for their eviction by the government, in favour of the hydropower dam. However, through the RUPES project, dialogues were facilitated to reconcile the differences in knowledge and expectations of multiple stakeholders; as a result, the stakeholders agreed to cooperate and use existing approaches or create new ways of rewarding local communities in their efforts to manage the watershed.

The approach to watershed management

The RUPES project is composed of three programs: the Community Forestry Program (HKm)*, the* River Care Program, *and the* Soil Conservation Program. The HKm is implemented by the Local Forestry Department following the rules and regulations of the National Government's Community Forestry Program; whereas both the RiverCare and Soil Conservation Program are governed by Forum Committees—both receive technical advice and organizational capacity building to ensure that the contracts are complied**.**

1. Community Forestry Program (HKm)

To avoid eviction, the RUPES Project helped local communities gain access to the Indonesian Government's Community Forestry Program (HKm). The HKm Program provides farmers with conditional land tenure for forest protection. In exchange, farmers adopt environment-friendly farming practices and protect the remaining natural forest, thus ensuring that the land will continuously produce forest and watershed protection benefits. The RUPES project participated in dialogues with HKm administrators, making use of research results to argue that sustainable coffee farming could not be the main culprit of sedimentation in the river and the dam. With persistence and effective boundary spanning strategies, the HKm administrators eventually, approved the granting of conditional land tenure to coffee farmers in Sumberjaya. To date, the HKm Program has covered 70 percent of Sumberjaya's protection forests and involved nearly 6,400 farmers, protecting 13,000

hectares of forest land. The RUPES Project views the HKm as a non-monetary reward for farmers who provide environmental services. HKm represents a major success for farmers, who are no longer at risk of eviction.

A recent impact study of land tenure in Sumberjaya carried out by researches of the RUPES Project, Michigan State University, and the International Food Policy Research (IFPRI) found that community forestry permits:

- increased land tenure security;
- doubled the local land value;
- reduced corruption;
- increased income, mostly due to a reduction in bribes;
- increased equity, relative to local resources farmers have;
- promoted tree planting/agroforestry;
- promoted soil and water conservation; and
- gave farmers more reasons to protect the remaining natural forest.

2. River Care Program

The Way Besai hydroelectric company (PLTA) in Sumberjaya would need up to USD 1 million per year to remove the sediments from its reservoir. This is a huge amount of money that may not be necessary if they can keep sediments from reaching the reservoir in the first place. The RUPES Project set up a pilot project with one community and one sub-catchment area to develop a payment mechanism for reducing sediments through a "RiverCare" program. A Forum or Working team was formed at each sub-village consisting of hamlet administrators, community forestry administrators and mosque administrators. The Forum is used as a medium for capacity building, social networking and conflict resolution. The Forum Committee consists of the chief, secretary, treasurer, conservation service section, community development section, agriculture and economic section, and public work section.

In the program, RiverCare members work with RUPES facilitators and researchers to learn principles and practices related to soil and water conservation, as well as sediment monitoring and measurements. Facilitated by the RUPES project, a Conservation Agreement was developed by the RiverCare group and the Way Besai Hydropower Company. The Agreements include activities such as the following:

- Construction and maintenance of dams to retain sediments from forest, coffee garden, paddy field, foot paths;
- Diversion of waterway and construct limited ridging and sediment pits on coffee gardens to prevent erosion;
- Planting grass strips along potential landslide hotspots on coffee gardens;
- Installing water channels and PVC pipes to stabilise water flows.

'Conditionality' is the main principle in this initiative. The Way Besai Hydropower Company was committed to pay for water quality via sediment reduction in the dam, as long as the RiverCare group delivers the service. The terms of the Conservation Contract are outlined in the table below.

Payment schedule of operational cost	US$ 1,100 total Schedule of payment: 50 percent at inception 50 percent at two months contingent on performance
Payment as ES reward	Reducing sediment up to: • 30 percent—cash payment up to US$ 2,200 (Gunung Sari) or a micro hydropower plant with the capacity of 5000 watt with similar monetary value to Gunung Sari (Buluh Kapur); • 21 to 29 percent-- US$ 850 • 10 to 20 percent: US$ 550 • less than 10 percent: US$ 280
Duration and monitoring	One year with monitoring every three months; termination if 50% of the contracted activities are not completed by midterm monitoring.
Cancellation or non-compliance results in:	• Ineligibility for second payment installation • Purposively destructing public physical construction and properties • Friction and conflict among community members • Indication of corruption • *Force majeure* or natural disasters

3. Soil Conservation Program

Another reward scheme is through a soil and water conservation program. The scheme involves paying farmers for reducing erosion and sedimentation. The practices applied by farmers on their farms are terracing, sediment pit and strip weeding techniques.

The monitoring activity is conducted four times in a year. The first monitoring is done on the 3rd month after contract signing, followed by the 6th month, 9th month and at the end of the contract. The farmers receive cash payments in the amount of Indonesian Rupiah 1,600,000 ($160) per ha for a one year contract period.

Evaluation: economic, environmental and social benefits

Economic benefits

In all three programs, local people directly benefit from higher yields in the multi-strata coffee production system and cash payments from soil erosion control and sediment reduction. The payments may be small, but could represent an increment in household incomes.

Environmental benefits

All programs have a strong 'conditionality', which is essential in a contract-mediated ES reward scheme. The payments or rewards are conditional, subject to environmental performance in the area of forest protection, soil and water conservation and sediment reduction. The benefits to the environment are thus manifold. The HKm conditional land tenure scheme requires protection of remaining natural forest and adoption of sustainable coffee production techniques whereas the RiverCare and the Soil Conservation Programs involve soil and water conservation technologies to reduce on-and off-farm soil erosion and sedimentation in waterways.

Social/poverty alleviation benefits

Clearly, all programs have had positive social impacts. Because poverty is multi-dimensional, the conditional land tenure acquired by forest people was a step towards emancipation from poverty. Local people are no longer threatened from eviction, giving them a sense of protection and security for their livelihoods. On the other hand, members of the RiverCare program and farmers involved in the soil conservation program not only earn additional income from soil erosion control and sediment reduction activities, but also raise their profile and value from doing extra work for the community. More importantly, the local community gained respect from the Local Government, the Hydropower company, the forest department, and scientists for their contribution to wider society, and for having accepted the responsibility of being environmental stewards.

Lessons learnt from implementation

Why did the reward schemes work?

- Hotspot areas were identified through research, and expected environmental service outcomes are clearly linked to it. The cause-effect relation is thus clearly established.
- Stakeholders involved have good knowledge about the causes of soil erosion, the location of hotspots and how to tackle the problem.
- The contract has a clear conditionality – the rewards are linked to a specific service, which is sediment reduction and monitoring is done in a participatory way.
- The pilot program was oriented involving several steps such as identification of environmental problems, capturing local knowledge and understanding farmers' management options.

What did we learn?

- Good social mobilisation
- RES negotiation will succeed if the community appreciates its opportunity and their role and impacts as "ES seller".
- The communities should be involved in the scheme in a voluntary manner, and should understand their bargaining positions based on optimal threat and cooperation with others stakeholders.
- Community based institutions should have well-functioning structures in order to effectively support an operational RES mechanisms.
- Modifying the current policy criteria.
- It is important to consider the heterogeneity of biophysical characteristics (on soils, geology, etc.) and other landscape elements (footpaths, roads, landslides and river bank

collapse) in solving landscape problems. Policy responses should encompass various issues, tackle divergent sources of landscape problems, and address specific issues, rather than apply a 'single solution' fits all approach (e.g. reforestation).

Scaling up and relevance for developing/transition countries

The experiences of the three programs provide lessons to learn from, especially for forest contested areas in developing countries where poor people eke-out a living from small-scale cultivation and extraction of forest products. The experience in Sumberjaya suggests that reward schemes for delivery of environmental services are a better option than 'eviction' of forest people. On hindsight, misunderstanding of expectations from forest and watershed functions where eviction is used as an option could lead to serious damage. The experience is very relevant for governments who often have full control, but have limited capability to manage forests and watersheds. It shows that educating decision-makers and stakeholders with research-based information can lead to changes in attitudes and actions towards sustainable forest/watershed management. It also shows the business case for private-sector engagement in ES rewards schemes. Finally, the experience demonstrates that rather than coercion, provisioning environmental services can be secured through negotiated arrangements amongst the government, private sector, local people, and scientists with a shared understanding on the relations between land use and watershed functions as a first step.

The potential constraint for scaling up however, is the amount of research and information gathering needed to structure an ES reward scheme. Substantial data is needed to inform decisions and to agree on the conditions binding the ES contract. However, research collaboration can be developed by governments intending to initiate a PES program – they can also streamline relevant ministries and mainstream the PES concept in sectoral plans, and using common sense knowledge and available data, a PES program or policy can be designed at the national level.

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Payment for Forest Ecosystem Services (PFES): pilot implementation in Lam Dong Province, Vietnam

Thomas Chiramba, Silas Mogoi and Isabel Martinez (UNEP), Tim Jones (DJEnvironmental)

Type of tool: investments and fiscal measures for biodiversity protection
Issue: watersheds
Location: Lam Dong Province, south-east Vietnam, Asia

Introduction

Together with national and provincial partners, Winrock's Asia Regional Biodiversity Conservation Program (ARBCP), funded by USAID, developed a sustainable PES-based financing mechanism (entitled 'Payment for Forest Environmental Services – PFES – in Vietnam') explicitly designed to maintain biodiversity at a landscape level. The pilot approach supported natural resource management and conservation in ways that provided real economic opportunities to rural communities, using sustainable financing targeted at poverty reduction. PFES has provided local stakeholders with a significant role in managing those forest resources that contribute to their livelihoods, helping to ensure continuing local support for conservation. Hydropower and water supply companies are among the principal beneficiaries of the ecosystem services provided by forested areas and make the greatest financial contribution towards safeguarding those services. Funding has been provided by Asia Regional Biodiversity Conservation Program (ARBCP), funded by USAID's Regional Development Mission for Asia (RDMA) and coordinated by Winrock International.

The successful pilot project has led to a national scaling up of PFES (enshrined in a Prime Ministerial Decree) and to significant interest elsewhere in the South East Asia region in replicating the approach followed in Vietnam.

The implementing partners have been:

- Vietnam Ministry of Agriculture and Rural Development
- Lam Dong Province Peoples' Committee
- Lam Dong Province Department of Agriculture and Rural Development
- Lam Dong Province Department of Natural Resources and Environment

A Steering Committee was formed to oversee the development and implementation of a workplan, including the allocation of roles and responsibilities.

Challenges and objectives

Threats to biodiversity in South East Asia are largely driven by the imperative for economic development. One of the most pressing issues for conservation involves offsetting the costs to rural communities of protecting natural habitats rather than converting them to agriculture or other uses that provide immediate income generation. Biodiversity and watershed conservation services provided by forests are frequently undervalued and few markets exist where conservation benefits can be converted into tangible economic values that in turn influence human behaviour to promote conservation. As a result, economic

returns to be derived from protecting forests are not high enough to prevent their conversion to other uses, leading to biodiversity loss and degradation of water quality and quantity.

In Vietnam, as elsewhere in the region, insufficient funding for conservation serves as a major constraint to achieving biodiversity goals. Costs of managing protected areas are high, particularly those related to biological and enforcement monitoring. Management boards for protected areas rely on funding provided by Vietnam's central government. Few funding sources are available for conservation initiatives located outside protected areas, and reforestation programmes have not received enough funding to meet and maintain required results.

The approach: how did PES help overcome barriers to dealing with the challenge?

Planning

In 2006-2007, Lam Dong Province was supported by ARBCP to develop its first Biodiversity Conservation Action Plan (BCAP), establishing clearly defined landscape-level management objectives and targets for strategic biodiversity corridors to be achieved by 2020. The plan set out the framework for using funds generated by Payments for Ecosystem Services (PES) mechanisms to support and sustain the Province's priority conservation targets. The BCAP was the first in Vietnam to be fully coordinated with a province's socio-economic development plan.

Box 1 Provisions of the Payment for Forest Environmental Services pilot policy

Three categories of Forest Environmental Services (FES) were stipulated in the pilot policy:

- water regulation
- soil conservation
- visual quality of landscape

FES 'providers' were identified as local farmers, local farming households and local farming communities who had already been allocated forest land.

FES 'buyers' were identified as:

- publicly owned water and electricity utilities
- tourism operators

The pilot policy directed these buyers to pay for FES (water regulation and soil conservation, in the case of the public utilities) and landscape quality (in the case of tourism operators).

Based on preliminary studies conducted by Winrock, the pilot policy set payment levels at:

- 20 VND[1] per kilowatt-hour from commercial hydropower production businesses
- 40 VND per cubic metre from clean-water production businesses
- between 0.5% and 2% of annual revenue from tourism businesses.

Pilot phase

In 2007 ARBCP assisted the Vietnamese Ministry of Agriculture and Rural Development (MARD) to develop a pilot policy on Payment for Forest Environmental Services (PFES) in Vietnam – see Box 1. The pilot policy came into effect through a Prime-Ministerial Decision in April 2008 and implementation of pilot testing activities in two provinces (Lam Dong in the south of the country and Son La in the north) took place between January 2009 and December 2010 under the overall responsibility of MARD. ARBCP led implementation in Lam Dong Province, while activities in Son La Province were supported by the German bilateral cooperation agency GTZ (now GIZ).

Project implementation preparations

The preparations and process for implementing the pilot PFES policy in Lam Dong Province included scientific studies, national and local awareness raising efforts, and provincial capacity building and training activities. A national PFES Steering Committee was established and a two-year workplan was finalised by Lam Dong Province's Department of Agriculture and Rural Development (DARD).

The Dong Nai river basin (see map, Figure 1) was chosen as the river basin from which to select pilot sites because:

- It possessed the necessary conditions to directly support conservation and development objectives set out by the Government of Vietnam in the BCAP;
- The high demand for watershed services from Ho Chi Minh City and surrounding urban industrial parks gave PFES mechanisms in the Dong Nai basin the best chance of success; and
- The area's proximity to major tourism markets offered opportunities to turn demand for biodiversity conservation services into tangible economic incentives.

A spatial assessment was conducted to determine the level of economic threats in priority conservation areas of the Dong Nai river basin and two macroeconomic assessments were carried out to understand the rate and direction of likely changes under future development plans. Based on the information available, two focal areas – Da Teh and Da Nhim (see map, Figure 1) were identified as suitable pilot sites. Both sites adjoin National Parks and lie along a forested landscape corridor of strategic importance for national biodiversity conservation goals.

Box 2 Public awareness

Throughout the two-year implementation phase, the provincial authorities and the Forest Protection and Development Fund (FPDF), supported by ARBCP undertook a major public information campaign on PFES, including installation of poster panels in four districts, display of more than 200 small billboards at major tourist sites and some 40 large roadside billboards, and distribution of more than 14,000 brochures, as well as convening meetings and workshops for local stakeholders.

The FPDF also launched a VND 438 million multimedia publicity programme in September 2009, which disseminated information on PFES through television and radio in Lam Dong

Province.

In addition, MARD and ARBCP developed a 30-minute video on PFES implementation – including interviews and discussions with national, provincial, and local PFES implementers – that aired on national television and featured at inter-ministerial and other key national meetings.

It is estimated that more than one million residents in the Dong Nai river basin received information about PFES and biodiversity conservation through provincial and national media coverage. Transmissions were timed to ensure the widest possible viewing among farming communities.

Protection contracts

In April 2009, the Steering Committee and Lam Dong Province People's Committee, determined that Da Nhim commune would be the first pilot site to enter into forest-protection contracts.

ARBCP carried out an initial forest valuation study for the Da Nhim watershed to provide baseline estimates of the tangible economic value of two key environmental services provided by intact forests, namely water regulation and soil conservation. This valuation study was instrumental in securing the confidence of policymakers with regard to setting payment levels to environmental service 'providers'.

Two hydropower companies, two water-supply companies and various tourism businesses were identified as buyers of Forest Environmental Services (FES). As determined under the pilot policy, the hydropower companies were required to pay VND[18] 20 per kilowatt-hour into a specially established Lam Dong Forest Protection and Development Fund (FPDF). Water supply companies had to pay VND 40 per cubic metre, while tourism companies contributed 1% of their annual gross revenues.

Early in 2009 hydropower, water supply and tourism businesses signed Memorandums of Understanding committing payments of USD 3.4 million to protect more than 220,000 hectares of forests and the ecosystem services they provide. By the end of the pilot implementation phase in December 2010, a total of approximately VND 108 billion (over USD 5.5 million) had been paid into the PFDF, which is overseen by a governing board composed of national and provincial authorities and monitored by independent auditors.

The FPDF and Lam Dong Province concluded forest protection contracts with five small farming communities, involving 218 contracted households, for undertaking specific forest protection activities covering 4,795 ha of forest in and around Da Nhim commune, starting with a trial period of three months. Extensive preliminary studies had been undertaken to assess how to set PFES payments to service providers based on forest quality and threat levels, ultimately employing the concept of a 'K coefficient'[19]. However, pilot communities in

[18] In January 2009 (start of project implementation) 100 Vietnamese Dong (VND) was equivalent to just over half of one United States cent (USD 0.005).

[19] The national pilot policy on PFES provided guidance for applying a coefficient (the 'K coefficient') to determine the relative value of different forest areas based on an average of four factors: forest type,

Lam Dong Province elected to keep the payments consistent on a 'per hectare' basis, to assure equitable payments and thereby avoid possible conflicts. Payment levels were initially set at between VND 270,000 per hectare per year (/ha/yr) for Dai Ninh watershed and VND 290,000/ha/yr for Da Nhim watershed. These payments rose to VND 350,000/ha/yr and VND 400,000/ha/yr, respectively in 2010.

Payments

According to FPDF's report of January 2011, PFES payments were made to 22 Forest Management Boards and forestry businesses and to 9,870 households during the lifetime of the project. Contracted forest protection activities covered nearly 210,000 ha of forest. In 2009 the average household payment was VND 8.1 to 8.7 million (approximately USD 440 to 470), rising to VND 10.5 to 12.0 million (approximately USD 540 to 615) in 2010. These payments are around four times higher than forest protection payments received under former national government policies.

Monitoring

With support from ARBCP, Lam Dong Province established a watershed monitoring system in sub-catchments of the Da Nhim watershed. This action supports the scientific premise that effectively maintaining and managing forest cover will reduce soil erosion and enhance water regulation, and in turn reduce future production costs for hydropower and water supply companies.

Evaluation

A mid-term evaluation was conducted and submitted to the Prime Minister early in 2010. In general, it was noted that the pilot policy was being implemented successfully, with payments made by the payers and received by the communities providing the forest protection service.

The income of households involved in the implementation of the policy was shown to have increased significantly. PFES payments were becoming an important source of income for poor households, especially those of ethnic minorities. As a result, forests in the pilot areas were acknowledged to be better protected, with the incidence of violations and encroachment reduced significantly. According to the report, businesses benefiting from forest environmental services understood that PFES was an input investment that fosters sustainability of their own business operations.

Scaling up

On September 24, 2010, the successful implementation of the pilot PFES policy in Lam Dong Province during its two-year trial culminated in an announcement from the Prime Minister of Vietnam that a National PFES Decree had been approved. The PFES Decree transforms

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K_{LR} (protection category/special use/production); quality of forest, K_{CLR} (rich/moderate/poor/secondary); origin of forest, K_{NGR} (natural forest/planted forest); and human impact, K_{TD} (near road or residential areas,/remote forest area). The K coefficient = (K_{LR}+K_{CLR}+K_{NGR}+K_{TD}).

the way forests are viewed and managed in Vietnam, providing a measure of assurance that critical forests, and the ecosystems services they provide, will be protected into the future through the scaling up of PFES nationwide. This regionally and globally significant achievement serves as a model for other countries in South-east Asia struggling to find economically viable approaches to support biodiversity conservation.

Vietnam is now developing as a centre of excellence, from which other countries in the region could learn about implementing PES mechanisms. As one example of this, the Minister of Environment of Cambodia has requested support in the development of a similar PES policy in Cambodia.

Lessons learnt from implementation

Lessons learnt during implementation of the pilot PFES policy were manifold. They not only informed the shape and direction of the pilot project itself but will also assist the Government of Vietnam in effectively implementing the PFES Decree nationwide. Implementing such an innovative mechanism also involved many challenges. This section provides an outline of these, as well as lessons learned in overcoming the challenges.

- The identification and emergence of champions at all levels of the implementation process (national, provincial, district, and commune) was a key factor in the success of the pilot policy.

- The limited number of environmental services implemented under the pilot policy (water regulation, soil conservation, and landscape visual quality) reduced the risk of implementation failure and made the pilot policy easier to approve. The policy also concentrated the learning effort entirely on two pilot areas.

- While studies were undertaken to determine the K coefficient for PFES payments, Lam Dong Province elected to keep the PFES payments consistent across all areas on a per-hectare basis, regardless of forest quality and degree of threat. This occurred because the communities involved wanted an equal distribution of payment, and saw the K coefficient as a source of potential social discontent. Nevertheless, if these payments are to be effective in encouraging communities not only to keep forests intact but to improve their quality through sustainable land management practices, the K coefficient will have to be employed in due course.

- Despite the fact that extensive studies were done to value the ecosystem services (as well as to determine the K coefficient), the final payment structure also took into consideration the socioeconomic and socio-political context of the communities in question. Strictly adhering to the valuation studies, while scientifically robust, would not guarantee the uptake of the project and the backing of the community and payers.

- Lam Dong Province implemented a number of measures to raise public awareness of forest values and to impart information on the PFES pilot policy to related departments, authorities, companies, and communities. The most effective way to raise the awareness of the community and households was deemed to be through village and/or commune meetings and information from the Forest Management Boards (FMBs) during preparation of forest protection contracts. For the paying companies and institutions, the

flow of data and information through formal channels involving national and provincial authorities and the company/institution concerned was the most effective way to raise awareness.

- The development of the management mechanism was greatly assisted by local household participation in its design, implementation, and evaluation. Local stakeholders suggested that payments through the FMBs would be most effective because they could track the payments and have a forum to resolve disputes.

- The proper and equitable distribution of payments is contingent on the equitable and precise allocation of forest parcels to households. However, lacking a private land tenure system and integrated land-use planning system, the process of forest demarcation, allocation, filing, and approval in Lam Dong Province required significant time and money, at times impeding the proper and timely disbursement of payments to households.

- There was an issue of whether payments under PFES should be considered as being made from the state budget or whether they replaced the water-resource tax that hydropower plants had to pay. These and many other issues, connected to the innovative concept of PES, took time to resolve among various stakeholders. (During the pilot implementation companies paid both the water resource tax and PFES monies.)

- Establishing automated gauging stations in a relatively remote provincial river basin was a great challenge. The choice of either relying on manual measurements of water flow, discharge, and sediment or fully automated systems (or something in between) needs to be made after taking full consideration of the institutional and technical capacities of all the actors that will be involved in monitoring.

- To increase the robustness of the existing monitoring approach, including the four gauging stations, a comprehensive monitoring system based on a watershed analysis, a system of sediment fences to measure sediment yields at the sub-catchment level, and depth surveys in the reservoir could be employed.

- To support monitoring of PFES mechanisms nationwide under the new PFES decree, it will be essential for the Ministry of Agriculture and Rural Development on one hand, and the Ministry of Natural Resources and the Environment on the other, to collaborate more effectively, to harmonise efforts, and to clarify roles.

- Setting up the PFES pilot policy and implementing it appropriately required the collaboration of many disparate stakeholders at national and provincial levels. As such, subordinate technical agencies did not always work closely together or in a timely fashion, resulting in slow implementation, especially in allocation of the budget to the province.

- Key to the success of the valuation studies was the involvement of the Da Nhim Hydropower Station technical staff. Their involvement in the design and implementation of the valuation studies assured that relevant research questions were being asked; as a result, they were better able to articulate the results to policy decision-makers.

- Although increased forest patrols through the forest protection contracts raised the likelihood of detection of illegal logging, the entire enforcement system should be evaluated to determine the likelihood of arrest, successful prosecution, judgments, and penalties paid in cases where illegal activity can be proved.

- To implement the recently issued national PFES Decree, it is important to promote the Lam Dong Province PFES pilot area as a centre for learning, sharing, and improving the PFES mechanism for the whole country.

Reference

Winrock International (2011). *Payment for Forest Environmental Services: A Case Study on Pilot Implementation in Lam Dong Province Vietnam from 2006-2010*. http://www.winrock.org/fnrm/files/PaymentForForestEnvironmentalServicesARBCPCaseStudy.pdf downloaded 18 Aug 2011.

5. The contribution of water technology to job creation and development of enterprises

Karl-Ulrich Rudolph[20]

"Green technologies can contribute to green growth because they have the potential to create new business opportunities, markets and jobs. They can boost water and energy use efficiency and contribute to achieving the Millennium Development Goals and building the green economy. Innovative water technologies can increase the amount of water available for drinking, agriculture, and manufacturing and can allow us to use water more efficiently. This can be done by technologies in areas such as water resources assessments, reduction of water losses, waste water treatment, efficiency of water utilities, bio technologies, etc.

Technology development – if combined with public awareness – can also contribute to decreasing water footprints through increased conservation, reuse and recycling, and greater efficiency in most water using sectors, particularly agriculture. This can enhance overall poverty reduction and socio-economic development.

Research and development (R&D) and innovation are central to the green economy since they can reduce the costs of existing environmentally sustainable technologies and deliver the new technologies that are needed to advance efforts to cut emissions, reduce waste and increase resource efficiency. In both developed and developing economies, innovation plays a critical role in generating employment; enhancing productivity and growth; increasing energy, carbon, water and material efficiency; improving performance of goods and services and creating new markets and jobs through knowledge creation and diffusion."

Information Brief: Technology, UNW-DPAC

Technological challenges for green growth in the water sector

The challenges to implement advanced and more efficient water technologies and management have been highlighted in the Sick Water Report of UNEP and UN-HABITAT (2010), especially for urban areas:

"*Already, half of the world's population lives in cities, most of which have inadequate infrastructure and resources to address wastewater management in an efficient and sustainable way. Twenty-one of the world's 33 megacities are on the coast where fragile ecosystems are at risk. Without urgent action to better manage wastewater the situation is likely to get worse: By 2015, the coastal population is expected to reach approximately 1.6 billion people or over one fifth of the global total with close to five billion people becoming urban dwellers by 2030. By 2050, the global population will exceed nine billion.*"

The combination of population growth, rising water consumption, improvements in public health and welfare, rapid urbanisation (causing problems like contamination of raw water

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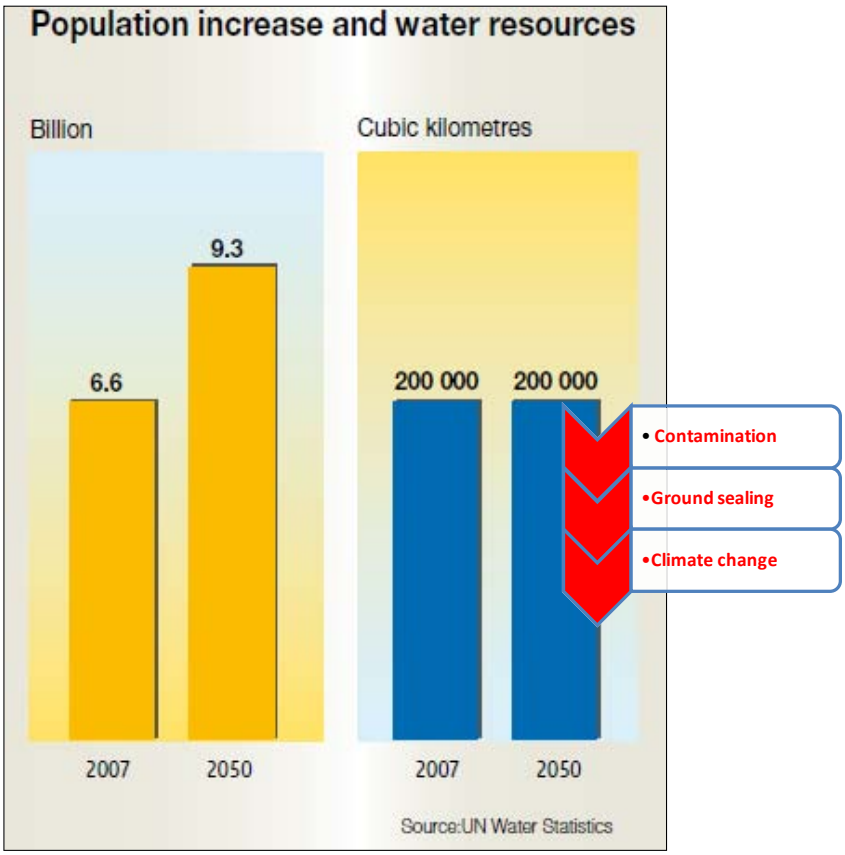
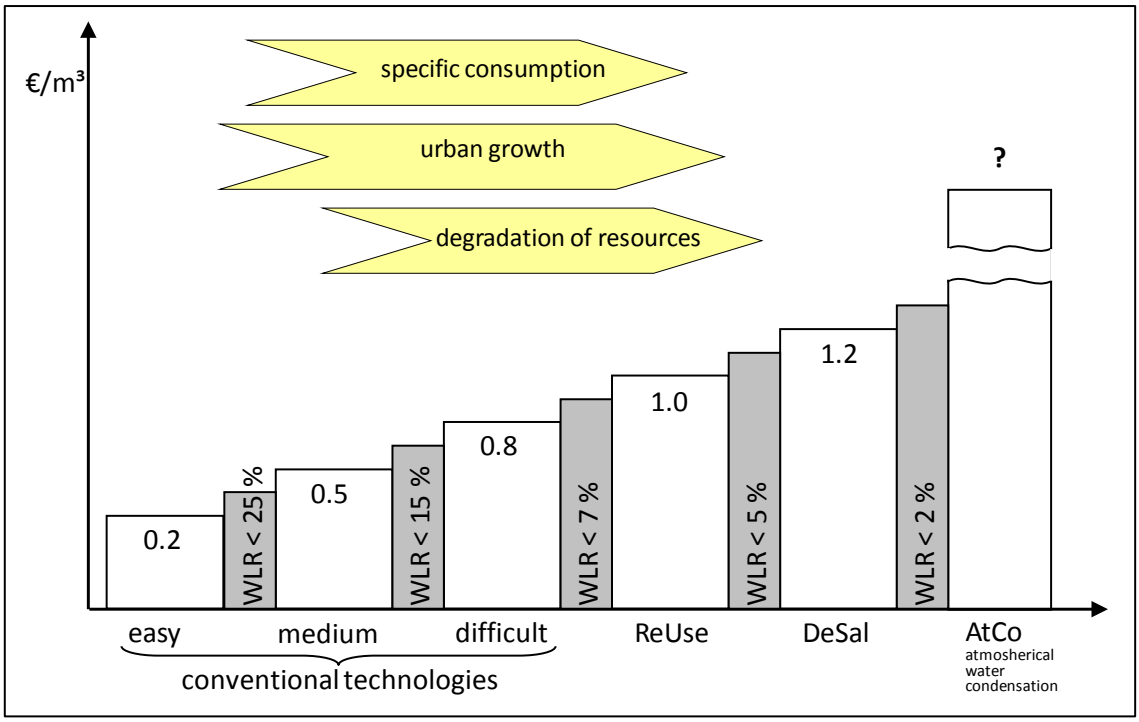
resources, widely spread land sealing with prevention of natural groundwater recharge), and the impacts of global climate change, will undoubtedly lead to more pressure on politicians and industry to resolve water problems (see figure below).



Water supply is a regional issue and shortages depend on location and time (seasons). This stands in contrast to energy supply, where problems (e.g. greenhouse gas emissions) are not related or limited to particular regions.

Water demanding agriculture, industry and settlements should (preferably) be located wherever cheaper water resources are available – from the view of water management. However, there are often other and more dominant factors driving spatial planning, meaning that it is impossible to prevent water intensive activities in arid areas or in urban areas which are short of water.

The need for improved technologies to expand water supply production and enhance water efficiency (the latter can be understood as driver of the green growth) is visualised in the following figure "Hierarchy of Water Production Costs".



The higher the costs of water production are, the more water saving measures, water loss reduction (WLR), and sophisticated water recycling technologies become profitable. WLR, selected for the figure above, is one important method within a broad toolkit to enhance water efficiency.

In locations where water production is easy and cheap (e.g. in towns with clean mountain water which needs no pumping to reach consumers), it may well be acceptable to tolerate water losses of 25 %. As soon as water production has to pump deep groundwater or purify contaminated raw water, requiring significant technical effort, water loss should be reduced and the economic optimum might range between 15 % and 7 %. In water scarce locations, conventional water production will need to be accomplished with more expensive technologies, like water reuse (wastewater re-cycling resp. down-cycling) and brackish-water or seawater-desalination. Under such circumstances, water loss rates above 5 % would not be feasible, economically. In cases with very high water production costs (like for supply-water condensed from the air, atmospheric water supply), the water losses should be as low as around 2 % (about the very best benchmark currently achieved in water distribution networks in Germany, where the national WLR 2010 is reported to be 6.8 %).

Considering the effort and status of WLR in many countries worldwide, one could say that the real value of water and water utility is not reflected appropriately in day-to-day water operations, and that there seems to exist a great potential for profitable WLR measures in many places.

Besides solutions contributing to water efficiency (i.e. efficiency in water consumption, such as water saving technologies and water demand management, water loss reduction, water reuse, utilisation of unused water resources such as rainwater harvesting, etc.), there are technological challenges contributing to non-greentech growth. Examples include seawater desalination technology which requires considerable energy consumption, as well as oil-, coal- or gas-powered, or high-energy consuming water reuse technologies (e.g. multi-stage

membrane technologies with reverse osmosis). However, even for these technologies, a trend towards greentech is happening (e.g. solar-powered desalination).

Another issue is improved welfare leading to water consumption in the "health and wellness sector" associated with a wide range of technologies from necessary medical applications to luxury applications, such as private pools and spas in arid and water scarce settlements. This field of water consumption bears a "green image", but is often accompanied with extensive water use and cannot be regarded as "green growth", at least not in water scarce locations and seasons.

Overall, the technical challenge in the water sector is advancing a multi-coloured growth, with strong elements of green-growth. Depending on market prices and the political costs of raw water resources and environmental pollution through wastewater discharge (which is very much a matter of governance and law enforcement), the powers of the market (which are stronger than political talking, in the long run) will focus either on GREEN or UNGREEN growth.

The role of the water sector regarding green growth is ambiguous, due to the fact that the sector is incorporating both strong drivers and strong barriers for green growth business development.

Value-wise, the water sector is less important (in nearly all countries, worldwide) than the power sector, the IT-/communication sector and (in industrialised, fully developed countries) strong industrial branches such as automotive. Furthermore, within the water sector, water supply is definitely stronger, value-wise, than wastewater and sanitation. This may contradict the importance that water supply and sanitation certainly has for the survival of deep land economies. And, it may be a strong contradiction to official statements from scientists, NGOs and politicians. Nevertheless, it is a fact that much more is paid for power, IT and cell phones in many countries, as well as in many slum settlements, than for water and sanitation.

Technology-wise, there has been huge progress in the development of new, adapted technologies in the water sector. Many of these are "collateral gains" from higher-valued sectors, like membrane technologies (first applied in industry and marine technology), IT/automation (most hardware and software originally developed and applied in higher-valued fields of business asset management etc.) or high-tech bio-technologies (many coming from organic chemistry or the pharmaceutical industry).

Barriers for technology in the green economy

Technological innovations may have unprecedented good or harmful impacts in the future and accountability for the harmful impacts is often lacking. Much depends on the framework in which it is developed and disseminated. More could be done to assess social, environmental or other impacts more thoroughly and holistically before they are embraced, disseminated and promoted on a large-scale.

The technological development cycle does not exist in a vacuum. It is influenced by government priorities, market interests, social trends and risk thresholds, and power dynamics. As a result, policies and market mechanisms do not necessarily direct

technological innovation to areas or people who need it the most or to advance sustainability.

If technological development is not regulated, the current uneven technological capabilities may aggravate existing inequalities between the developed and developing world and perpetuate polarities of have and have not's.

Structural or policy obstacles to technology transfer and dissemination due to intellectual property barriers, lack of investment in research and extension, lack of funding, may lead to regional disparities in access, potentially aggravating the current income gaps. Such gaps in access already exist, with small pockets of private sector interests holding the majority of public-interest patents and intellectual property rights.

Cultural obstacles to technological uptake, such as the resistance to the recycling of sewage water for drinking, can delay the adoption of technology. WWDR4

Technology is often seen as a proxy for progress and has sometimes raised unrealistic expectations as a cure-all for what ails society. More consideration could be given to broader implications of its development and dissemination – or lack thereof in some sectors. (SG Panel)

Inadequate governance and decision-making systems may create market distortions towards inefficient technologies, for example through inappropriate subsidies or a lack of long-term vision. (WWDR4)

The focus of investments is too often exclusively on those areas that will make returns at shorter term (i.e. specific renewable technologies that some governments favour more than others with specific subsidies). (UNECE)

The current economic and financial crisis lowers the financial potential of many countries to implement innovative water technologies. (UNW-DPC)

To understand the barriers to green growth in the water sector, it is necessary to highlight the specifics of the water sector, especially those in the DDM (donor-driven markets; in contrary to the CDM, customer-driven markets).

Water sector specifics	Greentech as a "state-guaranteed market"
The water sector (in the utmost of all countries) is state-guaranteed (especially wastewater, sanitation, which cannot survive without enforcement of environmental standards).	According to environmental standards set and enforced by the state (e. g. wastewater treatment plants for natural water body protection), greentech can be profitable or not.
The water sector (in utmost all countries) is state-regulated (the state defines which standards, which rules, which organisational structures, which technologies are admitted to that market).	Wastewater treatment is seldom serving the final beneficiary (this would be the water consumer, not the municipal utility or so, asking for private technology providers, operational services etc.).
The water sector is dominated by public entities (only 5 to 10 % of water services are provided by private industry, nearly 98% of water resources worldwide are owned, governed by the public).	Water greentech is working mostly for public customers (municipalities, water associations, municipal companies).
Due to the "natural monopoly" of network-bound infrastructural services (supply or disposal), there is no, little or limited competition.	Greentech providers have to obey public procurement procedures (in developing countries strongly influenced through donor banks).
Water tariffs, wastewater charges are no "real" prices, due to the lack of competition under the economic balance of supply and demand.	Greentech provider is mostly a contractor in a service market fed through state-set “prices” (water and wastewater fees, solid waste charges, carbon credits, subsidies for regenerative energies, etc.)
The need for better water services is not the same as the demand for better water services.	Wherever the public water utility does not fulfil the demand, customers who can afford to do so, seek other “unofficial” services.
There is a great difference between customer-driven markets (CDM) and donor-dominated markets (DDM) (the latter existing especially in developing countries).	Greentech in DDM is pioneering, but in CDM it is usually more efficient and financially sustainable.

Furthermore, greentech is seldom a "stand-alone-business":

- Sometimes, environmental protection is the main purpose of a business (e.g. a sewage sludge incineration plant)
- More often, environmental protection is one of several purposes of an investment (e.g. for a solid-waste-fed combined power plant)
- Very often, environmental protection is just side-purpose of an investment (e.g. for energy- and valuables-recuperation from wastewater).

The approaches

The importance of success stories

Taking into account the needs in the day-to-day operations of water utilities (which must provide reliable and safe, continuous water services and must try to avoid risks) and taking into account political decision-makers governing the water sector and local utilities (who want to be re-elected and tend to avoid to introduce promising technologies and solutions unless all related political risks are eliminated), it is obvious what the water sector needs.

Green growth must be explained, yes, but of greater value than general explanations and arguments are success stories from locations, situations, site-conditions, and cultures that seem comparable or transferable to the case under discussion.

Considering exceptions

There may be some important exceptions, such as: (1) biological water process technologies, such as the activated sludge process, forest removal, algae production or no-dig-pipe rehabilitation with robot-driven underground machines; and (2) the anaerobic process technology for biogas generation from organic waste. These technologies have been developed predominantly in and for the water and sanitation sector, with a spill-over of inventions and technical progress to other sectors of industries.

Learning from other sectors

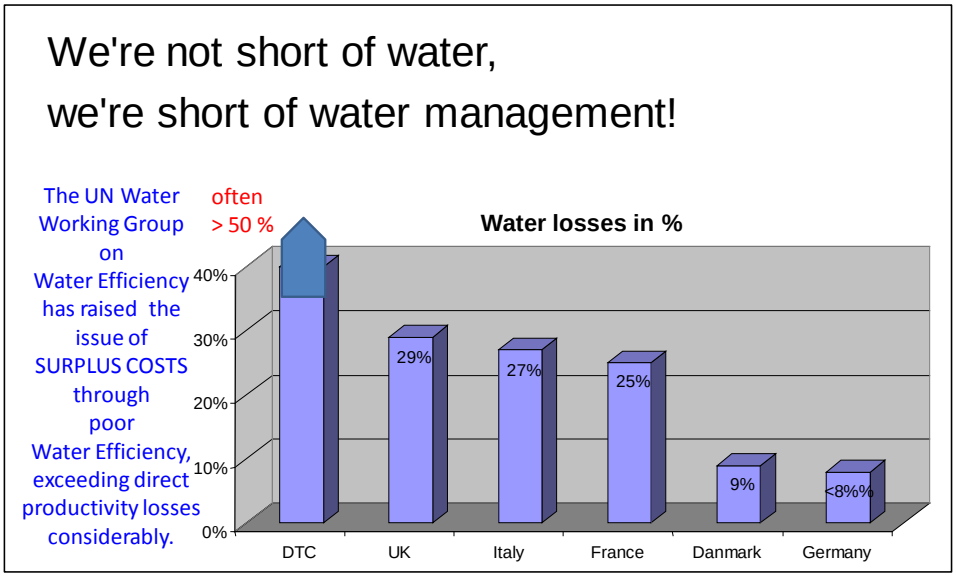
Water technology researchers, project developers and project implementers may be advised, in general, to have a closer look at other sectors of industry that are more technologically developed than the water sector, such as: (1) network construction and management for precious chemical gases; and (2) the technological set-up of the supply change in the automotive industry, such as monitoring and control systems in industry.

Technology choice

In the past, as long as water was not scarce, it has been reasonable to apply low-tech plus low-cost technologies in the water sector, even when neglecting certain negative side effects like secondary contamination (such as emissions of volatile organic compounds from water plants) and energy consumption (such as for robust pumps or aerators with limited efficiency, but easy maintenance and reliability, and cost-efficient in times when power was cheap).

Nowadays, as the transition to greentech is needed and becomes increasingly economically viable, there is a lot to do in the water sector.

The following figure highlights the gap between the current situation and the situation which should be realised in future, illustrating with the example of water loss.



There are huge deficits, especially in the developing and emerging countries. This also means there are huge opportunities to develop green business when moving from low to high water efficiency.

International cooperation and local collaboration on research and development (e. g. through networks or clusters) contributes to developing, absorbing, adapting, nurturing and diffusing innovation and green technologies.

One example, well known in the water and sanitation sector, is the progress in the use of small scale biogas plant technologies for rural farm estates, delivering gas for cooking and heating. This could not have happened without research collaboration in process and tank construction technologies, including international as well as local players, and strongly supported through multi-lateral donors for implementation.

The least developed countries' early stage of industrialisation offers avenues for leapfrogging and adopting technologies which offer greater energy and resource efficiency. They can adopt new and state-of-the-art technologies.

One very important example is the advances made in analysis technology for metering water toxicity on-line to locate harmful substances like pesticides, hormones, heavy metals and all kinds of non-degradable xenobiotics. Even though clearly high-tech and expensive, the analyser can bring enormous savings (a) for factory owners to detect and eliminate spill-overs of precious chemicals (e.g. in factories producing or mixing chemicals for agriculture) and (b) for environmental monitoring, to eradicate hazardous pollution near-to-source.

The experience with information and communication technologies is revealing of the capacity of poor countries and poor communities to achieve a jump in the technological development process"

One good example, although under political controversy, is the development and implementation of computer based remote controlled pre-paid systems technologies, allowing water utilities to serve poor income zones, without having to provide water without revenues from tariff payment, and without powers to prevent excessive waste of water. Pre-payment systems allow the limiting of free water service to e.g. 6 kl per connection and month.

Lessons learnt from the case studies

Two general mechanisms can be observed, which might be valuable elements for building a strategy for green business development:

1. **Political governance and donor finance have been able to open up opportunities to unlock greentech development potentials**, for example launching pilot projects for water loss reduction under a public-private partnership scheme, generating savings for the benefit of the utility which exceed the expenses (even though, due to low water tariffs, the utility has not yet reached the level of financial sustainability).

2. **Greentech developments have generated technologies which have proven strong enough to overcome down barriers and governance-deficits well-known in the water sector.** One deficit is the huge gap between environmental law and the environmental situation, as can be found in many developing and transition countries due to poor law enforcement. One example of technology which has been able to overcome this challenge is the online monitoring of wastewater effluents, with real-time data transmission preventing manipulation in sampling and analysis data, thereby increasing transparency in countries with poor law enforcement. Another example is decentralised technologies for water treatment and wastewater reuse, allowing for small-scale investment and development outside of fixed network structures, setting a strong benchmark in water and economic efficiency by producing "virtual competition" to non-efficient utilities. (The author has seen hotels operating their own small water supply after the public utility had failed to provide services, with membrane plant, greywater reuse and stormwater harvesting, and at a level of managerial and technical efficiency the politicians managing the utility could never achieve).

As a general, overall conclusion, it seems justified to say:

1. In this world, there is no lack of water resources; there is a lack of water management. Once water efficiency levels are equal to good technical practice, most regions suffering water scarcity will find themselves sufficiently served.

2. Subsidised water tariffs suppress green growth. From the author's view, it would be wise to subsidise the poor, not the water tariffs.

3. Green business needs business structures. There is a need to transition from charity to investment, including PSP options, to unlock potential and meet the demand for greentech-based water sector development.

All of the above statements may have to be differentiated and modified for implementation on a case by case basis, depending on political, cultural, regional priorities and conditions.

Web-based System for Water and Environmental Studies

Dr. Hani Sewilam, UN-Water Decade Programme on Capacity Development (UNW-DPC)

Type of tool: information technology / education and capacity development for providing the green market with qualified personnel
Location: MENA (Middle East and North Africa) with main focus on Egypt

Introduction

Egyptians have been managing the Nile water for irrigation for more than 5,000 years. However, water scarcity and the dramatic increase in population make the management task more complex because of the conflictive interaction between economical, social, and environmental aspects. Water management has never been only a technical or engineering problem as commonly recognised. Water management must be carried out in an interdisciplinary environment. Water engineers must cooperate with socio-economists and environmentalists to sustainably manage water resources. In Egypt, there is a marked lack of cooperation between farmers and water officials on one hand and even between water officials themselves (irrigation engineers, environmentalists, socio-economists) on the other hand. The exclusive focus on technical aspects in water management is causing many conflicts and problems for the Egyptian water system. Without interdisciplinary and integrated water management procedures, maximising the economical outcomes of agricultural lands leads to minimising the environmental outcomes. Water logging and soil salinity is becoming a serious problem in Egypt. Saline areas in the Nile Valley and Delta were estimated at 1,210,000 ha. Deterioration of water quality is a significant issue caused by the use of chemical fertilisers, which increased fourfold in the last two decades. Many social problems exist. For instance, the involvement of women in irrigation activities does not exceed 4% of those economically active in agriculture, and this ratio rises only to about 10% when unpaid family labour is included.

There is an urgent need not only in Egypt but also in the MENA countries to improve water resources management and water services, and to accelerate sustainable development in the water sector. Training of different stakeholders, networking of national experts, information exchange and dissemination of proven experiences are essential for the implementation of interdisciplinary water management. Blended learning and exchange of information

electronically can contribute to capacity building in water management and sustainable water development. These activities can also provide a framework for North-South and South-South cooperation.

TOTWAT

Think Interdisciplinary: A Training of Trainers Program in Interdisciplinary Water Management (TOTWAT) is an EU funded project under the umbrella of the TEMPUS programme. The consortium of this project is composed of five partners: the Cairo University (Egypt), Alfayounm University (Egypt), the National Water Research Center (Egypt), the RWTH Aachen University (Germany) and the Institute of Advanced Studies (Austria). This project has the development of a Training of Trainers (TOT) programme as a main objective. The training programme should be developed during the project lifetime (3 years) and be made available for the water officials from Egypt and other MENA countries. The specific objectives of the project can be summarised as follows:

- To design the course structures and develop courses' contents.
- To improve the training skills of the trainers of the three Egyptian partners to successfully deliver the training programme.
- To afford the necessary tools and equipments to successfully carry out the courses at both Egyptian universities.
- To develop multimedia, web-based and eLearning tools to support the training programme.
- To improve the skills of the IT administration team of both Egyptian Universities to be able to cope with the new multimedia-based training programme.

The main eLearning platform used in this project was Moodle Learning Management System which supports Arabic language. However, some adaptations were necessary to develop Arabic materials for certain courses. For example, Arabic video integration with PowerPoint was necessary to develop the online lectures. In addition, Arabic language Quiz for self-assessment was also a challenging issue to have a complete LMS.

Training Needs Analysis (TNA)

It was necessary to conduct an up-to-date and comprehensive training needs analysis (TNA) prior to the implementation of most of the TOT activities. This activity has been devoted to assessing the qualifications of the ministry staff responsible for the management of the Egyptian water system. The qualifications that have been assessed through questionnaires (first source of information) include the scientific background, IT skills, the knowledge of using computer models and the level of communication between different disciplines (engineers, socio-economists and environmentalists). The second source of information for this activity was direct interviews with the ministry staff. Almost 90 questionnaires were filled by the ministry staff members from all over the country and 20 interviews have been carried out. As an example of the results of the TNA, Figure 1 shows that the majority of the questioned staff members do not use computer models in their daily water management activities.

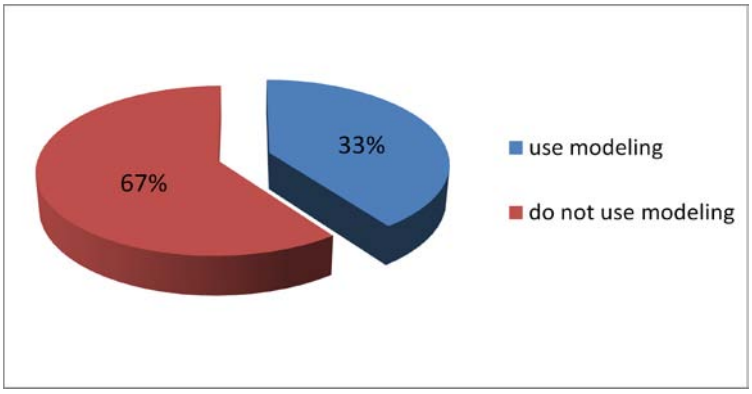


Figure 1. The TNA results (% of using computer modelling)

The TNA showed also that there is a lack of interdisciplinary water management and there is a need to bring engineers together with ecologists and socio-economists in day-to-day water management (Figure 2).

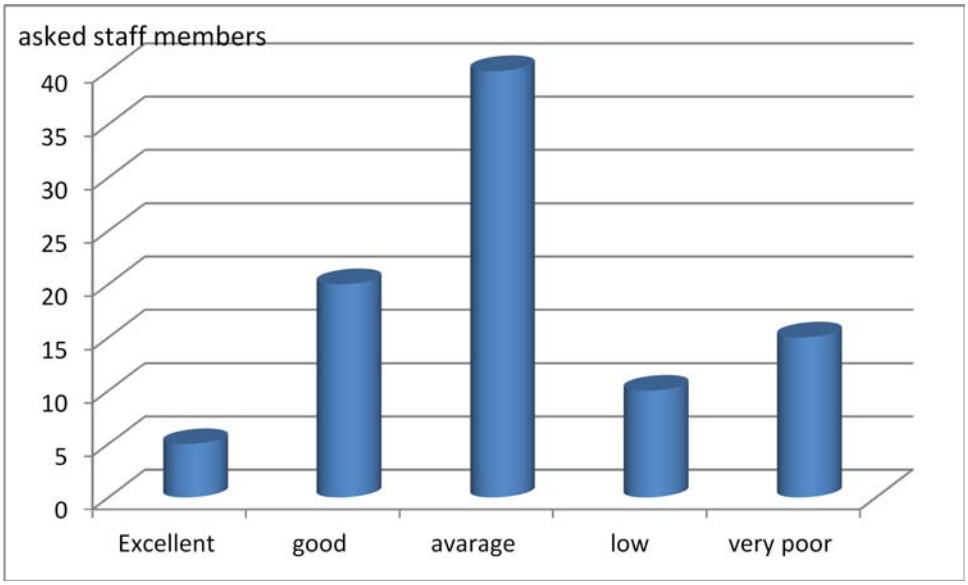


Figure 2. The level of interdisciplinarity in managing water resources

TOTWAT Training Programme

The TOTWAT Training programme has four targeted groups; water engineers, socio-economists, ecologists and modellers. Therefore, four TOT modules have been designed for the different targeted groups; Water Modeling and eLearning Module, Socio-Economic Module, Water Management Module and Environmental Module. Each target group had to attend two training courses (two weeks each in Egypt and Europe). More than 60 trainees have benefited from TOTWAT so far. All the four groups had to attend the same interdisciplinary training module (Module 5). This training module was composed of practical sessions. The trainees are exposed to a real-world water management problem, and their main task is to solve it in an interdisciplinary environment.

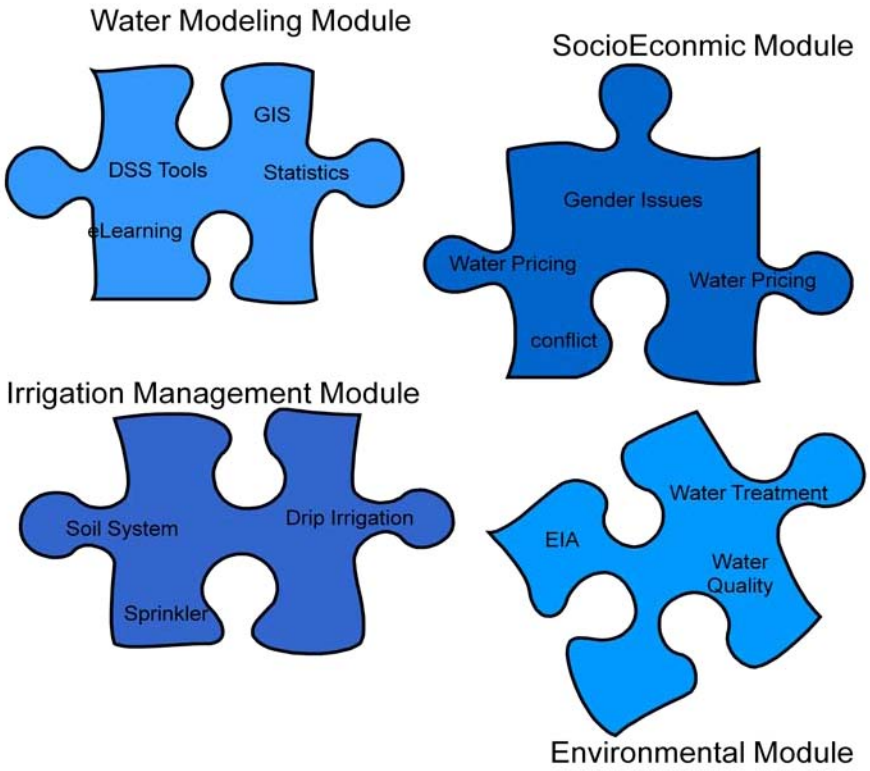


Figure 3. The first four modules of the TOTWAT

Overcoming barriers to technological development and adoption

The main technical challenge in the use of the eLearning technologies of TOTWAT was the unreliability of available home internet connections and their bandwidth.

To offer the users of the system the opportunity to overcome the bandwidth problem, computer labs were established at each of the involved universities with suitable internet connection. In addition, the system was adopted to offer Audio online lectures in addition to the video ones.

The developed LMS enables flexible accessibility for the mentioned target groups from any location and at any time. The system provides online courses to cover topics such as IWRM, EIA, water quality assessment, sustainable resource management, gender issues, socio-economical, desalination, water treatment etc. The courses were designed in a way to ensure understanding the interrelationships between technical, social, economical and environmental aspects related to water management. The LMS includes also a self-assessment tool that enables the learner/trainees to assess their knowledge before and after participating in any online course. The platform (LMS) also offers communication tools that ensure the continuous communication and social learning among the learners from different levels and target groups.

Lessons learnt: North-South knowledge transfer

This project provides several lessons that can be very important for furthering North-South cooperation in the MENA region. Two main lessons will be highlighted in the next sections.

Knowledge transfer through capacity building

Capacity building and knowledge transfer are critical tools without which developing countries and transitional economies will remain disadvantaged and unable to reap the environmental, social and economic benefits of a green economy. The strategy of TOTWAT aimed to transfer the European knowledge in interdisciplinary water management to enhance the skills of the Egyptian staff members through a capacity building programme. Five training modules have provided a great opportunity for transferring European know-how in interdisciplinary water management to the Egyptian trainees. Lessons learnt from the implementation of these five training modules can be summarised as follows:

- All training modules provided by trainers from European countries should be based on local problems in the south. The main task of the trainers should be trying to introduce European solutions for similar Egyptian situations. The solutions are normally intensively discussed until the trainers and trainees reach an agreement on the adopted knowledge.
- European trainers from different backgrounds had to be involved in the training modules (engineers, ecologists, sociologists, economists, etc.).
- Only trainers who understand and accept other cultures should be involved in such training courses.
- Materials must be as simple as possible because of the various backgrounds of the trainees.
- The training should consider the educational level of the trainees and their English language level.
- Social, religious and cultural habits have to be taken in to consideration while setting the training programme (praying time, feasts, etc.).

Knowledge transfer through blended learning

In TOTWAT, blended learning activities have been implemented very intensively for different reasons:

- To enable knowledge transfer without necessarily being available at the same location (trainers/trainees).
- Digital materials are easily transferred and usable online.
- Dissemination of knowledge to other groups who are not directly involved in the project is quite simple.

The TOTWAT activities are based on the Selection-Organisation-Integration theory (also called SOI theory). The fundamentals of the theoretical SOI model are:

- Human knowledge processing strictly separates aural and visual inputs (two separate channels for information entrance).

- The processing capacity of those two input channels and the short-term memory is limited (the magic seven).

- Learning is always an active process; we have to develop a coherent mental model (or reproduction) of the learning objects.

Based on the assumptions of the SOI theory, Clark & Mayer (2002) developed six principles that should be obeyed during the conception and creation of multimedia contents. The TOTWAT project has made the best out of combining both theories together. The characteristics/principles of the developed eLearning materials for the knowledge transfer can be summarised as follows:

- Multimedia Principle: a combination of text and diagrams/illustrations is a more effective method of knowledge transfer than text only.

- Modality Principle: explanations and descriptions dedicated to illustrations and diagrams are better grasped in spoken form (aural) than in written presentation.

- Continuity Principle: text information and diagrams that refer to each other are presented interrelated.

- Redundancy Principle: never present the contents in written and spoken form simultaneously (q.v. Dual Code Theory by Paivio).

- Coherence Principle: media elements should be used in a targeted and economical (thrifty) way; an overkill will have negative consequences for the learning process.

- Personalisation principle: expert sociolects should be avoided; in general, comprehensible explanations enhance and enrich the learning effect.

Based on the SOI theory and these principles of multimedia-based learning, in TOTWAT the materials have been designed in such a manner that more or less 80% of the information to transform into knowledge is presented in an aural way (independent of setting up a classical face-to-face or a pure eLearning module). Animated graphs, flash files or video sequences will fill the residual part.

Blended Learning Modules for the MENA Region

Two years of the project lifetime have been spent developing the blended learning materials. The final product is a blend of training technologies that answer the needs of many water institutions in the MENA region. The most important characteristics of the developed web-based systems are:

- Materials are available online and in Arabic language

- The training covers water related issues that fit the MENA region problems

- Moodle system (Learning Management System) also supports the Arabic language

- Simplicity of "learning how to learn online" – 10-15 minutes are required to learn navigation basics and some more time is needed to master learning in this type of environment

The eLectures are an essential tool for learning online. For each of the five modules, a series of eLectures have been developed. The lectures include a video of the lecturer synchronised with the PowerPoint presentations. This makes learning online very easy for the trainees. The techniques adopted allow any user to access the LMS and simply watch the lecture without any additional installations. Figure 4 shows an example for one of the lectures under the socioeconomic module that covers gender issues.

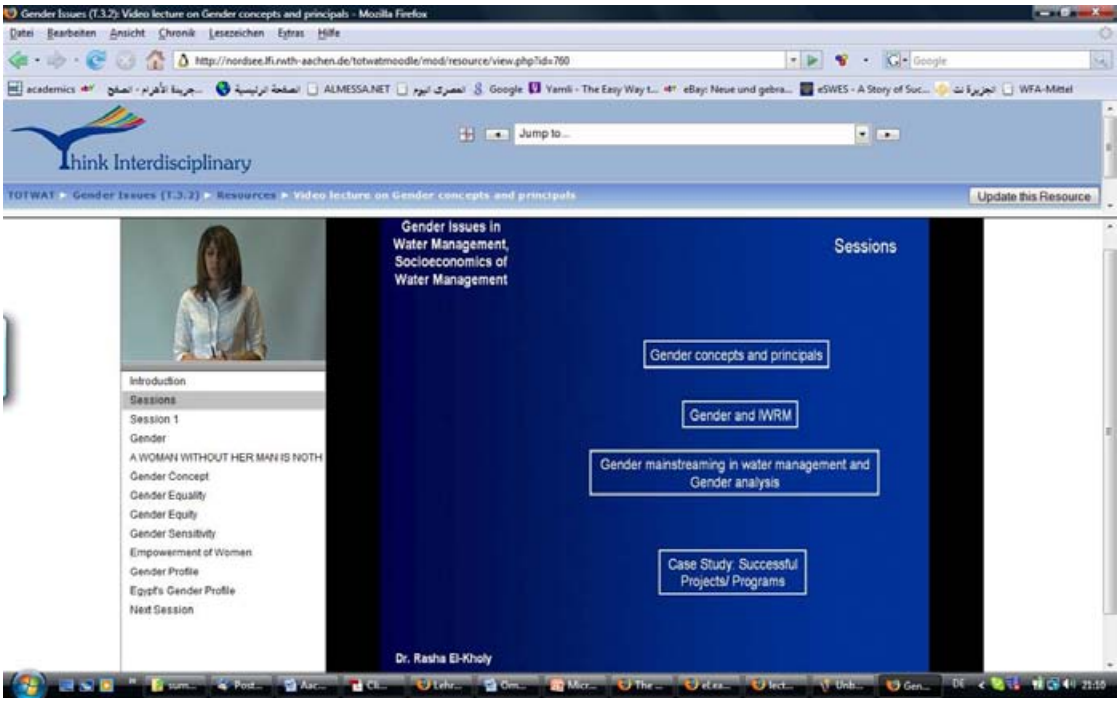


Figure 4. An example of the gender issues lecture of Module 4 (socio-economic in water resources)

In addition to the eLecture, the Learning Management System includes for each lecture a handout in the form of a pdf file. The handout describes the details of the lecture and provides references and case studies for the investigated subject. To assess the gained knowledge of the trainees, the LMS also offers a self-assessment system. This self-assessment system allows each trainee to go through an assessment process composed of ten different types of quiz (multiple choice, matching, short answer, essays, etc.). Each trainee can try the assessment and get the final grade of his/her answer. The trainees can also view the correct answer to enhance their knowledge.

Scaling up and relevance for developing and transition countries

The developed LMS and training materials of this project were used by other Egyptian universities. At a later stage the Ministry of Higher Education realised the acceptance of such technologies for education and capacity development. The government started to promote using such technologies for undergraduate students by motivating the professors to develop their undergraduate courses using web-based techniques.

Evaluation: economic, environmental and social benefits

Economic

The developed LMS is officially used by Zagazig University for civil engineering undergraduate students. More than 1,200 students have used this system for their courses. The impact assessment of the project on this group has shown enormous enhancement of the quality of graduates, especially in their knowledge of sustainable water management. In some cases, students started up their own business mainly in areas related to decentralised small water treatment unities for rural areas.

Two universities in Egypt (Helwan and Ain Shams Universities) are now using this system to enroll and teach a postgraduate diploma on “water and environmental management”. The universities have already signed different agreements with the local water and environment companies/consultancies to supply them with engineers with specific qualifications.

The LMS now enables Cairo University together with the National Water Research Center to offer training services for the professionals of the Ministry of Water Resources. According to the assessment of the impact of such training activities, the training has enhanced the skills of a large number of the water professionals responsible for managing water resources as well as researchers from the NWRC.

Environmental

The online modules developed included many environment related courses which helped thousands of people enhance their environmental capacities and knowledge.

Social

Although eLearning is often seen as a tool that has negative impacts on social communicating, such systems include social networking tools that bring not only people from the same country to communicate and work together but also people from all over the world who have common interests.

Conclusion

Knowledge transfer is one of the key tools to help the MENA Region to cope water scarcity and the serious impacts of climate change. One of the main mechanisms for knowledge transfer is capacity building. North-South cooperation to develop and organise training programmes is a key approach. Using blended learning techniques facilitates knowledge transfer and allows more countries and stakeholders to benefit from such programmes.

TOTWAT is an example of such north-south cooperation, serving to transfer European knowledge in the field of interdisciplinary water management to Egypt. More than 10 training courses have been organised in the fields of modelling, water management, socioeconomics, environmental engineering and interdisciplinary water management. The project also produced blended learning contents for dissemination and use by other water institutions in the MENA region. Through a network of national institutions and on-going projects of technical cooperation in the water sector, RWTH Aachen, along with other international partners, can organise and facilitate the exchange of capacities, experiences and relevant information with potential multiplier effects.

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http://blip.tv/eswes

http://blip.tv/totwat

http://blip.tv/waten

Improvement of water supply through a GIS-based monitoring and control system for water loss reduction

Yamba Harouma Ouiba, Director General of ONEA, Ouagadougou, Burkina Faso

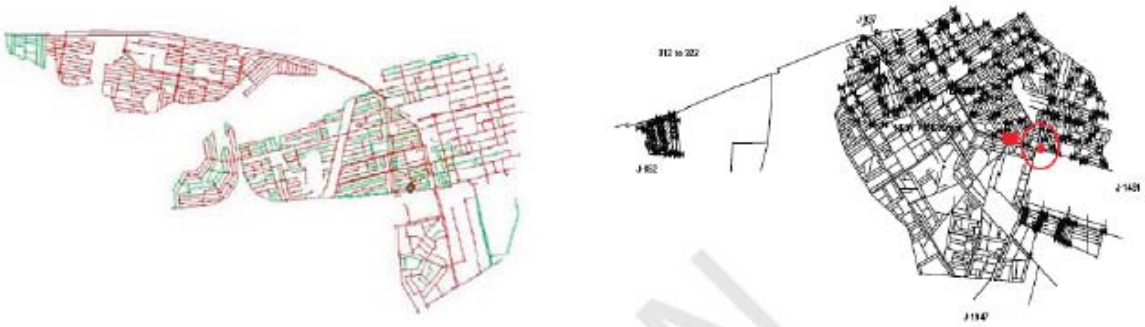
Type of tool: technology for efficient water use (specifically: GIS-supported dynamic pressure control, automated valves and leak detection systems)
Location: Ouagadougou, Burkina Faso, Africa, with the municipal water utility operated by ONEA, Office National de l'Eau et de l'Assainissement

The relevance of the challenge and objectives

In many countries of the developing world, including regions with water scarcity, water losses (technical leakage and water theft) are very high, mostly exceeding 40% and often even exceeding 60%. To improve water supply and serve more consumers (preferably from low income areas, which often remain unserved), the capacities of water supply systems must be increased. Very often, the necessary increase can be achieved through water loss reduction (WLR). WLR may be much more feasible (in economic and ecological terms) than the expansion of water production, i.e. through new river dams, desalination plants, underground well fields or else.

In Ouagadougou, a pilot project has been implemented, to reduce water losses within the distribution system of the municipal utility. The technical components of the process are leak detection devices, pressure and flow control sensors with real-time and online data transmission, automated pressure valves and an intelligent GIS-based computerised system to steer the whole process. The figure below shows the GIS (Geographical Information System) file of the distribution zone (left), with the most critical point of pressure and water

losses to be controlled through pressure reduction (right part of the figure below), as simulated with the hydraulic modelling tool EPANET.



Représentation SIG du secteur de distribution R7 (gauche) et identification du point critique par EPANET dans le secteur de distribution RE (droite)

The drivers of technological change

There has been tremendous progress in the use of computer-based control, both for pump efficiency (accompanied by energy efficient pumps) and for network management, especially dynamic pressure control. This provided the opportunity to introduce the water loss reduction programme. The driver of change to develop these technologies was, of course, water scarcity and the water losses being too high in the utility. Anyhow, the basic technological development has already taken place in other sectors from industry, dealing with higher financial volumes than in the public water sector (e.g. pump efficiency established at a very high technological level in the chemical industry, pressure control of gas pipeline networks, or oil pipeline networks in industrialised countries).

Barriers to technological development, adaptation and adoption

The strongest barrier slowing down technological development, adaption and adoption is the subsidisation of water tariffs. Full cost-recovery of water services provision cannot be achieved in many developing countries, due to political restraints and the need to support the poor with subsidies. The greatest barriers are the lack of willingness to charge and the lack of willingness to pay for water. In order to overcome these barriers, the implementation of the project was supported by an extensive capacity development programme to secure the necessary change process.

Lessons learnt from implementation

Implementation was successful for a limited zone within the city and service area of the utility. Due to the unstable political situation in the country and due to other issues being prioritised over water loss reduction (politically as well as financially), full implementation has not yet been achieved.

Scaling up

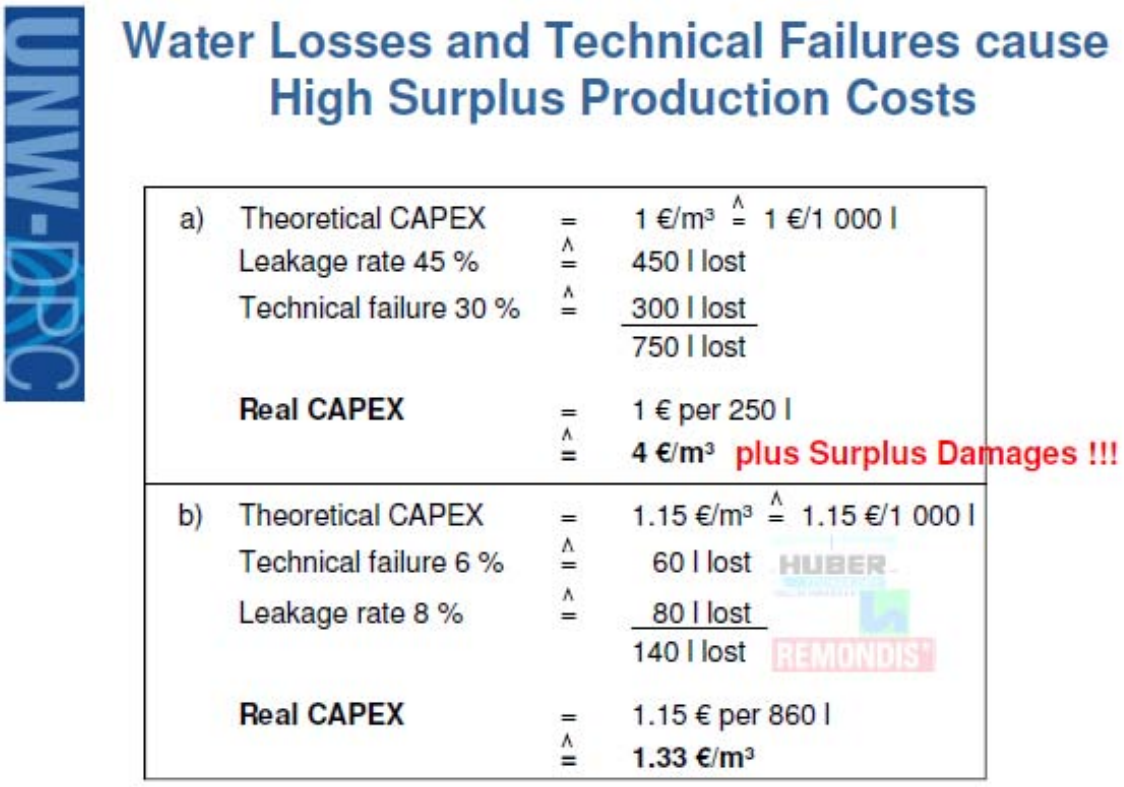
Regretfully, the Water Loss Reduction Programme has not yet been extended throughout the region, even though the profitability of the water loss reduction programme has been verified (taking the "low-hanging foods" first, in a priority of actions).

With support of UN-Water DPC, the scaling up of such water loss reduction technologies and programmes in other developing and transition countries could be done. One very helpful activity was a workshop with the African Water Association in Ouagadougou, where the success of the project was presented to other utilities, lessons learnt were shared and training activities were undertaken with participants from all over Africa. Furthermore, UN-Water DPC has disseminated the technologies and overall management concepts, including economic and financing aspects in other regions such as Latin-America and Asia.

Evaluation: economic, environmental and social benefits

The programme has generated positive benefits for the local economy. Local jobs have been created through the investment in and continuous operations of the water loss reduction programme. More importantly, the project has leveraged job creation due to the fact that economic development, public health and a comfortable environment are based on the quality of water and sanitation onsite – which has improved significantly since water efficiency had been increased through WLR.

The figure below indicates the direct monetary profit of the water loss reduction programme, accompanied by improvements of general maintenance and operations. Once the water losses are reduced from approx. 45% to 6%, and the technical failure from 30% to 6%, the water service costs would be reduced from 4 EUR/m³ to 1.33 EUR/m³ (see calculation in the slide below).

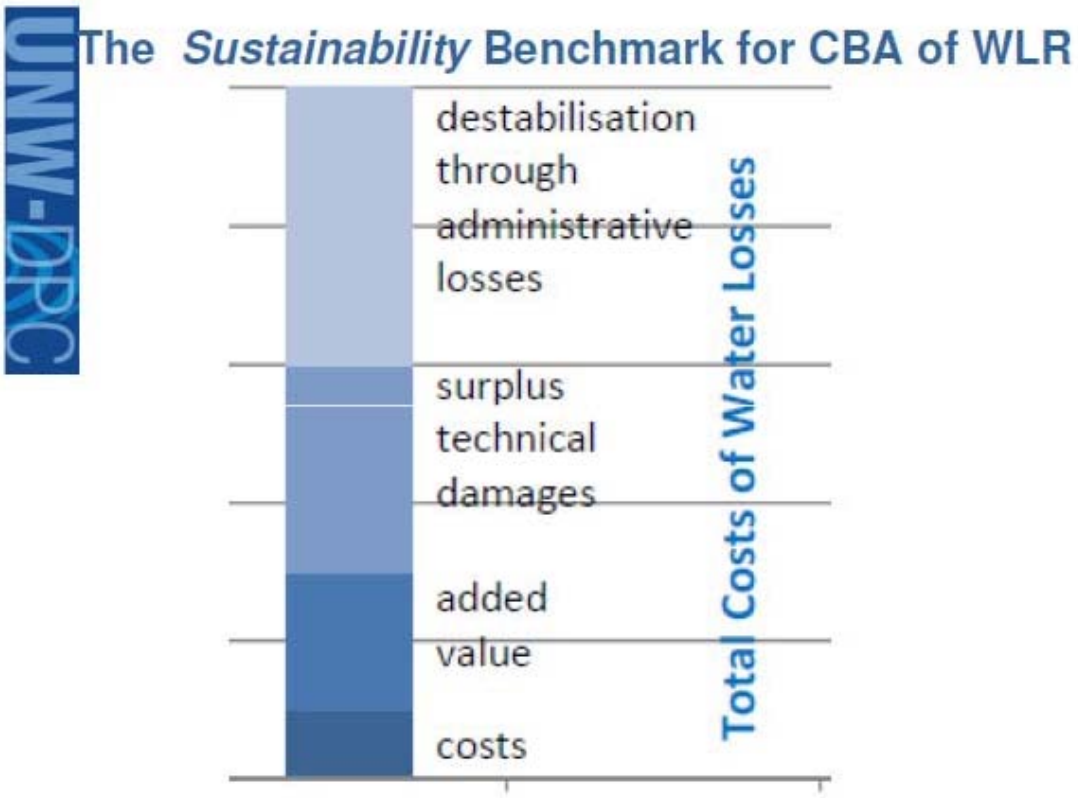


Additional economic gains are expected through the reduction of damages which accompany water loss ("surplus damages") in technical terms (especially reduced lifetime of the pipe network, caused by mechanical stress with non-continuous supply generating hydraulic

shocks) and in administrative terms (reduced willingness to pay from customers facing high water losses that see other consumers who are not charged or do not need to pay).

For the case of Ouagadougou, the direct savings of the water loss programme has been estimated to be around 0.8 EUR/m³. With the surplus costs on top, the total economic profit might well exceed 2.0 EUR/m³ (not yet calculating the external profits for public health and the gross national economic product.

The figure below indicates the factors that should be considered when defining a "sustainability benchmark" for cost-benefit calculations of water-loss reduction programmes and target values, site-specific standards of water losses (set as % percentage of raw water abstraction, or as m³ per day, or as m³ per pipe km).



Along with the improvements in water efficiency, the environmental situation will improve step by step, provided that the development of sanitation will follow the development of supply water efficiency.

Social benefits are derived from the enhanced performance of the utility and water services provision. The situation before project implementation was characterised by poor or no water supply in certain town areas and at certain times, water theft and a lack of concern about taking care of resources and public water properties. Since improving water efficiency, the water utility has been empowered to introduce transparent structures, cut water theft and raise awareness among the public and its customers of the need to take care of water properties.

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The role of water technology in development: a case study of Gujarat State, India

Dr. Rajiv Kumar Gupta, IAS, Government of Gujarat, Republic of India

Type of tool: technology
Location: Gujarat State, India

Introduction

This article traces the historical water problem in Gujarat both for drinking and irrigation that affected the development of the State, caused regional imbalances and increased incidence of rural poverty. Technological initiatives like the State Wide Water Grid, Micro Water Harvesting, Inter-Basin Transfer of Water and Power Sector Reforms have changed the entire water scenario in the State. There has been a great deal of emphasis on peoples' participation in water governance as well.

Water challenges in Gujarat

Gujarat has just 2.28% of India's water resources and 6.39% of country's geographical area. This is again constrained by imbalances in intra-state distribution. The State has an average annual rainfall of 80 cm with a high coefficient of variance over time and space and as a result droughts have been frequent. Out of 185 rivers, the State has only eight perennial rivers and all of them are located in southern part. Around 80% of the State's surface water resources are concentrated in central and southern Gujarat, whereas the remaining three-quarters of the State has only 20%. On average, three years in a cycle of 10 years have been drought years. Since Indian independence in 1947, the drought years of Gujarat have been as follows: 1951, 1952, 1955, 1956, 1957, 1962, 1963, 1965, 1968, 1969, 1972, 1974, 1980, 1985, 1986, 1987, 1991, 1999, 2000 and 2003 (Gupta, 2004).

Before the year 2001, drinking water scarcity posed a serious threat to human and cattle populations in Gujarat. Governments had to spend billions of rupees on temporary measures to supply drinking water by road tankers and sometimes even through special water trains. The State, which generally had a track record of peace and harmonious social ethos, even witnessed 'water riots' due to severe water scarcity compounded by poor water resources management.

Over drafting of ground water (as compared to annual recharge) caused serious water quality problems due to excessive fluoride, nitrate and salinity. The number of fluoride affected habitations increased from 2,826 in the year 1992 to 4,187 by the year 2003. The fluoride concentration in these villages ranged from 1.5 mg/litre to as high as 18.90 mg/litre. Fluoride has been the cause of extensive health damages in many parts of Gujarat. Dental fluorosis causes permanent pigmentation of teeth in children and bone deformities are caused by skeletal fluorosis even in adults. Other serious problems experienced due to high concentration of fluoride have been anaemia, loss of appetite, nausea and thyroid malfunction which sometimes results in brain impairment of children and adverse impact on foetus, in some cases causing abortion or stillbirth in expectant mothers.

The water problem also led to intra-state migration from drought prone regions like Saurashtra and Kutch (Western & South Western Gujarat) to the Central and South regions

of the State. Often this migration of people was accompanied by the migration of livestock population and also caused the shift of prime workforce of hundreds of thousands of people, dislocating them economically, socially and culturally. Therefore, the regional imbalances in Gujarat were accentuated because of increasing water scarcity (Gupta, 2003).

Earlier most of the drinking water supply was based on ground water for which deep tubewells with high capacity pumping machinery were being utilised in the State, leading to tremendous electricity consumption and high carbon footprints of water supply.

Technological initiative for drought proofing

During last one decade the State drew up an ambitious strategy for creating a '*State Wide Drinking Water Grid*' for bulk water transmission from sustainable surface water resources to water scarce and poor water quality habitations. Large scale infrastructure has been created which includes 1,987 km of bulk pipelines and more than 115,058 km of distribution pipelines. 10,781 hydraulic structures like elevated storage reservoirs with a total capacity of 1,164 million litres and 10,683 storage sumps and high ground level reservoirs with a capacity of 2,504.80 million litres have also been constructed in the State. Along with this 151 water filtration and treatment plants with a total capacity of 2,750 million litres per day (MLD) have been constructed. About 2,250 MLD of treated water is delivered to more than 10501 villages and 127 towns in the State, ensuring safe and assured water supply to about 65% of State's population in draught prone and water quality affected areas through the water supply grid.

Evaluation of the technical initiative for drought proofing

This major technological initiative has not only largely solved the drinking water problem but has also made a significant impact on water quality problems faced earlier.

Reduction in fluoride

All these efforts have resulted in considerable relief from the problem of excessive fluoride contamination. As per a recent survey, only 987 habitations have been found to be affected and the range of fluoride content has also been reduced considerably.

Table 1. Status of fluoride affected habitations

District	No. of Total Habitations	As per 2003 survey	As per recent survey	Maximum Fluoride level (PPM)
Ahmedabad	727	120	20	7.20
Gandhinagar	424	132	2	6.27
Patan	651	246	43	13.25
Mehsana	851	176	2	4.40
Sabarkantha	2438	531	9	6.93
Banaskantha	1736	521	20	5.75
Surendranagar	696	205	72	8.72
Rajkot	871	126	120	5.40

Jamnagar	756	52	5	2.00
Junagadh	925	76	48	2.80
Porbandar	184	46	0	3.70
Bhavnagar	804	108	66	6.40
Amreli	650	49	146	3.20
Kutch	1126	34	6	3.20
Vadodara	2187	438	189	5.81
Narmada	722	49	0	2.60
Kheda	2101	406	52	10.03
Anand	920	96	17	5.89
Panchmahals	2531	401	86	6.40
Dahod	3168	286	0	12.50
Surat	3258	44	29	2.20
Bharuch	790	21	30	4.00
Valsad	3923	2	25	1.79
Navsari	2080	22	0	--
Dangs	326	0	0	--
Total	34845	4187	987	

Source: Gujarat Water Supply and Sewerage Board, 2009

Less expenditure

This has also resulted in sharp decline in expenditure on tanker water supply in the State from 2003-04 onwards which is another indicator of creation of water security in the State.

Table 2. Annual expenditure on tanker supply from 1990 to 2009

Year	Village	Cost (Rs. in Million)*
1990-91	896	23.40
1991-92	1,943	92.90
1992-93	700	14.00
1993-94	1,803	83.00
1994-95	724	24.96
1995-96	1,619	96.30
1996-97	1,642	123.95
1997-98	1,447	62.19
1998-99	1,215	41.02
1999-2000	2,987	346.20
2000-2001	4,054	436.94
2001-2002	2,959	348.11
2002-2003	3,961	475.36
Sub-total		**2,168.06**

2003-2004	600	47.38
2004-2005	869	92.32
2005-2006	398	77.06
2006-2007	207	17.08
2007-2008	188	14.17
2008-2009	326	13.94
Sub-total		**261.95**
Total		**2,430.01**

Source: Gujarat Water Supply and Sewerage Board, 2009 * 1 US $ ≈ Rs.46

Reduction in carbon footprints in water supply

In several villages, the borewells are now utilised as a dual source and the operational hours have been reduced. Based on a random survey, it has been observed that a significant saving has been achieved in electricity consumption that is now available for alternative uses, proving to be an eco-friendly achievement. Solar pumps have also been commissioned in 260 villages in the State and about 200 more solar pumping systems will be installed in the near future. In various parts of the State, including coastal and tribal areas, roof top rainwater harvesting structures have also been taken up in public buildings, schools and individual household level, which is also resulting in substantial electricity savings. Comprehensive energy audits for various group water supply schemes have also resulted in energy savings.

Table 3. Emission savings in drinking water supply

Sr. No.	Particulars	Energy Saving MWh per annum	Equivalent Carbon Dioxide Emission per annum in tones
1.	Piped water supply to villages and towns	65,905.00	14,696.82
2.	Savings due to energy audit	5,184.78	1,156.21
3	Solar based pumping systems	611.16	136.29
4	Rooftop rain water harvesting	386.74	86.24
	Total	72,087.68	16,076.14

Source: Gujarat Water Supply and Sewerage Board, 2009

Paradigm shift

With a paradigm shift from dependence on drinking water supply by tankers, trains and deep bore wells to safe surface water, much of the fluoride affected habitation have been covered by piped water supply.

Technological interventions like defluoridation through reverse osmosis have also been taken up in some villages. In the remaining villages safe water sources have been identified or created and are being used for drinking water purpose. Thus, a 'vicious circle' has been transformed into a 'virtuous cycle' with a win-win situation for water, energy, environment and health sectors and with considerable economic benefits. In short, this is Gujarat's technology oriented response to the existing and future water stress and insecurity due to climate change.

New water governance model

The creation of the Water and Sanitation Management Organisation (WASMO) was a significant shift in the role of governance from provider to facilitator by empowering village level institutions through extensive capacity building and pro-active facilitation. Since its inception, WASMO has brought about effective citizens' engagement through its innovative governance model for facilitating the successful community led water supply programme throughout the State of Gujarat. Now more than 16,740 Village Water and Sanitation Committees have been formed in the State and are ready to take the responsibility for managing of service delivery and water resources at the decentralised level. More than 6,500 villages have already commissioned the infrastructure and water conservation projects in a demand driven mode. Another 4,547 villages are presently implementing the decentralised community managed rural water supply programme in their villages with a strong sense of ownership.

WASMO's strength lies in its organisational professionalism, innovations in governance, and strong partnerships with about 48 civil society organisations. The rural community is the central focus of WASMO's decentralised approach. Its innovation has led to the scaling up of reform processes to cover the entire State. Its professionals have created an enabling environment which has resulted in the community being fully empowered to take ownership of their water service delivery wherein operation and maintenance is done through tariff mechanism devised by consensus in the village assembly. It has also been able to institutionalise the rural water quality monitoring and surveillance programme. The majority of villages are now able to monitor their water quality teams which are duly trained. WASMO's innovation by Gujarat has emerged as a model for learning and exchange, influencing policy initiatives in the water sector at the country level. WASMO has also been given the United Nations Public Service Award in the category of fostering participation in policy-making decisions through innovative mechanisms (Modi, 2010).

Inter-basin water transfer through Sardar Sarovar Project

The Sardar Sarovar Project on river Narmada is a multi-State, multi-purpose river valley Project, borne out of deliberations of a constitutional body, following the principles of 'Equality of Right' and 'Equitable Utilisation' of the whole course of an Inter-State River. This unique project will irrigate 1.905 M ha of land, increase the agricultural production by 8.7 million tons per annum (worth US $ 430 million), generate environment friendly

hydropower with installed capacity of 1,450 MW, supply drinking water to 8,215 villages and 135 urban centres of Gujarat (around 20 million population), generate 1 million jobs (mostly in rural areas), and prevent rapid processes of desertification, salinity ingress and rural to urban migration being experienced in many parts of Gujarat. The command area and drinking water supply areas of the project are exactly the worst water scarcity-hit areas of the State (Gupta, 2003).

Stage	2003	2004	2006	Ultimate
Height	100 m	110.64 m	121.92 m	138.68 m
Gross storage	2,602.6 MCM (3.00MAF)	3,700 MCM (3.00 MAF)	5,265.8 MCM (4.27 MAF)	9,460 MCM (7.7 MAF)
Live (usable) Storage	_ _	_ _	1,565.8 MCM (1.27 MAF)	5,800 MCM (4.77 MAF)

Table 4. Sardar Sarovar Dam height and storage increase in the Sardar Sarovar Project

Source: Sardar Sarovar Narmada Nigam Limited 2009

Increased dam height and storage

With a concerted strategy and satisfactory compliance of the project obligations in terms of rehabilitation of project affected persons and environmental measures, the dam height was raised to 100m in 2003, 110.64m in 2004 and 121.92m in 2006. This facilitated a much higher increase in storage of Narmada waters.

Raising the dam height and the corresponding increase in the storage capacity have significantly improved the water supply. The real benefits of the project which were awaited for almost 15 years have now started flowing. Diversion of Narmada water to the main canal of the project (world's largest lined irrigation canal) was just 705 MCM in the year 2001, but it spectacularly increased to 5,195 in 2003 and to 6,194 MCM in 2004. Although the water flow has been decreased in subsequent years due to consecutive good monsoons, it remained to the extent of 4,201 MCM in 2005, 4,292 MCM in 2008 and 5,870 MCM in 2008 and 5,870 MCM in 2009. The construction of the main canal was also completed in the year 2008 and water supplies to neighbouring State – Rajasthan – were initiated in March 2008, fulfilling real objective of this project as an Inter-State River Project.

Not only this, with the command area being covered to the extent of around 500,000 ha, significant interlinking has been achieved in many rivers by the interbasin transfer of Narmada waters using the Sardar Sarovar Canal Network.

Hydro Power

Another long pending issue was that of operationalising the 250 MW Canal Head Power House (for want of required water head in the reservoir). We operationalised this power house in August 2004, and thereafter a river bed power house of 1,200 MW capacity was also put into operation in a phased manner starting from February 2005 to June 2006. The hydropower generation that commenced in the Sardar Saroval Project since August 2004 has resulted in the generation of 15,070 million kWh of electricity up until March 2010.

Micro Water Harvesting

The miseries of millions of small and marginal farmers due to vagaries of nature and difficult terrains have been reduced through rainwater harvesting by micro irrigation structures implemented through people's participation.

Sardar Patel Participatory Conservation Project (SPPWCP)

This scheme stipulated that checkdams and village tanks/ponds could be taken up for construction by a beneficiary group or any Non-Governmental Organisation (NGO) with technical and financial assistance from the District Panchayat (local representative body). They were initially required to contribute 40% of the estimated costs (later reduced to 10%) and the rest was to be funded by the Government depending upon the progress of the work. In 2007 they were also given the option of contributing their 10% by way of physical labour and, therefore, increasing their sense of belonging to the project by 'the gospel of dirty hands'. Six prototype designs were circulated with a maximum cost of Rs. 1,000,000.

However, the beneficiary groups were also given the latitude to take up the work as per their own design if necessary and feasible. The technical scrutiny and work supervision would be done by the engineers of local body. The entire responsibility of the quality of construction of work, however, would rest with the beneficiary group/NGO under continuous guidance and technical inputs from the Government technical staff. Maintenance works for these micro water harvesting structures would be carried out by the beneficiary group at their own expense. A total of 353,937 checkdams and village ponds/tanks have been created in the last eight years providing direct benefit to over 13 million people in rural Gujarat.

Drip irrigation - Gujarat Green Revolution Company Limited

Gujarat has created the Gujarat Green Revolution Company Ltd, a special purpose vehicle to popularise the adoption of drip irrigation among farmers. GGRC offers attractive subsidy-loans to adopters, but more importantly, it has fast-tracked and simplified the administrative procedures for accessing these. Farmers contribute only 5% of the cost initially; GGRC provides a 50% subsidy and helps arrange a loan for the 45% balance. Around 100,000 ha are covered by drip irrigation, and most of these have been moved to high-value crops (Gulati, 2009). It has been estimated that around 74.1 million kWh energy has been saved in just one year due to the adoption of drip irrigation by Gujarat Green Revolution Company – a body especially created for the purpose.

Jyotigram Scheme (technological initiative in power sector for irrigation needs)

Like elsewhere in India, unreliable farm power supply in Gujarat had been anathema for farmers as well as rural society as a whole. Uncontrolled farm power subsidies led to unsustainable increase in ground water withdrawals and left the Gujarat Electricity Board nearly bankrupt. To control farm power subsidies the government began to reduce the hours of three phase power supply used by tubewell owners while providing 24 hours single/two phase supply sufficient for domestic users. In response, farmers in many parts began using capacitor to run heavy motor-pumps on two-phase or even single phase power. This resulted in poor power supply environment in rural areas.

International donors and power sector professionals advocated metering of tubewells and consumption-linked charging for farm power. However, for a variety of reasons, farmers

strongly resisted metering. Researchers had advocated a second best policy of intelligent rationing of farm power supply by separating feeders supplying power to tubewells. In 2003 the Gujarat government implemented the Jyotigram Scheme (JGS – the 'lighted village' scheme), which incorporated the core ideas of the second best strategy of intelligent rationing. Jyotigram's aim was to provide three phase power supply to Gujarat's 18,000 odd villages; but this could be done only if effective rationing was imposed on farmers. During 2002-2006 around US $260 million were spent on the project, to ensure 24 hour, three-phase power supply for domestic and commercial uses in schools, hospitals etc. and eight hours a day, three-phase full voltage power supply for agriculture, i.e. continuous and full voltage power especially for agriculture at predictable timings for villages across Gujarat. By 2007/08, all the 18,066 villages were covered under JGS. With this, Gujarat has become the first State in the country where villages get three-phase power supply, and farmers get three-phase, uninterrupted power supply at 430-440 voltage for eight hours according to a strict, pre-announced schedule.

Jyotigram pioneered real-time co-management of electricity and groundwater for agriculture, found nowhere else in the world. Farmers were also happy that they were spared the very high repair and maintenance cost that poor power supply imposed on them. Moreover most farmers welcomed Jyotigram for limiting competitive pumping of water and addressing the common property externality inherent in groundwater irrigation. Ground water and power rationing through the Jyotigram scheme not only increased efficiency of water and power utilisation for agriculture, but also freed up these resources for the rural nonfarm economy to grow.

Higher access to water not only had a land augmenting effect, but also allowed for multi cropping and growth of high value fruits and vegetables like mango and banana (that require much water). More water has also been available for livestock, animal husbandry and fisheries, which are significant sectors in Gujarat's economy.

Evaluation of technological initiatives: economic, environmental and social benefits

There have been wide ranging impacts of both large scale water management and micro water harvesting in improving ecology of other rivers, reversing the trend of depleting water tables and generating tremendous growth in agricultural production.

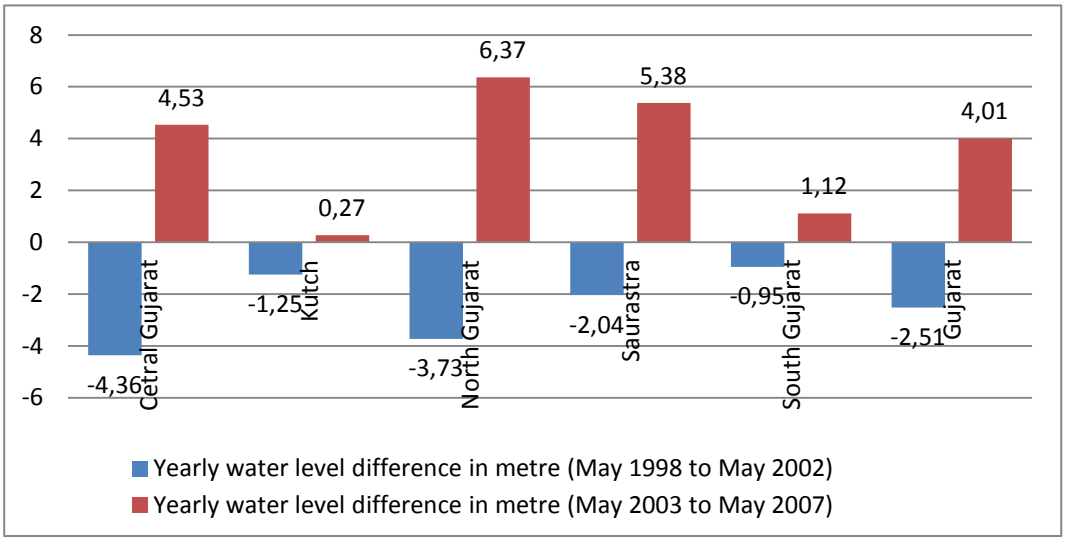
Greening of other rivers

Narmada water has been released in the dry beds of Heran, Orsang, Karad, Dhadhar, Mahi, Saidak, Mohar, Shedhi, Watrak, Meshwo, Khari, Sabarmati and Saraswati rivers. The ecology and water quality of these rivers have drastically improved over the last couple of years. In addition to minor rivers, around 700 village tanks have also been filled-up with Narmada water as part of drought management measures, which has substantially improved the water availability for irrigation in these villages.

Increasing water tables

The average depletion of water levels in north Gujarat before the launch of this massive programme was around 3m per year, which by now would have cumulatively declined almost 20-26m – leading to a sharp rise in electric consumption for withdrawal of ground water. But there has been a reported average water level rise of about 4m during recent years.

Figure 1. Groundwater level fall/rise (in metres)



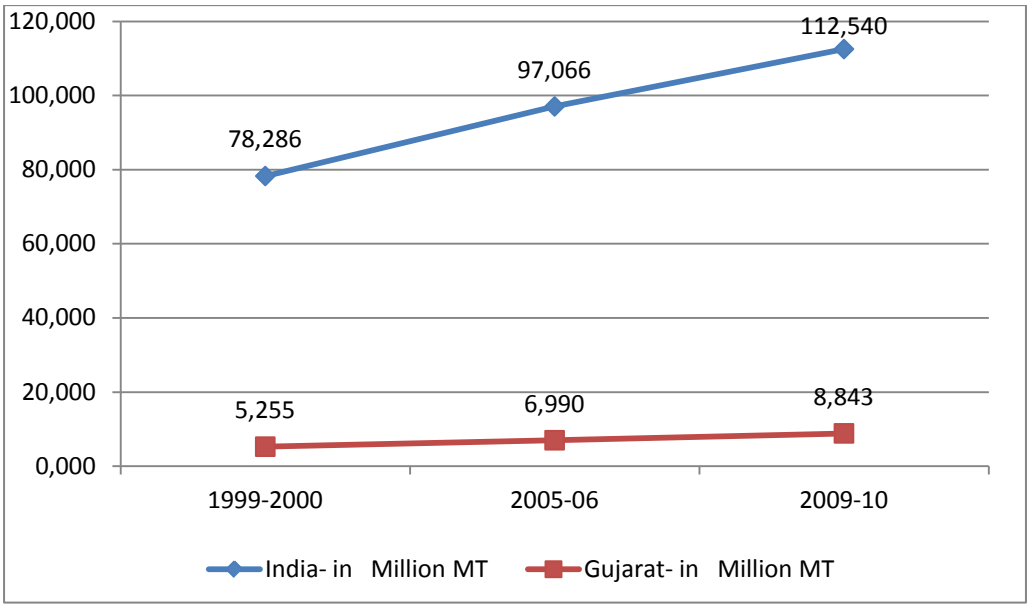
Source: Narmada, Water Resources, Water Supply and Kalpsar Department, 2009

Boost to the rural economy

Myriads of micro water harvesting structures dotting the landscape of Gujarat have led to the reduction in soil moisture evaporation in the surrounding agricultural fields and have facilitated the creation of orchards in places which barely used to produce single rain fed crops. Employment opportunities have been created for local residents, agricultural production has been enhanced, leading to rise in household incomes. The living standards and the average productivity of milk cattle have also gone up due to year-around availability of fodder.

The average annual growth rate of milk production of the State during last decade has been recorded as 6.83% whereas the same of entire country has been 4.38%.

Figure 2. Comparative growth of milk production in the last ten years



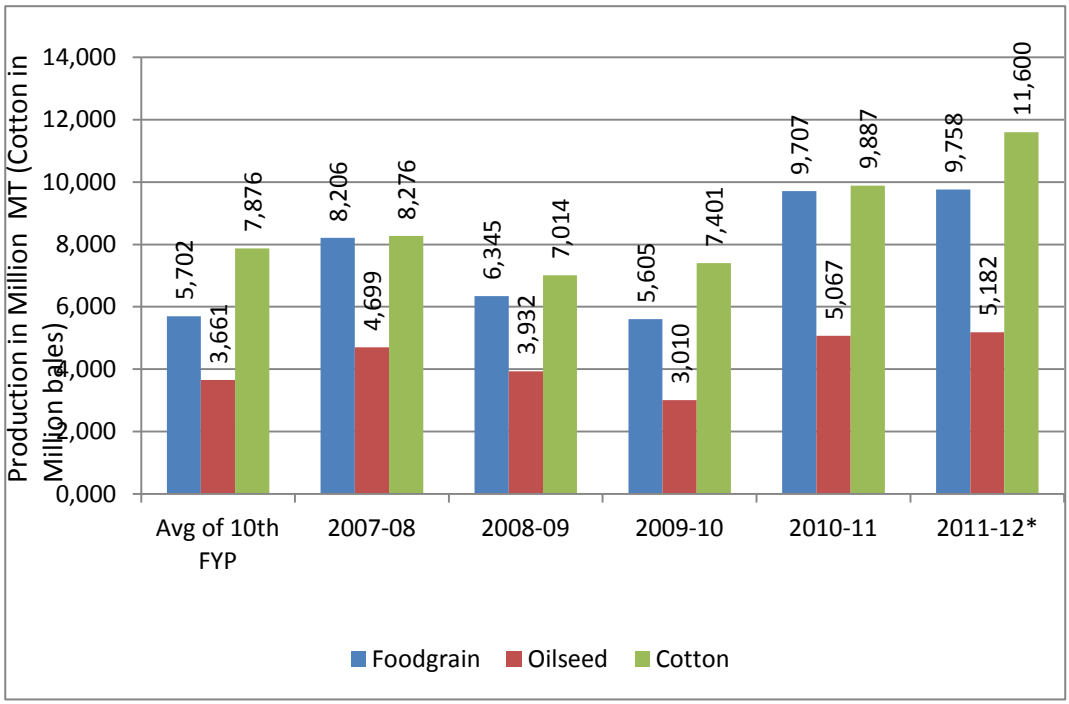
Source: Directorate of Animal Husbandry, 2010

This is in turn has bolstered the rural economy of Gujarat, particularly for the 4.2 million families of the State who rear animals for their livelihood.

Outstanding performance in agriculture

The cumulative effect of all these innovative technological and participative water management initiatives has been an increase in productivity of the major crops of the State, despite 0.1° to 0.9° average increase in temperatures recorded at various locations during the last couple of years. As compared to other States in India, Gujarat is an outstanding performer in agriculture, growing at the rate of 9.6% per annum. Though there is high volatility in the agricultural growth rate for almost all States in India, performance of Gujarat's agriculture is more than thrice the figure for the whole of India. The International Food Policy Research Institute, in a 2009 document, has especially commended Gujarat's recent growth in cotton, fruits, vegetables and wheat production.

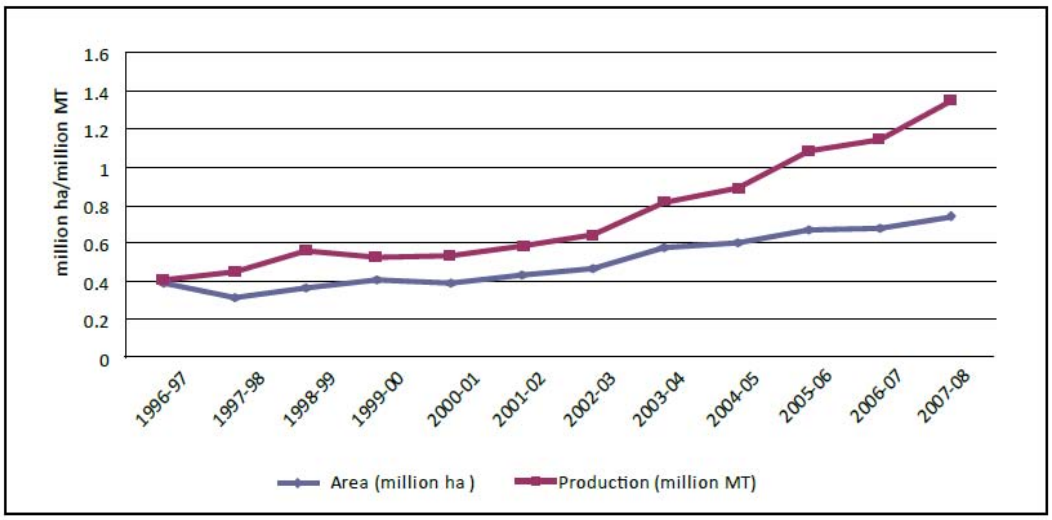
Figure 3. Agriculture production scenario



*Data of 2011-12 is provisional

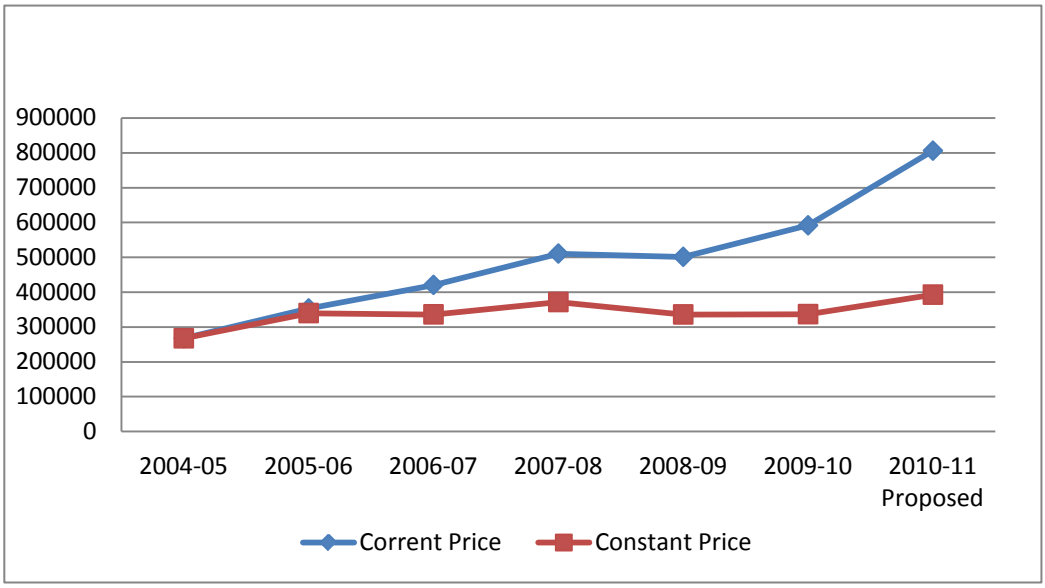
Source: Agriculture and Cooperation Department, 2011

Figure 4. Area and production under total fruits and vegetables in Gujarat (Area in Million ha, Production in Million MT)



Source: Directorate of Horticulture, 2011

Figure 5. Growth in agriculture income (Rs in Millions)



Source: Agriculture and Cooperation Department, 2011

Conclusion

The most important lesson that emerges out of the foregoing discussion is that technological initiatives to improve the drinking and irrigation water supply have to be duly complimented by grassroots people's participation in management of water distribution. The decentralised community managed water supply programme in Gujarat has proved to be an emulative model for the entire country. Another very significant lesson is the balanced importance that has been given to both micro-water harvesting and large water resources development projects, leading to unprecedented agricultural growth in the State. Increased water availability and reduction in consumption of conventional power has also led to a reduction in the carbon footprint of water supply, further promoting the development of a low carbon economy in the State.

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Industrial wastewater reclamation technology for urban irrigation

Piet DuPisani, Head of the Water and Wastewater Department of the City of Windhoek

Type of tool: technology for efficient water use, specifically: industrial wastewater treatment for reuse (irrigation) using a modified process technology for local operations, including MBR (membrane bio-reactor) and UV-disinfection
Issue: industry, agriculture
Location: City of Windhoek, Namibia, Africa.

Challenge and objectives

Many cities in Africa (and elsewhere worldwide) suffer from water scarcity. Fresh and clean water resources may be too valuable to be utilised for the irrigation of urban green, parks, small scale agriculture. In most cities, industrial compounds generate wastewater of quantity and quality that is worthwhile purifying to a standard adequate for irrigational reuse. Figure 1 shows some basic information about the City of Windhoek and its very scarce water resources.

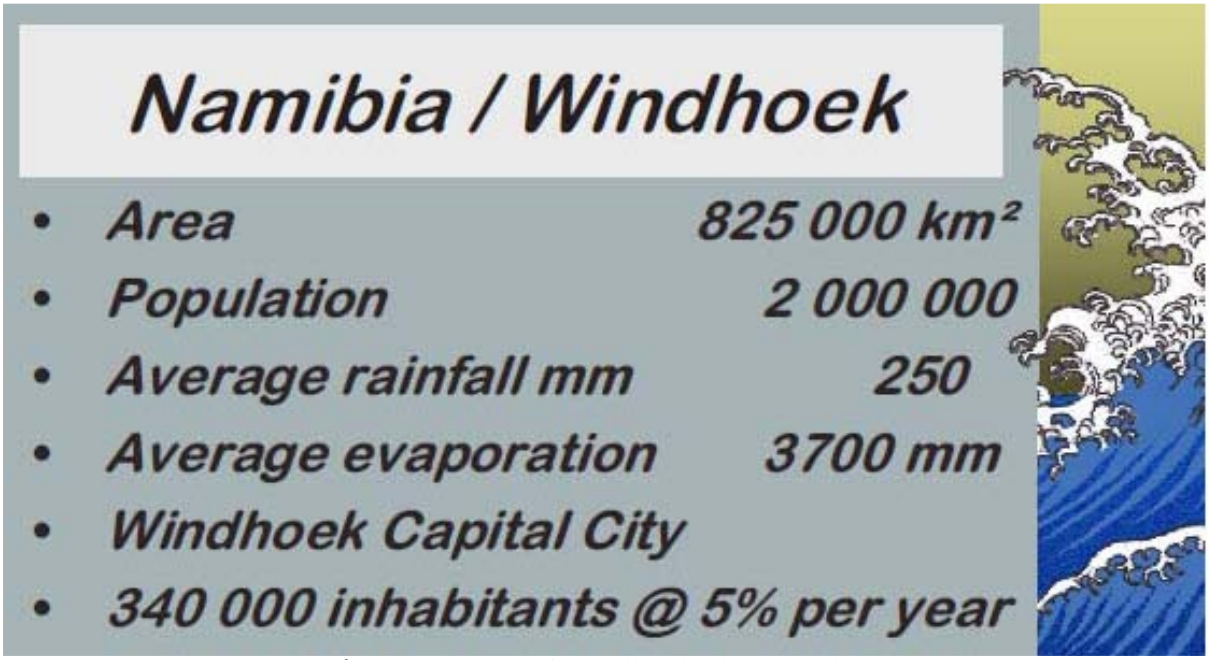

Figure 1. Data of Windhoek City, Namibia

The City of Windhoek is well known for being the first city worldwide to operate a wastewater recycling plant for direct, potable water reuse. The City is already operating a number of reclamation facilities, including for irrigation from domestic wastewaters (see Figure 2). The effort to utilise industrial wastewaters is however new and requires more ambitious treatment technologies exceeding semi-purified irrigation.

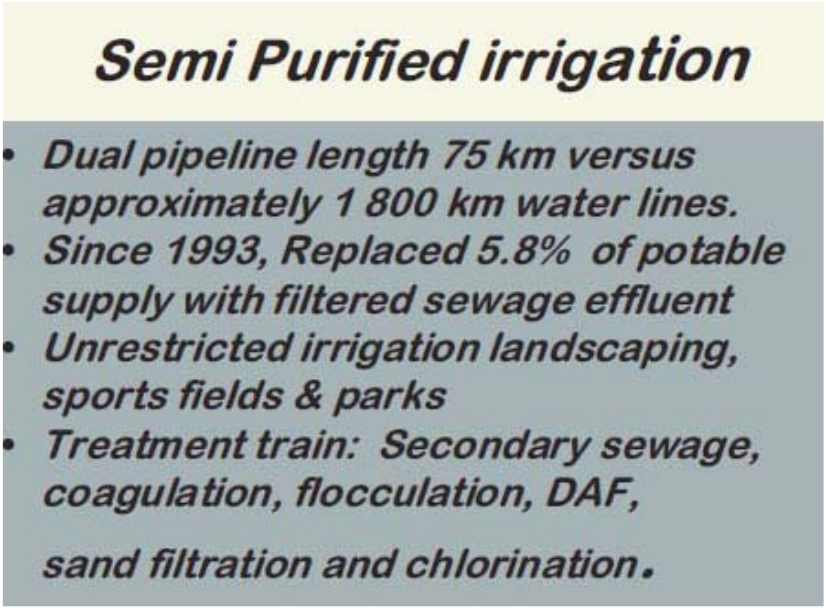

Figure 2. Semi purified irrigation

The objective of the project was to realise a wastewater reclamation plant, based on cost- and energy-efficient technologies, but still viable for local operations. The specific focus was on industrial wastewaters, which may not be suitable for drinking water reclamation, but suitable for irrigational use.

The technical components of the process are conventional mechanical treatment (buffer tank, robust type screening and sand trap), advanced biological treatment (membrane bioreactor, equipped with instrumentation for remote control, automation and easy operations onsite, see Figure 3), compact final settlement tank and post-disinfection through UV (with additional chlorination on request). The standards for wastewater disinfection are quite stringent, not only for crop irrigation, but also for Greenland irrigation (especially for golf courses). To avoid odours, a UV radiation unit for post disinfection of reclaimed wastewater for irrigation was installed (see Figure 4).

Figure 3. The membrane bioreactor with membrane units visible underwater (left), the membrane bioreactor aerated (right)

Figure 4. UV radiation unit for post disinfection of reclaimed wastewater for irrigation

The drivers of technological change

The membrane biological process – adapted to local conditions and with some simplification of the process technology – has made it possible to build a plant of the size and standards under discussion here. Other existing technologies, such as an activated sludge plant with post-treatment (of advanced purification) in a sand filter plus activated carbon etc., would have been too complicated and expensive.

Barriers to technological development, adaptation and adoption

The greatest barrier existing today is the specific cost for purified wastewater, purified up to a standard adequate for safe reuse in irrigation. Compared to the tariffs existing and affordable to be paid through the local industries, it was possible (using all means of cost reduction and efficient financing) to make ends meet.

How were the barriers overcome

The process of implementation was realised through a BOOT-type contract (build, own, operate and transfer), with a contractors consortium consisting of companies located in Africa and companies from Europe. A similar technology (operated on site by the same contractors) had already been proven to be viable for wastewater reuse, with non-industrial wastewater sources (easier treatment) and direct reuse for potable purposes [note: Windhoek was one of the first cities worldwide to realise direct wastewater recycling for supply water].

Lessons learnt from implementation

Without the cooperation of professional technology providers from the private sector and a very proactive public utility, both focusing on greentech business development in their local water sector, the scheme could not have been realised. Technological progress, as well as BOOT and good municipal governance and national finance, were all essential to the successful implementation of this greentech project.

Significant governance changes and institutional development in the local water sector are induced wherever wastewater is regarded as valuable resource, treated with care and reused instead of simply discharged to a sensitive environment.

Scaling up and relevance for developing and transition countries

Scaling up of this project is expected, once project success can be demonstrated and once water tariffs and wastewater charges are reflecting a reasonable portion of real costs (whereas scale-up would be difficult wherever water and wastewater are free of charge, and represent no or little value to the consumers and decision-makers).

Figure 5. Industrial wastewater reclamation technology

Evaluation: economic, environmental and social benefits

Economic benefits

Economic benefits of the project relate to increased land value. Whereas dry land with no water resources available for irrigation is worth little in the project area, irrigated land has quite a high value. This higher value is reflects the economic potential related to land use –

from luxury purposes like a golf course down to small agriculture or green land parks. These land use activities will generate new jobs and business opportunities.

Figure 6. Economic opportunities stemming from water reuse for irrigation

Calculating (1) a rise in land value from 2,500 to 20,000 EUR per ha, once irrigational water is available, and after converting bare land to a golf course or high-yield crop land, and expecting (2) that 3,000 m³ of irrigational water is required for each ha per year (with the UJAMS plant producing estimated mio 1,5 m³/a, sufficient for 500 ha), the direct economic value generated through the water reclamation plant is about 17,500 EUR per ha, which is mio 8.75 EUR.

The macro-economic multiplier (reflecting the jobs and incomes generated by the local business developed on the irrigated land, within the economic cycle of salaries spent generating income and salaries for third parties, fourth parties and so on) may be estimated at 2.3 (taking into account what extensive cost-benefit analyses have shown for similar infrastructural investments and operational outcomes), and the macro-economic capital value generated would be 2.3 times higher than mio 8.75 EUR and make as much as mio 20 EUR.

This economic perspective justifies the expenses for the wastewater reclamation plant, which will need an investment of about mio 8 EUR, and total costs of around 3 EUR per m³ (OPEX plus CAPEX under the BOOT contract).

Environmental benefits

Water reuse, in general, results in huge benefits for the environment. The reduction of fresh water intake and the elimination of contaminated wastewater discharge prevent negative environmental impacts.

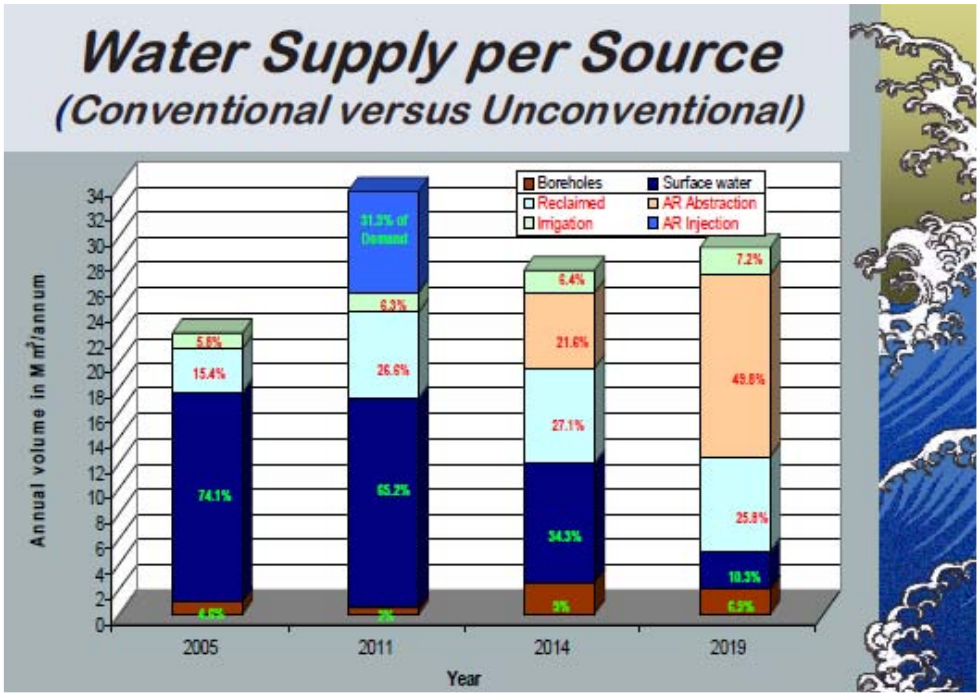

Figure 7. Water supply per source

Social benefits

The project does not directly target low income settlements or poverty alleviation. However, it will generate a considerable social benefit due to the increased availability of land for use after reuse water is available for irrigation. This land will generate business activities, contributing to the economic development of the City of Windhoek, and generating revenues which will serve the public budgets, including those for social welfare.

Furthermore, contamination of the receiving river will be eliminated after the reuse plant comes into operation. This will decrease pollution of the drinking water (raw water) of poor populations downstream who are forced to rely on this source (as they have no other source, or cannot afford water from public stand pipes or elsewhere).

Hydropower for the green economy: a new approach to capacity building and sustainable resource development

International Hydropower Association

Type of tool: assessment tool
Issue: watersheds, industry
Location: worldwide

Challenges

In many countries there is considerable potential for hydropower to contribute to the emergence of a green economy, as it offers much-needed low-carbon electricity for development. However there remain significant challenges to ensure that hydropower can deliver sustainable developmental benefits locally, regionally, and globally, and meet the expectations of all stakeholders.

A key challenge is the institutional capacity to effectively integrate sustainability into the design, construction and management of hydropower projects, and, prior to the design of a project, to assess alternative options. Sustainability in hydropower is complex, involving a broad range of economic, social and environmental aspects, and often requiring trade-offs between these aspects. Reaching consensus continues to be a challenge – between government and non-governmental stakeholders, nationally and internationally – at all stages of the development of a project. In turn this lessens the willingness of financial institutions to provide essential finance and expertise, thereby reducing prospects for the green economy. The Hydropower Sustainability Assessment Protocol is a response to these challenges.

Objectives

This case study presents the Hydropower Sustainability Assessment Protocol 2010 ('the Protocol')[21], a globally applicable framework for assessing the sustainability of hydropower projects. The Protocol enables project operators to assess the sustainability of projects according to a range of sustainability topics and to get an overview of where current operations meet basic good practice and proven best practice, as well as scope for improvement. It will show that sustainable hydropower plays a significant and growing role in the green economy and that the last decade has provided the sector with insight on lessons learned from previous tools and applications. Moreover, the Protocol has benefitted from significant multi-stakeholder engagement during its Protocol, and these stakeholders continue as members of the committee governing the Protocol.

In the green economy, hydropower plays a key role in both climate change mitigation (in its function as a low carbon electricity source, as well as an enabler for other renewable energy source) and climate adaptation (for example, reservoirs play a key role in water resources management infrastructure, and often include hydropower, often the primary or only source of funding for the development of this infrastructure).

[21] http://hydrosustainability.org/

Drivers of change

The Protocol was developed by the Hydropower Sustainability Assessment Forum, a wide-ranging multi-stakeholder forum convened by the International Hydropower Association, over a period of three years from 2008 to 2010. The range of stakeholders involves was extensive, with government and non-governmental stakeholders, developed and developing country stakeholders, and industry and financial organisations each involved, and convening their own reference groups to discuss and agree on key issues.

The approach: the Hydropower Sustainability Assessment Protocol

a. Protocol principles and structure

The Protocol assesses the four main stages of hydropower development: Early Stage, Preparation, Implementation and Operation. Assessments rely on objective evidence to create a sustainability profile against some 20 topics (Table 1) depending on the relevant stage, and covering all aspects of sustainability.

Table 1. Protocol topics that are typically addressed during an assessment: Sustainable development requires people to look for synergies and trade-offs amongst economic, social and environmental values. This balance should be achieved and ensured in a transparent and accountable manner, taking advantage of expanding knowledge, multiple perspectives, and new ideas and technologies.

Cross-cutting	Environmental	Social	Technical	Economic / Financial
Climate Change	Downstream Flow Regimes	Resettlement	Sitting and Design	Financial Viability
Human Rights	Erosion and Sedimentation	Indigenous Peoples	Hydrological Resource	Economic Viability
Gender	Water Quality	Public Health	Infrastructure Safety	Project Benefits
Livelihoods	Biodiversity and Invasive Species	Cultural Heritage	Asset Reliability and Efficiency	Procurement

It is important to emphasise that a Protocol assessment will provide a sustainability profile (

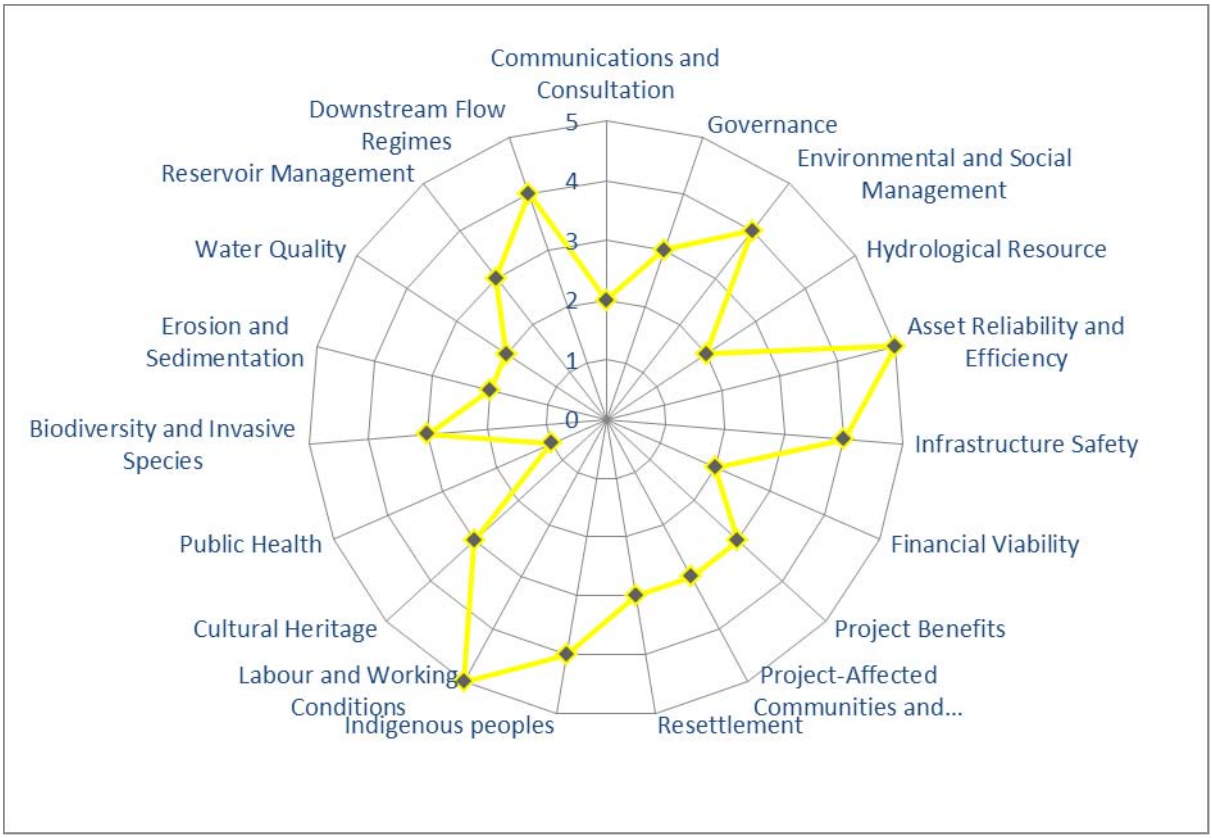

Figure 1) of a particular hydropower project/facility at a specific stage of its development, but not a 'pass' or 'fail' result. There is a common view across a diversity of sectors (e.g. governments, NGOs, civil society, industry, banks) on the important sustainability considerations that need to be taken into account to form a view on hydropower project sustainability. The Protocol itself however makes no specification on requirements for acceptable performance. Instead, it aims to provide an analysis of the various sustainability topics being assessed. As is presented in

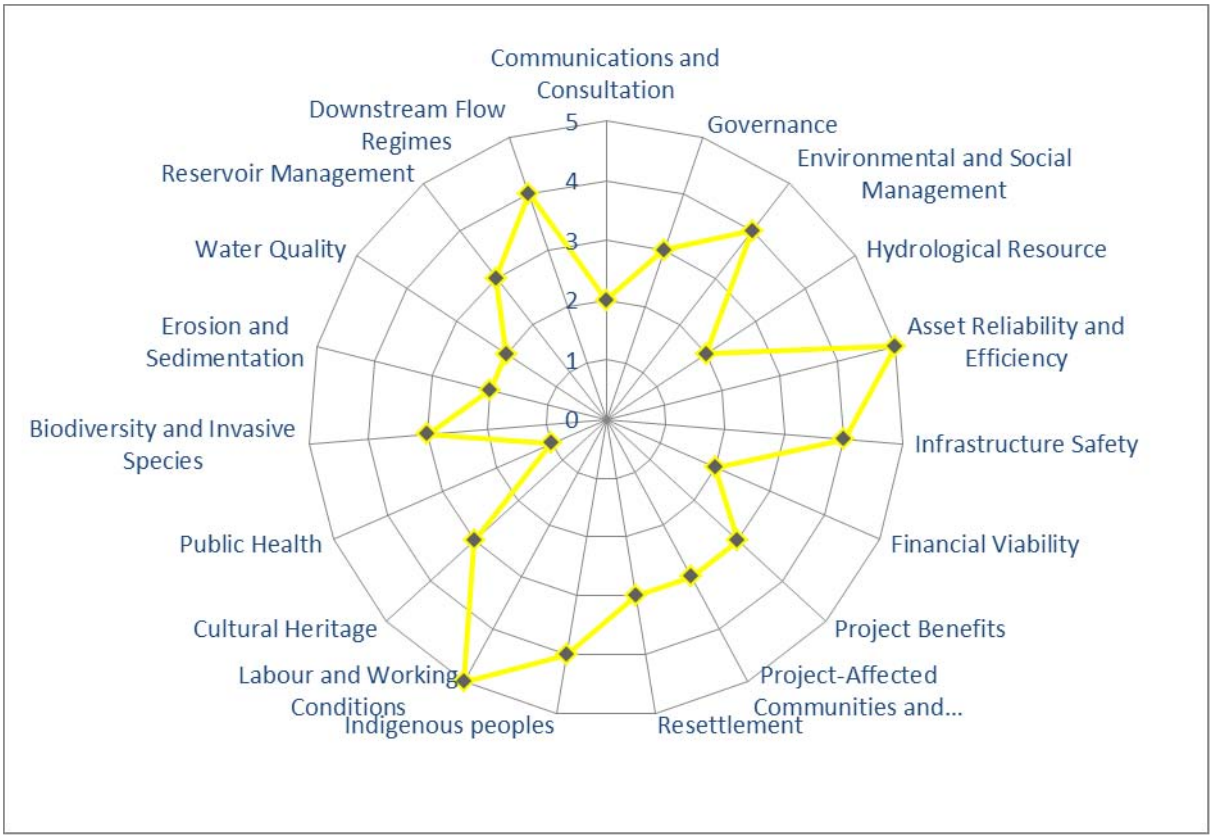

Figure 1, scores are allocated in a range from 1-5, with a 3 score 'basic good practice' and a 5 'proven best practice'. Thus, the scoring system highlights areas for improvement and provides an incentive for continuous improvement of the operations.

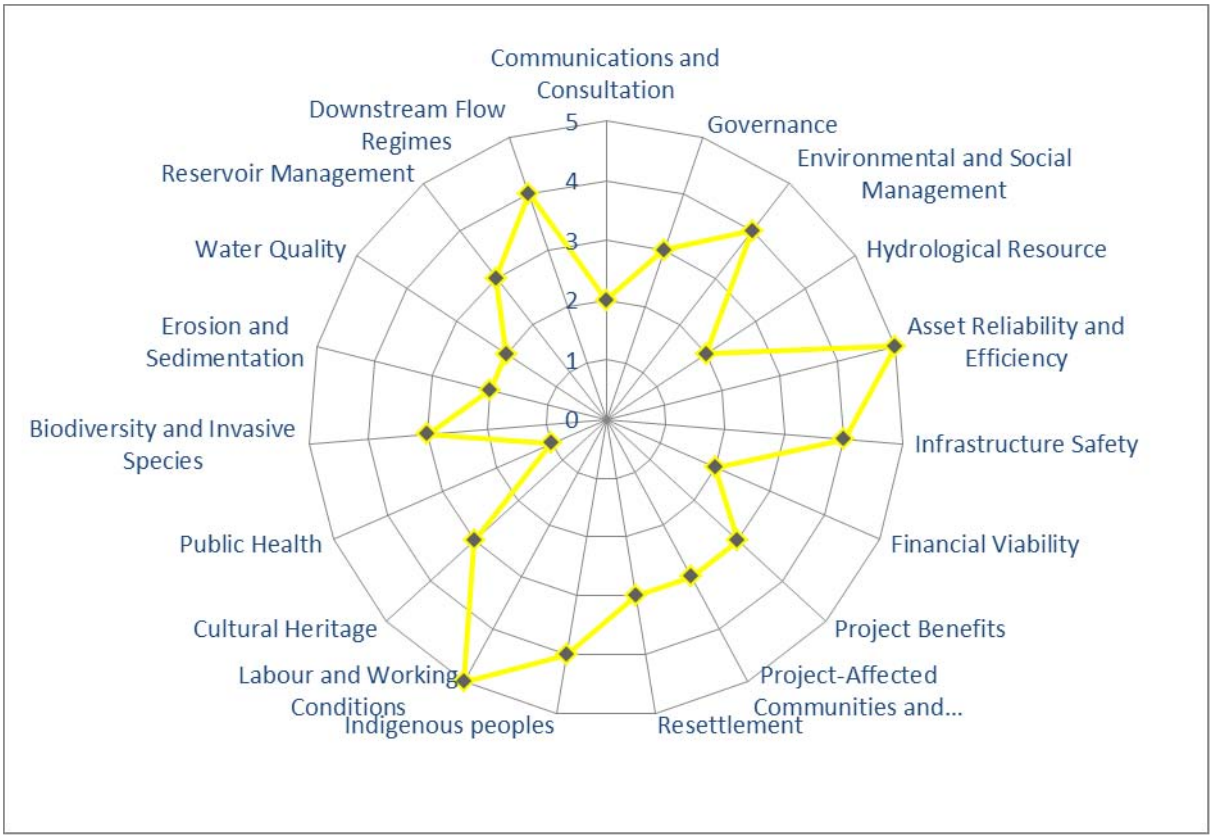

Figure 1. Sustainability Profile: For each sustainability topic, performance is scored from 1 to 5, with 5 being proven best-practice, and presented in an easy-to-read profile

b. Protocol development

The Protocol is the result of intensive work from 2008 to 2010 by the Hydropower Sustainability Assessment Forum, a multi-stakeholder body with representatives from social and environmental NGOs (Oxfam, The Nature Conservancy, Transparency International, WWF); governments (China, Germany, Iceland, Norway, Zambia); commercial and development banks (Equator Principles Financial Institutions, The World Bank); and the hydropower sector, represented by IHA[22]. Further to the variety of stakeholders within the Forum, the development and review process of the Protocol was substantial, with four drafts developed over a period of two and a half years, 20 field trials in 16 countries across 6 continents, and overall stakeholder engagement with 1,933 individuals in 28 countries (**Error! Reference source not found.**). Several of these trial reports are available on the internet[23].

[22] http://hydrosustainability.org/Hydropower-Sustainablility-Assessment-Protocol/Phase-1--Protocol-development-%282007-2010%29/About-the-Forum.aspx

[23] Hydropower Sustainability Assessment Protocol 2011, http://www.hydrosustainability.org/

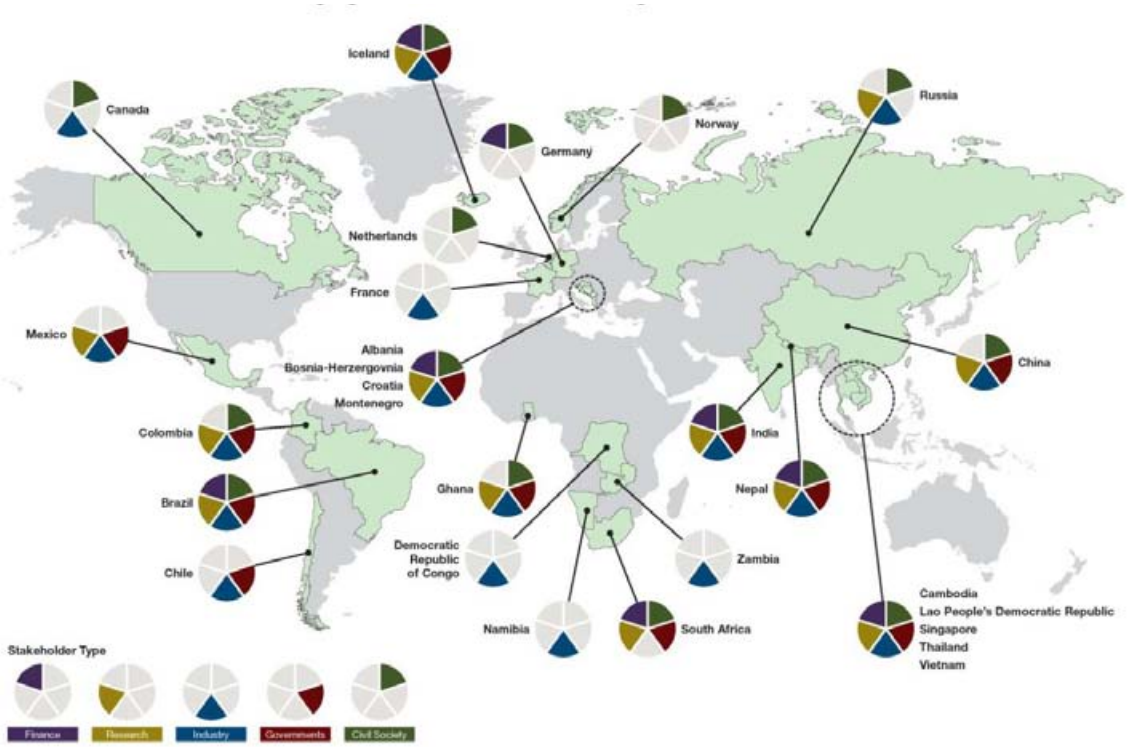

Figure 2. Extent of HSAF Engagement Activities during Consultation Phases

The Hydropower Sustainability Assessment Forum completed its work in November 2010. Between November 2010 and June 2011, an interim governance committee developed both the Terms and conditions for use of the Protocol[24] and a Charter for the Hydropower Sustainability Assessment Council[25]. The latter document outlines the permanent multi-stakeholder governance framework for the Protocol. This Council comprises several chambers representing environment or conservation organisations, social impacts and indigenous peoples' organisations, and project affected communities, development, public or commercial banks, financial organisations, and private investors/ investment funds, emerging and developing economy country governments, advanced economy country governments, hydropower consultants, contractors or equipment suppliers, and hydropower operators or developers.

These chambers will elect representatives to a governance committee tasked, among other things, with ensuring that assessments constitute appropriate applications of the Protocol and with considering and approving formal training material for use with the Protocol. Dr Joerg Hartmann, Water Security Leader, WWF International, is the first chair of the Protocol Council's Governance Committee.

In addition to the governance committee, a management entity exists to manage the day-to-day operations relating to the Protocol, including ensuring compliance with the terms and conditions for use. The management entity currently resides within the International Hydropower Association's Central Office in London.

[24] http://hydrosustainability.org/Hydropower-Sustainablility-Assessment-Protocol/Phase-2--Protocol-implementation-%282007-2010%29/T-C.aspx
[25] http://hydrosustainability.org/Hydropower-Sustainablility-Assessment-Protocol/Phase-2--Protocol-implementation-%282007-2010%29/Interim-Governance-Committee.aspx

c. *Protocol application*

The core strength of the Protocol is that it provides decision-makers, both internal and external, to a project in development or a facility in operation, with a powerful tool to guide informed decision-making. An assessment using the Protocol provides a clear snapshot of a project's strengths and weaknesses, based on a rigorous analysis of a wide variety of verbal, visual and documentary evidence. It also allows the decision-maker in question to overlay their own regulatory or financing requirements over the results.

i. *Sustainability Partners*

In initial discussions with potential Protocol stakeholders, it became clear that a 'package' of Protocol activity would be most beneficial to potential participants so that they could clearly see the process of continued improvement which occurs from multiple Protocol applications. Accordingly, a package was developed whereby project participants would work with IHA as Sustainability Partners and receive the following:

- Pre-assessment visit and training

This is a workshop for participant organisations and nominated external representatives (e.g. from NGOs or relevant regulators) to ensure that participating staff are sufficiently prepared for the Protocol assessments, and that the unofficial Protocol assessment can be conducted in accordance with guidelines for official assessment. The intent of including external representatives is to both communicate information on the project to a wider range of stakeholders, and to demonstrate the participating organisations' sustainability commitment to organisations such as external stakeholders, agencies or regulators and assist in the building of on-going relationships. It is also intended to embed Protocol systems into participating organisations.

- Unofficial Protocol assessment

This is, in essence, a 'training run' Protocol assessment on a specific hydropower facility. Engagement around this assessment will enable staff of the participating organisation not only to conduct further internal Protocol assessments, but also to prepare for official assessments, understand project sustainability weaknesses and strengths and address them, and to promote the incorporation of sustainability criteria into management and reporting systems. This assessment provides a valuable opportunity to implement the learning developed through the in-country training and capacity building phase of the partnership.

- Official Protocol assessment

Subsequent to the unofficial assessment, an official Protocol assessment of the project will be conducted. An official Protocol assessment is defined in the Protocol Terms and Conditions[26] and must meet key conditions. These include that the assessment is carried out by an accredited assessor and with the written support of the project developer or owner. At the partner organisation's discretion, this assessment can include the participation of regulators to demonstrate broader regulatory compliance. This engagement is intended to increase knowledge and capacity around the Protocol and hydropower sustainability more generally. Publicising the results of this assessment is encouraged as it can serve as a powerful

[26] http://hydrosustainability.org/Hydropower-Sustainablility-Assessment-Protocol/Phase-2--Protocol-implementation-%282007-2010%29/T-C.aspx

indicator of commitment to sustainability, and will promote more informed dialogue and decision-making.

ii. Life+

In 2010, the European Parliament approved substantial funds to enable application of the Protocol. This project is called Hydro4LIFE[27] and comprises a €1.2 million investment over three years (2010-2013), 50% co-funded by the European Commission's Life+ Environment Policy and Governance programme, and 50% by IHA, focusing on implementing the Protocol within the European Union. Sustainability Partners operating within the European Union will participate in Hydro4LIFE.

d. Development of a database based on past assessments on basic good and proven best practices

In order to share experiences and knowledge of good and best practices, an assessment database is being developed. This database will be available online and capture the results of all official Protocol assessments. The intent of the database is to present the results of Protocol assessments and provide information to allow the Protocol and its implementation to be improved over time. This database will also enable operators to learn from lessons at other projects and to liaise with the operators on potential impact mitigation and benefit maximisation opportunities.

Further to the database, which will be an on-going tool for practice sharing, past findings on sustainable hydropower are presented online[28] as a guidance and learning tool for operators, researchers, practitioners, policy makers and regulators.

Evaluation: economic, social and environmental benefits

a. The protocol from a sustainability perspective

The sustainability principles upon which the Protocol is founded include the critical concept of considering synergies and trade-offs between economic, social and environmental values. The balance between these trade-offs should be achieved and ensured in a transparent and accountable manner, taking advantage of expanding knowledge, multiple perspectives, and innovation. The approach of the Protocol can be considered a 'hard sustainability' approach as it calls for key natural and social assets, such as biodiversity or cultural heritage to be addressed, and not considered convertible to physical or financial capital vis-à-vis 'soft sustainability'. Other core sustainability principles include social responsibility, transparency and accountability. It is also notable that the Protocol takes an integrative approach, prompting consideration of aspects of hydropower that cannot be easily categorised as one of economic, social or environmental.

It is critical to assess the sustainability of hydropower, because if it is developed and managed in a sustainable manner, it can provide national, regional, and local benefits, and has the potential to play an important role in enabling communities to meet sustainable development objectives.

[27] http://hydrosustainability.org/Hydro4Life.aspx
[28] Sustainable Hydropower Website, http://www.sustainablehydropower.org/

The Protocol allows consideration of hydropower under the traditional sustainability perspectives. With regard to environmental considerations, the Protocol promotes improved performance in environmental and social assessment and management, hydrological and sedimentation management, and water quality and biodiversity for example. Social and poverty alleviation impacts are addressed through improved performance in a wide range of social issues, e.g. project-affected communities, resettlement, indigenous people, working conditions and cultural heritage. From an economic point of view, the Protocol promotes improved performance in financial and economic viability of hydropower projects, as well as sharing of project benefits. By providing a common platform for dialogue on sustainable hydropower, the Protocol promotes the contribution that sustainably developed hydropower will make to economic development.

All countries and organisations adopting and supporting this Protocol respect the need for institutions to have their own policies and positions on acceptable performance for a hydropower project. All organisations expressing support for the Protocol recognise that a Protocol assessment can make a substantial contribution towards understanding and achieving sustainable projects. In producing a sustainability profile, the Protocol can help inform decision-making on projects, which can be done by individual institutions and organisations or even country governments.

b. The protocol for capacity building

There are three aspects related to the use of the Protocol and capacity building.

Firstly, any Protocol assessment is accompanied by training on sustainable hydropower, which is provided to industry partners, local NGOs as well as relevant regulators. This is being done under the Sustainability Partnership model, which has been developed as part of Protocol implementation. The training builds capacity of the participants and thus enables them to apply the Protocol to other projects and also enables the operator as well as local regulators and civil society to understand requirements a sustainable hydropower project would be required to meet. Sustainability considerations can thus be incorporated in a broad range of stakeholder activities.

Secondly, it is an integral part of the requirement for an official protocol assessment that the assessor is officially accredited to carry out Protocol assessments. The Protocol governance committee is currently developing a system to qualify and accredit assessors. There will be an incentive for existing assessors with relevant experience to receive training to become accredited to carry out Protocol assessments on a variety of sustainability considerations.

Thirdly, since the Protocol is freely available and written in accessible language, it has the added value that it can be used to provide general guidance. For example it may be used in training, in internal objective-setting, or to provide inspiration for hydropower sectoral guidelines for environmental impact assessment. Thus the Protocol provides guidance to operators and regulators beyond the immediate projects that are assessed.

c. Context of hydropower in the green economy

If well managed, hydropower provides many solutions for energy and water management in a green economy. With regard to climate change mitigation, hydropower as a clean, renewable energy source contributes directly to global low carbon energy goals, and

therefore to climate change mitigation. Hydropower's capacity to enable the further development and use of other renewable energy sources, such as wind and solar, means that it has a vital further mitigation role to play.

Climate adaptation, on the other hand, is now increasingly considered on a par with climate change mitigation as critical to the success of international efforts to deal with climate change. It is often acknowledged that extreme weather events will become more frequent. World economies will be increasingly vulnerable to the devastating consequences of droughts and floods if their development agendas exclude investment in water management.

Hydropower offers a number of benefits by enabling current and future adaptation to the effects of climate change. A reservoir, as part of hydropower infrastructure, has the advantage of offering multiple services. As well as offering clean, renewable energy, a hydropower reservoir can enhance water security and management, providing flood mitigation, storage for irrigation and other purposes, and the stabilisation of downstream flow regimes. Other facilities a hydropower reservoir offers include tourism and recreational facilities, habitats for biodiversity, and increases in income generation options for example through fisheries.

Lessons learnt from implementation

The single most important lesson from the development of the Protocol is that consensus on sometimes controversial sustainability challenges *can* be achieved, with some persistence and a willingness to engage on the part of all. The diversity and breadth of stakeholders – some with highly divergent views and previously entrenched positions – agreeing to the detailed content of the Protocol documents (and the terms and conditions for its use, and governance mechanisms) is unprecedented. Only one area of non-consensus remains, in the issue of consent of project-affected communities, displaced people, and indigenous peoples.

Since agreement on the Protocol document was reached in late 2010, one Protocol assessment has been carried out, offering useful lessons for protocol implementation. The assessment of the Shardara multi-purpose project in Kazakhstan (in support of the GTZ programme *Transboundary Water Management in Central Asia*) Programme provided important experience in the practicalities of Protocol assessment, confirming the need for clearly-defined roles during Protocol assessment, detailed preparation which is critical to evidence-gathering, and the importance of carefully scheduling consultations with local communities. These lessons have been used in the compilation of a series of training and reference manuals which guide the lead assessor, assessment team and project developer/operators (and others) during a Protocol assessment. These lessons and manuals will be drawn upon in up-coming Protocol assessments scheduled in the near future in Australia, Southeast Asia, Europe and Latin America.

Global application and relevance for developing and transition countries

The Protocol as a globally-applicable framework; indeed it was actively designed to be globally-applicable, and applicable to all types and sizes of project. The application of the Protocol is particularly important in developing countries in Asia and Africa, where there is significant un-tapped hydropower potential and yet there are highly significant sustainability risks and weaker institutional capacity to manage and deliver sustainable outcomes. IHA is looking for Sustainability Partners to implement the Protocol in developing countries and

elsewhere. Sustainability Partners are organisations that are keen to take a take on the challenge of continuously improving hydropower sustainability performance. Sustainability Partners receive training and capacity building on the Protocol, an unofficial assessment of a chosen project/facility and finally an official assessment of the same project.

Conclusion

Sustainable water resources development will be crucial for implementation of the green economy in all countries. Hydropower development or review of existing practices will be an important consideration in many countries. The Hydropower Sustainable Development Protocol provides a means to build capacity, learn from past lessons and implement future hydropower with a consideration of local communities, maximising benefits from multi-purpose development as well as the broader sustainability topic.

ZINNAE: Zaragoza Urban Cluster for Efficient Water Use

Marisa Fernández Soler and Clara Presa Abós, Technical Secretariat of ZINNAE

Type of tool: technology
Issue: cities
Location: Zaragoza, Spain, Europe

Challenges

The city of Zaragoza has made important collective efforts to increase efficiency in water use in all social sectors. The combined process of institutional and technological change and adoption has lead to the creation of specialised companies and to accumulated experience. **The city has become a space for permanent demonstration and innovation for projects related to urban water use.**

Zaragoza:

a) Concentrates a varied critical mass of companies linked to the water cycle, covering different activities related to the efficient use of water (supply, treatment, products, green areas, etc.).

b) Public administrations in Zaragoza have been engaged in water quality improvement and water demand reduction.

c) It has research and training centres linked to water and energy efficiency with an important international tradition.

d) The demonstration project "Zaragoza, Water Saving City" has been developed in the city since 1997, the purpose of which is to save water and to use it efficiently in the city through changes in both behaviour and technology.

The city was the venue for the Expo Zaragoza 2008 exhibition, which had the motto "water and sustainable development". The event reinforced the brand of the city in relation to the efficient use of water.

There was a need to realise synergies and maximise potentials for companies in Zaragoza and nationally. In 2009, several organisations fostered the creation of an Urban Cluster for the Efficient Use of Water, focused on boosting the innovative business sector linked to water use efficient in urban areas, thereby creating employment in the city. In addition, a new variable to this initiative is to be introduced: the energy efficiency linked to the urban water cycle.

The drivers/ opportunity for creation of the cluster

Two external global trends guarantee the timeliness of this initiative:

- The water market is one of the first five markets of the world, with a turnover reaching US$400 billion and an annual growth rate of 7%, according to data disseminated by Watertech Online.

- Global water demand will continue to increase, largely due to the growth of urban population (in 2020 "over 50% of the population in developing countries will be urban").

The approach

Defining the mission and the vision

The Urban Cluster for the Efficient Use of Water in Zaragoza was created with the following **mission:** To promote efficient and sustainable use of water as well as associated energy consumption in urbanised areas of Zaragoza, getting different public and private actors to collaborate, starting with knowledge generation, demonstrative projects and innovative solutions.

And with this **vision:** To become a leading international collaboration, knowledge and innovation example for efficient and sustainable water use in urbanised areas as well as a driver of quality employment for Zaragoza.

Establishing strategic targets

These mission and vision were translated into **three strategic targets:**

1. To boost **efficiency** and **sustainability** in **water** use and management as well as in the associated **energy consumption** of the city of Zaragoza.

2. **To position the AEI** on a national and international level as a collaboration, knowledge and innovation referent for efficient and sustainable water management in urbanised areas and for the reduction of the associated energy consumption.

3. To turn water use efficiency into a **driver of quality employment** for the city.

Establishing membership

In 2011 ZINNAE includes twenty six public and private entities which take part in the hydrological cycle management in the urban area. They are all part of the water efficiency sector in Zaragoza:

Business Sector (17 members):

- Alfredo Sanjuan
- Aquagest
- Aqualia
- Barrabes
- Brial
- Contazara
- DAM
- ESHYG
- Griferías Grober
- Grupo Raga
- IDATA
- Jacob Delafon
- Libelium

- Mann+Hummel
- Sopesens
- Veolia Agua
- Zeta Amaltea

Regional and Local Authorities (4 members):

- Ayuntamiento de Zaragoza
- CHE
- INAEM
- Gobierno de Aragón

RTC Centres (2 members):

- CIRCE
- Universidad de Zaragoza

Other members (3):

- ECODES
- Ecociudad Valdespartera
- Feria de Zaragoza

Implementing actions

ZINNAE has four axes of action:

1. Demonstrative projects

- Research on urban water demand in Zaragoza
- Demonstrative projects for the improvement of urban water demand efficiency and sustainability

2. R+D+i, new technologies and experimentation

- Fostering and supporting R+D+i projects
- Identifying and disseminating new knowledge and emerging technologies

3. Development of the innovative business group

- Dynamising the local sector
- Exploring opportunities to collaborate with external agents, both nationally and internationally

4. Sectoral development

- Favouring the local establishment of actors belonging to the sector (projects, entrepreneurs, institutions, companies, etc.)

- Building capacity for the professionals of the sector (architects, installers, tradesmen, etc.)

Partnering for implementation

ZINNAE members participate actively in the cluster's activities. The cluster's priority initiatives are defined annually in the Assembly, identifying projects and actions for which working groups and commissions are created. Depending on the aims and contents/subjects of the projects, each member is represented in the working groups or commissions by the Area or Department that best defends its interests: Environment, Marketing, I+D+I Department, or other.

As well as specific Cluster projects, ZINNAE promote active cooperation among its members, facilitating bilateral or multilateral initiatives which contribute to the overall targets established in the Strategic Plan 2010-2013.

Lessons learnt from implementation

The general lessons learnt from implementation are:

- A cluster must be mainly composed of business and the RTD sector (linked to water in ZINNAE), but it is crucial to launch the initiative with the collaboration and support of regional and local authorities, to attract the most innovative agents.

- It is necessary to articulate and organise the participation of the RTD Sector. It usually runs many initiatives relevant to the business sector but they often not known.

- The cluster secretary must analyse its members' activities and priorities individually in order to promote active cooperation among the cluster members to launch multilateral initiatives.

Approach	Lessons learned
Formulation of Strategic Plan	The Strategic Plan formulates the mission and vision of ZINNAE. This is essential to set up a multisectoral organisation such as a cluster.
Identification of 13 possible cooperation projects	The technical secretariat of the cluster, which organises the initiative, analyses the activities and priorities of each member. This is necessary to promote cooperation between the different partners and to launch the multisectoral initiatives.
Commissions and Project Groups	The urban water cycle covers a wide range of companies. Many of these companies do not compete, but are complementary. The key for achieving cooperation between the different members is to facilitate and stimulate bilateral meetings between these members.
The three sectors that are integrated in the cluster are:	To attract the most innovative agents, a cluster must include companies and research centres, but it is also crucial to gain

research community, private sector and public administration	support of the local and/or regional public authorities.
Two of the main research centres of Zaragoza joined the cluster	Water-related initiatives are often isolated and not shared between the public and private sector. It is essential that the research community and technical sector participate in the cluster.
Recruitment of members	ZINNAE does not focus on the recruitment of new members, but aims to deepen the collaboration with existing members. Still, the number of members has doubled in the two years since its foundation. It should be the members who set the pace of growth of the cluster, combining the joint activities with the recruitment of new members.
Launch of the Waterlabs: identifying urban spaces for innovative experiments	Although there are already examples in Zaragoza of demonstration and innovation via “living” laboratories, it is critical to count on the research community and technical sector to systemise the results of these demonstrations and innovations.
Workshop Waterlabs: national experiences with innovation through the Living Labs methodology	All living labs at the national level start with a large initial investment to ensure the monitoring and analysis of results. In Zaragoza we have to use the existing platforms (Ecocity Valdespartera, Brial experiences in hotels, Switch experience in Actur) if we want to implement a "living laboratory" for products and services related to water.
Implementation and leadership of projects 2011-2012 The Strategic Plan defines 13 cooperation projects. The first year started with Waterlabs, a proposal from the technical secretariat. In the second year (2011-2012) we will initiate two other projects (one as a continuation of Waterlabs), led by two member companies.	The companies know the need for action and innovation in the water sector and are the engine of the cluster and of the cooperation projects that they set into motion.

Follow up for scaling up

In 2010 the Waterlabs project was established, based on Living Labs methodology for innovation. The project aims to boost Zaragoza as an experimentation site in order to test the

effectiveness of existing practices, solutions and technologies for efficient and sustainable water use, in terms of water consumption and energy. WATERLABS' targets are:

- To fit out and facilitate settings for permanent experimentation in the city.
- To attract the most innovative agents of both the sector and complementary sectors to R+D+i projects in Zaragoza.
- To boost R+D+i of products and efficient solutions for water and energy (associated to the water use) consumption.
- To develop new technological solutions that are marketable on both national and international levels.

Both the cluster development and Waterlabs project should increase the innovation potential of the business sector, and identify RTD projects for the Research Centres. This is relevant for developing countries in two ways:

- Launching Research and Technology Development projects for water solutions.
- Favouring the cluster working methodology which involves joining efforts between the research sector, business sector and local and regional authorities.

6. Water planning in the transition towards a green economy

Rafael Romeo (Ebro River Basin Authority), Manuel Omedas (Ebro River Basin Authority), Rogelio Galvan (Ebro River basin Authority), Carlos Mario Gomez (University of Alcalá and IMDEA Water Foundation)

Freshwater is a finite and vulnerable resource, essential to sustain life, development and the environment;

Water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels;

Women play a central part in the provision, management, and safeguarding of water;

Water has an economic value in all its competing uses, and should be recognised as an economic good.

The Dublin Principles

The opportunity to improve governance arrangements is one of the biggest opportunities to speed transition to a greener economy. In any area where there is water scarcity, it is critical that governance arrangements are put in place to prevent over-use and overdevelopment of the available water resources.

UNEP (2011)

The challenge for planning

Water is not only essential for the production of single commodities, goods and services and for meeting individuals' drinking water and sanitation needs. Water is also fundamental for the maintenance of the entire economy. Development prospects in any nation are propelled or constrained depending on the way water resources are managed. Welfare advances and economic progress in poor and rich nations are more or less vulnerable, depending on the state of conservation of water resources and water infrastructures. Personal development opportunities depend on the access people have to basic drinking water and sanitation services. The fragile border between social peace and civil conflict often depends on how the benefits and costs of water use are shared amongst individuals and countries. Ultimately, the future of humanity depends on the conservation of the earth's ecosystems and their ability to provide the critical environmental and water services the economy and the entire global society depend upon.

For all the aforementioned reasons, decision making on how and how much water to use in the economy or to conserve in nature cannot be simply left to individual interest. *Water needs to be governed*. But water planning is not only concerned with building the infrastructures to satisfy rising water demand as a result of economic and population growth. This is not possible in the long term because, firstly, water resources have a limited capacity

to cope with water abstractions and effluent discharges, and secondly, because the benefits we obtain from using and transforming water ecosystems (by abstracting, diverting, degrading water sources, etc.) enter in conflict with other important economic benefits whose provision depends on the conservation of water sources and their associated ecosystems. The last services include, for example, security in the face of droughts and future uncertain water supply due to climate change, flood control, self-treatment and depuration, biodiversity support, navigation, landscape and recreational opportunities and also the regulation of the water cycle which the provision of water depends on.

The transition towards the green economy requires improvements the water environment without harming prospects for economic development. This implies not only making welfare and social improvements compatible with the preservation of water resources but also finding new and innovative opportunities for economic growth and social development through sustainable water management. *Water plays a key role in economic development and water planning is a powerful social instrument for optimising growth, poverty reduction and environmental benefits.* This is the case in advanced, transition and poor economies as the cases of Spain, Korea and Laos show.

Water planning has a distinct role to play in less developed countries. The benefits of providing basic water and sanitation services in this early stage of development are of paramount importance for lifting people out of the poverty trap. Gains in health and education opportunities mean increased prospects for personal and social progress if revenue raising opportunities are also available (e.g. food production in rural economies). Water planning is important to start and sustain the development process. But water development can be challenging if water is scarce, requiring substantial investments in public infrastructure or the development of alternative water sources (such as water harvesting or desalination).

Climate change will increase the uncertainty and variability of water availability and will reduce the security of water services. Increasing water scarcity and variability (occurrence of droughts and floods) will affect rain-fed agriculture and water supply for domestic use, energy, industry and agriculture, and will likely generate pressures for increasing irrigation and cultivating marginal lands. *Water planning must provide the institutional space to build a collective response to the climate change challenge and build the resilience of water management.*

The alternative to water planning is allowing the spontaneous, unplanned and uncoordinated actions of anyone affected by water stress; actions that could lead to increased vulnerabilities. Spontaneous responses from people, businesses, and farmers in rural communities depend on their perception of value and risk, the options available to them and their individual economic incentives. These responses may not necessarily produce the most sustainable outcomes. For example, they may add more pressure to cultivate marginal land, or unsustainable cultivation practices may be adopted when yields are reduced because of erratic rainfall. The end result may be increased water scarcity, land degradation and the endangerment of biodiversity, thus increasing vulnerability and reducing capacity to respond to climate change and other risks later on.

Planned and anticipated responses are needed to ensure the provision of water services which underpin the economic system. Water planning is also necessary to cope with

environmental challenges such as water scarcity, water quality degradation and climate change risks.

Approach: the elements of planning

Reaching a social agreement on the desired balance between water use and water resource conservation

The first purpose of water planning is reaching a social agreement on the desired balance between water use and water resource conservation, or in other words, agreeing on the balance between water use and pressures on the one hand, and conserving water on the other. This basic but politically challenging agreement is a necessary condition for successful water planning. For example, since 2002, the Water Framework Directive of the European Union has set the objective for water planning as making economic progress compatible with the improvement and protection of the status of the affected water bodies (any exception to this principle requiring a special justification in terms of improvements in economic welfare).

In an international river basin, this basic agreement on the balance between water use and water resources conservation might only be driven by the need to cooperate in sharing the benefits derived from the river. By specifying the responsibilities of each country and by enforcing the agreement among them, all the countries ensure their contribution to the benefits of preserving the international river basin. Successful cooperative agreements of this kind are based on the mutual responsibility to comply with some precisely defined and observable environmental standards. A practical way to implement this kind of cooperative agreement is to incorporate these standards in national and local water planning so that the fulfilment of the international agreement and the credibility of the national partners are reinforced and foster cooperation. This is the case for the Mekong River basin international agreement and its important influence on the goals and means of water planning in the Lao PDR.

Harnessing development opportunities and coping with water and development challenges

In the Ebro River basin, water management has been a tool for development. Water underpins the powerful agro-food industry, based on the development of irrigation systems, and a dynamic energy complex, centred on hydropower along the main river and its tributaries but also replying on water to cool thermal fossil and nuclear power plants. The river valleys are also essential for transport, the manufacturing industry and population settlement. Water planning has undoubtedly played a role in the progressive economic development of the region, but the amount of water used has exceeded its sustainable limits and recent efforts have been made to reduce water pressures and increase conservation of water resources. Modernising irrigation systems is now a priority for guaranteeing water supply and increasing the resilience of agriculture to droughts.

The existing dams in the Ebro basin are able to provide a reliable supply of water for urban areas and for irrigation as well as flood control services, but some efforts are required to avoid negative impacts on sediment balances, river bed encroachment and saline intrusion in the lower Ebro. Water development has been able to provide enough water of the desired quality for a variety of water uses, but increased use has reduced the amount of water stored

and the potential for hydropower, thus reducing the value of the installed power generation capital. All this has reduced environmental flows and altered the habitat conditions, making river restoration one of the main objectives of recent water planning. The main objective of water planning in the Ebro today is recovering the balance between the status of water resources and their critical environmental services, and the gains already achieved in economic development.

The case of Laos is distinct because the country has abundant water resources (in fact most of the runoff of the lower Mekong comes from Laos). Moreover, in the Mekong river basin, Laos is a late comer to economic development and water resources are affected by water regulation in the upper basin, and in particular the significant hydropower projects already built or under construction in China. The transboundary nature of the river basin also means that intensive water use in Laos might have detrimental impacts on the already developed irrigation fields and populated areas of Vietnam and Cambodia in its delta. The development of Laos is only possible if water planning is able to address potential conflicts between water users and uses, and able to transform competition over scarce resources into mutual cooperation to conserve and share the benefits of improved water resources. Adapting hydropower dams in China in order to meet irrigation needs in Laos, and water uses in Laos to help maintain environmental flows required in the Vietnamese Mekong delta, are examples of such mutually beneficial arrangements.

In contrast to the Ebro, Korea is a transition economy where there are still opportunities for the construction or the expansion of dams and weirs as a central element of water planning. Nevertheless, environmental objectives are still important as public demand for recreation and well preserved water landscapes increases with income levels. Moreover, there is a commitment to preventing further deterioration of water quality and water landscapes due to the perceived importance of water security and the need to meet water demand in the long term.

Building governance and institutional capabilities

Building governance and institutional capabilities is essential for agreeing on, designing and effectively implementing long-term integrated water management plans in order to support the transition towards green growth. The Laos experience illustrates a progressive strategy of improving water governance, by developing technical abilities, creating river basin management institutions, improving information systems and promoting stakeholder engagement.

Coordinating public policies

Water planning can only contribute to green growth if water is not perceived as a simple policy area (e.g. agricultural, energy or industrial policy). In the transition to the green economy, water planning needs to be converted into a cross-cutting policy, in order to guarantee that all other policies and projects – from urban planning to agricultural policy – are coherent with the collectively agreed objectives of water planning.

Policy coherence is critical because of the limited ability of water ecosystems to meet all the increasing and competing demands for water in the economy. Global water demand is increasing due to population growth, rising living standards, and expanding production of agriculture, hydroelectricity, and the many goods and services for which water is an essential

input. Water requirements today and in the future cannot be met unless all these uses of water are coordinated and water sources are conserved. Water planning enables the coordination and alignment of the many public policies (such as land use, urban and rural development, manufacturing and energy policies) and public policy objectives (such as economic efficiency, equity, basic needs coverage or cost recovery) which influence and are influenced by water management. Instead of being another public sector action, water planning makes water policy a horizontal axis connecting and coordinating many individual areas of public policy.

Green growth means increasing economic wealth and welfare without further deterioration of the water environment, and this is impossible without more efficient water allocation. But efficiency arguments are not valid when used to oppose the legitimate option of charging less than full cost recovery prices to provide basic water services in order to reduce poverty. Even in this case, there is a dilemma between subsidising water services and sustaining the provision of these services in the long term, for which self-financing is required. Cost effectiveness and budget constraints might also lead to excessive focus on the urban poor, offering them the lower cost alternative rather than providing water services to scattered populations in the rural areas. Deciding on the objectives for a river basin is a political and not a technical exercise. Identifying tradeoffs between different objectives and decision criteria in water management (such as efficiency, fairness, financial and environmental sustainability) is key to the planning process and provides the basis for political decisions to be made over what actions to take. A transparent planning process with stakeholder participation at all stages is essential and ensures that all voices are heard.

Stakeholder engagement and public participation

Effective water planning requires the cooperation and engagement of a wide range of stakeholders. Public participation helps construct a shared vision of the objectives, opportunities, challenges and collective and individual responsibilities involved in the management of water resources. It helps foster the perception of water as a collective asset to be preserved by mutual cooperation rather than a common pool resource to be depleted by open access and competition.

When people are aware of the benefits of cooperation through, they have incentives to build a reputation of good behaviour and social responsibility, fines can be perceived as fair and the threat of moral sanctions can deter misbehaviour. But this collective action can only be based on the common perception that water benefits are distributed fairly. This requires trust that the water authorities represent the common interest and follow transparent rules instead of their own discretion. Cooperation also requires that individual behaviour is observable in such a way that deviations are detected and pay a cost. Building effective participatory water planning therefore requires proper incentives, and must ensure that decisions are perceived as fair, rules are enforced, and there is transparent and adequate information available to all.

Aligning private decisions with collectively agreed goals

Within limits any water user has the option to decide how much water to use, for what purpose, in combination with what other inputs. These decisions depend on many factors such as income generated by the productive activity, water prices, and installed water use technologies. For water planning, it is essential that all the decisions taken by water users are

compatible with the different objectives of water policy. Incentives and regulations are then an important part of the package of measures in water plans. Charges for water services are one instrument to consider. If, for example, water is charged for with a flat rate, productive uses might have an incentive to use more water than their legally authorised water use rights, neglecting the needs of other downstream users and causing negative environmental impacts. These external impacts are not taken spontaneously into account in private decisions unless there are adequate incentives in the form of tariffs or penalties, controlled by a regulator. Energy subsidies, yield-linked agricultural subsidies and even water flat fees are all examples of incentives that may not be compatible with the objectives of water plans, including environmental goals. Water planning needs to address the compatibility of incentives transparently, identifying situations where these incentives are justified, and where they are not.

Establishing collective responses to scarcity and risk

Poor and water-scarce societies that are now trying to develop their water resources and provide basic water and sanitation services are faced with the potential adverse effects of climate change, constituting a real threat to development (World Bank 2010). Water planning is the proper institutional framework for coping with the challenge of adapting to climate change and for developing resilient and adaptive responses to drought, floods and other water related risks. Increasing uncertainty and competition for reliable water supplies makes devising water policy difficult and requires adaptive responses. Water allocation decisions and water demand management are especially crucial in the context of increasing competition and scarcity.

The options that may need to be considered in water planning include, as proposed by the IPCC, no regret strategies and climate justified strategies. No regrets strategies are measures that are worth taking anyway, regardless of climate change. Water storage schemes and infrastructures, water conservation programmes, and improvements in efficiency are examples of the kinds of measures already considered as beneficial but that are even more valuable in a climate stressed context (see Korea's four rivers programme). Climate justified strategies are measures which need only be considered in the face of uncertainty, for example, diversification of water sources (such as desalination or non-conventional sources), the upgrading of storm water systems, the reversal of coastal developments to reduce exposure, the recovery of floodplains for flood protection, and the recovery of aquifers for buffering security stocks. Achieving water security requires agreeing on a combination of the available options.

Summary of the elements of the approach

- **Obtaining consensus of the population.** Not only are the goals and instruments of water planning important but also the procedural aspects of how these goals and instruments are chosen with the participation of all the potential stakeholders. Participation can promote the vision of water as a social and economic asset that needs to be properly preserved instead of only as a provider of services. This way water planning promotes a common and shared vision of water assets such as aquifers and river basins.

- **Providing guidelines for economic activities and cities to make decisions on water use.** Once the goals and instruments of water policy are agreed upon, many practical recommendations are given to individuals, firms and institutions so that they

can adapt their actions in order to improve their contribution to water conservation and green growth.

- **Making sustained welfare improvements and economic growth compatible with the recovery and adequate protection of water providing ecosystems.** This is the essence of sustainable green growth.

- **Coordinating individual actions with collectively agreed goals in terms of water use and water resources conservation.** Water planning can be a powerful instrument to ensure that the actions of individual water users are not in contradiction with the common social goal of protecting water resources, making growth sustainable, and ensuring intra- and intergenerational justice.

- **Avoiding the negative impact of individual, spontaneous and uncoordinated responses to natural disasters and climate change.** These kind of responses can lead to water scarcity, impair water related ecosystems and increase inequalities and social exclusion. Water planning can foster collective, anticipated and planned responses to climate change, water scarcity, floods, droughts and other water related risks.

- **Conflict resolution and management of the many social conflicts associated with the distribution of water among people, economic uses, time and regions.** Planning is a means to foster collective agreements, public participation and consensus building which are basic elements to promote a common vision of the river basin as a collective asset.

- **Promoting social justice** by guaranteeing basic human needs are met, despite the lack of market incentives to provide basic water and sanitation services. Planning can also promote equitable distribution of water use rights and water development opportunities among potential water users.

- **Helping preserve water resources and water providing ecosystems.** Instead of adapting water resources to the needs and demands of the economic system, the focus of IWRM is to ensure that economy expansion is not obtained at the expense of further degradation of water providing ecosystems, but on their improvement and adequate protection.

Lessons learnt from implementation of planning processes

The approach	Lessons learnt from implementation
Reaching a social agreement on the desired balance between water use and water resource conservation	Setting the achievement of a good or fair ecological status of the water bodies as the main objective of River Basin Management Plans in the European Union has been an important element of water planning in the Ebro River Basin in Spain and has helped make economic development compatible with environmental objectives. Adopting a set of international commitments regarding the environmental status of the Mekong River Basin in Laos has been a central element of the coordination of water planning with national development policies. In Korea, clear objectives for the recovery of river ecosystems has been a critical element for increasing legitimacy and gaining public approval of an extended programme of water works and infrastructure development in Korea that is critical for sustaining economic growth.
Harnessing development opportunities and coping with water and development challenges	Water planning has played an essential role in the development of the agro food and energy complex that now represents a competitive advantage and a defining characteristic of the Ebro River Basin in Spain. In Laos, water policy has been the cornerstone the country's success in progress with the Millennium Development Goals and in the ongoing transition from a rural to a urban economy. In Korea, water planning has been developed as an anticipatory strategy to foster economic growth, preserve the welfare gains already achieved and provide water security in the future.
Building governance and institutional capabilities	An ambitious programme of building water governance structures is already in place in Laos. Transparency, regulation and enforcement, and building technical competences are key elements for this strategy to succeed, as seen in the Ebro river basin.
Coordinating public policies	The simultaneous development of the energy, the agro food industry as well as urbanisation and the expansion of the manufacturing industry have been possible within the capacity of the limited water resources available in the Ebro river basin. The agreed commitments of the international Mekong agreement have been a central element in the National Development Plan of the Lao PDR and have contributed to the coherence between objectives in the different economic sectors and the general

	objectives of water policy.
Stakeholder engagement and public participation	Active participatory mechanisms have contributed to the design of water management plans in the Ebro River, are being used in Laos and are an integral part in the management of water at local scales in Korea.
Establishing collective responses to scarcity and risk	The Water Framework Directive and the Mekong Agreement are promising examples of collective responses that have served to develop systematic efforts at a national and local level to respond to water challenges.
Monitoring progress and compliance	The acquisition of technical skills, the development of information systems, the building up of reporting strategies, etc. are all elements that have contributed to the reputation and credibility of river basin authorities in the Ebro and in the case of Korea. The capacity of the Lao PDR to manage its own water challenges have given credibility to its commitments in the Mekong agreement and has allowed Laos, in spite of being a LDC, to improve its position with respect to other national partners.

Lesson learnt from the specific cases

The lessons learnt from planning experiences are the following:

Cases	Lessons learnt from implementation of planning processes
Laos	Water planning needs to be based on and accompanied by institutional development. It is important to foster water governance structures such as the **establishment of River Basin Authorities**. **Investment in the appropriate technical skills and the information technology** is essential for assessing the status and the potential of water resources for development, verifying the actual outcomes of water policy and for monitoring and enforcing the compliance of water regulations. Specific attention has to be given to **the development of participatory decision frameworks** and to favour stakeholders' engagement in the policy making process. **Focused efforts to improve the ability of stakeholders to manage information**, compare complex water management options and also to agree on the objectives and instruments of water management are paying off. **Fostering transparency** of water allocation decisions and the gradual replacement of discretional decisions by rules and the application of norms

	is proving key to the avoidance of conflicts. **Improving reporting and communication skills** can foster the ability of water management to fulfil international agreements in the framework of the Mekong river agreement.
Korea	**Establishing clear objectives**: The Four Major Rivers Restoration Project of South Korea is to restore the Han River, Nakdong River, Geum River and Yeongsan River in order to provide water security, flood control and ecosystem vitality. It has five key objectives: 1) securing abundant water resources against water scarcity; 2) implementing comprehensive flood control; 3) improving water quality and restoring ecosystems; 4) creation of multipurpose spaces for local residents; 5) regional development centred on rivers. More than 929 km of national streams will be restored as part of the Four Major River Restoration Project. **Linking it with national policy:** This project was first announced as part of the "Green New Deal" policy launched in January 2009. It was later included in Korea's five-year national plan released in July 2009. **Coordination of sectoral Ministries**: The Four Major Rivers Restoration Project systematically approaches its objectives of restoring the rivers. As a comprehensive public project, the program includes a variety of plans submitted by several ministries, but coordinated by the Office of National River Restoration under the Ministry of Land, Transport and Maritime Affairs. The overall project consists of three sets of projects: 1) Main projects: the Han, Nakdong, Geum and Yeongsan rivers revitalization projects; 2) projects on the 14 tributaries of the four major rivers; 3) refurbishment for other smaller-sized streams.
Spain (The Ebro River Basin Management Plan	**Establishing social development objectives**: The Ebro Water Plan is a social opportunity to build a system of water management which is ethical, efficient and sustainable within the Ebro River Basin in Spain. Under the principles of Integrated Water Resources Management it includes ambitious environmental objectives (at least 85% of river water bodies will achieve good status by 2015), and also contributes to sustainable growth, strengthening the agro-food complex in the Ebro valley and the role of water as an energy source in a future which relies on energy from mostly renewable sources, and encourages the inclusion of new uses of water, such as recreational uses. **Implementing key measures**: The commitment to reduce pollution and the efforts to increase water efficiency are cornerstones of a process contributing to green growth. In particular, **technologies for modernisation of irrigation** in Ebro basin are necessary for efficient water management and the reduction of diffuse pollution, whilst simultaneously facilitating higher productivity. On the other hand, reducing pollution from point sources implies the creation of many **green jobs**. All in all, 56% of all the investments considered in the Ebro Water Plan are to improve water environmental status.

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The Four Major Rivers Restoration Project

Yoon Jung Cha, Myung-Pil Shim, and Seung Kyum Kim, Office of National River Restoration

Type of tool: water planning
Issue: watersheds
Location: South Korea, Asia

Challenges

The project is designed to address the significant environmental challenges faced by the Han, Nakdong, Geum and Yeongsan rivers in Korea. Repeated flooding and droughts have caused human casualties, ecosystem loss and habitat degradation, property damage and forced displacement of riverine residents. Extreme weather events that lead to flooding and droughts are expected to worsen in frequency and intensity due to climate change impacts. In the case of the Yeongsan River, toxic contamination from domestic and industrial waste disposal has resulted in water quality levels unfit even for agriculture and industrial use. These environmental challenges have dramatic economic consequences.

In Korea, cases of torrential rainfall over 100 mm in a day have increased by 1.7 times during the last 10 years. In 2002, Typhoon Rusa brought record-breaking rainfall of 870 mm a day in Korea. Moreover, torrential rainfall is expected to increase by 2.7 times and droughts are expected to become 3.4 times more frequent in the near future.

The annual average precipitation of Korea is 40% greater than the world average. However, the amount of water available per capita in a year is only about 12% greater, because two-thirds of the annual rainfall occurs during the rainy season from June to September, and almost no rain occurs in the dry season. As a result, disasters caused by repeated floods and droughts used to be commonplace. In addition, the river reaches in Korea are relatively short and channel slopes are steep. Therefore, flooding occurs quickly, peak flood discharges are great, and flow variations are comparatively large.

Objectives

The goal of the Four Major Rivers Restoration Project of South Korea is to restore the Han, Nakdong, Geum and Yeongsan Rivers and to provide water security, flood control and ecosystem vitality. The project will prevent natural disasters such as floods and droughts, protect the environment and promote historical and cultural tourism. The project will result in the creation of many new jobs, furthering economic growth and broadening the horizon of Korea's green growth initiative.

The Four Major River Restoration Project consists of three sets of projects: (1) Main projects – the Han, Nakdong, Geum and Yeongsan rivers revitalisation projects; (2) projects on the 14 tributaries of the four major rivers; and (3) refurbishment for other smaller-sized streams. The project has five key objectives: (1) securing abundant water resources against water scarcity; (2) implementing comprehensive flood control; (3) improving water quality and restoring ecosystems; (4) creation of multipurpose spaces for local residents; and 5) regional development centred on rivers.

This project was first announced as part of the "Green New Deal" policy launched in January 2009. It was later included in Korea's five-year national plan released in July 2009. The Four

Major Rivers Restoration Project systematically approaches its objectives of restoring the rivers. As a comprehensive public project, the programme includes a variety of plans submitted by several ministries, but coordinated by the Office of National River Restoration under the Ministry of Land, Transport and Maritime Affairs.

Drivers of change and project initiation

The Four Major Rivers Restoration Project is a comprehensive, pan-governmental project, representing the planning commitment of several Korean governmental ministries to work together to restore the Han, Nakdong, Geum and Yeongsan rivers.

The roles of each Ministry in subsequent projects are as follows:

- The Ministry of Land, Transport and Maritime Affairs: Restoration of the four rivers and local tributaries
- The Ministry of Culture, Sports and Tourism: The "Rivers of Culture" project
- The Ministry of Knowledge Economy & Korea Communications Commission: Production of new and renewable energy and information technologies
- The Ministry for Food, Agriculture, Forestry and Fisheries: The "City of Beautiful Scenery" project, known in Korean as "Geum-Su-Gang-Chon," and maintenance of forests in the upstream watersheds of the four rivers
- The Ministry of Public Administration and Security: Restoration of small branch streams flowing into the four rivers.

At the level of planning and even during project implementation, the government set expert advisory groups from seven different fields: senior committee meeting, policy advisory meeting, water resources, water quality, ecology and environment, landscape, culture and tourism, and local development. The advisory groups consist of professors, specialists, academics, and local representatives. In addition to the operation of the expert advisory group, the government gathers NGOs such as religious groups, environment groups, local citizens associations, etc. on a regular basis to discuss and gauge opinions.

From these participatory processes, twelve cities and provinces submitted 836 recommendations worth 98.3 trillion KRW. 213 river-related cases worth 6.9 trillion KRW that were coherent with the master plan were incorporated into the Four Major Rivers Restoration Project at the beginning. Examples are dredging sediments, fortifying existing levees, and restoring ecological rivers.

The government has taken the following steps toward implementation:

1) Dec. 2008. The Project was commenced at the Presidential Committee on Regional Development as part of the "Green New Deal Project." A master plan was drafted by the Korea Institute of Construction Technology and the Korea Culture and Tourism Institute. The first projects were launched: December 2008 in Andong and Naju, February 2009 in Chungju, and March 2009 in Busan.

2) Feb. 2009. The Ministry of Land, Transport and Maritime Affairs established a joint task force comprised of several ministries to supervise the restoration as a comprehensive pan-governmental project. The Project has since developed as follows:

- In April 2009, the task force, which had operated at the directorate level, became the Office of National River Restoration at the ministerial level to improve relations and communications among the participating ministries.

- The Association for Government Support at the Office of the Prime Minister began operations, along with the Local Government Association of the Four Rivers, which collects input from local communities.

3) April 2009. A joint briefing was convened with three committees and the four participating ministries and government agencies.

4) May 2009. A series of regional conferences and forums were held with public officials, experts and distinguished guests.

5) June 2009. The Master Plan for the Four Major Rivers Restoration Project was published.

6) Dec. 2009. Ground-breaking ceremonies were held.

The approach: how the Four Major Rivers Restoration Project addresses the challenges

The Four Major Rivers Restoration Project comprises the following activities to achieve its five objectives:

- *Water storage.* The project will aim to secure sufficient water quantities by building waterways and 16 weirs. These 16 weirs are expected to secure 800 million cubic metres of water. The project will increase peak water levels of 96 agricultural reservoirs so as to secure 250 million cubic metres of water. Additionally, the construction of three small and medium size multipurpose dams is expected to yield another 250 million cubic metres of water. These infrastructures will enable the storage of water needed during the dry season. By dredging riverbeds, the flood water level will decrease, and the water flow capacity will increase significantly. This will significantly reduce annual floods and the damage they cause.

- *Flood control.* Flood control measures involve an expansion of the water gates of tributaries, allowing a quick water level decline and fast draining of flood. In addition, two flood-control areas and three underflow areas of riversides will together expand the flood control capacity up to 920 million cubic metres of water.

- *Water quality and ecological restoration.* By 2012, the water quality of the mainstream will be improved to an average of level two (Biochemical Oxygen Demand less than 3ppm) by expanding sewage treatment facilities and establishing green algae reduction facilities. Moreover, the ministry is trying to restore ecological rivers, create wetlands, and relocate farmlands in the rivers to rehabilitate the river ecosystem.

- *Creation of multipurpose spaces for local residents.* To create the riverfront as a multipurpose area for improving lifestyle, leisure, tourism, cultural activities, and green growth, bicycle lanes (1,728km) will be developed, hands-on tour programmes will be promoted, and walkways and sports facilities will be expanded.

- *River-oriented community development.* The project will also contribute to regional development through various plans that utilise the infrastructure planned in the project and the scenery. The examples are 'our major rivers that flow with culture' of the Ministry of Culture, Sports, and Tourism, and 'Creating a vivid land of beautiful scenery' of the Ministry for Food, Agriculture, Forestry, and Fisheries.

The implementation of the project follows three phases. In phase 1, approximately KRW 16.9 trillion will be spent on the 'main project' dredging operations, and building dams and reservoirs on the four major rivers. Most of the main projects are planned to be completed by 2011; projects for dams and reservoirs for irrigation will be completed by 2012. In phase 2, another KRW 5.3 trillion will be invested on improving water flow and sewage systems of tributaries. Projects for the development of Sumjin River and other tributaries to the four rivers would be completed by 2012. Phase 3 includes restoring local and small rivers, and developing cultural and tourism attractions around the four major rivers. The Ministry of Culture, Sports and Tourism is involved in this phase.

The Office of National River Restoration under the Ministry of Land, Transport, and Maritime Affairs is the lead agency for the project. In the implementation of the project, the office will operate in cooperation with the Ministry of Culture, Sports and Tourism, the Ministry for Food, Agriculture, Forestry and Fisheries, the Ministry of Environment and the Ministry of Land, Transport and Maritime Affairs.

Assessing the environmental impact of the project

The Korean Government conducted an environmental impact assessment (EIA) of the Four Major River Restoration Project in order to assess the potential effects of the project and to devise response measures. The results of the EIA were announced on November 6, 2009.

The Environmental Impact Statement (EIS) was prepared by the Regional Construction Management Administration after collecting opinions from various stakeholders. The EIS includes the anticipated and assessed environmental impacts. The draft was shared with the local residents, environmental organisations, and relevant experts to gather diverse opinions for 20 days. The EIS was then submitted to the Regional Basic Environmental Offices, under the authority of the Ministry of Environment. To verify feasibilities of the EIS, Korea Environment Institute (KEI) and the Environmental Assessment Team comprised of independent experts were entrusted for review of the EIS. The final EIS agreement was set after the opinions of KEI were considered. The final EIS, agreed by the Regional Basic Environmental Offices and the Regional Construction Management Administration, covers four categories (ecosystem, natural environment, water quality, and others).

On ecosystems, the assessment identified around 68 legally designated protected species and natural treasures that may be affected by the Four Major River Restoration Project. The assessment concluded that direct impacts would be minimal if mitigation measures are implemented. Measures planned include an adjustment and reduction of the intensity of the construction work during the winter time when migratory birds arrive. Small size habitats such as small rivers corridors and food places will be created to provide sanctuaries and places for laying eggs. In addition, green belts will be constructed to provide additional habitats for animals to live in a natural environment.

With regard to the natural environment, the assessment mainly addressed potential risks to wetlands that surround the four rivers. It was found that out of 100 wetland sites located in the project area, 54 wetlands may be directly or indirectly affected by the project. These 100 wetlands cover 12.5 per cent of the total area which will be affected by the project. Considering the ecological functions of the wetlands, the Korean Ministry of Environment decided to conserve wetlands that have high ecosystem value. Parts of the wetland areas that are likely to be affected are compensated for through the construction of man-made wetlands. As a result, after the four major rivers projects, a total of 84 alternative or new wetlands are expected to be created and ecological and environmental functions of the rivers are expected to be improved. In addition, lower river ways will be created with mild slopes of 1.5 ratio so as to lead to a natural creation of wetland areas after the completion of the projects.

Regarding water quality, Korea's National Institute of Environmental Research, which was entrusted with an assessment of water quality, concluded that water quality will generally be improved as a result of the project. It has been estimated that pollution from mud that may occur during the construction phase will not lead to weighted density (by standard of dry season) of more than 10 mg/litre. In the case that floating matters exceed 15 mg/litre, it is planned that the construction period and intensity will be adjusted and that additional pollution reduction facilities will be installed. As 570 million of cubic metres of dredged materials will result from the dredging of the rivers, there is a plan to create a sedimentation basin and a diversion waterway will be installed at the storage yards of the dredged material in order to prevent secondary water pollution. The Korean government is considering options for a differentiated use of the dredged material according to the grain size and the level of contamination.

The Korean Ministry of Environment has the responsibility to ensure follow-up and implementation of the conclusions of the IEA. In that process, the existing Environment Evaluation Board will be transformed into a Post-management Investigation Commission after a re-composition of its membership. The future Post-management Investigation Commission will be entrusted with monthly investigation, monitoring and inspection of the implementation of measures to mitigate identified environmental effects.

Main implementation barriers that were overcome

Political opposition was a major challenge faced by this project. The opposing political party utilised environmental groups and NGOs to voice opposition to the project. Continuous communication, education and public relations were the main tools used to overcome the barriers. More than often, opponents had wrong information about the project; providing the correct information with project briefing and data helped to gain understanding and acceptance. Establishing a project advisory group with regional citizens, professionals, and academics has provided a means to gather the views of stakeholders.

A dispute started to arise when environmental societies asserted that the rare wild plant 'Danyang aster helophyllus' only found around the Southern Han River was threatened with extinction because of project constructions. The ecoactivists have called for the closure of the project. The wild plant is classified as the 'Endangered Species Plant 2nd Grade', being the biennial plants of Asteraceae Class. However, the Office of National River Restoration officially announced on 2 May 2010 that there was no founded danger of extinction even for

'the Danyang aster helophyllus' (Danyang Ssukbujaengi) due to implementation of the project.

The Gangcheon Isle, Gangcheon-myeon, Yeoju-gun, Gyeonggi-do (province) is located inside of the construction area of 'the 6 Sector' of the Project. There is a plan to create a 'Nature Ecological Experience Park' with protected wild species including 'the Danyang aster helophyllus'. The government also announced an official plan for their preservation in all the habitats except the area that will be inevitably damaged in the creation of an artificial stream. This indicates that both government and constructors have environmental values, recognising the importance of protecting endangered species like 'the Danyang aster helophyllus'. The government and constructors designated the habitat bed as 'reservation area' so that with visible boundaries, damage from construction activities is minimised. Presently 'the Danyang aster helophyllus' is waiting mass proliferation due to the successful research for proliferation by the authorised institutes of 'Hwanghak Mount Arboretum', 'Pyeonggang Botanical Garden', 'the Botanical Garden of Shingu University', 'Danyang Technical Center of Agriculture', and a private farm in Danyang county (all the spots have the permissions from the Ministry of Environment under the Clause 14 of the Endangered Species Act). Provided that soil condition meets the standards level, this plant can grow well.

At the end of 2010, Buyeo County conducted a survey with approximately 12,000 residents to gather their views on the appropriateness of the project. The survey revealed that 70% voted in favour of the project. Also 70% answered that they were aware of the project, suggesting that those who knew about the project voted in favour of it. It seemed that the remaining 30% did not have appropriate information on the project.

Effective contribution expected or already delivered to green growth

The project seeks to achieve, by 2012, a 90 percent increase in water quality (BOD less than 3ppm) by expanding sewage treatment facilities and establishing green algae reduction facilities. In terms of adaptation strategies to climate change and sea level rise, federal and local governments are bound to maintain an adequate level of salinity concentration to protect drinking water supply and other water usages. In order to monitor water quality, Korea’s Ministry of Environment is expanding the existing Tele-Monitoring System (TMS) to 586 sewerage and waste water treatment facilities by the end of 2009. This includes 323 sewerage facilities, 58 waste water treatment facilities, and 205 operating sites.

On ecosystem restoration, an Eco-river Restoration Program (ERP) initiated in 2008 is being implemented in the context of the Four Major River Restoration Project. One of the ultimate goals of the program is to restore indigenous and endangered aquatic species and maintain the quality of water and ecosystems. The other national program to restore freshwater ecosystems is to develop an aquatic ecosystem-monitoring network. Since 2007, preliminary field surveys have been conducted at more than 540 locations. More than 929 km of national streams will be restored as part of the Four Major River Restoration Project. A follow-up project will be planned by 2010 to restore more than 10,000 km of local streams. More than 35 riparian wetlands will also be reconstructed. Riparian areas will be afforested or reforested, and will also be used for biomass production.

Finally, the project seeks to support regional economic development. This is pursued through the creation of multipurpose spaces for cultural and touristic activities near rivers which are expected to contribute to job creation and local economic revitalisation. Overall, it

is expected that the project will create 340,000 jobs and generate an estimated KRW 40 trillion of economic benefits.

- 340 thousand (340,000) jobs created by the project is calculated from the project as a whole including major projects by several ministries (MLTM, ME, MA, Etc). The number includes direct and indirect employment inducement effect. In addition, Korean government is expecting that there will be more new jobs created in leisure, tourism, cultural industries, etc by this project.

- The number is calculated based on the Construction Employment Induction Factor from the Bank of Korea (2006) which provides the most objective data.

- The Ministry of Land, Transport and Maritime Affairs, initially in the presentation of the master plan, estimated job creation in the whole industrial field to be 340,000 (Ministry of Land, Transport and Maritime Affairs: 231,142 / Ministry of Environment: 67,236 / Ministry of Agriculture: 40,098) with application of 'the coefficient of employment induction' (17.3 per 1000 million people) of 'Korea Bank'.

Evaluation of benefits already delivered

A typhoon in June proved the Four Rivers 'flood-proof'. It was predicted that this year's summer would have more frequent torrential rainfall with a larger amount of rain than average. As the first 'attack', the Typhoon Meari in June and the subsequent rainy season were enough to make those involved with the project tense and nervous. Paradoxically, this torrential rainfall became a good opportunity to demonstrate the effect of the project. From June 22 to 27, it rained a total national average of 207.7 mm. This is equivalent to 20 billion ton reaching 17% of annual rainfall. Despite the concerns about safety on the sites of the Four Rivers, damage turned out to be meagre. Particularly, the northern area of Gyeongbuk Province, Daejeon and some areas of Chungcheong region had no considerable damages. This is due to the effect of lowered flood level achieved from dredging.

The sites have already experienced lowered flood levels from dredging 420 million m^3 soils. According to a survey of Ministry of Land, overall water levels have been lowered: 2.55 m in Yeoju (the Han River), 3.5 m near Sangju (the Nakdong), 0.84 m in a vicinity of the Buyeo Weir, and 1.12 m near the Seungchon Weir of the Yeongsan River. The construction of weirs will be completed by late June or July, so the condition of flood prevention can be said to be improved. As for devastating flood damage, the safety level has been dramatically elevated. Before the typhoon and rainy season came, the sites were fully prepared. Cofferdams and construction roads were taken away. Meanwhile, riverbed maintenance structures (structures for preventing erosion of the riverbed) were completed to be installed. Waterfront parks under construction were accelerated in its final touch. By late June, dredged soils piled up on the terrace land of the river were moved outside of the riverside area in order to prevent them from crumbling and also to secure more space for water flow.

There have been significant economic benefits derived from the project due to job creation. According to the Ministry of Labour (at an employment policy inquiry commission, Press Center, Seoul, 30 June), an analysis shows employment effects to be equivalent to KRW 7.37 trillion from 2009 to 2010 for 2 years, creating job opportunities for 88,400 workers. Those were fewer amounts (11,852 – 11.8%) than the 10,252 released from the master plan of the

Ministry of Land. However, since the Four Major Rivers Restoration Project consists of complex processes including civil engineering, construction, landscape architecture and more technologies, the employment induction effect in other fields might compensate the gap. In addition, the Korean government is expecting that there will be more new jobs created in leisure, tourism, cultural industries, and so on, by this project.

We have been making the participation of local construction companies mandatory, and advising the clean allocation of constructions for the local subcontractors. This will ultimately provide support to local economies.

The Korean Government has identified several policy tools to maximise local development potential through the river restoration initiative. The Master Plan mandates that local companies should account for at least 40% of all joint ventures (with the exception of turn-key projects, which require 20% participation of local companies). Currently, 187 of 338 companies (55%) are implicated in the project. Specific lots have been consigned to the local government; as of March 2011, local governments are coordinating nearly a quarter of the lots associated with the project.

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Water planning in LAO PDR

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Type of tool: water planning
Issue: watersheds, industry, agriculture, cities
Location: Lao PDR, Asia

The challenge and aims: water and growth in LAO PDR

Although it still is one of the poorest countries in South East Asia, Lao People's Democratic Republic might actually be one of the most dynamic and rapidly transforming poor economies in the world. The economic reforms carried out since 1986 – when the transition from a centrally planned to a market economy started – represent in many ways the breaking free from the low income and poverty situation in which its rural and traditional society was trapped. The first decade of the new century was marked by rapid economic transformation with rates of economic growth that averaged 9% annually. In spite of rapid population growth that averaged 2.8% in the eighties and nineties, the economy was able to grow enough to improve the per capita gross national product in such a way that the real purchasing power parity per inhabitant in 2009 was more than four times that of 1970 while the population increased from 2.8 to 6.4 million in the same period[29]. These favourable trends and the current macroeconomic equilibrium make the prospect of becoming a middle income country before 2020 likely, as intended in the National Socio-Economic Development Plan.

Advances were not only significant in terms of the scale of the economic activity but also in some relevant aspects of human development. Life expectancy at birth improved from below 50 years in 1980 to more than 65 in 2010 and the average years of schooling more than doubled in the same time averaging 4.6 in 2010. When compared with other countries Lao PDR was ranked sixth in the list of countries showing greatest improvements in the 20 years since the Human Development Index making assessments.

Successful economic growth is behind the steady decline in poverty indices which, as measured by the Millennium Development Goals Assessment Criteria, passed from 46% to 33% between 1992 and 2002. While the number of those below the poverty line is diminishing and they are becoming less poor on average, economic growth is also increasing economic inequality and the share of the poorest quintile in national consumption also fell from 9.6 to 8 percent. Net enrolment rates in primary also rose from 58% of primary school-age children in 1991 to 84% in 2005, although progress in retaining students is still low at this level. Significant advances have been made in gender equality (the number of girls for 100 students rose from 77 to 86 in primary school between 1991 and 2006 and these advances are lower but still significant in secondary and higher education). Advances in the MDGs are completed with relevant improvements in child mortality, maternal health, steps

[29] These figures were obtained from using the Penn World Tables (Heston, A., Summers, R and Aten, B. (2011) Penn World Table Version 7.0. Center for International Comparisons of Production Income and Prices. University of Pennsylvania May.

against malaria, HIV and other diseases and the country is considered to be on a relatively safe track to reach the MDGs by 2015[30].

The challenges for water planning

The significant increase in the number of people with access to safe water, rising from 30% to 60% of the total population between 1990 and 2003, is associated with relevant reductions in the time required to meet basic water needs for many households, freeing time that is now available for education, child care and income earning activities with important benefits also in terms of gender equality. Apart from its undeniable relevance for the many concerned households, in a context of economic growth, these benefits lead to an increase in the labour supply and therefore the productive potential of the entire economy.

In addition to that, the increased coverage of improved sanitation facilities (from 11% to 45% between 1990 and 2003) means an effective reduction in water related diseases. This is association with significant improvements in the effectiveness of education, the productivity of labour and in life expectancy at birth which all contribute to increased and improved human capital, a crucial production factor in any growing economy.

Subsistence agriculture still accounts for nearly half of the gross domestic product and provides 80% of the employment as 69% of the population still live in rural areas. Nevertheless, low lands suitable for agriculture are relatively scarce in Laos (no more than 13% of the watershed, compared with 72% in Cambodia and 65% in Thailand) and without modern techniques and appropriate soil preparation, Laos' arable land is mostly suitable for rice cultivation. As a consequence, cropping still follows the natural supply of rain, being at its peak during the monsoon season and declining to less than 10% in the dry season. Food security is still heavily dependent on water supply. Improvements in health, water supply and sanitation, as well as some irrigation development, are responsible for the substantial reduction in rice shortages in most of the lowland cultivated areas of Laos. Rice pads also provide fish which is the other important protein source in rural Laos[31].

Growth in population and income levels leads to an increased demand of agricultural products that, without the development of competitive products to be exchanged in the international markets, can only be satisfied by increasing local production of food. This is possible with both the above mentioned improvements in human capital as well as the existence of abundant water resources. The increase in rice yields per hectare, due to mechanisation and irrigation development, has led to higher amounts of stubble available for grazing and feeding more pigs, chickens and ducks. In terms of growth and development, this productive transformation allows food production to increase, even when part of the rural workforce are migrating to expanding urban areas. It also serves to diversify the rural economy beyond traditional subsistence, allowing for the production of market and income earning goods and integrating the rural economy into the local and international economy.

[30] See Government of Lao PRD and the United Nations (2010) Millennium development Goals: Progress report Lao PRD 2008.

[31] See also: Nessbitt, H. Johnston, R. and Solien, M. (2004) Mekong River water: Will river flows meet future agriculture needs in the Lower Mekong Basin? In. Seng, V.; Craswell, E.; Fukay, S. and Fischer, K. Water in Agriculture. ACIAR Proceedings 116e.

Development also comes with and is supported by an increase in energy consumption. Although Laos has only developed about 4% of its potential for hydropower, it is already recognising the value of expanding power generation capacity and distribution networks in order to foster economic development both in rural and urban areas. It is estimated than 26 hydropower projects are under construction in the lower Mekong basin and at least 12 mainstream projects and 30 tributary dams are planned for the next 20 years, mostly in Lao PDR. Although hydropower is the main purpose, the water storage capacity that comes with it is important for promoting development in other critical areas and particularly for providing reliable water supply for new irrigation developments (covering between 100 to 300 thousand hectares in Laos in the next 20 years), providing flood control, aquaculture, and an opportunity to develop tourism.

The drivers of planning

Although access to water and sanitation services has been extended rapidly, further advances require reaching populations in upland regions and scattered rural areas. Providing these services in hard to reach areas where crop yields are often lower and more uncertain (due to poor soil and traditional practices) is still financially challenging, due to both provision costs and low capacity to pay in the receiving communities.

In the years to come, economic growth is expected to continue to be based on economic diversification, integration in the regional and international markets, and progressive advances in infrastructure and human capital development. Expanding populations with improved living standards will lead to the demand for agricultural products and electricity that will become the main driver of the transformation of the rural economy. In spite of its relative abundance, water development needs to consider the compatibility between the multiple uses of water. For example, hydropower might result in alterations of river flows and sediment balances with consequences for fishing, biodiversity, and the water supply for irrigation. The changes required to increase crop yields might also alter water quality with significant impacts on biodiversity. The expansion of agriculture and livestock in uplands might result in significant losses in forest and biodiversity with impacts on runoff and erosion.

All countries in the Mekong River basin are dynamic transition economies and compared with China in the upper basin, and Vietnam and Thailand in the lower basin, Laos is in the relatively early stages of water development. This means that development strategies need to be coordinated in order to avoid water conflicts and to guarantee the sustainability of social improvements. Laos provides at least 35% of the renewable water resources of the Mekong River basin and has well preserved water ecosystems whose services can be harnessed for economic development. But water development in Laos might have significant consequences for the water resources in Cambodia and Vietnam, particularly for their extended irrigation systems. Developments in Laos could potentially aggravate saline intrusion problems already present in the river delta, just as hydroelectric development in China has had impacts on the lower basin.

Main barriers to planning

The main barrier is the lack of institutional development, the limited information available and in general the short history of water governance in the country. All this makes reaching

the required consensus, involving relevant stakeholders, defining a set of measures, selecting projects, and implementing and monitoring them a difficult task.

The approach to water planning in Lao PDR and the green economy

Water management has played a crucial role in starting and sustaining growth as well as in the advances made so far in human development. The development of water resources represents a mix of opportunities and challenges for the transformation of the Lao PDR's economy. Water policy plays an essential role in a progressive economic development strategy with already proven benefits in terms of poverty reduction, gender, and equity. Despite the multiple challenges faced, a development strategy based on an integrated water resource management framework has the potential to make the transition of the economy compatible with conservation of the water resources. Water planning requires the development of an institutional framework and the social and technical capacity to implement development strategies agreed on through a participatory and transparent decision-making process. The building of these institutional abilities is already in progress.

Water development can make a real contribution to economic growth and socio-economic development in the whole river basin, but decisions need to be coordinated to avoid conflicts between competing water development priorities both at a national level, between water users, and at an international level. Coordination is also required to guarantee the welfare gains of economic development are preserved in the long term.

The Agreement for Cooperation

By subscribing to the Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin in 1995, the governments of Cambodia, Laos, Thailand and Vietnam agreed to jointly manage the basin's water resources and to coordinate decisions concerning the use of these resources for economic development. The Mekong River Commission (MRC) was formed for this purpose and in 1996 China and Myanmar became dialogue partners of the agreement and they are now working together within a common cooperation framework.

Developing a shared understanding of the opportunities and risks: creating a shared strategy and defining priorities and objectives

For the first time since the Mekong agreement was signed in 1995, the member countries have developed a shared understanding of the opportunities and risks of the national plans for water resources development and agreed in 2010 on an integrated water resource management based basin development strategy for the Lower Mekong basin. This strategy is based, first on the identification of a set of "strategic priorities to optimise the development opportunities and minimise uncertainty and risks associated with them"; second on the agreement on the "urgent priority to develop and agree on basin-wide environmental and social objectives and baseline indicators, against which to apply future developments"; and third on the understanding of the "critical importance of strengthened basin management and in particular a strong programme of institutional, technical, organisational and human resource capacity building for sustainable basin development"[32].

[32] See Mekong River Commission (2010) IWRM Based Basin Development Strategy for the Lower Mekong Basin.

Coordination of national water development

Provided the institutional framework is already in place, international cooperation can be a powerful instrument to coordinate national water development, transforming potential conflicts into mutually beneficial agreements. Advances have also been made in translating river basin priorities to national basin development plans[33] and in particular, for the case of Laos, to integrate them into the economic development strategies[34].

Water planning at the basin level enables an assessment of the costs and benefits of the different development options from a social perspective, rather than only on the basis of private and individual interest. Some examples in the Mekong River show how, for example, existing and planned hydropower development in the upper basin in China can be adapted to provide sufficient dry season flows to meet all consumptive demands in the lower basin as projected in the national development plans for the next 20 years while maintaining the baseline water flows.

Establishing an IWRM approach

Besides the VII NESDP, some other National Policies and Strategies should be taken into account, such as the National Water Resources Policy and the Strategy and Action Plan. The main objectives and challenges were agreed to be the following:

- Institutional strengthening and cooperation
- Legislative and detailed strategies
- River basin and sub-basin water resource planning
- Data collections and analysis
- Water allocation
- Protection of water quality and natural health
- Management of water resources risk
- Financial aspect of water resource management
- Awareness, participation and capacity building

Considering all potential benefits and costs of different development alternatives

Water planning at the river basin level allows for the consideration of all the potential benefits of hydropower development, for example, fishery or tourism potential in the reservoirs and the reduction of flood damage and salinity intrusion downstream. However, costs and environmental impacts also need to be recognised, in particular when these impacts are unavoidable and irreversible. Hydropower development, for example, can result

[33] See Mekong River commission (2011) Planning for BDP 2011-2015 Bridging Period.
[34] See: Lao People's democratic Republic. Ministry of Planning and Investment (2011) The Seventh Natonal Socio-Economic Development Plan (2011-2015).

in changes in sediment flows causing irreversible river bed incision and bank erosion with some predictable impacts such as wetlands losses, impaired agricultural productivities, reduced potential of freshwater fisheries and potential impacts on marine fisheries depending on the river's nutrients loads. Understanding all costs and benefits and the associated risks of different development options is essential for agreeing on which options to adopt, the distribution of the costs and benefits, and the necessary measures to compensate or mitigate potential damages and minimise the risks[35].

Creating institutional capacity and generating hydrological information

Institutional capacity development is critical in all member countries for the effective implementation of surface and groundwater monitoring, water use permitting, compliance assurance of permit conditions and regulations, and maintaining a water information system. Most of the procedures to be implemented have been developed and adopted in the framework of the Mekong River Committee and others are under study.

Engaging and coordinating national public actors

A number of government bodies are involved in water resources management in some way:

- The Lao National Mekong Committee (LNMC): responsible for coordination with the Mekong River Commission and for supervising the planning and the management of river basins in Lao PDR consistent with the Mekong Agreement and its plans and strategies. It works as the national water resources apex body.

- The Ministry of Agriculture and Forestry (MAF): deals with issues related to cultivation, irrigation, livestock, fisheries and forestry.

- Ministry of Communication, Transport, Post and Construction: responsible for urban water supplies and inland waterways.

- The Ministry of Energy and Mines: responsible for electricity, hydropower and mining.

- The Ministry of Health: responsible for safe drinking water.

- The Prime Minister's Office.

- The Science Technology and Environment Agency (STEA)

- The Water Resources and Environment Administration (WREA), including a Department of Water Resources, Department of Meteorology and Hydrology and environment responsibilities. It has a mandate for management of water resources, the environment, meteorology and hydrological activities throughout the country.

- The National Tourism Authority

Lao PDR has the following levels of administration:

[35] See Mekong River Commission (2010) Assessment of Basin Wide Development Scenarios. Technical Note 13: Economic Benefits and Costs.

- The National Government
- 16 Provinces and Vientiane Municipality
- 142 districts
- About 11,400 villages

Creation of River Basin Committees

One of the most important aspects of this scheme is that a body of 17 Provincial Water and Environment Offices are represented. These Provincial organisations will work in close cooperation with the River Basin Committees (RBCs). As a matter of fact, WREA works mainly as the technical support organisation for the RBCs. The RBC is a non-permanent organisation. It has a mandate to act as a water resources executive in the river basin under the direction of the Lao National Mekong Committee for the management, development, conservation, rehabilitation and utilisation of water resources in the river basin area.

The RBC will be chaired by a Provincial Governor, elected on a five-year basis by the Riparian provinces, along with a supporting Secretariat. The Secretariat acts as a technical advisory body to assist the RBC in facilitating and monitoring all its activities. The RBC consists of government and individual representatives and other related sectors who are nominated by the Prime Minister of Lao PDR based on the proposal of the Prime Minister's Office, the Head of the WREA. The chairperson takes initial action based on the agreement of provincial river basin representatives.

The very first RBC was the Nam Ngum River Basin Committee. The NNRBC was established by the Prime Minister's Decree 293 on June 15th, 2010 as the first of several such organisations in the country. The importance of this particular RBC is strategic because it was the first IWRM plan and will serve as template for River Basin Committees elsewhere in the Lao PDR.

The following main objectives and plans for the future of the NNRBC have the highest importance for the future of water management in the country:

Task 1: Building the capacity to manage the NNRBC

Task 2: Encouraging sustainable water use

Task 3: Optimising hydropower outcomes

Task 4: Developing the sustainable potential of the basin

Task 5: River sub-basin management

Task 6: Reducing risks and impacts from water related disasters

The main tasks for the NNRBC are clearly closely related to the goals of the VII NSEDP.

Developing the legal framework

The main legal documents are the following:

- Decree on the Establishment and Activities of Water Resources and Environment Administration, No. 149/PM, dated May, 10th, 2007.
- Decree on the Establishment and Activities of Lao National Mekong Committee, No. 197/PM.
- Decree on the Establishment and Activities of the River Basin Committees, N° 293/PM, dated 15 June 2010.

The last of the aforementioned Decrees, Decree 293, puts into place an intergovernmental and multi-sectoral body to sustainably manage the priority river basins and sub-basins of the country. The Decree is a significant milestone for implementing several water resource management programmes and projects in Lao PDR.

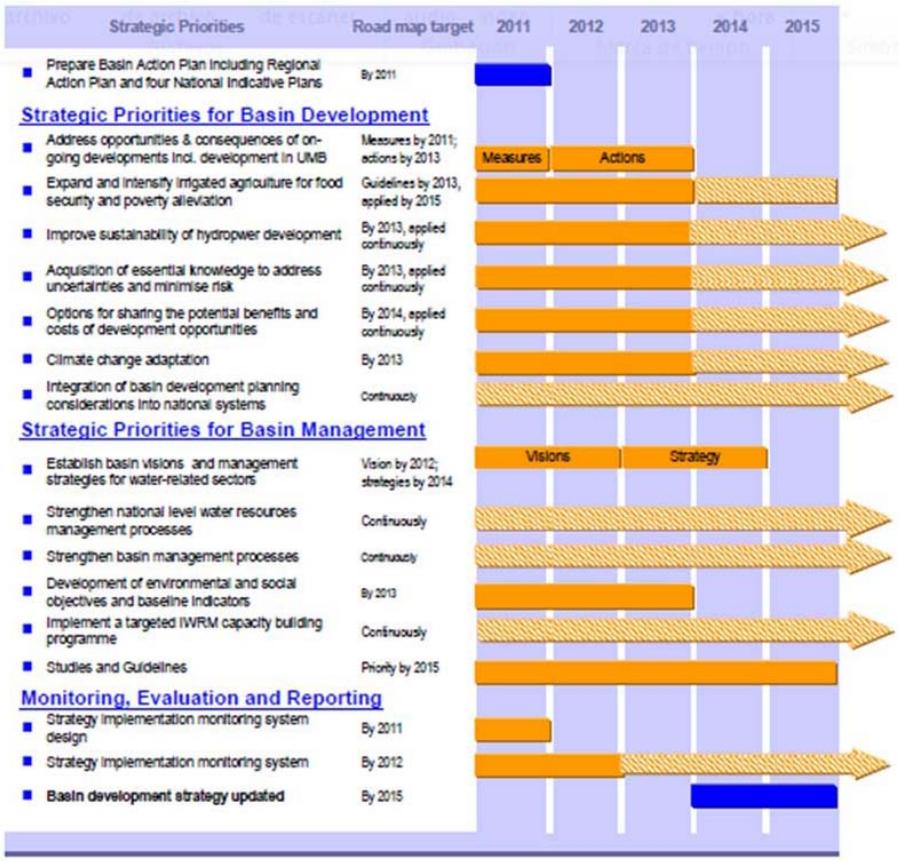
Decree 293 outlines the responsibilities, duties, jurisdictions, organisational structure and working methodology of the River Basin Committee to promote water resource management through systematic planning and implementation. The objective of the RBC is the achievement of the following goals:

- Supply sustainable water resources to water sectors through systematic planning and implementation
- Reduce socio-economic and environmental impact from water related disasters
- Manage water quality in the country
- Improve livelihoods
- Contribute to the national socio-economic development plan

Agreeing on a roadmap and ensuring national ownership

The whole strategy is outlined on a road map which guides its implementation until the end of 2015. The strategy is owned and implemented by each member country.

The Road Map of IWRM: 2011-2015



Evaluation

Considerable progress has been made so far in the development of an institutional framework for water planning. These advances are more evident at an international level and they provide the basis for developing water planning institutions at national and local levels.

The Nam Ngum River is a main tributary to the Mekong River in the Lao PDR. The area of its basin is 16,841 km^2 (7% of the country) with a population of some 550,000 people (8% of the country). With a rainfall of 2,200 mm per year and a discharge of 22,000 million m^3 per year, the basin contributes 14% of the flow of the Mekong River at the confluence, and 5% of the total discharge to the sea.

The benefits of a functional RBC to coordinate the many agencies and levels of government became clear during the preparation of the Nam Ngum River Basin Development Sector Project (2004-2010). This project developed the approach and capacity for river basin management including the development of a comprehensive knowledge base, the preparation of a basin development plan, and the generation of human skills and capacity.

The NNRBC now operates under the umbrella of the Lao National Mekong Committee for national water resources management as well as in compliance with the Mekong Basin Agreement and in collaboration with the Mekong River Commission.

Main lessons learnt

The approach	Lessons learnt from implementation
Reaching a social agreement on the desired balance between water use and water resource conservation	Adopting a set of international commitments regarding the environmental status of the Mekong River Basin in Laos has been a central element of the coordination of water planning with national development policies.
Harnessing development opportunities and coping with water and development challenges	Water policy has been the cornerstone in Laos' success regarding the Millennium Development Goals and in the ongoing transition from a rural to an urban economy.
Building governance and institutional capabilities	An ambitious programme of building water governance structures is already in place in Laos. Transparency, regulation and enforcement, and building technical competences are key elements for this strategy to succeed.
Coordinating public policies	The agreed commitments of the international Mekong agreement have been a central element in the National Development Plan of the Lao PDR and have contributed to the coherence between objectives in the different economic sectors and the general objectives of water policy.
Stakeholder engagement and public participation	Active participatory mechanisms are being used in Lao PDR and are an integral part of water management at local scales throughout the whole country.
Monitoring progress and compliance	There have been advances in the acquisition of technical skills, the development of information systems and of reporting strategies. The capacity of the Lao PDR to manage its own water challenges have given credibility to its commitments in the Mekong agreement and has allowed Laos, in spite of being a least developed country, to improve its position with respect to other national partners.

Water planning towards a green economy in the Ebro River Basin

Manuel Omedas, Rogelio Galván, Carlos Mario Góme
Type of tool: water planning
Issue: watersheds
Location: Spain, Europe

The challenges for water planning and the green economy in the Ebro

Spain is a pioneering country for water management at a basin level. Since its foundation in 1926 as a partnership of private users and public authorities to promote and exploit common interest public works, the Hydrographical Confederation of the Ebro River Basin (CHE by its name in Spanish) was the first water authority created to coordinate water policy in a river basin in Spain. During the last century water and water management have played a central role in the process of economic development and particularly in transforming the pre-existing semiarid Ebro Valley and its influence area into a prosperous economy. Demography, agricultural expansion, energy and manufacturing development are all growth processes that cannot be properly understood without recognising the critical role played by water management.

The role of water management has gradually evolved through several stages. Its initial objective was to promote and coordinate the building and operation of water infrastructures to support productive transformation, initially based on the agricultural development. An intermediate stage saw water policy being used as an instrument to meet water demands stemming from economic growth. Today, the primary objective of water management is reconciling economic growth with the protection and improvement of the water resources which are critical to sustaining economic welfare in the long term. By focusing on the last two decades and ongoing innovative water planning processes, this case study illustrates the transition towards green water planning in the Ebro River basin.

Located in the North East of the Iberian Peninsula, the Ebro river basin covers 85,700 square kilometres (17.3% of the Spanish soil). The average rainfall of 622 mm/year is unevenly distributed both in time and space. The spatial distribution can vary from 3,800 mm/year up in the Pyrenees to just 100 mm/year down in the central river valley where the main economic activities are located. A Mediterranean river basin rainfall is variable through time and may range between 800 and 450 mm in wet and dry years.

Meeting the challenge of governing this uneven and uncertain supply of water lies at the heart of both the relative success and the current challenges of economic development in the Ebro River basin. To adapt the available water resources to the times, locations and quantities of services demanded by the economy, the Ebro has been gradually transformed into one of the most regulated river basins in the world. The 108 big dams built provide a storage capacity of 7,580 million cubic metres, equivalent to more than half of the average long-term renewable water supply of the river basin (estimated at 14,623 million cubic metres).

By building collective facilities to support the accumulation of capital in agriculture, manufacturing, energy and drinking water provision industries, water policy has played a role as an engine of growth in the region. Indeed the availability of water infrastructures has

so far been perceived as the critical factor underlying both the constraints and the opportunities of economic growth in the region.

The complex agro food system which gives the economy of the Ebro River basin its main competitive advantage now accounts for one fifth of the agrarian production and about one third of the meat supply in Spain. The decline in agriculture in the upper ranges of the Pyrenees is accompanied by the modernisation and transformation of agriculture in the lower valleys.

Irrigated agriculture, covering an area of 700,000 hectares in the valleys of the Ebro and its main tributaries, is the basis of the agro food system. Apart from the financial support provided in the past by the Common Agricultural Policy of the European Union, the market advantages are based on the availability of land, a relatively cheap labour supply, the proximity to markets in Spain and central Europe and also on the capacity of using crops as inputs for livestock activity in the upper river basin and the low Pyrenees. The viability, profitability and success of agriculture in the region relied on the development of water-related infrastructure for storage, transport, distribution and irrigation.

Water development has also played an essential role in the emergence of a highly competitive power generation sector in the river basin. Currently the basin produces about one third of the nuclear power of the country, it has one fifth of the installed capacity of hydropower of the country shared between 360 plants across the basin, and one tenth of the country's thermal generation capacity. This important contribution to the generation of electricity is based on a heavily engineered hydrological system, providing a convenient supply of stored and running water, turbinating 38,000 million cubic metres per year (four times the average water runoff in the basin) and using more than three thousand million cubic metres to refrigerate nuclear and thermal power plants.

Although the amount of water used in the manufacturing sector represents a minor fraction of the total water used in the basin, the sector depends on raw materials produced by the agricultural sector (for food production) and the local demand of inputs for that activity (agrochemicals, equipment, etc.). The Ebro valley is an industrial corridor and the sector provides almost 30% of the value added in the basin economy (compared with a contribution of less than 23% of the same sector to the entire Spanish economy).

Water development is also important factor influencing the dynamic of population trends in the basin, both directly through the provision of drinking water and sanitation, and indirectly through the development of employment and production opportunities as above mentioned. The Ebro River basin has only 34 inhabitants per square kilometre, less than one fifth of the average in the European Union and only two fifths of the Spanish population density. However, thanks in part to water development the Ebro valley has become an important settlement axis linking the rich industrial economies of the north of Spain, from the Basque Country to Catalonia, along an economic corridor.

The drivers of change

The collective success in making water an integral part of economic development in the Ebro River basin has been accompanied by the emergence of new problems, requiring changes to traditional water policy in order to cope with them. New challenges include the limited ability to cope with increasing water demand as the population and the size of the economy grow, the limited ability to meet these new demands with the traditional means of new infrastructures and subsidised water facilities, the difficulty of meeting competing demands from different sectors and reconciling these demands with the available supply of resources, and increased vulnerability to droughts as water withdrawals increase.

The emergence of new challenges is the main driver of the gradual transformation of water planning and policy in the basin, from the early focus on building water infrastructures, to meeting the needs of an expanding economy and population, to the introduction of integrated water management to ensure water use is compatible with the preservation of the ecosystems and the ongoing provision of services underpinning economic growth. It is in this context that the connection between this new kind of water planning and green growth can clearly be established. Before showing how water planning is coping with emergent water problems, the following insights about the interlinkages between water and economic growth in the Ebro River basin can illustrate the current challenges for water planning.

The consumptive use of water in the river basin each year already represents more than 34% of the average long term renewable resources of the basin (5 billion cubic metres of 14.6). According to the European Environmental Agency, the water Exploitation Index of the Ebro, although high when compared with other central European river basins, is lower than in other southern Spanish river basins, such as the Guadalquivir and the Segura where the water used every year exceeds 50% of the long term renewable resources and where, due to a competitive agricultural sector and higher water scarcity and drought vulnerability, water is perceived as more valuable than in the Ebro.

Apart from regional disagreements, water development is also a growing source of potential conflict between the different economic sectors and water users within the river basin. Although the figures mentioned in the previous paragraph indicate that available resources are sufficient to cover all the existing demands, water demand and supply vary in space and time and in fact deficits and vulnerabilities have increased over time. For example 200,000 out of the 700,000 potentially irrigable hectares (mainly in the right margin of the Ebro River) suffer from structural deficits meaning that their needs cannot be met in all years.

In the new European water policy framework, the main long-term objective of water policy is making the maintenance and expansion of economic uses of water compatible with the improvement and adequate protection of water providing ecosystems. Thanks to this development, the environmental objectives, which were already considered in the hydrological plans legislation of 1985, are not only more stringent and more precisely defined but are the dominant criterion to judge the success or failure of water policy in the years to come. The setup of the Water Framework Directive has allowed for a systematic analysis of the detrimental impacts caused by the pressures of the economy on water bodies. The prospective analysis of water use and its pressures and impacts resulted in the identification of surface and ground water bodies in risk of non-compliance with the good status requirements for the years 2015 and 2021.

The challenges for change

Motivated by the importance of promoting rural development, all public authorities are reluctant to give up ambitious plans for developing new irrigation areas, despite the lack of water regulation infrastructures and decreased guarantee of supply. The number of projects approved or under study for the years to come is still considerable and new provisions are required to coordinate this effort with the existing water resources and the other actions required in order to make them viable in economic and financial terms (see CHE, 2008 EPTI, p. 92).

Given the priority given by national policy to drinking water, the irrigated sector supports the risk associated with the variability of water supply in the river basin. Although the average long-term resources are about 14.6 cubic kilometres per year, they may range from 24 on wet years to only 8.4 cubic kilometres during meteorological droughts. In spite of the stabilising effect of the 7.6 cubic kilometres of storage capacity, the expansion of the agricultural sector is associated with an increasing insecurity in the water supply which affects the profitability of existing and new irrigation developments. This has contributed a shift in focus from increasing irrigation capacity to growing concerns over the guarantee of supply.

Meeting the increasing demand for water means diverting greater amounts of the resource, resulting in a reduction in river flows and in the water effectively stored in the system. Aside from the environmental impacts, this represents another source of potential conflict as there is less water available for non-consumptive uses (particularly for the more than 360 hydropower plants along the river network). In fact due reduced water availability, the hydropower system delivers a volume of energy every year which falls short of its installed capacity (no more than 50% even in rainy years and falling to only 11% in dry years). These stylised facts show the importance of coordinating the investments in infrastructure in the different sectors such as irrigation and hydropower as well as the potential gains from improving the conservation of water resources.

An analysis of the factors driving water demand in the river basin shows, in the business-as-usual scenario, a trend towards a significant increase in water demand for drinking water (fostered by population growth, better living standards and urban growth), irrigation water (from new developments despite the considerable gains from current programmes for modernising and improving irrigation technology) and for power generation (from existing hydropower and thermal projects). Without actions to reduce water demand or improve water use efficiency, these new developments are generally feasible within the range of the existing resources nor compatible with the improvement of the ecological status of the water bodies in the basin.

All the above mentioned factors are also associated with an increased risk of hydrological droughts (distinct from meteorological droughts which are associated with natural causes, these refer to the ability of the system, given a natural rainfall, to cope with existing water demands). Furthermore, simulation and statistical models shows some evidence of a likely reduction in water runoff attributable to climate change. A reduction of 5% flow in the Ebro River basin is projected by 2027, based on studies carried out by CEDEX on assessing the potential impact of climate change on water resources. The combination of increased

scarcity, higher drought risk and uncertain supply due to climate change is a powerful argument for prioritising water resilience and security in the water policy agenda.

The planning approach for transitioning to a green economy in the Ebro River basin

Water planning has played a key role in the productive transformation and economic development in the Ebro River basin. The perceived role of water planning has changed through time as new challenges have emerged. The transition towards integrated water resource management in the last decades shows how water planning can make a real contribution to sustainable development and green growth. Water planning has responded to the aforementioned challenges in many different ways that can be summarised as follows:

The setting of an institutional framework for transparent stakeholder involvement and public participation

There has been a long tradition of public participation in the Ebro basin since the foundation of the Hydrographic Confederacy of the Ebro: regions, municipalities, central government agencies and civil society are represented in several participatory bodies of the Ebro Water Authority and take part in the decision making process.

The Water Framework Directive has demanded even more active public participation. An extensive public participation network was created reaching all the sub-basins in the river basin. This network has proven successful in providing a forum to share information and fostering a common understanding of water challenges and measures to be taken. Public participation has also provided a means to pursue the coherence of water policy with other public policies (e.g. land use, urban and rural development, energy). Public participation is a learning-by-doing process and substantial advances are expected as information and skills improve over time.

Public participation is also a proven institutional framework for agreeing on practical, observable and enforceable environmental objectives. This has been demonstrated in the Ebro River basin, for example through the setting of targets for the status of water bodies and minimum flows, as well as drought indicators. Since 1998 thousands of initiatives (public and private projects) have been studied by the river basin authority in order to determine their compatibility with the environmental objectives of the river basin management plan.

Establishing ambitious environmental objectives

In the Ebro River basin, the institutional decision has been made to give primary importance to the environmental objectives of water planning. This has resulted in the setting of precise environmental objectives in terms of the quality of water bodies. It is against these objectives that competing demands of water users and other stakeholders must be accommodated. Once these objectives are set, they become the criteria that the water authority adopts to allow new water uses.

The new water policy framework allows for the actions and measures that guarantee the achievement of environmental objectives and that generate minimum economic losses (i.e. cost effective analysis used to choose the set of measures in the river basin management

plan) or maximum welfare gains (e.g. from more efficient water provisioning systems or alternative water supply sources).

So far the still ongoing public consultation is addressing the objective of achieving good status in 85% of the water bodies by 2015. By comparing information on the current status of water flows with that of the natural conditions, an agreement is expected to be reached on the minimum environmental flows needed to be maintained in the different rivers. This agreement must consider the uses affected by minimum flows and the potential benefits of improving the habitat conditions. The minimum environmental flows decided upon will be verifiable and enforceable through the monitoring network of gauging stations.

The allocation of water resources needs to be balanced in such a way that by 2015, total water consumption will not exceed 34% of the long term available resources.

Creating opportunities for productive uses whilst respecting environmental standards

Water policy is an instrument to advance sustainable development. In the Ebro basin, water has a particularly important role in strengthening the agro food complex, as a source of renewable energy, and increasingly for new uses such as recreation and tourism services.

Without discarding current plans to expand water using activities (such as existing urban or irrigation developments) the plan conditions their implementation to the proven existence of available resources. This way the emphasis is placed on an ambitious programme to modernise the irrigation systems as a necessary condition for increasing water efficiency and reducing diffuse pollution.

Building a strategy to manage uncertainty including drought management and flood control

So far the institutional response to drought has been reactive and usually late reactive actions. Recent institutional changes have been aimed at replacing unplanned emergency management responses with new anticipated, preventive and planned responses.

The Special Action Plan in Situations of Alert and Temporary Drought for the Ebro Basin has been approved and incorporated as an integral part of the river basin management plan. The drought contingency plan defines a set of observable indicators to classify the drought situation (as normal, pre-alert, alert and emergency) and outlines a clear set of actions to be taken in each case, including the reduction of water use rights. The replacement of discretion by decision rules is considered a positive step forward in water governance.

The identification, assessment and selection of projects to restore the water environment

The water planning process for the Ebro River basin has contributed to the selection of a combination of projects aimed at restoring the water environment. They include an ambitious programme for water quality improvement through a mix of effluents treatment and water reuse projects combined with a zero tolerance programme to monitor and control pollution discharges.

A set of water saving measures have also been identified, combining intake, transport, treatment, distribution and efficiency projects throughout the entire river basin. These programmes are accompanied by a set of projects focused on the restoration of rivers and river banks, the recovery of wetlands, the restoration of sediment balances and hydrological regimes, the removal of polluted sediments, the control of invasive species and other measures aimed at improving the ecological status of the river basin ecosystem.

The twelve key elements of the Ebro River Basin Management Plan 2010-2015

- **A social opportunity** to build a management system that is ethical, efficient and sustainable within the whole framework of the basin, creating a symbolic reference point for the Ebro.

- **Integrated management**, under innovative principles of public participation and a historical cooperative model that includes all stakeholders within the shared authority of the watershed organisation.

- **Ambitious environmental objectives**. At least 85.3% of river water bodies will attain good status by 2015.

- **A firm commitment to reducing pollution**, both from diffuse agricultural sources and other sources, such as urban centres and industry.

- **A proposal for realistic environmental flow regimes**, set for the main gauging stations, allowing habitat conditions according to prescribed methodologies. These should be enforceable and verifiable.

- **Sustainable development** that contributes to strengthening the agro-food complex in the Ebro valley, strengthens the role of water as an energy source in a future which relies on energy from mostly renewable sources, and encourages the inclusion of new water uses, such as recreational uses.

- **The modernisation of irrigation** as a necessary action for efficient water management and the reduction of diffuse pollution.

- **Balanced allocation of resources**. By 2015, water consumption will be around 34% of the available natural water resources.

- **Participation** is the cornerstone, from start to finish and from bottom to top. The Water Council of the River Basin leads the project, but with a participatory network that reaches throughout all the sub-basins of the main basin.

- **A financial effort** shared by all administrative bodies.

- **A commitment to cost recovery** through the prism of socioeconomic territorial balance and targeted rural development programmes.

- **Vigilant and adaptive monitoring.** Implementation of extensive monitoring networks and procedures to verify the adoption of measures and achievement of objectives.

Evaluation: economic, social and environmental benefits

Social

Public participation has been particularly important for increasing understanding of the tradeoffs between the environmental, economic and social objectives that need to be considered in water policy. Water has been key rural development, for example by providing alternative development opportunities such as rural tourism. These ambitions sometimes conflict with the limited capacity of rural areas to finance their own water management projects or even to pay for the entire cost of the water services they receive. For this reason, with the support of public participation processes, the development of the river basin plan focused on identifying actions with the highest potential for promoting local development in sensitive rural areas. The planning process also assessed and identified low income areas where social objectives should be prioritised and exceptions to full cost recovery of water prices permitted.

Economic

Although significant progress has been made, the coordination of agricultural, land use, energy and other sector policies in the water policy framework is still to be achieved. Around 70% of the new irrigation areas proposed in the 1998-2008 planning period were carried out. Many irrigation expansion projects are still pending for implementation or under study, and some of them have been implemented but unable to achieve their objectives due to a lack of sufficient water resources. The importance of sustainable water management and environmental conservation is increasingly being recognised and accepted, in contrast to the sole promotion of local development.

Environmental

Significant advances have been made in controlling diffuse pollution, mainly through changes in agricultural practices and also through the management of pollution from scattered livestock in the upper reaches of the river basin. In 2008, already 74% of the water bodies assessed were of a good ecological status.

Lessons learnt

The approach	Lessons learnt from implementation
Reaching a social agreement on the desired balance between water use and water resource conservation	Setting the achievement of a good or fair ecological status of the water bodies as the main objective of River Basin Management Plans in the European Union has been an important element of water planning in the Ebro River basin in Spain and has helped make economic development compatible with environmental objectives.

Harnessing development opportunities and coping with water and development challenges	Water planning has played an essential role in the development of the agro food and energy complex that now represents a competitive advantage and a defining characteristic of the Ebro River basin in Spain.
Building governance and institutional capabilities	Transparency, regulation and enforcement, and building technical competences have been key to successfully building governance capabilities in the Ebro River basin.
Improving the information and analysis base	The Ebro River basin boasts an efficient hydrological information system open to stakeholders, researchers and private and public institutions.
Coordinating public policies	The simultaneous development of the energy, the agro food industry as well as urbanisation and the expansion of the manufacturing industry have been possible within the capacity of the limited water resources available in the Ebro river basin.
Stakeholder engagement and public participation	Active participatory mechanisms have contributed to the design of water management plans in the Ebro River basin.
Aligning private decisions with collectively agreed goals	There are clear regulations for water abstraction and quality requirements, a transparent playing field and indicative planning for private investments.
Establishing collective responses to scarcity and risk	The Water Framework Directive is a promising example of a collective response that has served to develop and coordinate efforts at a national and local level to respond to water challenges.
Monitoring progress and compliance	The acquisition of technical skills, the development of information systems, the building up of reporting strategies, etc. are all elements that have contributed to the reputation and credibility of river basin authorities in the Ebro basin.

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7. Water and the green economy in Latin America and the Caribbean: regional context and lessons learnt

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Regional context

Latin America and the Caribbean possesses about a third of the world's water resources. However, these resources are spread unevenly among and within countries. Many large urban centres and important economic activities are settled in arid or semi arid areas and water availability is increasingly reduced by intense use and or water pollution. Latin America is already the world's most urbanised developing region, with more than 80% of the population living in towns and cities, in many cases in precarious conditions, such as the 100 million people still living in slums.

Water management in Latin America and the Caribbean has evolved over time. Attention has shifted from the construction of large infrastructure projects for irrigation and hydroelectricity generation in the 50s and 60s to the provision of water supply and sanitation services in the 70s and 80s, to increasing emphasis on non-structural measures, water conservation, environmental management and pollution control in the 90s and 2000s, as the region started facing challenges of increasing water scarcity, pollution and climate change. The governments of the region have also recognised the importance the water sector can have in creating conditions for economic growth and in the alleviation of poverty.

The main issues facing the countries of the region in water management have not changed significantly in recent years. There has been a widespread inability to establish formal institutions that are able to deal with water allocation issues, extreme events and externalities (water pollution, aquifer depletion, etc.) under conditions of scarcity and conflict. The water sector still exhibits many examples of poor management; when formal norms exist, they are often inadequate to deal with the problems at hand and the operational capacity to implement them tends to be extremely limited. There is a general absence of self-financing and a consequent dependence on fluctuating political support. In general, there is an inability to respond to crises. Despite much improvement, reliable information is often missing, including on the resource itself, its availability and use, on the infrastructure, on institutional responsibilities and on future needs. Poor water management in the region means conflicts over the resource are still persistent and widespread. Issues over water allocation and competition amongst sectors – e.g. agriculture, industry, mining, urban water supply, water for environmental protection and indigenous groups – will increase significantly as economic development continues to augment. It is estimated that the region will keep on growing – regional growth is projected to exceed 4% for 2012. At the same time, Latin America and the Caribbean has the most inequitable income distribution in the world. Universal service coverage and resolution of environmental problems have been hampered by these inequalities.

Important efforts have been made to improve water supply and sanitation coverage. At the regional level the Millennium Development Goal to reduce by half the proportion of people without sustainable access to safe drinking water has been already met with few exceptions

(Haiti, Dominican Republic, Peru, Jamaica, etc.). However, service quality (intermittency, water quality control, etc.) is mediocre and infrastructure is often in bad condition, which is illustrated by high water losses that can reach up to 50-75%. Coverage in rural areas is much lower and those without drinking water and sanitation services are the most impoverished segments of society. Almost 40 million people still lack access to safe drinking water, while almost 120 million people do not have access to sanitation. And more than 70% of sewage is discharged into the nearest water bodies without any treatment causing alarming water pollution problems.

Agriculture is the main user of water in the region representing over 70% of the total water extractions in almost all countries. Currently, the region produces 31% of the global supply of bio-fuels and 48% of soybean. Tendencies show that agricultural production will keep on growing in most of the countries in Latin America resuming the expansion achieved between 2000 and 2007. Irrigation can play an important role in increasing agricultural yields. In many Latin America and the Caribbean countries, the levels of irrigation efficiency are in the range between 30% and 40%. Expansion of the area under irrigation has slowed down in many cases and an increasing urban population will add pressure to reallocate water from the agricultural sector to urban drinking water supply in cities.

Many parts of the region are highly vulnerable to the adverse consequences of climate change, and this could potentially threaten the progress made towards achieving the Millennium Development Goals. The expected effects of climate change will generate risks, challenges and opportunities for water management. The risks and challenges can be seen in the Andean countries which experience El Niño-Southern Oscillation (ENSO) and in the succession of long droughts in the northeast of Brazil. Moreover, the countries estimated to be in areas of high and extreme risk from global climate change are the poorest countries of the region in Central America, the Caribbean and the Andes. The most serious challenges arising from climate change for the management of water resources in Latin America and the Caribbean can be expected to lie in the following areas:

- A significant deterioration in the quality, quantity, and availability of water for all uses in many areas.
- Damage to coastal areas owing to a potential rise in sea levels, which in turn will affect river regimes.
- Increased economic damage from the greater intensity and frequency of hurricanes and tropical storms due to higher ocean surface and air temperatures

Challenges

The issues that water management in Latin America and the Caribbean has to confront do not all come from within the water 'box'. There have always been strong external drivers or forces affecting both water management and the water resource. The more significant of these come from general social change, but also include macroeconomic policies, often with a negative influence, stemming from abrupt changes in domestic policies and from outside, such as the international financial crisis of 2008-2009; but sometimes with positive effects as macroeconomic administration has improved domestically and globally, as with the expansion of world markets in recent years.

Water resources management often presents problems requiring a holistic approach. Among these the following are significant: coordination of supply and demand policies; policies for the quality and quantity of water resources; the joint use of surface and groundwater; the multiple use of resources and multi-purpose projects; coordinated management of land use, vegetation cover and water; management of externalities; improvements in data collection and information management; and environmental conservation policies.

In Latin America and the Caribbean, institutions are often weak, they lack operational capacity and rules are insufficient or not enforced. Fragile institutional frameworks and corruption, not only in the water sector, but in general have affected water management. The absence of appropriate water management institutions causes uncertainty, deepens conflicts over water and hampers economic development. Water provision and allocation needs clear rules, strong government institutions, transparency and a holistic approach which in most of the countries of the region are missing. There has been an effort to transit towards integrated water resource management as a framework for helping overcome these challenges; however, it often remains as a concept difficult to translate into reality.

Advances have been achieved both at the national level, through the implementation of new water management systems based on new legislation; and at the river basin level with watershed or river basin organisations, however these efforts have been isolated and had limited success. Over the last two decades, the water supply and sanitation sector has been subject to extensive reforms in the majority of the countries of the region. Unfortunately there have been few success stories, as in many cases reforms encountered difficulties or went astray due to the lack of consensus, capture by special interest groups, and especially failure to consider the structural limitations of national economies and sound principles of public utility regulation and economics of service provision. Lack of integrated planning has hindered advances in many countries. Public awareness and stakeholder participation are key to solving conflicts. Not involving communities in decision making has proved to have explosive effects (e.g. Cochabamba). Although the situation has improved over the years, it is in general still affecting the proper management of water resources in the Latin America and the Caribbean region.

Aging water infrastructure, insufficient investments and inadequate regulatory frameworks are at the heart of the challenges for the provision of drinking water and sanitation services. Tariffs should serve as a proper signal to water users, however they often do not reflect even operational and maintenance costs. Some countries, such as Chile, have implemented full cost recovery tariffs supported by subsidy systems for the poor; however this is not the case for many countries in Latin America and the Caribbean. Water operators find financial sustainability difficult to attain due to high levels of poverty and the fact that decisions, often taken outside the economic realm, set tariffs that are too low. There is a need to bring tariffs to cost recovery levels, but accompanied by significant public investment (political priorities are very important) and creation of effective subsidy systems for the poor.

Approaches

Some countries have implemented significant reforms. For example, Brazil has adopted a new water legislation and a national water management policy; new water laws have also been recently adopted in Honduras, Nicaragua, Peru, Venezuela, among other cases; Chile has reformed its water law and the water supply and sanitation sector, and privatised all

water-related utilities; and Mexico reformed its water legislation and created river basin councils. The water supply and sanitation sector has been subject to extensive reforms in the majority of the region's countries particularly in Argentina, Bolivia and Colombia. In addition, a large number of countries are currently discussing modifying or reforming their water-related legislation.

Economic instruments, such as subsidies, tariffs, fees, incentives to mobilise resources, regulatory controls and prices signals have been implemented in the region with mixed results. In the countries of the region – which do not have the human and financial resources of developed countries, nor a State or private apparatus with the equivalent organisation and management capacity – interest in trying to apply economic instruments is not always compatible with the basic conditions they require. Good results are generally vetoed by the prevailing conditions of user informality, lack of information, perverseness or ignorance about good practices concerning the use (or rather abuse) of water, in combination with an almost absolute inability to enforce the law even where formal legal conditions exist. Among other basic conditions that are lacking, most of the countries of the region do not have efficient institutionalised systems of water management. Without this, very little can be done, bearing in mind the enormous fragmentation of institutions and responsibilities involved in water management. Widespread poverty, lack of trained personnel, lack of control and monitoring systems, the concentration of economic and social power, the ease with which regulators or managers (where they exist) can fall under undue influence, all constitute impediments to the use of economic instruments.

Reforms in the water sector have taken place, yet there is still work to be done as many of the changes undertaken have not yet yielded the benefits they were expected to produce. It has been acknowledged that to achieve universal coverage and good quality services, systems need to be financially and economically viable. Many systems charge for the cost of administering water resources. There are also examples of charges intended to recover costs of water works, pay for water-related services and treatment of wastes, cover administrative expenses and induce water conservation and environmentally sound behaviour. However, legislation charging for water as such is not so abundant. Nevertheless, some countries of the region have already implemented or are implementing systems of charges for water as a resource.

Improving efficiency helps achieving equity. By providing services efficiently, costs can be reduced allowing the allocation of resources into maintenance programmes or even new infrastructure investments.

To transition towards a green economy, Latin American and the Caribbean countries will need to focus on elements such as:

- Water use efficiency, loss reduction, metering, efficient water use.
- Energy efficiency in the provision of drinking water supply and sanitation services.
- Drinking water supply and sanitation in the fight against poverty, for social cohesion and integration, green employment and their role in countercyclical policies.

- Generation and management of new and unconventional water sources (such as seawater and brackish water desalination, wastewater reuse, market reallocation, watershed management and payments for environmental services) for human supply and other competing uses (especially mining).

- Domestic wastewater treatment and recycling, full water cycle management.

- Climate change adaptation and mitigation in drinking water supply and sanitation; methane recovery in wastewater treatment.

Water management, direct regulation and economic instruments: the Colombia case

For more than 35 years, Colombia has been building a wide range of instruments for water management: regulatory controls of quality and quantity, price signals to encourage efficient use of the resource, and obligatory investments to protect water resources. Sometimes, productive sectors respond effectively to price signals and command and control measures. Nevertheless, despite some advances, various limitations hinder sustainable use of water in accordance with the challenges of economic growth. This case shows that:

a) When price signals are applied properly and with appropriate institutional enforcement, the positive effects on the rationalisation of the use of water are clear and effective.

b) A financial strategy of environmental investment associated with economic growth and the use of natural resources is more effective than exclusive dependence on the political will of national authorities.

Source: http://www.faae.org.co/PolicyPdf/policy-26.pdf

Lessons learnt

There is a need for integrated water planning to satisfy economic objectives, environmental requirements and social concerns, through the generation of a shared vision regarding the future evolution of water availability and use at the river basin level. These are some of the main lessons that have been drawn from experiences across the region and the consensus that has been built amongst stakeholders and experts to improve water management in the region:

Water legislation

- Water laws must clearly state that water belongs to the public domain of the State.

- Water laws must determine specifically that water use rights, when granted under conditions of, or which aim at, effective and beneficial use and that do not cause environmental damage, are protected by private property clauses in the constitution.

- In the case of water rights and uses that were in existence prior to the legislative change, including traditional and indigenous uses, they should be recognised in accordance with their effective and beneficial, historical and current use, without this affecting the possibility of imposing appropriate regulations.

For the regulation of drinking water supply and sanitation services

- Reasonable tariffs and profits. It is important to bear in mind that privatisation does not miraculously make unprofitable operations profitable.

- A subsidy system that avoids as far as practicable cross-subsidies and that guarantees the low-income groups a basic minimum supply.

- The right to adequate and opportune information, both for the regulators and for customers.

- Obligatory uniform regulatory accounting; and control of transfer prices, holdings and intra-holding transactions.

Regarding centralisation and decentralisation

- Depending on the activities involved, determine the appropriate level for decentralisation or centralisation, in accordance with technical considerations and economies of scale and scope.

- Preserve a residual capacity at the central level, to promote or implement the necessary activities or measures in the event of decentralised bodies being negligent or unable to carry out their functions.

- National legislation should recognise the two basic principles that govern disputes between decentralised authorities: (i) equity and reasonableness; and (ii) not causing significant harm.

Regarding water management institutions

- The authority responsible for water allocation and management should be independent from sector influences, with authority and resources in line with its responsibility.

- Inserting water management within environmental agencies may result in minimising its potential for driving socioeconomic development.

- Therefore, it seems appropriate that the water resources have their own stable and independent institutions, even when these are closely linked to institutions responsible for the strategic vision of national development.

- Water-related decision making has economic content, and special interest group pressures can promote or dissuade certain decisions. Accordingly, water authorities should have independent budgets and chief executives appointed for fixed terms and protected from arbitrary removal.

- River basin level organisations are valid options for water management. Critical requirements for their creation include a precise definition of their specific exclusive functions focused on water resources, and adequate authority and funding.

Regarding regulatory agencies for drinking water supply and sanitation services

- Clear institutional separation between the functions of sector policy formulation, regulation and provision of services.
- The regulator must have independence and stability, and be subject to rules of good conduct and ethics.
- The regulator must have the necessary powers and resources.
- The regulator must have appropriate legal capacities.

Lessons learnt from selected cases in the LAC region

Case	Lesson learnt
Greening (ecologizacion) the economic regulation for the provision of drinking water and sanitation services in Peru: lessons from SUNASS	Cost recovery tariffs coupled with clear and transparent subsidies for low income families is an efficient way to rationalise water use and increase coverage of water and sanitation services; however an important precondition is public investment in the universalisation of service coverage. Providing access to drinking water and sanitation services can be used as a way to alleviate extreme poverty and social exclusion. Projects which are designed considering environmental dimensions can reduce their maintenance and operative costs, avoiding future expenditures on new supply infrastructure. Communities accept subsidising those who cannot afford to pay for water services, however, they are not willing to pay on behalf of "free riders". It is necessary to acknowledge the cultural and environmental context on a case by case basis; there is no solution that can fit all. Transparency on the water bill enhances the end user understanding of its water consumption.
Design and approval of the Multi-annual Sectoral Plan for Water and the Environment of the Republic of Guatemala and the creation of the Water Advisory Group (Gabinete Específico del Agua GEA)	Policy coherence and coordination is necessary to improve water management. Consensus building at the national and local level among relevant stakeholders is key for success. The role of institutions and organisations outside of the water sector can be critical to the success of water governance within the sector. Political commitment and innovative approaches can generate positive changes.

Public management of water in Colombia	Colombia has a legal, institutional and financial framework that allows the implementation of measures for the regulation of water use and for ensuring the sustainable development of production and consumption. When price signals are applied properly and with appropriate institutional enforcement, the positive effects on the rationalisation of water use are clear and effective. A financial strategy of environmental investment associated with economic growth and the use of natural resources is more effective than exclusive dependence on the political will of national authorities. Financial sustainability of water authorities is necessary, but not sufficient, to ensure the effectiveness of water management. As well as supervision and control of water users being necessary, appropriate monitoring of water authorities by the control entities and citizens is also essential.
Community water management in Central America as an environmental, economical and socially feasible choice	Community based management can be a low cost efficient initiative especially for low income groups. This level of involvement generates economies of scale that enhance the provision of services. The approach used by the communities now involves not only water management but also the protection of forests, recharge areas, integrated watershed management, and sustainable agricultural practices. Water has become a valuable resource for agricultural purposes and for small scale hydroelectric generation. The development of networks has allowed knowledge sharing and the adoption of best practices in different communities.
Prices that reflect the costs and benefits to the poor in Bogotá and Medellín, Colombia	Cost recovery and financing- economic instruments helped reduce water consumption. Financial sustainability of water utilities can be attained, reducing their dependence on government budget allocations. The introduction of a law requiring the implementation of full cost tariffs set a clear legal framework. Communication strategies to emphasise the value of water and the value of paying its cost, and the support from the local mayor were necessary for the successful implementation of the tariffs.

Gabinete Específico del Agua de la Presidencia de la República de Guatemala, mecanismo para definir, coordinar y dar seguimiento a la política pública del agua, su estrategia, programas, acciones y presupuesto

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Tipo de herramienta: políticas e instrumentos económicos
Tema: Ciudades
Localización: Guatemala, América del Sur

Introducción y descripción del problema

Guatemala se sitúa en el norte de la región centroamericana, lindando con México; al sureste, con El Salvador y Honduras; al sur con el Océano Pacífico y al Oeste, con el Mar Caribe. Su extensión territorial es de 108,000 km3 y su población se estima en 14 millones de habitantes, de los cuales el 52% se sitúa en el área rural. La ciudad capital, Guatemala, alberga cerca de 3 millones de personas en tanto que los demás centros urbanos reúnen entre 100 y 200 mil personas, como máximo.

En el 2008, el producto interno bruto PIB de Guatemala ascendió a 2,850 dólares, tres veces menor al promedio de América Latina (CEPAL, 2010); la tasa de alfabetización es del 72% y el promedio de educación formal, solo llega al 4º grado del nivel primario.

Se estima que cerca del 50% de la población son pueblos indígenas de ascendencia maya. Del total de hogares, el 51% son pobres y de éstos, el 15% son indigentes. La pobreza alcanza el 70% en el área rural, en donde se concentra la población indígena, en tanto llega al 15% en las áreas urbanas; y en la región de América Latina, la desigualdad en el ingreso en Guatemala, aplicando el índice e GINI (0,59), solo es superada por el de Brasil.

El Estado de Guatemala cuenta con disponibilidad teórica de agua más allá de su demanda y de los requerimientos previstos; pero no ha sido capaz de articular la gestión y gobernanza del agua al cumplimiento de metas y objetivos nacionales, de interés público y social. Utiliza sólo el 10% de este capital natural, mas aún no cuenta con cobertura universal de servicios públicos de agua y saneamiento y los servicios existentes se consideran, en general, de muy baja calidad—calidad, costo, continuidad.

El potencial hídrico para fines agrícolas se aprovecha en un 25% y el energético en cerca de un 19%, más no se producen alimentos para toda la población, la matriz energética se basa en el empleo de derivados del petróleo y por otro lado, y la cobertura de servicios de energía eléctrica no es aún universal. Por su posición geográfica, Guatemala está expuesta a fenómenos hidroclimatológicos extremos como huracanes, depresiones tropicales, La Niña, el Niño, entre otros, acentuados por la variabilidad climática y el cambio climático, lo cual exige una buena gestión de riesgos.

La cobertura de agua para consumo humano con servicio mejorado alcanza el 78% (2006), con grandes diferencias según regiones; en las zonas urbanas la cobertura alcanza cerca del 80% mientas en el área rural es cercana al 53%; y el servicio de saneamiento promedia el 47% a nivel nacional—77% en ciudades y 17% en el área rural. Se estima se tratan cerca del

5% del total de aguas residuales, lo que se han constituido en el problema de contaminación de las aguas más común y grave.

El sistema de gobierno de Guatemala es unitario, representado por un Presidente y un Vicepresidente, quienes actúan en Consejo de Ministros, mediante gabinetes específicos y comisiones ad-hoc, y al nivel nacional actúa principalmente a través de ministerios y secretarías de estado y, al nivel local, a través de las gobernaciones y delegaciones sectoriales.

Administrativamente el estado de Guatemala se divide en 22 departamentos y 334 municipios y conforme la Ley de Descentralización y la Ley de los Consejos de Desarrollo, los Consejos Departamentales de Desarrollo CODEDES son quienes disponen como invertir los fondos en su territorio, instancias que se integran con representantes de los consejos municipales y comunitarios de desarrollo.

Aún cuando se han dado pasos muy importante como la firma de los Acuerdos de Paz (1996) y en materia de descentralización de la planificación, presupuesto y ordenamiento territorial , el régimen legal de los recursos naturales sigue siendo centralizado y causa de no pocos conflictos sociales, especialmente los aprovechamientos mineros e hidroeléctricos, situación que se torna aún más complicada en el caso del agua porque el país no ha contado con un régimen legal e institucional especial para administrar el agua como bien natural, social y económico ni para administrar el conjunto de derechos y obligaciones de los diversos usos y aprovechamientos (1963-2007).

El gobierno central aún se organiza a partir de sectores usuarios del agua y del ambiente. El desempeño de las atribuciones de Ministerios rectores y de Secretarías de Estado ha carecido, inclusive, de planes sectoriales del agua, y hasta ahora se plantean herramientas comunes de política nacional del agua (2008-2011). En la gestión pública descentralizada, los consejos departamentales de desarrollo carecen de orientación y líneas estratégicas para disponer de los fondos públicos y las municipalidades, en su tarea fundamental de prestar los servicios públicos de agua potable y saneamiento.

Dado el estado de cosas, es evidente que el desempeño institucional público (1970-2007) no ha sido capaz de desarrollar los recursos hídricos ni en razón de objetivos sectoriales ni en función de contribuir al logro de objetivos y metas superiores, nacionales de interés público. Este desempeño institucional ha favorecido el deterioro del agua; no ha permitido cerrar la brecha de las demandas sociales insatisfechas, entre éstas, las de agua potable, saneamiento y seguridad alimentaria; ni promover los usos productivos del agua de manera estratégica; tampoco ha sido capaz de resolver conflictos por acceso al agua; y posee bajísima capacidad para gestionar el agua ante riesgos naturales.

Retos, objetivos, componentes y procesos de implementación

En respuesta a la necesidad de articular la gestión y gobernanza del agua al desarrollo nacional, el Gobierno Central crea el **Gabinete Específico del Agua GEA** (2008-2012), conforme disposiciones de la Ley del Organismo Ejecutivo, como instancia de coordinación de política, planificación y presupuesto. El Vicepresidente de la República preside y coordina el **GEA**, integrado[36] por 10 Ministerios y 5 secretarías de estado, dos consejos nacionales y la

[36] Ministerio de Relaciones Exteriores, del Ministerio de Finanzas Públicas, del Ministerio de Comunicaciones, Infraestructura y Vivienda, del Ministerio de Educación, del Ministerio de

red de gestión de riesgos. El **GEA** se reúne ordinariamente una vez al mes, es permanentemente apoyado por las carteras de relaciones exteriores, ambiente, agricultura, salud e infraestructura; y cuenta con el apoyo de una Secretaría Técnica, integrada por 8 profesionales, quienes se reúnen periódicamente con el señor Vicepresidente para informar avances y recibir instrucciones, apoyan los requerimientos de Ministerios y Secretarías de Estado e integran comisiones técnicas interinstitucionales especializadas.

El mayor reto institucional del **GEA** ha sido generar condiciones favorables para promover e implantar un proceso nacional de gestión estratégica del agua que promueva el desarrollo de los recursos hídricos a favor de metas y objetivos del desarrollo nacional. Con la emisión de la Política Nacional del Agua (2011), se han definido objetivos, principios, orientaciones y líneas estratégicas comunes, de manera tal que las acciones y presupuestos sectoriales de nivel nacional, cumplan tanto metas y objetivos sectoriales/temáticos como nacionales y de interés público; y los gobiernos municipales y el sistema de los consejos de desarrollo cuenta con un referente nacional.

Sin embargo, la voluntad política del Ejecutivo debe enfrentar el reto de carecer de institucionalidad para hacer operativas todo el conjunto de medidas de la Estrategia de la Política Nacional del Agua, actuar efectiva y eficazmente en su labor de coordinación de planes operativos con múltiples instituciones; y especialmente enfrenta el reto de no contar con un sistema de información del agua robusto, más si con un conjunto de demandas sociales, políticas y ambientales a las cuales debe e intenta encontrar solución que, en general, exigen mejorar notablemente la calidad de la gestión y gobernanza del agua.

En el 2008 el **GEA** adopta seis líneas de trabajo definidas por el Gabinete General de Gobierno y organiza su plan estratégico de coordinación de política, planificación y presupuesto en relación con los ejes siguientes: (1) Agua y saneamiento para el desarrollo humano, cuya rectoría corresponde al Ministerio de Salud Pública y Asistencia Social; (2) Gobernabilidad y planificación del agua, cuya dirección corresponde al grupo asesor **GEA**, por carecer el país de autoridad rectora del agua; (3) Manejo de bosque, suelo y calidad del agua en cuencas, cuya rectoría corresponde al Ministerio de Ambiente y Recursos Naturales; y (4) Aguas internacionales, cuya rectoría corresponde al Ministerio de Relaciones Exteriores, con el apoyo del Equipo Nacional de Expertos, coordinado por Grupo Asesor del GEA.

Paralelamente el GEA trabaja la definición de la **Política Nacional del Agua PNA** y la ***Estrategia Nacional del Agua ENA*** y su grupo asesor participa activamente en otros procesos de planificación y presupuesto, entre los cuales destaca el ***Plan Sectorial Multianual de Ambiente y Agua PSMAA*** (2010), la ***Política Nacional de Cambio***

Agricultura, Ganadería y Alimentación, del Ministerio de Economía, del Ministerio de Salud Pública y Asistencia Social, del Ministerio de Energía y Minas, del Ministerio de Cultura y Deportes, del Ministerio de Ambiente y Recursos Naturales, de la Secretaría de Comunicación Social, de la Secretaría de Coordinación Ejecutiva de la Presidencia de la República, de la Secretaría de Planificación y Programación de la Presidencia de la República, de la Secretaría de Asuntos Agrarios, de la Secretaría de Seguridad Alimentaría y Nutricional de la Presidencia de la República, del Consejo Nacional de Áreas Protegidas, del Consejo Nacional de Ciencia y Tecnología y de la Coordinadora Nacional para la Reducción de Desastres

Climático y el ***Plan de Reconstrucción con Transformación*** (2010); y establece vínculos con el ***Sistema Nacional de Diálogo***.

El objetivo general de la **PNA** es "***Asegurar la contribución del agua al cumplimiento de metas y objetivos de desarrollo económico, social y ambiental del país, mediante la institucionalización del sistema nacional de gestión y gobernanza del agua que satisfaga el mayor número de demandas, prevea los requerimientos futuros, gestione los riesgos hídricos y proteja el bien natural, en un marco de armonía social, desarrollo humano transgeneracional y soberanía nacional;*** y sus objetivos específicos, concretados conforme los avances habidos al dar cumplimiento a los compromisos del ***Plan Estratégico del GEA 2008-2011***, y son los siguientes:

1. Contribuir al mejoramiento de las condiciones de calidad de vida, bienestar individual y social como parte del desarrollo humano de los habitantes de Guatemala, mediante el mejoramiento de la gestión pública sostenible de los servicios públicos de agua potable y saneamiento y de las prácticas de manejo del agua para el consumo humano;

2. Contribuir a la adaptación nacional al cambio climático mediante la conservación, protección y mejoramiento de las fuentes de agua y de los bosques, suelos y riberas de ríos que regulan el ciclo hidrológico en cuencas;

3. Contribuir con los objetivos de desarrollo económico y social y con la adaptación nacional al cambio climático, mediante la gobernabilidad y gestión eficaz del agua, la planificación hidrológica y el sistema nacional de obras hidráulicas que regulen el ciclo hidrológico para satisfacer el mayor número de demandas, prever requerimientos futuros y gestionar los riesgos hídricos;

4. Adoptar gradualmente un sistema nacional de gestión del agua que promueva la modernización del régimen legal e institucional para asegurar la implementación de acciones de planificación, programación y presupuesto vinculadas a las políticas sociales, económicas, ambientales y de relaciones exteriores del país; y

5. Contribuir al logro de los valores de justicia, seguridad y bien común del país, mediante la implementación de los lineamientos y principios de negociación que establezcan esquemas de compensación para proteger los cursos de agua internacionales a través de tratados bilaterales y que primero Guatemala debe satisfacer las necesidades de su población, economía y ambiente.

La **Estrategia Nacional del Agua ENA** identifica dos escenarios, el tendencial, dejar pasar y dejar hacer, y el escenario probable, el cual adopta. Este segundo escenario se funda en dirigir iniciativas más allá de los sectores usuarios del agua (doméstico, agrícola, energético) y en adoptar medidas de protección (incipiente control de contaminación), a favor de acciones estratégicas que favorezcan la competitividad del país, el cumplimiento de las metas de los Objetivos de Desarrollo del Milenio y de los objetivos sociales y ambientales de la política gubernamental.

La ***ENA*** define líneas estratégicas y propone un conjunto de medidas para ordenar y hacer eficaces las acciones y recursos institucionales, focaliza actividades y tiene como fin

instrumentalizar los objetivos de la Política Nacional del Agua. Las líneas estratégicas son las siguientes:

(1) **Agua potable y saneamiento para el desarrollo humano,** cuyas líneas de acción son las siguientes: (1.1) Ampliación de cobertura y mejora del funcionamiento de los servicios públicos de agua potable y saneamiento; (1.2) vigilancia, monitoreo y mejoramiento de la calidad del agua para consumo humano y saneamiento; (1.3) Gestión social en APS; y (1.4) administración, operación, mantenimiento de los servicios públicos de APS.

(2) **Conservación, protección y mejoramiento de fuentes de agua, bosques, suelos y riberas de ríos en cuencas** cuyas líneas de acción básicas, las siguientes: (2.1) formulación, aprobación y/o implementación de la Políticas, Normas y Programas para la conservación, protección y mejoramiento de bosques, suelos, fuentes de agua y riberas de ríos en cuencas; (2.2) formulación, aprobación e implementación de normativa y del programa nacional de valoración y esquemas de compensación por bienes y servicios ambientales hídricos; (2.3) Formulación e implementación del programa nacional de protección y recuperación de la calidad de las aguas; (2.4) formulación e implementación el programa nacional de recuperación de cuencas estratégicas; (2.5) Diseño e implementación del sistema de información para la conservación, protección y mejoramiento de la calidad el agua, bosques, suelos, fuentes de agua y riberas de ríos en cuencas (2.6) Ciencia y tecnología para la conservación, protección y mejoramiento de bosques, fuentes de agua, riberas de ríos y calidad del agua en cuencas; (2.7) Educación y participación ciudadana para la conservación, protección y mejoramiento de la calidad del agua, bosques y suelos en cuencas; y (2.8) Programa de Manejo integrado de la zona costera.

(3) **Planificación hidrológica, Obras hidráulicas de regulación y Gobernabilidad del agua,** cuyas líneas de acción son las siguientes: (3.1) Formulación de lineamientos nacionales para la planificación hidrológica y obas hidráulicas de regulación; (3.2) Diseño e implementación del Sistema de información y conocimiento del Agua de Guatemala enfocado al uso, sequías e inundaciones; (3.3) Diseño y construcción de sistemas de micro y pequeñas obras de regulación del agua en cuencas medias y altas, vinculadas a la región semiárida del país; (3.4) Formulación de lineamientos nacionales de participación ciudadana para promover la construcción de acuerdos sociales que favorezcan la gobernabilidad eficaz del agua; (3.5) Diseño y promoción de estrategias y lineamientos nacionales para la modernización del régimen legal e institucional del agua; (3.6) Formulación e implementación del Programa nacional de identificación y sistematización de prácticas sociales de gestión y gobernanza del agua; (3.7) Formulación e implementación del programa nacional de mediación y resolución de conflictos del agua; (3.8) fortalecimiento del sistema CONRED para elaborar e implementar el Sistema Nacional de Gestión de Riesgos Hídricos para sequías e inundaciones; (3.9) Formulación e implementación de Políticas y Planes de los usos sectoriales del Agua; y (3.10) Diseño e implementación del Plan Nacional del Agua, el Sistema Nacional de Inversión Púbica del Agua y el Sistema nacional de Administración del Agua.

(4) **Política pública y régimen legal e institucional de Cursos de Aguas Internacionales,** cuyas líneas de acción son las siguientes: (4.1) Preparación, desarrollo e implementación de la Estrategia de comunicación para la coordinación y socialización de la Política de Estado en Materia de Cursos de Agua Internacionales; (4.2) Preparación, desarrollo e implementación del Diagnostico y Estrategia para la Negociación Bilateral de las

Aguas Internacionales con visión de soberanía nacional guatemalteca; (4.3) Diseño e implementación del Sistema de Información y Comunicación de Aguas Internacionales para la toma de decisión; y (4.4) Preparación, desarrollo e implementación del Diagnostico y Estrategia a Nivel Multilateral para favorecer la implementación de la Política de Estado en Materia de Cursos de Agua Internacionales.

(5) **Acciones principales, plazos e institucionalidad responsable,** que consisten en las matrices de cumplimiento—actividad, plazo e instituciones responsables—elaboradas por todos y cada uno de los Ministerios y Secretarías de Estado que integran el GEA.

Cambios hacia el crecimiento verde y beneficios en la economía

a. Cambios Significativos generados por GEA

Los cambios significativos generados por la instancia **GEA** son básicamente los siguientes: (1) colocar la definición y seguimiento de las políticas públicas de gestión y gobernanza del agua dentro de las prioridades de la política pública nacional; (2) Instituir una instancia de coordinación al más alto nivel político, en el seno del Gabinete General de Gobierno, presidido por el propio Vicepresidencia de la República; (3) Articular la política nacional del agua principalmente con la política social, la política de desarrollo rural, la política ambiental y la política de cambio climático ; (4) Fijar objetivos, metas y líneas estratégicas de acción comunes para todas las agencias del gobierno central y con ello establecer un referente para la institucionalidad local; y (5) contribuir a mejorar el desempeño institucional de ministerios rectores y secretarías de estado, dándole valor agregado a sus acciones en función de cumplir tanto metas sectoriales como objetivos superiores de índole nacional.

b. Impactos en el ambiente

En materia institucional, la labor de coordinación del GEA ha permitido diferenciar la gestión y gobernanza del agua de la gestión del bien natural en el ambiente; ha permitido identificar las relaciones de interferencia e interdependencias entre el agua y los otros bienes naturales y el ambiente; y ha hecho evidente la necesidad de administrar los bienes y servicios ambientales proveídos por el agua de manera específica y especializada, distinguiéndolos de aquéllos proveídos por el bosque y la biodiversidad.

Por otro lado, ha hecho evidente que la función rectora del Ministerio de Ambiente y Recursos Naturales de proteger, mejorar y recuperar el bien natural, debe ser fortalecida, precisamente para ejercer funciones de dirección, regulación y vigilancia respecto a la calidad, cantidad y comportamiento; y al mismo tiempo debe diferenciarse de acciones que competen a otros entes rectores, como es el caso de la medición del recurso y la administración de derechos de aprovechamiento, y de aquéllas en donde las acciones conjuntas y horizontales son indispensables, como la gestión de riesgos.

c. Impactos sociales y efectos en la reducción de la pobreza

Como consecuencia de las medidas de ajuste estructural promovidas por el sistema financiero internacional, durante la década de 1980 la capacidad del Estado de Guatemala fue totalmente debilitada; y la relativa al acceso universal al agua para fines domésticos sencillamente desapareció. En el 2008 se confirma que las leyes del mercado no ofrecieron a los segmentos pobres del país, que infortunadamente abarcan cerca del 50% de la población y además padecen niveles vergonzosos de desnutrición, acceso a estos servicios públicos.

Actualmente, 50% carece de servicios mejorados de saneamiento y cerca del 25% de servicios de agua potable.

El Gobierno 2008-2011 define una política social integral; el sector público central de agua y saneamiento inicia su recuperación, el contexto del GEA se organiza el Programa Presidencial Agua Fuente de Paz, para facilitar el proceso político de restablecer la rectoría en el Ministerio de Salud Pública y Asistencia Social, cuyo despacho instituye la Unidad de Seguimiento de la Rectoría del Agua Potable; y para coordinar acciones con entes descentralizados responsables de ejecutar fondos públicos. Se promueve un sistema nacional de administración de los servicios públicos de agua potable y saneamiento, que integre también a las municipalidades y a los operadores privados y comunitarios. Se logra refinancia el sector (US$150 Millones contra US$2 Millones encontrados en el 2008). En este proceso se cuenta con los análisis y propuestas planteados por CEPAL[37]; y con la experiencia del proceso de negociación de una donación proveniente del Fondo del Agua de España y de un préstamo BID para agua potable y saneamiento 2008-2010.

Cambios en la gobernanza y gobernabilidad

En la gobernanza del agua se transitó de una gestión pública sectorial sin planificación ni coordinación interinstitucional alguna, hacia una coordinada, estableciendo herramientas de política, planificación y presupuesto, basadas en una política y estrategia común; se avanzó en la definición de un Plan Sectorial Multianual de Ambiente y Agua; y en materia de gestión de riesgos, transitó de atender las emergencias provocadas por los eventos naturales hacia abordar causas de los riesgos hídricos.

Aún está pendiente el proceso de articular el sistema de los consejos de desarrollo y los grupos organizados de la sociedad civil al proceso de definir políticas locales y con ello mejorar las condiciones de gobernabilidad del agua.

Coherencia, integración e impactos de la política en otros sectores

El aspecto relevante de las labores del GEA precisamente se caracteriza por la coherencia de sus propios planteamientos y de éstos con los otros procesos políticos, de planificación y presupuesto en que participa, como lo evidencian principalmente el Plan Sectorial Multianual de Ambiente y Agua PSMAA y el Plan de Reconstrucción con Transformación, ya comentados.

El **PSMAA** es el resultado del trabajo de las 34 instituciones gubernamentales que integran la Mesa Sectorial de Ambiente y Agua, instituida por el Gobierno a fines de 2008, para dar cumplimiento a las declaraciones de Paris (2005) y de Accra (2008). El **PSMAA** constituye el Marco Estratégico del Sector de Ambiente y Agua e innova el carácter de la planificación pues la establece en función de resultados. El **PSMAA** se construye a partir de planes y políticas sectoriales o temáticas, entre éstas la del agua; identifica los bienes y servicios que conforme sus mandatos legales las entidades del sector ambiente y agua deben proveer así como los costos de su producción; los vincula con el presupuesto; y da seguimiento y evalúa el desempeño institucional y los resultados alcanzados. Finalmente identifica vacíos para la

[37] Servicios de Agua Potable y Saneamiento en Guatemala: beneficios potenciales y determinantes de éxito, por E. Lentini para CEPAL; y Taller celebrado en Ciudad de Guatemala, organizado por CEPAL, diciembre 2010

eficiente, eficaz y oportuna producción de bienes y servicios y define los proyectos necesarios para superar brechas institucionales y presupuestarias.

El **PSMAA** define 4 objetivos estratégicos y 58 resultados, los cuales prioriza. El objetivo estratégico 2 literalmente dice ***"gestionar de forma integrada las cuencas hidrográficas y el recurso hídrico para hacer accesible el agua técnicamente factible a beneficio del desarrollo humano transgeneracional y la economía nacional, promoviendo mejores prácticas de uso y saneamiento, en un marco de gobernabilidad del agua"*** que comprende 15 resultados, de los cuales 4 se incluyen como las prioridades uno, dos, tres y nueve de los 58 resultados del Plan.

Los fenómenos hidroclimatológicos extremos han impactado (1541[38]), impactan (Huracán Mitch 1996, tormenta tropical Stan 2005, Sequía 2009, tormenta tropical Agatha 2010) y se prevé que en el futuro lo harán con mayor frecuencia e intensidad. Se estima que las pérdidas económicas ocasionadas por estos fenómenos, sin incluir los de la sequia 2009, ascienden a US4 2718.3 millones, que según Vargas superan el crecimiento económico del país habido en las 4 últimas décadas[39]. Mejorar la gestión y gobernanza del agua, como lo plantea el GEA, es sin duda un mecanismo estratégico para contribuir a la mejor gestión de estos riesgos, asociada con otras medidas.

El **Plan de Reconstrucción con Transformación PRT** (2010) elaborado luego del paso de la Tormenta Agatha y de la erupción del volcán de Pacaya de abril-mayo 2010, incluye en la ficha 14 el programa GEA de Planificación Hidrológica y Gobernanza del Agua. La aplicación del Plan corre a cargo de la **Comisión Nacional de Reconstrucción CNR**, presidida por el Ministerio de Ambiente y conforma dos subcomisiones, la de gestión de cuencas y la de Planificación Hidrológica, Obras Hidráulicas de Regulación y Gobernanza del Agua. Durante la **Conferencia de Donantes** 2010 convocada por el Presidente de la República para dar a conocer este Plan a la comunidad internacional, Doña Soraya Rodríguez, Secretaría de Estado para la Cooperación del Reino de España, compromete la suma de 30 millones de euros para financiar el programa de la ficha 14, cuya formalización está en proceso.

Así mismo, la labor del GEA es complementaria y coherente con las políticas sociales, ambientales, de cambio climático y seguridad alimentaria.

Lecciones aprendidas y tipo de intervenciones

La voluntad política al más alto nivel es fundamental como también lo es contar con la institucionalidad apropiada para traducirla en planes, programas y proyectos así como contar con el presupuesto necesario para garantizar acciones.

Apoyar el cumplimiento de metas de otros sectores del desarrollo, se constituye en una ventana de oportunidad para favorecer se mejore la institucionalidad del agua, cuando el país carece de cultura institucional hídrica.

[38] El acta del escribano de gobierno, referida a las lluvias del 12 y 13 de septiembre de 1541 dan cuenta de cómo la capital del reino de Guatemala fue destruida por la lluvia , deslizamientos de tierras y lahares del volcán de Agua

[39] Vargas

Contar con recursos hídricos suficientes no garantiza se articule el desarrollo del agua a objetivos superiores Guatemala no padece en sí de una crisis de escasez de agua sino más bien de una crisis de gobernabilidad que sumada a los previsibles impactos de la variabilidad climática y el cambio climático, hace crítico el favorecer condiciones en pro de la seguridad hídrica del país.

El tipo de intervención es eminentemente político, de coordinación de entes rectores que participan en el proceso de gestión del agua, pero año con año se integran a los planes operativos institucionales sectoriales y reciben presupuesto.

Aún cuando las intervenciones del **GEA** tienen vocación de constituirse en política pública en tanto no estén basadas en mandatos legales de ministerios y secretarías de estado, se convierten en políticas gubernamentales y corren el riesgo de ser deslegitimadas por próximos gobiernos.

Innovación

Dadas las circunstancias del contexto político, legal e institucional, el **GEA** se constituye en un mecanismo alterno de gestión del agua que integra elementos innovadores como la planificación hidrológica y resalta la importancia de promover condiciones para la gobernabilidad eficaz y equitativa del agua. En medio de las limitaciones, mejora la capacidad del Organismo Ejecutivo de cumplir con mandatos legales existentes, en tanto el Congreso de la República no emita legislación capaz de modernizar la institucionalidad del agua.

Innova el **GEA** al integrar acciones a favor de otras políticas, lo cual le permite favorecer el desarrollo de los recursos hídricos en función del cumplimiento de metas y objetivos naciones, entre estos, las de carácter social, desarrollo rural, seguridad alimentaria y cambio climático, mediante trabajo interdisciplinario e interinstitucional favoreciendo cultura de trabajo en equipo y de adaptación de medidas basadas en conceptos comunes y únicos, como por ejemplo, delimitación de la zona semirárida, definición de boletas para recabar información sobre fuentes de agua y sobre estado de los servicios púbicos de agua potable y saneamiento..

Aplicación práctica

A lo largo de tres años y medio, el mecanismo de coordinación **GEA** ha podido concretar la **Política Nacional del Agua** y su respectiva Estrategia; participa en la construcción y aplicación del Plan Sectorial Multianual de Ambiente y Agua así como en la elaboración y aplicación del Plan de Reconstrucción con Transformación. Principalmente, logro cambios institucionales en el Ministerio de Salud Pública y Asistencia Social, en cuanto a la rectoría en materia de calidad de los servicios públicos de agua potable y saneamiento; y en relación con la definición y aplicación de la Política de Aguas Internacionales.
Como ya se mencionó, los ministerios y secretarías de estado miembro del **GEA** son fiscalizadas por el propio Vicepresidente y se comprueba su voluntad política en la medida que integran en sus planes operativos anuales (presupuesto) las acciones comprometidas ante el **GEA,** lo cual verifica la Secretaría General de Planificación y el Ministerio de Finanzas Públicas, en el proceso de preparar el presupuesto anual con el apoyo del Grupo Asesor del **GEA**.

Replicabilidad

El mecanismo institucional de coordinación de políticas del agua al más alto nivel, como el **GEA**, podría tomarse como modelo para aquéllos casos en que los Estados carecen de estructuras institucionales sólidas; así como en aquellos Estados que carecen de política nacional del agua y que por tanto, los sectores y rectores nacionales no contribuyen al logro de metas y objetivos superiores, nacionales y de interés público. Igualmente, se proyecta sirva el **GEA** para dar seguimiento y evaluar los avances en el cumplimiento de la política nacional de agua y de aquéllas metas parte de otras políticas nacionales.

La ecologización de la regulación económica de los servicios de agua potable y saneamiento en el Perú. Lecciones aprendidas de la implementación de un esquema de pago por servicios ambientales. Caso EPS Moyobamba

José Salazar, Presidente SUNASS

Tipo de herramienta: políticas e instrumentos económicos
Tema: ciudades, cuencas hidrográficas
Localización: Perú, América del Sur

Retos para la gestión del agua y la regulación económica en el Perú

El Perú viene liderando una nueva ruta al desarrollo sostenible a partir de la conservación de los ecosistemas estratégicos y sus servicios ambientales para asegurar el recurso agua a las EPS, y el agua potable a las ciudades, y la gobernabilidad en la cuenca. Las inversiones en agua potable y saneamiento en Perú se han modificado, desde la perspectiva del regulador económico sectorial, SUNASS (www.sunass.gob.pe), desde que se inició la ecologización de la SUNASS (año 2007) hasta la fecha, año 2011. La experiencia el caso de la EPS Moyobamba, región de San Martin, Perú es un ejemplo que ilustra su aplicación y resultados.

Motores del cambio para la ecologización de la regulación de los SAPS en Perú

Entre los motores del cambio en Perú, se encuentran:

- Mantener el crecimiento económico más limpio con justicia social, requiere invertir en nuevas fuentes de agua y de energía renovable, con tarifas justas.
  - Presión sobre el recurso hídrico en la cuenca por grupos de interés, e.g., agrícolas y mineros que restringen el paso del agua cruda a ciudades, limitando su desarrollo urbano.
  - Reducción de cantidad y calidad de la fuente de agua por cambio climático y pérdida de cobertura arbórea, limitan el crecimiento económico regional.
- La decisión política del Presidente de la República de incluir el acceso universal en la agenda política-económica, con tarifas justas.
  - Millones de ciudadanos sin acceso exigen al candidato-Presidente, una política pública.
- La decisión política de crear el Ministerio del Ambiente, y apoyar una agenda ambiental.
  - Conservar el capital natural para usarlo, vía valorización económica total.
  - Sin embargo, la autoridad del agua (ANA) se quedó en el sector agrícola, desconectada de la política de ordenamiento territorial y del ente rector ambiental.
- Decisión del regulador: con enfoque de gobernabilidad armoniza los motores de cambio antes expuestos, hibridando teorías, instrumentos para hacer sostenible el servicio público.

Barreras para la implementación del Pago por Servicio Ambiental (PSA) en las tarifas de agua potable y saneamiento

- Empirismos aplicativos[40]: la teoría regulatoria no entiende-gestiona la compleja realidad porque las fallas sistemáticas de la teoría económica del mercado no reconoce el valor ambiental, y crea una ilusión de sostenibilidad económica y tarifaria.
- Discordancias normativas[41]: la organización del estado en sectores estancos ha creado una ilusión de sostenibilidad legal. Estas leyes sectoriales entran en conflicto al confrontarse con la cuenca.
- Distorsiones[42]: El desconocimiento de la población de la realidad de la cuenca, origina que no valoren los servicios ambientales, que no conecten la ciudad y el campo (que les provee de energía, agua, alimento), que no se identifiquen como co-responsables de la cuenca, que no paguen el valor de los servicios, que no demanden a los políticos una agenda hídrica.

El modelo de SUNNAS de nueva regulación económica del siglo XXI

Aspectos generales

Aportando soluciones, SUNASS ha iniciado el proceso de "ecologizar la regulación del servicio de agua potable". Primero: incorporando proyectos sostenibles (infraestructura+conservación), junto con el **pago por servicios ambientales en las tarifas** (necesaria, legítima, no legislada). Segundo, la incorporación del enfoque de gobernanza-gobernabilidad (a partir del **usuario-ciudadano y la gestión de riesgo ante desastres naturales de la empresas de agua**) (Salazar, 2010).

Nuevo modelo de pagos a los ciudadanos rurales por los servicios ambientales

A partir del reto de gobernabilidad, SUNASS promueve un nuevo enfoque en la formulación de los proyectos de conservación de fuentes de agua que reconozcan **la complementariedad entre proveer agua (obras de infraestructura) y hacerlas sostenibles (conservación de fuentes de agua), que beneficia al usuario-urbano-EPS, que paga al ciudadano-rural por su servicio ambiental**. Así se reconecta campo-ciudad, a partir de una estrategia de carácter integral, transversal, inter-generacional y multi-dimensional.

Según Salazar (2011), SUNASS aprende-haciendo una hibridación de teorías económicas, ambientales y de gobernabilidad, que avanza de la eficiencia a la sostenibilidad. La estrategia fue ecologizar la regulación económica del servicio público, **incorporando una tarifa ambiental e instrumentos económicos-financieros-ambientales para conservar fuentes naturales de agua.**

Regulador independiente

Esta regulación tarifaria, gira alrededor del regulador neutral-independiente (impone orden en monopolios naturales, protege al usuario de abusos de las EPS y hace sostenibles las EPS) enfrenta retos ambientales, de gestión-riesgo-desastres por cambio climático y de

[40] Cuando el planteamiento teórico no se acomoda a la realidad.
[41] Cuando una norma se contrapone a otra norma no ajustándose a la realidad
[42] Cuando externo al sistema en estudio, existe un elemento que ajeno a la realidad, impacta en la actividad en estudio.

gobernabilidad. Entonces, dos décadas después, la regulación económica del servicio público ha evolucionado frente a su enfoque del siglo XX. Estos cambios responsables reflejan la necesidad del regulador de: a) entender la realidad (múltiples escenarios ambientales y sociales), b) enfrentar la problemática (multiplicidad de actores, discordancias normativas, empirismos aplicativos, etc.), c) monitorear los resultados multi-dimensionales-temporales del agua potable, d) asegurar la sostenibilidad ambiental-financiera-social de la EPS, en el siglo XXI.

Los principios del modelo

1.- Reconocimiento de que la ciudad depende del campo para existir

En la teoría regulatoria económica, la sostenibilidad del servicio se genera dentro del sistema cerrado de agua potable-saneamiento, de la EPS hacia adentro, y considera a la fuente de agua desde su captación (no en la fuente). Esta teoría niega que su sistema depende de la existencia del agua en la cuenca, que por su naturaleza es aleatoria, finita y valiosa; pues responde a leyes naturales (no humanas). En cambio, para la teoría de la economía ambiental, la disponibilidad de agua en calidad y cantidad depende del ciclo del agua y no de tecnologías humanas. Aquí se reconoce la dependencia de la ciudad del campo y por lo tanto que la sostenibilidad del servicio (EPS) está ligado a la sostenibilidad de la cuenca.

2.- Incorporación de las externalidades ambientales en las tarifas (principio contaminador-pagador)

La teoría regulatoria económica, calcula la tarifa basada en un modelo matemático donde el ambiente es una externalidad (externalidad positiva). Esto se refleja hoy en la herramienta regulatoria, el plan maestro optimizado (PMO), el cual no incluye la variable ambiental, ni los costos ambientales. Estos costos ambientales, según la teoría económica ambiental, son resultado de los impactos negativos de las actividades económicas desarrolladas por los diferentes actores en la cuenca, por ejemplo deforestación que reduce la captación de agua, o aumenta la turbidez, la descarga de efluentes en cauces de agua. Estos impactos son absorbidos por los ecosistemas cuando no sobrepasa el límite de resiliencia de los mismos, pero cuando sobrepasan este límite, se degrada irreversiblemente los ecosistemas, agotando en calidad-cantidad el recurso agua. Su impacto no es internalizado por los responsables (efecto *free rider*), y son los usuarios a través de la tarifa que subsidian a los contaminadores. Esta situación es insostenible e injusta. En la dualidad ciudad-campo, la ciudad no reconoce el valor real del agua que consume, y que proviene de las zonas altas de la cuenca; aquí esa ciudad debe pagar por potabilizar el agua contaminada por las externalidades negativas de las actividades, cuenca-arriba. El nuevo modelo regulatorio debe corregir las externalidades en ambos sentidos (Salazar, 2011).

3.- *Incorporación del valor económico de los servicios ambientales hídricos*

La economía regulatoria define beneficios desde el punto de vista de la teoría microeconómica, como la diferencia entre el valor que tienen los bienes resultado del proceso del proyecto (e.g., agua potable) y los que se emplearon en el mismo (CAPEX-OPEX), deducidos los demás gastos de operación y mantenimiento (OPEX). Esta definición, sesgada al principio "valor por dinero" establece que "un servicio público debe ser suministrado ofreciéndose una mayor calidad a un determinado costo o los mismos resultados de calidad a un menor costo, contemplando solo en los costos los inmersos en el

proceso de potabilización, distribución, alcantarillado y tratamiento final. La economía regulatoria, maximiza la satisfacción de los usuarios del servicio y optimiza el valor del dinero, solo reconociendo los valores de uso directo en la tarifa que se calcula por la prestación del servicio. Este análisis limitado no reconoce en la tarifa otros valores que dan sostenibilidad al servicio. Entonces, el PMO solo reconoce los valores de uso directo sin contabilizar los valores de uso indirecto que representan todos los beneficios intangibles que se generan con la conservación de fuentes de agua. A pesar que la academia ha desarrollado metodologías que cuantifican los beneficios de proyectos ambientales, estas herramientas no son usadas en beneficio a la gobernabilidad sectorial. Así las EPS no contabilizan los beneficios de los proyectos ambientales en la sociedad en general como empleo, calidad de vida, resiliencia, gobernabilidad.

4.- Incorporación de proyectos ambientales beneficiando al usuario-ciudadano y la EPS

En la regulación económica tradicional, la herramienta principal de planeamiento y de eficiencia de los servicios de agua potable y saneamiento es el Plan Maestro Optimizado (PMO), no incorpora al capital natural con su valor económico total, sino bajo el sesgo antropocéntrico donde el recurso natural genera valor a partir de la extracción y/o aprovechamiento del recurso, por tanto, el valor se genera si se cuenta con proyectos de infraestructura que permiten captar y transformarla en agua potable, hasta la descarga de las aguas residuales tratadas. Este enfoque antropocéntrico, donde el mundo gira alrededor del ser humano, define al agua como recurso renovable-ilimitado-barato, lo cual es irreal e insostenible frente a la realidad. La economía ambiental sostiene que el capital humano, financiero y físico dependen del capital natural de la cuenca (léase las funciones hidro-ecológicas que crea el ciclo del agua), con procesos independientes de la intervención humana y del dinero, en función de procesos bio-geo-químicos del ciclo del agua. El capital natural traducido a proyectos de conservación de fuentes de agua, y el capital físico como proyectos de infraestructura ingenieril, son complementarios, haciendo rentable a las EPS, con menores incrementos tarifarios para los usuarios y con servicios sostenibles. Los proyectos de conservación de fuentes de agua, cuentan con pocos beneficios de corto plazo pero son durables, y cuentan con beneficios múltiples intangibles, los cuales hacen sostenible la EPS, mejoran la calidad de vida del usuario-ciudadano y de futuras generaciones, y a la gobernabilidad democrática de la cuenca (Salazar, 2011).

5.- Reconocimiento del usuario como un ciudadano con derechos políticos

Bajo la teoría de la gobernabilidad, la EPS pública considera al usuario actual como consumidor así como al usuario futuro, ciudadano con derechos políticos que elige a su gobernante y le exige una agenda política hídrica y de agua potable. Un usuario-ciudadano, representa a un individuo que: i) tiene disponibilidad a pagar la tarifa de acuerdo a los beneficios que el servicio representa en calidad y acceso, ii) exige a sus autoridades elegidas los proyectos que aseguraran el acceso y la calidad del servicio que esperan recibir, iii) reconoce el VET pues está conectado con el capital natural. La teoría económica regulatoria considera al usuario parte de una transacción-oferta-demanda, donde como consumidor paga la tarifa por la prestación del servicio de agua potable y saneamiento pero que ignora el VET-agua y los servicios ambientales. Esto por la desconexión entre el usuario-citadino con la realidad de la cuenca, por desconocer su dependencia del capital natural. Esta teoría ignora la población sin acceso, que crece en número, sin derechos ante el regulador, pero elige a las autoridades de la ciudad y de la cuenca para exigirles una agenda política; pues los

ciudadanos sin acceso son los más sensibles a la conservación y uso racional, porque es sinónimo de calidad de vida (SUNASS, 2011-c).

Los elementos del modelo en la práctica

Para pasar de grandes ideas a acciones concretas, se requiere de un claro enfoque conceptual para no confundirse, pues se hibridan teorías, instrumentos para resolver la problemática.

Identificar la cadena de valor ambiental a partir de costos evitados: materializa los beneficios para el usuario-ciudadano, la EPS y la cuenca

La disponibilidad de agua (cantidad y calidad) que hace posible la vida, es uno de los servicios que se obtienen de los ecosistemas, pero la realidad ambiental de la cuenca (deforestación, cambio climático, contaminación, etc.), reduce sus caudales a calidad, arriesgando la sostenibilidad de las EPS y las ciudades. Ante esta situación, el regulador ha identificado la problemática ambiental en la cuenca y su impacto en la cadena de valor ambiental en el sistema de agua potable (Sunass, 2011-c). Si bien cada EPS presenta una problemática diferente, el regulador ha logrado tipificarlas traduciéndolas en impactos para la región a través del uso de herramientas como *waterfootprint* de las ciudades y costos evitados a la EPS. La metodología de los costos evitados es usada por la economía de mercado y por la economía ambiental, y permite interconectar al mundo financiero con el mundo ambiental. Los costos ambientales se reflejan en la reducción de la disponibilidad del recurso hídrico (cantidad y calidad) en la cuenca, pero si se reconocen como costos-evitables se reduciría el impacto en el flujo de caja de las EPS, en los costos (CAPEX, OPEX) y en los incrementos tarifarios. Así los costos evitados por la complementariedad entre el capital natural (proyectos de conservación) y capital físico (proyectos ingenieriles) en el PMO aporta en la sostenibilidad de la regulación de los servicios de agua potable y saneamiento. Según Salazar (2011), costos evitados, es una herramienta ambiental de valoración económica de los costos ambientales, en la cual el regulador ha encontrado un instrumento que puede adecuarse a diversos escenarios de cuenca, en cuanto a ubicación, problemática, variables y soluciones; es de fácil entendimiento, bajo costo y practicidad en el cálculo. Así el regulador, viene aplicando el planeamiento de escenarios futuros con costos evitados, que identifica el proyecto ingenieril y ambiental, impactos en calidad y cantidad, del recurso agua a largo plazo y que suponen menores costos.

Valorar para conservar e invertir en las fábricas naturales de agua potable para lograr ciudades sostenibles

Los ecosistemas (e.g., humedales, manglares, bofedales, aguajales, bosques relictos, bosques secos, pajonales, paramos), son las fábricas naturales de agua, que se ubican en las partes altas-medias de las cuencas, y alimentan a las EPS con materia prima necesaria para la prestación del servicio de agua potable (SUNASS, 2011). Estos ecosistemas y los servicios ambientales, no son reconocidos económicamente por el modelo regulatorio tradicional. Del VET-valor económico total, en el PMO tradicional solo se incorpora el valor de uso directo, es decir el costo del proceso de potabilización de agua; no reconoce el valor de uso indirecto ni el de opción que es generado por el ciclo de agua el cual asegura la disponibilidad del recurso agua para su tratamiento. Tampoco se reconoce los valores de no uso (opción-existencia), que son aportes a la gobernabilidad (Salazar, 2011).

El actual sistema de agua potable y saneamiento está definido como aquellas instalaciones y procesos que están dentro del ámbito de la EPS, es decir desde la captación de la fuente de agua hasta el tratamiento y disposición final de aguas residuales. En este contexto, quedan sin incluir la fuente de agua, conllevando a que la EPS no pueda incluir en su PMO y destinar una partida presupuestal al desarrollo de proyectos de conservación de fuentes de agua, por ejemplo: aportes a fondos de agua en la costa, conservación de cabeceras de cuenca en zonas alto-andinas, de protección de áreas forestales en la amazonia pues se encuentran fuera del ámbito geográfico del servicio (léase la ciudad).

Valoración contingente refleja la confianza del ciudadano en su EPS, en su estado-nación

SUNASS usa la valoración contingente que considera a la disponibilidad de pago del usuario-ciudadano como la aceptación de un incremento tarifario por la inclusión de nuevos proyectos, como el beneficio que el proyecto representa para este, o una preferencia del consumidor ante el servicio. Desde el enfoque de la gobernabilidad, representa un voto de confianza en la EPS, el regulador, en el Estado que proporciona el servicio público, reconociéndose que la confianza es la columna vertebral de la gobernanza en la cuenca y dando sostenibilidad social a la EPS (SUNASS, 2010). Entonces, el modelo matemático arroja una cifra y la D.A.P arroja otra cifra, aquí el regulador decide por la franja inferior, para avanzar progresivamente en la recuperación-confianza.

Así por ejemplo en el caso de SEDAPAL se realizaron estudios sobre la capacidad y disponibilidad de pago de la población, con el propósito de cuantificar el nivel tarifario máximo que los usuarios podrían afrontar con sus ingresos y la disponibilidad a pagar un mayor recibo por la prestación de los servicios. La información mostró cómo los hogares limeños gastan en los servicios de saneamiento un porcentaje muy inferior al 5%, que es establecido como umbral de gasto. Los resultados obtenidos, que representan el pago aproximado por el servicio de agua en viviendas conectadas, según la división por Niveles Socio Económicos, son resumidos en el siguiente cuadro:

NSE	Intervalo 95% conf. (mínimo)	Capacidad de pago predicha (S/.)	Intervalo 95% conf. (máximo)
A	44,12	46,80	49,49
B	39,82	41,57	43,31
C	33,58	35,02	36,47
D	23,93	26,32	28,72
E	17,53	19,62	21,71

Sin embargo, un Estudio Complementario realizada por la Consultora Directo para la SUNASS estimó la Máxima Disposición a Pagar por la ejecución de nuevos Proyectos en SEDAPAL, estableciéndose que más del 50% de las familias de bajos recursos manifiestan su imposibilidad de pagar un adicional para destinarlos a proyectos, En el nivel E se llega a 64.6%. Casi el 50% del total de entrevistados manifiestan no tener la intención de pagar más en su recibo. Del resto típicamente, los niveles altos pueden pagar 5 soles más y los bajos entre 1 y 2 soles más inclusive.

Los eco-proyectos con mayor encadenamiento-sinergético, se incorporan en el PMO- EPS, y crean mayor valor durable para la EPS y fortalecen la gobernabilidad

Por definición un proyecto de índole ambiental, trasciende este ámbito; impactando positivamente en las dimensiones cultural, social, económica y política. En este contexto, es más rentable para las EPS incorporar en su PMO proyectos de conservación de fuentes de agua que generen beneficios sinergéticos directos o indirectos en la cuenca, lo cual se aprecia en el V.E.T. (Salazar, 2011).

A partir de las funciones ecológicas que aseguran la cantidad y calidad de la fuente de agua, se identifican los proyectos de conservación así como los impactos directos a las fuentes de agua como resultado de la ejecución del proyecto y otros beneficios sinergéticos en la cuenca. Esta metodología define una prelación entre los proyectos de regulación atmosférica, climática, amortiguación de perturbaciones, regulación hídrica, disponibilidad hídrica y sujeción de suelos, para efectos de su inversión. Desde el lado de proyectos ingenieriles, debe evaluarse la mejor combinación posible, que pueda crear valor durable para la EPS y la cuenca (e.g., represas, transvases, recargas de acuíferos, nuevas captaciones, plantas de tratamiento de sedimentos, de tratamiento de contaminantes, de cloración, diques de defensa ribereña.

Identificar, armonizar, cuantificar y monetizar las inversiones en la cuenca, permite visualizar el aporte de la inversión ambiental en la gobernabilidad de la cuenca

Todavía existen restricciones para invertir fuera del ámbito geográfico que se fija en los contratos de explotación entre las EPS y los Municipios. Por esto, se necesita articular las inversiones de los municipios-regiones que están fuera de esa demarcación geográfica-legal dentro de la cuenca. Los aqua-fondos son parte de la solución pues articulan fondos privados y fondos públicos para invertir en la cuenca bajo un nuevo paradigma de sostenibilidad, y con un claro liderazgo político por cuenca.

Debido al alto encadenamiento sinergético entre las inversiones ambientales, que sustentan las actividades humanas (las económicas entre otras), toda la infraestructura ecológica, genera empleo desde abajo hacia arriba, revaloriza las técnicas ancestrales peruanas, evita la migración del campo a la ciudad, no se requieren de tecnologías sofisticadas difíciles de mantener, crea un espacio de encuentro de las diferentes generaciones y pueblos en zonas de amortiguamiento (que antes eran zonas de conflicto limítrofe), es el sustento de la paz social en la cuenca (que resuelve disputas centenarias por el agua), entre otros. Todo esto no está cuantificado por la métrica del mercado (que sólo mide dinero por producto-servicio en función de la oferta y demanda), y requiere un nuevo abordaje conceptual para valorizarlo en diversas unidades de medida, que el regulador lo contabiliza como un aporte a la gobernabilidad de la cuenca, complemento a la definición tradicional de desarrollo sostenible acuñado en la comisión Brutland.

Para aplicar el principio contaminador-pagador, se debe delimitar la responsabilidad de pago de la EPS frente a los contaminadores (free-riders) de la cuenca

En la cuenca se presentan externalidades resultado de las actividades de los actores (agricultura, ganadería, industria, minería, ciudades, entre otros) estas impactan

negativamente en el recurso agua, afectando a la cuenca, a la población y a la EPS, estas últimas ubicadas en la parte baja. Entonces, se presentan responsabilidades compartidas pero diferenciadas, donde la EPS no puede pagar los pasivos ambientales de todos los actores de la cuenca. También se ha incluido las externalidades positivas, la existencia de servicios ambientales que proveen agua en calidad y cantidad (SUNASS, 2011). Diversos actores ubicados en la cuenca alta y media, no limpian sus efluentes y los descargan en los ríos, lagos, los cuales contaminan las fuentes de agua natural de las EPS, lo cual se refleja en mayores costos de potabilización, que deben pagar todos los ciudadanos. Esto es injusto, pues no cobrar a estos contaminadores (denominado *free rider*), genera incentivos perversos a incumplir con la norma. Entonces, se debe promover leyes para incorporar el esquema de contaminador-pagador en todos los sectores económicos, para reducir los costos de limpieza del agua en la zona baja de la cuenca.

El Sector de Saneamiento ha promovido un Decreto Supremo Nº 021-2009-VIVIENDA, publicado en el diario oficial El Peruano el 20.11.2009, se aprobaron los Valores Máximos Admisibles de las descargas de aguas residuales no domésticas en el sistema de recolección del servicio de alcantarillado sanitario. En base a esta normativa la SUNASS ha determinado la metodología para la determinación de los pagos adicionales para los usuarios del servicio de alcantarillado que efectúen descargas de aguas residuales no domésticas cuyos valores se encuentren por encima de los establecidos en el Anexo Nº 1 del mencionado Decreto Supremo que son la DBO, DQO, Aceites y Grasas y Sólidos Suspendidos.

Para efectos de establecer el Pago Adicional, de acuerdo a cada rango, se establece un Pago por Exceso calculado en base del ajuste realizado a la facturación del servicio de alcantarillado por un Factor (F), que interioriza los niveles de concentración de los parámetros de DBO, DQO, AyG y SST. En ese sentido, se ha establecidos los siguientes límites del pago adicional para cada rango establecido en el cuadro siguiente:

Definición de Límite de Pago Adicional

RANGO	LIMITE DE PAGO ADICIONAL
Rango 1	25% del importe facturado por alcantarillado
Rango 2	75 % del importe facturado por alcantarillado
Rango 3	100% del importe facturado por alcantarillado
Rango 4	10 veces del importe facturado por alcantarillado
Rango 5	20 veces del importe facturado por alcantarillado

Fuente: SUNASS

Dónde:

- Primer rango: Concentraciones de transición en donde los valores atribuidos no causan problemas serios considerando una dilución en la ciudad.
- Segundo rango: Concentraciones que siguen siendo de transición, generando algunos sobrecostos operativos para la EPS y potenciales riesgos en el deterioro de la vida útil de

las tuberías y operación de las plantas de tratamiento de aguas residuales.
- Tercer rango: Concentraciones que generan mayores costos operativos para la EPS y potenciales riesgos en el deterioro de la vida útil de las tuberías y operación de las plantas de tratamiento de aguas residuales.
- Cuarto rango: Concentraciones elevadas que ocasionan sobre costos operativos (para tratar de cumplir con los grados de remoción exigidos por la normativa vigente) y de mantenimiento. Además ocasiona el deterioro de la vida útil de la infraestructura.

De esta manera, se internaliza los costos ambientales en las empresas que hoy contaminan sin pagar los costos. SUNASS ha avanzado con nuevos parámetros (basado en el nuevo marco legal aprobado por el ministerio del ambiente y ministerio de vivienda, construcción y saneamiento), para fijar las tarifas por carga contaminante, pero corresponde a la autoridad de la cuenca (ANA), cobrar a estos contaminadores, y enviar un mensaje claro, el pago-tarifa no es una licencia para contaminar.

Armonizar los marcos legales institucionales de los actores de la cuenca para permitirles conectar la compleja realidad peruana con su institucionalidad y la política pública

El Estado y sus instituciones no están integrados a la cuenca, por el contrario se encuentran sectorizados por compartimientos estancos, esto sumado a la falta de armonización de los marcos legales institucionales, por falta de una visión holística del ciclo del agua en la cuenca, hace necesario proponer fórmulas que ayuden a lograr complementariedad y no la desarticulación entre los diferentes niveles de gobierno para ejecutar las políticas de Estado, respetando las autonomías respectivas. Este es un tema pendiente.

Según Salazar (2011), el marco legal sectorial no ha sido adaptado al enfoque de cuenca ni al eco-sistémico, por lo que no contempla el funcionamiento del ciclo del agua ni del servicio público en la cuenca. Esta situación ha generado un descalce entre la realidad ecológica y la legalidad, creándose una realidad desconectada y fragmentada en la cuenca, y por lo tanto, discordancias normativas entre los actores, que tienen marcos legales desintegrados, generando conflictos-confusión. Entonces, ninguna autoridad local, regional, o nacional de una cuenca está obligada a coordinar sus intervenciones en la misma cuenca, a diferentes cotas. No existe ley que los obligue a coordinar, lo cual hace ineficiente, ineficaz, inefectiva la política pública ambiental y de saneamiento, en una cuenca (SUNASS, 2011).

Incorporación de variables ambientales en el PMO

El PMO, es la herramienta sombrilla del regulador económico (SUNASS) para ordenar el planeamiento de largo plazo de la EPS y aprobar tarifas para pagar el portafolio de proyectos que la ciudad necesita (SUNASS, 2011-c). La incorporación de variables ambientales en el PMO sincera los costos totales del servicio, pues modela escenarios de su realidad de la cuenca, que afecta su disponibilidad de agua en cantidad (por razones climáticas o de explotación no racional), y en calidad (por contaminación de las mismas). Por ejemplo: capacidad, rendimiento y calidad de las aguas de cada fuente de agua. Se incorpora un análisis de hechos naturales-externos a la EPS, que ponen en riesgo los servicios de saneamiento (cambios en el clima que disminuyen la capacidad de las fuentes, ubicación de infraestructura en zonas inundables, de riesgo sísmico, de deslizamiento de tierras, o de contaminación) (SUNASS, 2011-c).

Herramienta de planeamiento flexible: Tarifa de costes e inversiones de mediano y largo plazo

Un PMO-plus, resulta ser una herramienta de planeamiento flexible, con enfoque holístico e integral de los recursos hídricos, permite emplear instrumentos ambientales con el propósito de abordar (en el diagnóstico y solución de los sistemas de agua potable y alcantarillado) el proceso de adaptación de las EPS al cambio climático, mitigar presiones sobre sus fuentes de agua y sumideros, y enfrentar los riesgos por cambios imprevistos en las condiciones externas, asegurando la materia prima de las EPS y gestionando el paradigma-sostenibilidad en las EPS (EAD, 2009). La incorporación en la tarifa del pago por servicios ambientales y la gestión de riesgos ante desastres naturales asegura la fuente de agua de las EPS. El regulador convierte iniciativas voluntarias (PSA) en ingresos mandatorios, permanentes con bajos costos de transacción para conservar la fuente de agua. Ha combinado PSA (instrumento ambiental) con tarifa (instrumento económico) con fiducia (instrumento financiero) con institucionalidad-local para ecologizar los servicios de agua potable (Salazar, 2010).

En suma, se obtiene una menor Tarifa Media de Mediano y Largo Plazo por costos e inversiones evitadas por la conservación y/o recuperación de las fuentes de agua. Se aporta a la sostenibilidad de los servicios de saneamiento, se evitan conflictos sociales por el agua entre los diversos actores (EPS, agricultores, usuarios de los servicios de saneamiento que presta la EPS, otros demandantes de recursos hídricos).

El recibo de agua potable instrumenta el nuevo contrato social entre campo-ciudad, porque el usuario-ciudadano tomará conciencia de su dependencia del campo

Las empresas de agua están diseminadas, dispersas, desconociendo el vínculo campo-ciudad en una cuenca hidrográfica. De esta forma, la ciudad y el campo existen como dos mundos separados, sin reconocer que la ciudad depende del campo para su agua, alimentos y energía. Por ello, las EPS no se integran con las EPS de la misma-cuenca, generándose proyectos contra-puestos, ineficiencias, conflictos todo lo cual se refleja en mayores tarifas que paga el usuario. El regulador ha incorporado el concepto de usuario/ciudadano en la regulación, como eje de la demanda del servicio, de las políticas públicas y la elección de autoridades que garanticen el acceso universal y sostenibilidad del operador (SUNASS, 2010).

El recibo de agua potable, resume un conjunto de actividades-proyectos que la EPS ejecuta, como parte de su PMO, y es la conexión directa entre el ciudadano cosmopolita-urbano con el campesino-rural, que no se conocen ni reconocen, que no intercambian información ni dinero. Entonces, si en el recibo se incluye (a título nominal) el V.E.T. de los subsidios del campo hacia la ciudad, el ciudadano urbano tomará conciencia del subsidio que recibe y estará dispuesto a pagar por servicios ambientales intangibles.

Maximizar el uso del financiamiento concesional para acceso universal, adaptación-mitigación al cambio climático, gestión-riesgo-desastres-naturales se traduce en menores tarifas para la población y mayor valor-EPS

Existen fondos concesionales (con bajas tasas de interés, largo plazo de pago) que no se usan por falta de proyectos de calidad, buena estructuración financiera, operadores-calificados. Esta adecuada combinación crearía mayor valor en menor plazo para la EPS y la sociedad en su conjunto, y facilitar la participación del sector privado en actividades donde si crea valor durable (Salazar & Salardi, 2011-b).

Los resultados de los últimos desastres naturales han demostrado el incremento de la vulnerabilidad provocada por la acción del hombre, ha aumentado la frecuencia y el impacto de los desastres, esto sumado a los efectos del cambio climático impactan en los servicios de agua y saneamiento-EPS con pérdidas por los cuantiosos daños directos e indirectos que se generan en sus sistemas por los desastres, directos como los daños físicos a la infraestructura, e indirectos como los costos de manejo de emergencias a los que se suman los costos adicionales por la búsqueda de nuevas fuentes de agua (infraestructura de captación y conducción) y a la falta de recaudación o morosidad por la falta y baja calidad del servicio; presentándose en la población impactos negativos en su bienestar y salud a falta del servicio de agua potable y saneamiento (EAD, 2009). La experiencia ha revelado que usar financiamiento privado ha duplicado el valor-final-obras y demandado mayores tarifas (en menores plazos); y que contar con financiamiento concesional, ha reducido a la mitad el valor-final-obras, con mas obras con el mismo techo-tarifario (Salazar & Salardi, 2011b). En suma, una combinación de fuentes de fondos (públicas y privadas) bien calzada con los tipos de proyectos y los diferentes ciclos de negocios que conviven dentro de una EPS, crean mayor valor durable.

Transparencia en el recibo de agua potable contribuye a la gobernabilidad

Este nuevo enfoque de gobernabilidad en la cuenca, se debe traducir con transparencia en el recibo de agua potable, como reflejo del nuevo contrato social del tercer milenio y de la primacía de la realidad: sin agua no hay vida, y que no existe substituto humano para el agua potable. Por tanto, el recibo de agua se convierte en una fuente de información para la toma de conciencia de los usuarios-urbanos sobre su dependencia del agua, ubicada en las zonas rurales; y en una rendición de cuentas de su EPS ante sus clientes, consumidores, usuarios, ciudadanos.

Capacitar a nuevos líderes cívicos del agua ayuda a mantener un balance político de las localidades, y recuperar la confianza del usuario–ciudadano en su Estado-Nación

Se requiere para armonizar los intereses de empresas-públicas, autoridades, con privados (hidroeléctricas, mineras, agroindustrias, comercio) porque hoy no existe marco legal que los obligue. Las autoridades de la cuenca no tienen la obligación de coordinar sus inversiones, sin embargo, con el liderazgo político se puede crear un espacio de diálogo en la cuenca para una nueva generación de líderes del agua. A nivel municipal, mantiene un balance político porque revela la voluntad de los ciudadanos-usuarios en su esencia-misma, como fuente de legitimidad de las decisiones comunales (SUNASS, 2009).

El ciclo político del agua revela que la ley electoral peruana puede elegir al alcalde con el 20% de los votos válidamente emitidos pero tiene control total del concejo municipal y decidir la asignación de subsidios con presupuesto municipal. La evidencia empírica ha revelado que en algunos casos, la autoridad local tiene prioridades que entran en conflicto con el 80% de la población (que está de acuerdo con el portafolio de proyectos-SUNASS-EPS). También ha sucedido que líderes comunales (no electos por la ley electoral) aprueban proyectos y no las autoridades formales, lo cual crea mundos paralelos que no se reflejan en la ley electoral. Entonces, este desbalance entre legalidad y legitimidad requiere de una nueva generación de líderes cívicos del agua, que debidamente entrenados recuperan el balance de gobernabilidad (Salazar, 2011). Sin embargo, el fin último es legitimar la función de las entidades públicas (gobiernos nacionales o sub-nacionales, EPS), sobre la base de confianza y efectividad de las

políticas públicas. Entendemos legitimidad, al igual que Habermas, como: ”el hecho por el cual un orden político es merecedor de reconocimiento, basado en las razones de la ciudadanía para obedecer al poder” (Habermas, 2002).

Beneficios de la ecologización de la regulación de los servicios de agua potable y saneamiento en el Perú

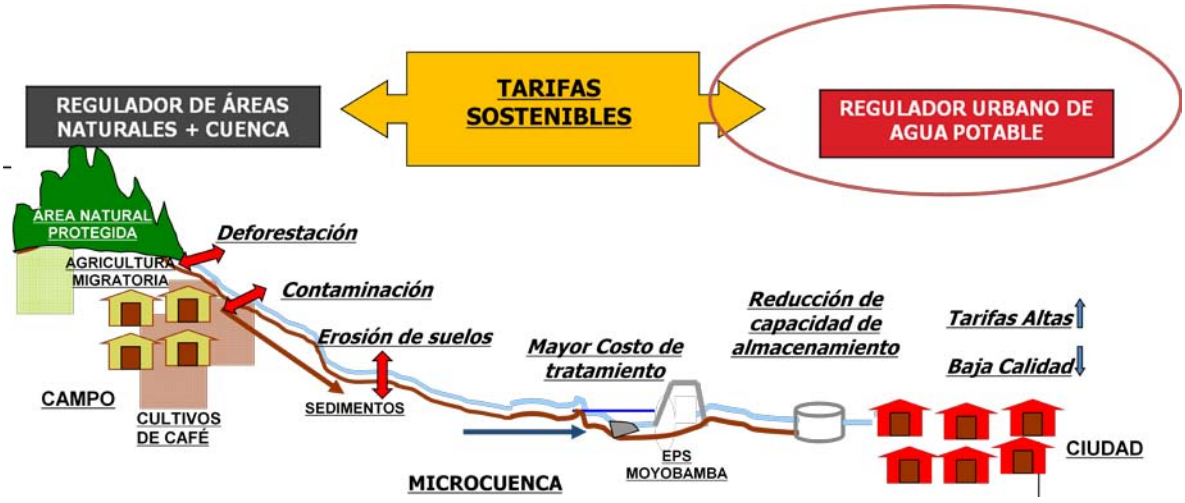
Para la cuenca	
Desde la dimensión económica-financiera	- Aumento de valor de propiedades urbanas al asegurarse el servicio de agua potable. - Reducción de la migración empresarial por falta del recurso agua para sus actividades productivas y por deficiencias del servicio de agua potable en sus instalaciones. - Reducción en inversiones para nueva infraestructura de captación o tratamiento de agua en la cuenca. - Menor pérdida de exportaciones en el marco de los TLCs debido a la reducción en disponibilidad del recurso agua y del servicio de agua potable en calidad y cantidad. - Aumenta potencial turístico por la conservación de bosques y por prestación de servicios de agua potable de calidad y cantidad, aumentando el empleo y los ingresos de los habitantes de la cuenca alta.
Desde la dimensión ambiental	- Asegura supervivencia del ser humano: mantener los ecosistemas que sustentan el ciclo del agua, vital para mantener los sistemas de vida del planeta tierra. - Reduce incremento de enfermedades infecciosas por deficiencias del servicio de agua potable en las viviendas, instalaciones hospitalarias y otros. - Al conservar los bosques, se conserva la biodiversidad de la zona, y los ecosistemas estratégicos que brindan el servicio ambiental hídrico. - Se generan negocios ambientales en la cuenca, gracias a la existencia del agua.
Desde la dimensión social-gobernabilidad	- Se detiene la migración poblacional de áreas urbanas, de la cuenca, o región hacia otras zonas por la deficiencia del servicio de agua potable y del recurso agua para las actividades agrícolas. - Se mejora la calidad de vida de los habitantes de la cuenca, en forma tangible e intangible. - Se generan beneficios tangibles e intangibles en la cuenca impactando positivamente a todos los actores ubicados en ella. - Existirá paz social**,** porque la población tendrá acceso a los servicios de agua y saneamiento, a una tarifa justa y sostenible. - Menor pérdida de capital político de autoridades locales por no tomar acciones a tiempo. - Se reduce los conflictos políticos generados por el problema de suministro (calidad y cantidad) de los servicios de agua potable, por los incrementos tarifarios de las tarifas, y por mantener la reducción del recurso agua para el desarrollo normal de las actividades económicas en la cuenca. - Reconectar las poblaciones de ciudad-campo, sin violencia cultural, reconociendo su interdependencia.

Para la EPS	
Desde la sostenibilidad ambiental	- Al conservar los ecosistemas estratégicos se conserva los servicios ambientales y la regulación hídrica, lo cual permite atender los servicios de agua y saneamiento según las necesidades de la población.
Desde la sostenibilidad económica-financiera	- Reduce nuevo presupuesto para una nueva captación de agua. - Aumenta el tiempo de vida de la infraestructura de la EPS, reduce la necesidad de nuevas inversiones. - Reduce costos de potabilización por sedimentos o sustancias contaminantes, traduciéndose en menos costos de operación y mantenimiento (OPEX). - Fortalece la capacidad de resiliencia para prevenir desastres naturales (huaycos, inundaciones, etc.) porque la cobertura forestal funciona como barrera natural a los desastres. - Asegura la provisión de agua en cantidad, calidad y oportunidad, se ofrece un buen servicio público, y se puede cobrar el íntegro de la tarifa al ciudadano.
Desde la relación usuario-ciudadano con la EPS	- Aumenta la capacidad de almacenamiento de la EPS, reduciéndose las interrupciones del servicio y aumentando la continuidad del servicio para la población. - Mejora la relación usuario-ciudadano-EPS, por mejor calidad de los servicios de agua potable. - Reduce las necesidades de incrementos tarifarios mayores, por menores costos en la potabilización.

Retos en la EPS Moyobamba

Hoy, el cambio climático, la deforestación y contaminación de aguas por agricultura migratoria (café), en las microcuencas Rumiyacu-Mishquiyacu y Almendra, zonas donde se ubican las fuentes de agua de la ciudad de Moyobamba, impactan negativamente en la prestación de los servicios de agua potable y saneamiento brindados por la EPS Moyobamba. Estos impactos son: a) Disminución de la disponibilidad del recurso hídrico, b) Mayores costos de tratamientos para la potabilización del agua, c) Mayores incrementos tarifarios, d) Disminución de la calidad del servicio, e) Mayores quejas y reclamos por parte de los usuarios.

Figura 1. Problemática de las EPS Moyobamba



Fuente: SUNASS, 2011

Modelo aplicado en la EPS de Moyobamba

Complementar los proyectos de ingeniería con proyectos de conservación

En la Tabla N° 1, se muestra la propuesta de SUNASS es avanzar hacia una regulación sostenible que complementan los proyectos ingenieriles del PMO-EPS con proyectos de conservación de la fuente de agua actual, fortaleciendo la gobernabilidad en la cuenca.

Tabla 1. Problemática-Soluciones de la EPS-Moyobamba, región San Martin, Perú

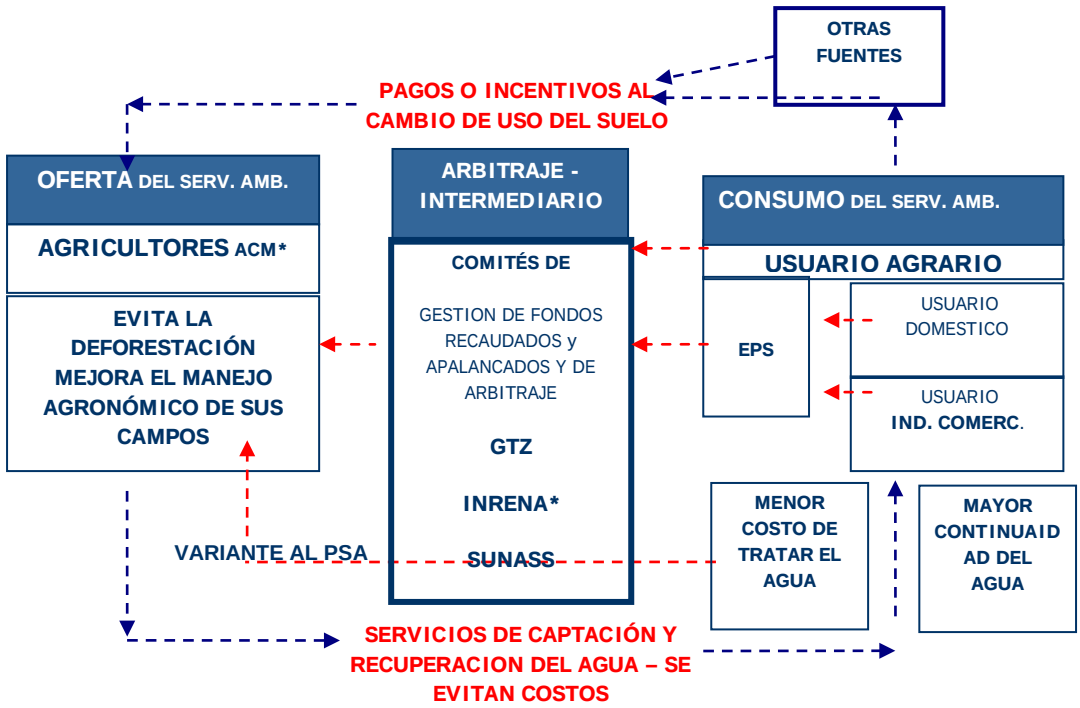
EPS	Región	Problemática	Solución ambiental	Proyectos ambientales
EPS Moyobamba	San Martin (selva)	Reducción de disponibilidad de agua en cantidad y en calidad (presencia de sedimentos) a causa de la erosión resultado de la deforestación de la cabecera de cuenca.	Esquema de pago por servicios ambientales hídricos en las quebradas Rumiyacu, Mishquiyacu y Almendra	Nueva captación + Conservación de las nacientes y fajas marginales. Recuperación de las nacientes y fajas marginales. Mejoramiento de prácticas agrícolas, cacao (PEAM). Desarrollo de experiencias agroforestales (PEAM).

Elaboración propia. Fuente: Salazar (2011)

Compensación a los agricultores y reinversión en formación y asistencia técnica

La implementación de un PSA-hídrico, donde la población urbana financia la conservación y recuperación de los servicios ambientales hídricos a través de la compensación a los agricultores y el financiamiento directo de acciones de reforestación y monitoreo del área; donde, dicha compensación es entregada a los agricultores través de una capacitación y asistencia técnica orientada a la **transformación de un sistema de producción (tradicional) de café a un sistema de producción agroforestal, así como la transferencia de pequeña infraestructura (pozos y letrinas) a los agricultores.**

Figura 2. Esquema de Pago por servicios ambiental – EPS Moyobamba



*ACM: Área de Conservación Municipal.

Plan Maestro Optimizado para el incremento de tarifas sostenibles

La incorporación del PSA en la tarifa[43] de agua se hizo incorporando proyectos ambientales en el programa de inversiones de la EPS, el cual forma el Plan Maestro Optimizado-PMO que es base de los incrementos tarifarios a ser aplicados a las tarifas de los servicios de agua potable.

La estructura tarifaria de la EPS consideró la aplicación de un incremento tarifario condicionado de 3,0% y 6,5% al segundo y cuarto año para el servicio de agua potable y de 3,0% y 6,6% al segundo y cuarto año para el servicio de alcantarillado:

Proyecto	Año	Incremento tarifario	
		Agua potable	Alcantarillado
Mejoramiento de la calidad y cantidad del recurso hídrico mediante la intervención en las fajas marginales de las fuentes de agua adyacentes a las zonas de captación de la EPS – Moyobamba.	Año 2[1]	3,0%	3,0%
	Año 4[2]	6,5%	6,6%

(1) El primer incremento tarifario estará condicionado a la presentación a SUNASS, por parte de la EPS-Moyobamba S.R.Ldta, de:

[43] Resolución de Consejo Directivo 080-2007-SUNASS-CD.

Condiciones	Situación actual
a. Acta de constitución del Comité Gestor de Servicios Eco-sistémicos en la región de San Martín.	Cuentan con Estatutos, y son conscientes de su función supervisora de los proyectos Falta Inscribirse en Registros Públicos
b. Documento de conformidad del directorio de la EPS – Moyobamba S.R.Ltda., para que los recursos recaudados por este incremento se depositen en el fondo exclusivo de inversión, constituido por la EPS Moyobamba S.R.Ltda. para financiar sus inversiones. El incremento condicionado, para efectos de su inclusión en el fondo exclusivo de inversión, equivale a un nuevo sol por mes por conexión activa, desde el año 2 al año 5 del quinquenio.	Falta la conformación del fondo exclusivo de inversiones
c. Estudio a nivel de perfil del Proyecto "Mejoramiento de la calidad y cantidad del recurso hídrico mediante la intervención en las fajas marginales de las fuentes de agua adyacentes a las zonas de captación de la EPS – Moyobamba S.R.Ltda.", elaborado de acuerdo al contenido mínimo establecido en el anexo SNIP 05-A. El presupuesto estimado para la implementación de este Proyecto es S/. 500,000.00.	Están al 80% en la elaboración del Proyecto para su aprobación por la OPI Saneamiento. Piensan realizar convenio de cooperación con PDRS-GTZ para ayudarlos en la elaboración del proyecto. PEAM-GTZ se han comprometido en iniciar un proceso de sensibilización sobre este proyecto y el aprobado para el PEAM por S/ 1,500,000 para la misma área
d. Documento metodológico que describa el sistema de monitoreo del Proyecto, basado en "indicadores de resultados objetivamente verificables", que reflejen las mejoras en las condiciones ambientales en las fuentes de captación de interés para la EPS- Moyobamba S.R.Ltda.	El Próximo mes, agosto 2008, llega una experta colombiana que determinará los Indicadores para monitorear estos proyectos (PDRS-GTZ).
e. Documento de aprobación por parte de INRENA, de acuerdo al Convenio Marco de Cooperación Interinstitucional entre INRENA y SUNASS, del sistema de monitoreo descrito en el literal anterior.	La propuesta de indicadores debe ser aprobada por la EPS, SUNASS e INRENA, para el proyecto de interés de la tres instituciones

(2) El segundo incremento tarifario estará sujeto a la conformidad con la ejecución del Proyecto en los años 2 y 3 del quinquenio, emitida por el INRENA, como supervisor técnico del Proyecto en mención (de acuerdo al Convenio Marco de Cooperación Interinstitucional entre INRENA y SUNASS). Este incremento no se hará efectivo en caso que la EPS Moyobamba S.R.Ltda. haya utilizado el dinero del fondo intangible, conformado por este incremento condicionado, para otros fines; o la ejecución financiera del proyecto no guarde relación con el avance de las metas físicas.

SUNASS lo operacionalizó con:

i) la herramienta de costos evitados (enfoque de oferta), en donde se ha valorado los beneficios para la EPS en el desarrollo de proyectos ambientales para la conservación de sus fuentes de agua. El cálculo de costos evitados del proyecto ambiental en Moyobamba en un período de 30 años, a la EPS le ahorraría un V.P.N[44]. al 2010 costos de S/. 2,991,579. La población evitará a V.P.N. al 2010 costos de S/. 1,204,932 y a la cuenca (ecosistemas) evitará a V.P.N. al 2010 costos de S/. 2,017.734. Esto quiere decir que el desarrollo de esquemas de PSA genera beneficios adicionalmente a la EPS, a la población y a la cuenca.

ii) la valoración contingente para determinar la disponibilidad de usuarios-ciudadanos de pagar por proyectos (enfoque de demanda). Como resultado de la encuesta desarrollada en Moyobamba se obtuvo que los usuarios-ciudadanos estaban dispuestos a pagar el valor de S/. 1 nuevo sol mensual por la incorporación del proyecto ambiental a través del esquema de PSA.

Con esta combinación el regulador ha convertido aportes voluntarios (PSA tradicional, liderado por ONG y cooperantes) en flujos estables-mandatorios usados como capital semilla para apalancar aportes de otros actores de la cuenca: ej. Presupuesto Participativo Regional o Local, donaciones corporativas y/o bilaterales, aportes de industrias ubicadas en la cuenca, entre otros.

Coordinación y participación de actores en la aplicación del modelo

Actor	Rol
EPS Moyobamba	Prestación de los servicios de agua potable y saneamiento en la ciudad de Moyobamba, región San Martin, Perú
Usuario-ciudadanos	Usuarios del servicio de agua potable, con derechos políticos. Revelaron su disposición a pagar por eco-proyectos.
Cooperación Técnica–GIZ	Cooperación Técnica: estudio de DAP, institucionalidad inicial.
PEAM	Programa del Gobierno Regional para el desarrollo sostenible del Alto Mayo
Comité Gestor del Área Natural Protegida	Administrador y tomador de decisión del fondo, conformada por la sociedad civil, gobierno regional y municipal, entre otros actores de la cuenca
Superintendencia Nacional de Servicios-Saneamiento-SUNASS	Regulador de los servicios de agua potable. Institución que aglutina y genera confianza entre los actores.
Ministerio del Medio Ambiente –MINAM	Regulador de las áreas naturales protegidas. Autorizó la creación de la zona de conservación municipal

[44] Valor Presente Neto

Lecciones aprendidas en la aplicación práctica del modelo

Elementos del modelo	Lecciones aprendidas: ¿Cómo hacerlo mejor?
Identificar la cadena de valor ambiental a partir de costos evitados	Los proyectos diseñados con dimensión ambiental reducen costos de operación y mantenimiento y evitan a futuro inversiones en infraestructura para abastecimiento. Por tanto, los costos evitados estima el valor evitado como consecuencia de la implementación del Proyecto ambiental.
Valorar las fábricas naturales de agua para lograr ciudades sostenibles usando valoración contingente	Encuesta para estimar la disposición a pagar de los diferentes usuarios de la cuenca por proyectos ambientales.
Identificar, armonizar, cuantificar y monetizar las inversiones en la cuenca	Permite maximizar la inversión ambiental en la gobernabilidad de la cuenca.
Invertir en las fábricas naturales de agua para lograr ciudades sostenibles	Los eco-proyectos con mayor encadenamiento-sinergético se incorporan en el PMO-EPS.
Armonizar marco legal institucional de los actores de la cuenca	Incorporando el enfoque de cuenca-eco-sistémico en el rediseño legal institucional del estado, caso por caso.
Delimitar la responsabilidad de pago de la EPS frente a los contaminadores (*free-riders*)	La población es solidaria con el que no tiene, pero no acepta subsidiar a los agentes económicos que evaden su responsabilidad.
Incorporación de las variables ambientales en el PMO agrega sostenibilidad	Reconocer la heterogeneidad cultural y ambiental, caso por caso, porque no existe una receta de talla única.
Establecer la Tarifa de costes eficientes e inversiones de largo plazo	Maximiza el uso del financiamiento concesional para acceso universal, adaptación-mitigación al cambio climático, gestión-riesgo-desastres-naturales se traduce en menores tarifas para la población y mayor valor-EPS
Transparencia en el recibo de agua potable como el nuevo contrato social entre campo-ciudad	La población se conecta con la EPS cuando lee-paga la factura, la cual aporta información de proyectos, como rendición de cuentas permanente.
Concienciación del usuario-ciudadano de su dependencia del campo a través del recibo del agua.	El usuario paga en función de su DAP, que depende de la percepción de beneficios que la conservación genera para él. La información es clave para que el usuario recupere la confianza en su EPS.
Capacitar a nuevos líderes cívicos del agua con enfoque de interculturalidad	La sociedad civil participa mejor si está informada y entrenada. La heterogeneidad cultural requiere de capacitar a líderes de identidades colectivas regionales, porque ellos traducen el mensaje de la EPS en lenguaje del pueblo y le agregan credibilidad.

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8. Water and the green economy in Western Asia: regional context and lessons learnt

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Regional context

The Arab region is one of the most water scarce regions in the world, as most countries are located in arid or semi-arid areas. In 2008, 16 out of 22 Arab countries were below the annual per capita water poverty threshold of 1,000 m^3 of total renewable water resources[45], a situation that is rapidly worsening as populations continue to grow. Rapid population growth also boosts demand for food, in turn driving intensive domestic agricultural water use and threatening the sustainability of water resources. Energy poverty of Arab countries outside the Gulf Cooperation Council (GCC) limits the ability to produce and distribute water resources to urban, rural and remote communities in an optimal manner since the production and distribution of water is closely related to the availability of energy. Improvements in the quality of water have been limited by sewage infiltration to water networks resulting from poor infrastructural investment and maintenance as well as intermittent water supply. Climate change is also expected to have negative impacts on water resources of the region. These water challenges restrict progress towards achieving the MDGs related to poverty and hunger, health, education, gender equality, and environmental sustainability.

Arab countries have responded to these water challenges with various policies. GCC countries as well as Egypt, Iraq and Jordan have constructed desalination facilities. The reuse of treated wastewater is also being encouraged for use in irrigation as to help protect and alleviate some of the pressures on the limited fresh water resources. Integrated water resource management (IWRM) principles and tools, natural resources accounting, and virtual water calculations have been promoted by international and regional organisations to improve the valuation of water resources as an integral component of development planning. This has contributed to the reform of water tariff structures and gradual phase-out of agricultural subsidies in some parts of the region. These measures, however, have not been sufficient to meet the growing regional water demand and to ensure the sustainability of water resources in the region. Most countries continue to consume more water than their renewable water resources budget can bear, which is leading to the reduction of water resources on a net and per capita basis. As a result, progress towards the achievement of the MDG targets on water supply and sanitation is limited and has not resulted in the multiplier effects that a sound and sustainable water sector can provide for achieving the other MDGs.

Arab countries have shown some progress in achieving the MDG targets related to access to improved water and sanitation services, although the Least Developed Countries – including Sudan and Yemen – and countries in conflict are still suffering from limited access to improved water and sanitation services in urban and rural areas. As of 2008, eighty-five percent of Western Asia used improved sanitation (an increase of 5% from 1990) and 90% had access to improved drinking water sources (an increase of 4% from 1990)[46]. However, with intermittent water supply most people in the region do not receive a sufficient amount

[45] FAO, AQUASTAT

[46] WHO and UNICEF, 2010

of good quality water services. This has imposed an additional economic burden on the general population, and particularly on the poor, since most people still resort to private water vendors or informal mechanisms to offset gaps in the quality or quantity of water provided through the public water distribution networks. In response to this challenge, the Arab Ministerial Water Council (AMWC) mandated ESCWA to lead a regional coordination mechanism involving the Arab Countries Water Utilities Association (ACWUA), the Arab Water Council (AWC), the Centre for Environment and Development for the Arab region and Europe (CEDARE) and the Arab Network for Environment and Development (RAED) to develop, on the basis of the basic water and sanitation MDG indicators, a monitoring mechanism that incorporates an additional set of indicators specific to the Arab region. Reporting on the progress of the Arab countries in achieving the basic as well as the additional indicators is expected to be done through this regional monitoring mechanism and under the political umbrella of the AMWC.

MDG-7 on ensuring environmental sustainability has often been considered at odds with efforts to achieve rapid economic growth. Aggressive economic growth has in turn been negatively associated with environmental degradation, which has left many to perceive economic growth and environmental sustainability as competing goals. In the end, both must be pursued in a manner that supports progress towards sustainable development.

Efforts to foster a green economy seek to highlight opportunities that the environment sector presents for development by attracting new investments, as well as cleaning up existing inefficient or polluting industries. An improved water sector is one of the industries that can lead the way towards a greener and cleaner future by providing the enabling infrastructure and input needed to meet sustainable development targets. However, care must be taken to ensure that efforts to promote opportunities in the water industry and associated sectors that seek improved service delivery from the industry (e.g. agriculture, tourism, etc.) do not neglect questions of water resource sustainability, particularly in the water scarce ESCWA region. Doing so can result in serious implications for rural poverty, employment, food security and human health.

A green economy would thus facilitate the search for alternative solutions for multifaceted challenges through a sustainable development lens. This includes highlighting how new technologies and traditional techniques can be used to build a bridge and find a balance between the needs of today and the future.

Some recent projects in the Arab region show how green economic thinking has already resulted in new initiatives that are driven and derived from the unique regional setting. ESCWA countries have started to deploy different technologies and technical solutions to meet regional challenges. Some are adaptations of ancient techniques, while others are grounded in the research and development of new technologies. These examples are then complemented by lessons learned from building the capacity and strengthening the institutions responsible for delivering modern and improved water services in the ESCWA region.

The session on water and the green economy in the ESCWA Region focuses on how progress towards the MDG targets related to water supply and sanitation can contribute to fostering a green economy within the context of sustainable development and poverty eradication. This is realised through efforts to improve the technical and financial capacity of water utilities to

deliver accessible and reliable water services for domestic use in urban and rural communities. This is examined through two case studies elaborated by the session panellists, which will showcase different models for improving the efficiency, performance and service delivery of publicly and privately operated water utilities through centralised and decentralised approaches.

In addition, case study briefs are provided to offer insights into other success stories and challenges facing the water sector in the ESCWA region that complement many of the lessons drawn from the two case studies. These include reference and recognition of regional specific characteristics and concerns related to the water-energy nexus, the use of traditional knowledge, and efforts underway to overcome the extreme level of water scarcity faced in the region through the development of non-conventional water resources and management schemes.

Challenges

The main challenges for water management in the ESCWA region are:

(a) Water scarcity and water quality

While many countries in the world do not enjoy sufficient amount of water resources, water scarcity of the ESCWA region in terms of per capita availability of renewable water resources is unique. In 2008, the total annual per capita share of renewable water resources in the ESCWA region was only around 566 m^3, while 5 out of the 14 ESCWA countries had an annual per capita share of even less than 100 m^3. Furthermore, this extremely low level of water resources availability is rapidly decreasing with the blossoming regional population that quadrupled in the last half century from about 67 million in 1961 to over 250 million in 2009.[47] This lack of water resources constrains the economic and social development of the region which also affects the progress towards achieving the MDGs. Moreover, the quality of water is poor in several countries mainly resulting from discharge of untreated wastewater, and poor maintenance and lack of investment. Increasing salinity of groundwater due to excessive pumping of groundwater and sea water intrusion due to reduction of river run-off is also affecting the quality of water resources.

(b) Shared water resources and conflicts

Water resources in the region are mostly shared among countries, thus leading to competition over their use. Most of the major rivers of the region including the Nile, the Euphrates and Tigris as well as many groundwater aquifers are shared between countries inside and outside of the ESCWA region. Without adequate mechanisms to reduce the risks of conflicts over shared water resources, the region is a candidate for disputes and conflicts, not only between riparian countries of international watercourses, but also between riparian countries of smaller shared surface water and transboundary aquifers. Geopolitical factors and power imbalances significantly contribute to the existing low level of cooperation in the management of shared water resources in the region.

(c) Water, food and energy nexus

[47] World Bank, World Development Indicators; FAO, AQUASTAT

Excessive agricultural water use and energy shortages in several ESCWA countries are additional water challenges of the region. Agriculture is still a very important economic sector in many countries of the region and employs large segments of the population. In particular, for many people living in rural areas, agriculture is still probably the most important source of income. Also, domestic agricultural production can reduce external commodity price shocks that have been witnessed globally between 2007 and 2008. However, agricultural sector consumes over 80% of total water withdrawals in Yemen, Oman, Saudi Arabia, Syria and UAE, all of which suffer from extreme water scarcity.[48] This level of agricultural water use seriously threatens the sustainability of water resources of the region, particularly the non renewable aquifers. Additionally, the high scarcity value of water in the region makes water use in non-cash crop irrigation economically unfeasible. Nevertheless, considering the rooted role of agricultural sector in the lives of people living in the rural areas of the region, national agricultural policies need to be reviewed in light of the growing water scarcity and a holistic socio-economic and political perspective on food security.

The linkage between water and energy adds another water challenge to the region. In energy deficient ESCWA countries, water supply is sometimes limited due to energy shortages as energy is required for the production and distribution of water. The Yemen case represents this issue well. In the case of the energy rich GCC countries, although they, to certain extent, have been able to address the water challenges through increasing investments in desalination, the large government subsidies for the construction and the operation and maintenance of these desalination plants is viewed to be economically unsustainable on the long run.

(d) Climate change

It is predicted that climate change will have significant impacts on the water accounts, and this in turn threatens to negatively affect water availability in the region. While the impacts of climate change is expected to vary from country to country, from the regional perspective, the ESCWA region is expected to suffer a reduction in its water availability as a result of less precipitation, higher temperature and more active evapotranspiration. Although detailed impacts of climate change on water resources are still to be scrutinised, considering the high water scarcity level in the ESCWA region, even a slight reduction of water availability or a change in the pattern or frequency of its flows will result in significant social and economic national and regional impacts. Moreover, as a result of climate change, extreme weather events such as droughts and floods are already increasing in the region. Cyclone activity in the Gulf region has also recently intensified with the three strongest cyclones occurring since 2000.[49]

Approaches

Financing, capacity building, water planning, and technological application and development are commonly used tools identified from regional experiences. In order to address the increasing gap between water supply and demand, some countries in the region have

[48] FAO, AQUASTAT

[49] Gulf news, "*Facts about Tropical Cyclone Phet*", 6 June 2010, available at http://gulfnews.com/news/gulf/oman/facts-about-tropical-cyclone-phet-1.636372

undergone institutional reforms adopting the principles of integrated water resources management within their policies.

Many countries of the region have tried to strike a balance between supply and demand management approaches in order to satisfy the growing water demand. Among the tools that are being adopted by an increasing number of the region's countries is an increasing reliance on the use of non-conventional water resources, namely desalinated water and treated wastewater. Investment in desalination of sea water and brackish groundwater is growing in the region, particularly in the energy rich GCC countries, and to a lesser extent in other countries of the region; although use of desalinated water is mostly confined to domestic and industrial uses only. Treated wastewater has also attracted interest in many countries of the region, not only because of the direct benefits that are realised from its reuse especially for irrigation thus alleviating some pressure on the limited freshwater resources, but also for the direct and indirect environmental benefits realised from the treatment of domestic and industrial wastewater that would otherwise be a source of public health hazards and a source of contamination of other fresh surface and groundwater resources. Treated wastewater, although representing only a small percentage of national water demand, is considered a significant and reliable water resource in and around the large urban centres. In this regard, treated wastewater from the city of Cairo, Riyadh, or Damascus constitutes a water resource that can contribute to partly satisfying the demand for irrigation water within and around those cities.

For the water and sanitation service sub-sector, the adopted national reform programmes have also led to the establishment of more efficient decentralised water and sanitation utilities. Both the utilities and consumers have directly benefited from these reform programmes. Tariff readjustments, autonomy and commercialisation have allowed the utilities to provide better and more reliable and predictable service levels, relieving consumers from the need to seek other less quality and more expensive water services from private vendors.

The use of traditional water management approaches is also considered to be an important tool that can contribute to effective management of water resources. Some countries of the region are investing in maintaining and restoring some of these traditional water collection systems like terracing of mountains in Yemen and household level rainwater harvesting reservoirs in Palestine and Jordan as well as the revitalisation of traditional rules, customs and norms for water allocation in Yemen. Traditional landscaping, urban planning and traditional architecture are also being considered in some areas as an integral part of water and environmental management. Reintroduction of local indigenous plants within national efforts to create work opportunities and generate income by increasing the competitiveness of micro and small agro-industries is being implemented in South Lebanon. Similarly rooftop water rainwater collection and farming help some Palestinian households to partly satisfy their water and vegetable needs.

Like traditional approaches, advances in technology are also considered to be an important tool in the management of water resources. Advances in desalination technology have assisted some countries of the region to adopt strategies that rely on desalinated water to satisfy growing domestic water demand. In this regard, the UAE have adopted strategies that promote the recharge of groundwater with excess desalinated water in an effort to establish a strategic groundwater storage reserves. Oman, in an effort to maintain groundwater reserves

for future generations, has also adopted a strategy that prohibits the use of groundwater and promotes investing in desalination as an alternative source for domestic water supply. Water planning and technological application and development is also actively pursued to address interrelated challenges of water, food and energy. In Saudi Arabia, solar energy desalination technologies are pursued to reduce energy costs of desalination, while greenhouse hydroponics farming has been experimented in the ESCWA region including Lebanon, UAE and Qatar, where over 90% of food is imported. Many of the countries of the region are realising the benefits of applying water saving technology, especially in agriculture. In this regards some countries have introduced financial incentives for farmers to invest in sprinkler and drip irrigation.

It should also be realised that while the application of technology has led in some cases to water savings and higher water use efficiency and productivity, in other cases the use of technology, like the introduction of deep drilling and heavy submersible pumps have led to the near exhaustion of many aquifers, like is the case in the highlands of Yemen. The shift from rain-fed farming to irrigated agriculture in Syria has also lead to higher land productivity, but leading at the same time to wasteful irrigation practices in areas relying on surface water and to depletion of aquifers in groundwater irrigated lands.

Lessons learnt

- Although most countries of the ESCWA region have already achieved, or are on track to achieve, the water and sanitation MDGs targets, financial constraints and political instability of some countries are considered to be the main reasons for their inability to achieve those targets.

- Water planning and capacity building (management, human resources, institutions, etc.) have played an important role in increasing access to water and sanitation services.

- Having been developed mainly on the basis of health considerations, the current water and sanitation MDG indicators do not reflect the level or quality of water and sanitation services. This in turn has raised the need to develop a regional initiative to complement the current MDGs with additional indicators that, while clarifying the level and quality of services; take also the specificities of the region into account.

- In the ESCWA region, water challenges are closely connected to agricultural development and food security as the agricultural sector consumes the majority of the available water resources. Nevertheless, the agricultural sector is economically sensitive since in many countries of the ESCWA region it provides the largest employment opportunities.

- Current levels of agricultural water use in many of the countries of the region are not sustainable and irrigation practices are not efficient. Agriculture, on the other hand contributes to the social stability of the region. Ideally scarce water should be allocated as to optimise the social and economic value derived from its use. In this respect, sustainability of groundwater use needs to be realised and considered within the national plans of the region's countries.

- Agricultural subsidies in the region need to be reevaluated as to promote water saving and increase the water use efficiency in irrigation. Cost recovery of water supply and

sanitation services is a strong element of the financial sustainability of water utilities and allows for better service delivery to consumers.

- Education, awareness raising and communication programmes that target the agricultural sector are likely to have significant impact, especially when integrated with other programmes and projects that introduce water saving technologies and techniques.

- Water challenges are also connected to the energy sector as the production and distribution of water requires energy. Frequent energy cuts have contributed to depriving consumers of adequate water supply services.

- As shown from regional experiences, technological developments play an important role in addressing water challenges in the region. Advancements in desalination, wastewater treatment, and water loss reduction can contribute to facing the water challenges in the region. Nevertheless, technological advancements in drilling and pumping have contributed to the near exhaustion of many aquifers.

- Traditional water systems and knowledge need to be revitalised and integrated into the concepts and principles of integrated water resources management. Rain-fed farming, rainwater harvesting, reintroduction of indigenous agricultural species, and customary water allocation rules are examples of these traditional water management systems.

- While the region shares common aspects of some water challenges, differences between countries of the region require taking into account national specificities when addressing ways to tackle these challenges at the national level.

- Integrated planning among national institutions and stakeholder participation are important elements of policy development, sustainable water and sanitation services, and successful project implementation.

Capacity development in the Arab Region: The role of ACWUA in promoting the exchange of experiences and expertise

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Type of tool: cost recovery and financing, capacity development
Issue: Cities, watersheds
Location: the Arab Region, Western Asia

Challenges

The Middle East and North Africa Region (MENA) or the Arab region is the most water scarce region in the world. One half of the Arab's population lives under conditions of water stress. Moreover, with the population expected to grow from around 300 million today to around 500 million in 2025, per capita water availability is expected to halve by 2050. The water sector in the Arab region suffers from chronic problems, such as water scarcity, weak water and environmental policies, high investment needs, lack of management and technical expertise, increasing demand due to growing populations, and regional conflicts.

The source of water varies from one country to another. While Egypt and Iraq rely mostly on surface water from large international rivers, others, like Yemen, Djibouti and the Gulf Cooperation Council countries depend almost entirely on groundwater and desalination, while others use a mixture of surface and groundwater. Most Arab countries have mobilised almost all available surface water, and many major rivers do not reach the ocean.

More than any other region, water resources in the Arab region are considered as a development issue. In this respect, Arab countries have responded to scarcity by heavily investing in water related infrastructure. Many have heavily invested in water storage infrastructure and in expanding their irrigation systems. Additionally, the Arab region leads the world in using non-traditional water resources through the use of desalinated water and reuse of treated wastewater is increasingly gaining importance in many countries of the region. However, these large investments have not always been accompanied by the necessary institutional and policy changes, and are often not generating optimum economic returns. Non-water policies in particular create incentives for inefficient water use in agriculture for example, which uses 85 percent of the region's water, and unsustainable pumping of groundwater, which is similarly encouraged in some countries through heavy energy subsidies[50].

The drivers of change

With respect to water supply and sanitation infrastructure, large disparity exists within the Arab region on the level of population access to these facilities. In the Third Arab Report on the Millennium Development Goals prepared in 2010, Arab countries were classified into 4 categories[51]. Overall water supply coverage of the first category comprising the GCC countries (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates) is estimated at 93 per cent while sanitation coverage at 98 per cent. Only Oman stands out as it

[50] The world Bank, Water Sector Brief: http://go.worldbank.org/JQVM8LMP70
[51] ESCWA MDG report 2010

lags behind other fellow GCC countries due to its high percentage of rural population. The second category comprises countries that are on track to achieve the water supply and sanitation targets (From the Mashreq region Egypt, Jordan, Lebanon and the Syrian Arab Republic and from the Maghreb region Algeria, Libyan Arab Jamahiriya, Morocco and Tunisia). Overall water supply and sanitation coverage stands at 96 per cent and 89 per cent, respectively for the Mashreq countries and 87 per cent for both for the Maghreb countries. The third category comprises the Least Developed Countries (LDCs) (Yemen, Comoros, Djibouti, Mauritania and Sudan) that are not currently on track to reach their WSS target. Overall water supply and sanitation coverage is estimated at 66 and 46 per cent, respectively in Yemen while for the LDCs as a group it stands at 67 and 38 per cent, respectively. The fourth category comprises countries in which their respective water and sanitation infrastructure deteriorated due to political instability, occupation and/or internal strife and as such face an uncertain prospect of reaching the desired water supply and sanitation goal. These countries include Iraq, the Occupied Palestinian Territory and Somalia. Overall water supply coverage is estimated at 78 per cent for Iraq and the Occupied Palestinian Territory and less than 30 per cent for Somalia.

The water situation in the Arab region is increasing the cost of supplying water to the Arab population and by association is increasing the pressure on water operators to improve their efficiencies and capacities. In order to improve and promote regional cooperation and exchange of experiences towards improving the efficiency of water utilities in charge of water supply and sanitation, the Arab Countries Water Utilities Association (ACWUA) was founded as a result of an initiative by key water sector representatives in the Arab region. This Association is expected to provide a platform for communications and exchange of experience for water utilities for improving the level of services and benefits. This will be achieved through the development of performance indicators, the development of modern technical standards, building capacity and improving the management of large investment projects.

The approach

1- Creation of the association

At the end of July 2009, the Arab Countries Water Utilities Association (ACWUA) was officially launched in Amman, Jordan. Since its creation, the ACWUA had the support of the Economic and Social Commission for Western Asia of the United Nations (UN-ESCWA) and the German Technical Cooperation (GTZ). Through its working groups, ACWUA focuses on the management of utilities, water resources management, water and health, utilities reform, benchmarking as well as capacity building and training.

ACWUA, as a regional centre of excellence, partners with water supply and wastewater utilities in Arab countries to provide best practice service delivery to their members through:

1. Serving as a regional platform for exchange of knowledge and best practice amongst member experts and professionals.

2. Developing resources, facilitating training programmes, and advocating for professional certification to enable member utility staff to perform their duties in a professional, reliable and cost-effective manner.

3. Promoting standards of performance for the governance, management, operation and maintenance of water supply and wastewater utilities.

4. Supporting the interests of ACWUA members including the provision of advice and consultation in water legislation, policies, and sector management and reform.

5. Developing, promoting and disseminating publications and other knowledge products to meet the needs of members and other regional professionals.

2- Development of capacity building tools

Through its close cooperation with local governments, international associations, training specialists, donors, academic and research institutions, think-tanks, and international organisations, ACWUA was able to offers its members a strong networking platform. This platform included the identification and creation of Technical Working Groups (TWGs), developing training and capacity building programmes along with their associated tools, and the establishment of an e-platform for knowledge management and network collaboration (ACWUA Wiki).

ACWUA Technical Working Groups comprise qualified experts from Arab region and deal with priority areas identified by its members at their general meetings. Members of the Working Groups deliberate on the identified issues and come up with a work plan to enhance exchange of experience and disseminate lessons learnt from best practices. The current technical working groups and associated sub-groups are detailed in table 1 below.

Table 1. Working Groups and associated sub-groups

No.	Technical Working Group	Sub-groups
1	Utilities Management	1.1 Cost Recovery 1.1.1 Non Revenue Water (NRW) 1.1.2 Water for the Poor 1.1.3 Energy Efficiency 1.2 Asset Management
2	Capacity Building and Training	2.1 Training Strategy 2.2 Certification
3	Water Resources Management	3.1 Governance 3.2 Master Planning 3.3 Protection of Resources 3.4 Adaption to Climate Change 3.5 Integrated Water Resources Management (IWRM)
4	Water and Health	4.1 Domestic Water Supply 4.2 Waste Water Treatment and Re-use

No.	Technical Working Group	Sub-groups
5	Utilities Reform	5.1 Autonomy/Commercialization 5.2 Public-Public Partnership 5.3 Private-Public Partnership
6	Benchmarking	

With respect to training and capacity building programmes and tools for water and wastewater utilities, the programmes cover institutional, managerial, technical and financial topics with the aim of building up a regional pool of Arabic trainers to address the needs of the region. Figure 1 below provides an illustration of ACWUA's training practice.

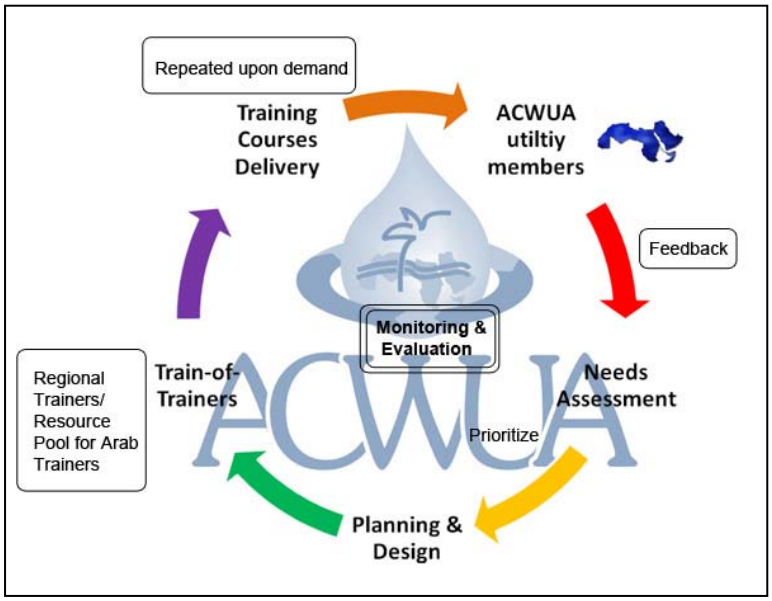

Figure 1. ACWUA training practice

The outcomes and exchange of lessons learnt

1- Development of an Improved Water Utilities Performance programme (WUP-TRAIN)

ACWUA in cooperation with GIZ developed and conducted regional capacity building programmes to improve the performance of water and wastewater operators in the Arab region. Since the launch of the programme, 220 top and middle management staff from the different Arab water and wastewater utilities have been trained. Modules prepared for this programme include:

1. ELAC - Effective leading and communication in water utility management
2. NCCG - Negotiation and cross sectoral coordination for enhanced water governance
3. PIAS - Key performance indicators and benchmarking
4. BPQS - Enhancing business performance of water utilities through quality management and standards

The WUP-Train programme is designed to benefit top management of water utilities and decision makers in the water sector; senior to mid management of technical and commercial

departments in utilities; senior professionals from government agencies involved in policy formulation, supervision and regulation; academia, representatives from the civil society and other water sector professionals and practitioners involved in programme development, formulation and implementation.

2- Water Utilities Management Capacity Building Programme (WUM-CBP)

ACWUA in cooperation with Engicon O&M and the German Association with Water, Wastewater and Solid Waste (DWA) launched in 2011 the Water Utilities Management Capacity Building Programme (WUM-CBP). This programme works on building linkages with the private sector in water industry in order to provide a wider variety of training modules to its members in water utilities management aspects. Modules prepared for this programme include:

1. Operations & Maintenance of Water Pumping Stations
2. Operations & Maintenance of Water Distribution Networks
3. Operations & Maintenance of Water and wastewater Treatment Plants
4. Operations & Maintenance of Sewage Networks
5. Operations & Maintenance of Sewage Pumping Stations
6. Basic/ Medium/ Advanced levels of Non Revenue Water Management

3- Exchange of best practices in Arab Region

More than 100 water experts from the Arab region gathered at the Dead Sea on 15-16 October 2008 in order to exchange their experiences on utility management practices and to set the Arab Region's Standards of Operation and Maintenance (SOMPs) of water and wastewater systems. Such standards are considered essential for improving the efficiency and effectiveness of utility operations. These SOMPs act as risk management measures that reflect positively the delivery of services to consumers. The quality and quantity of distributed water should improve as these procedures are applied. Also, these procedures will act as a base for job descriptions, and help to set training guidelines. Accordingly, the efficiency and skills of the operating workers is expected to improve.

Almost 300 water experts from the Arab region exchanged their best practices on the issue of "Non-Revenue Water in the Arab Region" during a regional conference that was organised by ACWUA and other partners in Rabat, Morocco in January of 2010. The experts reviewed and discussed the situation in different cities of the region and provided up-to-date information and practical examples through numerous case studies on many topics including: rehabilitation methods, company strategies, as well as monitoring and financial strategies to reduce water losses and management of customer relations.

Exchange of lessons from Arab countries on water cost recovery[52]

At present, the Alexandria Water Company (AWCO) is recovering its costs and is generating profit. AWCO's strategic plan till 2037 was prepared based on systematic thinking and scientific analysis methods. A population projection study of Alexandria was prepared and according to this study the future water demand was determined, a technical study of the

[52] Extracted from the proceedings of the Arab Water Week held in Amman Jordan from 5-9 December 2010.

water plants and networks current situation was performed, and accordingly a strategic plan of the necessary projects needed in the future was drafted and included all the economic and financial aspects. Within the strategic plan, the main factors that were considered in tariff setting were:

a. Preparing an overall business plan.
b. Increasing the efficiency and effectiveness of the working environment and reducing costs to the minimum.
c. Categorising the water fees in accordance with the social standards of customers.
d. Enhancing the water fees collection efficiency with an aim to increase it by 10% every 5 years.
e. Reducing both physical and administrative water losses by enhancing network management.

Since 1974, the National Water Supply Authority in Tunis (SONEDE) has been using an increasing block rate structure for charging water consumption. Currently, the modified structure includes five blocks, with a volume of 20 m^3 per quarter in the first block. Separate schedules are applied for standposts and tourism consumption. Through its new pricing policy, SONEDE aims to:

a. Enable the low-income socio-economic segment of the population, located in rural areas and in peripheral urban zones, to have access to drinking water at low cost.
b. Ensure that the water sector is more viable by covering operating and financing costs and partially the set-up costs.
c. Provide a pricing policy that orientates consumers' decisions while seeking an optimum utilisation of water.
d. Ensure that the pricing system is easily understood and accepted by water consumers.

Since introducing the modified pricing structure, SONEDE, through the new tariff system, has been able to cover all the running costs, including depreciation, and increase the capacity of self-financing by around 40%.

In Palestine each local community is responsible for supplying water for the community, each applying a different tariff and not achieving cost recovery. To remedy the existing situation the Palestinian Water Authority prepared a tariff policy guideline. This policy guideline puts the basis and standards upon which tariff and prices are based. It explains and illustrates the procedures and steps for applying the Tariff Regulation. These standards must equally apply to all municipalities, utilities and other water providers. Although the standards have been unified for all service providers, the water prices may be different from place to place or from provider to another, because of the cost to access the different water sources. The Tariff Regulation must fulfil many of the main objectives of water policy. The tariff structure and prices set shall ensure cost recovery for the individual utilities whereby revenues are expected to exceed costs. The water utilities shall increase revenue collection in the following stages until full cost recovery is achieved.

In Yemen, the assessment of the general performance of Local Corporation for Water and Sanitation (LC) in IBB – Yemen took place in May 2007. It showed that the LC was working under difficult technical, administrative and financial conditions. Main recommendations of

this assessment included the need for tariff adjustment according to inflation and electricity prices in coordination with Local Administration; restructuring the customer / management relation to improve process efficiency; starting of GIS based digital customer management systems; introducing GIS in meter reading and quality management for readings; application of DCMMS (Dorsch Consult Maintenance Management System) to improve networks maintenance; and the need for analysis of repair data to prioritise investments. The application of these recommendations resulted in recovery of O&M costs in 2009 and is expected to recover depreciation costs by the end of 2010. In addition to being rewarded the "best public service in 2009", the decrease in total cost of maintenance and the additional services being provided to customers have generated additional income to the LC.

Reform of the urban water supply and sanitation sector in Yemen

Issue: Cities
Location: Yemen, Western Asia

Abstract

This paper summarises the experience of on-going reform in the urban water supply and sanitation (UWSS) sector in Yemen. The reform is supported financially and technically by several international players including the GIZ, World Bank, the Embassy of the Kingdom of the Netherlands (EKN). The reform has dramatically reshaped the UWSS sector shifting power away from a central authority to local agencies. Better customer services, more financial stability, and better protection of the least advantaged groups are some of the most positive outcomes of the reform initiative.

Challenges and objectives

Being one of the least water endowed countries with a high population growth, Yemen is facing a serious water scarcity problem that threatens its socio-economic development. Prior to recent reforms, poor financial performance and inadequate services characterised the Urban Water Supply and Sanitation (UWSS) sector in Yemen chiefly attributable to centralisation of these services in one national agency, the National Water and Sanitation Authority (NWSA). Badly kept infrastructure, weak technical capacity and very high unaccounted-for-water (UFW) rates have adversely impacted the quality of NWSA services and its financial viability. To address these problems, in the early 1990s, the Yemeni Government with financial and technical support from several donors including the GIZ, World Bank, and the Embassy of the Kingdom of the Netherlands (EKN) embarked on a long-term plan to reform the UWSS sector by decentralising services at the governorate level. The main goal of the reform programme is to restructure the UWSS sector to a system composed of several local corporations (LCs) each managed autonomously and independent of the NWSA to serve a specific governorate in Yemen. The reform process was facilitated by an overall national policy for reform and decentralisation.

The framework of the reform process was set in place in 1996 by a Policy and Strategy Study (PSS) authorised by the government and funded by the World Bank[53]. The study highlighted several objectives to be achieved by the reform process including: creating an independent regulatory body separate from the executive, financial sustainability, decentralisation, commercialisation, human resources development, stakeholder participation, and private sector participation. The recommendations of the study were adopted by the National Cabinet in 1997 which passed a resolution (#237) setting the legal framework for the reform of the UWSS sector. The resolution specially set several targets – that parallel PSS recommendations – including increasing UWSS coverage, achieving financial sustainability, separation of the regulatory body from the executive one, decentralisation, capacity development, and community participation.

[53] John Kalbermatten and Associates (1996). "Yemen Water Supply and Sanitation Sector Policy and Strategy Study." Washington, D.C, John Kalbermattern and Associates.

In parallel to this process, a new water and sewerage project was developed in the city of Rada'a where principles of cost-recovery based tariff setting, community participation, and high quality services were emphasised. Learning from the successful implementation of this project the Yemeni government and donors, EKN, the World Bank and GIZ, developed through extensive discussions and consultation, the "Rada'a Principles" to guide the UWSS reform programme. The Rada'a Principles (see Table 2) are essentially a design blueprint of a model autonomous local utility. They emphasise independence from the central agency, separation of regulations and operation, setting local cost-recovery tariffs, and independent auditing.

Table 2. Rada'a Principles

• The Branch will operate independently of NWSA Head Office while remaining accountable to NWSA on regulatory matters and to the Minister of Electricity and Water on policy issues.
• The Branch will be accountable to the community it serves through a Local Advisory Committee which will monitor and review the Branch's activities.
• The Branch will set its own local cost-recovery tariff, apply this upon approval by the Minister, operate its own billing system and retain revenues in its own bank accounts separate from any NWSA authority, while paying an overhead contribution to NWSA Head Office for regulatory/technical services.
• The Branch will appoint its own staff, except for the three main management posts which will be via Ministerial resolution on agreed criteria.
• The Branch will apply a staff incentive scheme based on actual performance to supplement staff remuneration according to civil service standards.
• The Branch will prepare monthly operational reports and quarterly and annual statements of account for NWSA Head Office and the Minister of Electricity and Water.
• The Branch will have its accounts audited by a private auditor appointed by the Central Audit Board while retaining the right of NWSA also to audit the Branch accounts as necessary.

The Technical Secretariat (TS), funded by GIZ,[54] was formed in 1995 to oversee and guide the implementation of the reform programme. The TS articulated the findings of the Policy and Strategy Study into a reform agenda that was adopted in the Cabinet Resolution #237. The reform agenda contained an elaborate array of tasks to carry out the reform process including conducting awareness raising, supporting technical and institutional capacity development. The TS supported the public private partnership (PPP) process in Sana'a LC including contract preparation. The TS also provides technical and financial support for the Performance Indicator Information System (PIIS) which was developed to monitor and assess the performance of LCs. The TS is instrumental in supporting of developing national policy documents and studies. It particularly provided support in the development of the

[54] TS/GIZ refers to Technical Secretariat (TS)/Reform of the Institutional Framework in the Urban Water and Sanitation Sector and GIZ.

National Water Sector Strategy and Investment Programme (NWSSIP) (2005-2009) and carrying out joint annual reviews (JARs) of the NWSSIP for the years 2006, 2007 and 2008.

Implementation of the reform process

Three main activities were considered in implementing the reform process: support of the reform process, decentralisation and development of public private partnerships (PPPs).

Support of the reform process

To support the reform process several key activities were emphasised including technical and institutional development, stakeholder participation, community participation, information sharing, and customer relations. The process of technical and institutional development focused on policy analysis and diagnosis, implementation of the Cabinet Resolution #237, and monitoring and evaluation based on annual joint reviews.

Over 50 workshops were organised between 1996 and 2008 to engage a wide range of stakeholders. The workshops focused on education and building consensus. These workshops acted as a platform to involve local communities. These communities were also involved through the participation of local councils, civil societies, and others members of the communities in the boards of director and the advisory boards of the LCs. Public awareness campaigns and media releases were used routinely to disseminate information on the reform programme.

A great emphasis was placed on customer relations. Dedicated departments were developed in LCs to handle customers inquires and complaints. Community mobilising workers (CMWs) were trained to reach out to the public through awareness activities. Women played a key role as part of the CMWs. In certain areas, such as Sana's and Aden, the LCs have offices that in addition to handling bill payments, respond to customer's complaints and minor technical problems.

Decentralisation

Utilities were supported to achieve independence and maintain financial sustainability. Although LCs were initially required to recover at minimum their operation and maintenance cost (O&M), this requirement was relaxed given that these utilities achieve O&M cost recovery at a later stage[55].

Support for decentralisation was in the form of providing technical and financial assistance to carry out several interventions including for example setting supervisory boards, assessment of investment needs, setting up organisation structure, and developing capacity in modern management tools, accounting, human resources management, tariff analysis, asset management and setting up service agreements.

Public private partnership (PPP)

PPPs have not yet shown great promise in the reform programme. Sana'a LC attempted to establish a PPP. Despite some initial interest from the private sector during the pre-bidding process, no bids were made to undertake a lease offer for 8-10 years. Several reasons were

[55] It is reported that these decisions are primarily in response to local demand and under the pressure of political interventions.

cited for the lack of interest from the private sector including the acute water scarcity conditions in Sana'a, the provision to maintain the current staff, high level of poverty, lack of information on affordability and socioeconomic conditions, and the lack of independent regulation. There was also resistance from the LC staff and board of directors to enter on a management PPP.

Another example of a PPP is the Utility Support Programme (USP) between Taiz Water and Sanitation Local Corporation (TWSLC), Vitens NV and Netherlands government. The USP was established to deal with very poor water utility services. However, after two years the TWSLC could not manage to recover its O&M costs. This poor performance was attributed to weak communications between TWSLC and Vitens, and the ambiguity of the implementation procedure.

Status of the reform programme

The status of UWSS reform programme can be assessed based on changes in the following conditions: sector governance structure, level of coverage, financial sustainability, regulation and human resources development.

Sector governance structure

The reform programme has dramatically reshaped the UWSS sector. By 2008, 95% of the urban populations were served by the decentralised UWSS utilities that include LCs, LC branches and autonomous UWSS utilities (AUWSSUs). These utilities are mostly running their own operation, making investment and staffing decisions. Although the overstaffing problem has been partially addressed through early retirement, this problem is still serious given the high poverty rates in the country and poor social security system.

Level of coverage

Table 3 shows the achieved and target level of coverage for water supply and sanitation. Although changes look modest, it is worth noting that Yemen has one of the highest population growth rates worldwide, with a national annual average of 3% and as high as 7-9% in the main urban centres.

Table 3. UWSS coverage rates

	2002	2007	2009 (target)
Water supply	47%	71%	56%
Sanitation	25%	52%	31%

Financial sustainability

Most LCs were able to achieve full recovery of operation and maintenance costs. Some were also able to recover the electro-mechanical depreciation. Full cost recovery is still not achieved mainly attributed to the substantial cost of capital investment and very low ability to pay due to widespread poverty.

Tariffs were restructured from six to three blocks. An affordable life line rate is charged on the first block or bracket of 5m³ to 10m³ to benefit the poor. The lifeline tariff assumes that the water and sanitation bill accounts for no more than 5% of the monthly household income of the poor and there are cross-subsidies from the higher block tariff. The average share of total monthly household expenditure on water is about 1.10%.

Regulation

It was recognised from the onset of the reform initiative that regulation is necessary to maintain adherence to high quality services and financial transparency. A regulation study was completed in 2006 and recommended establishment of a provisional interim unit reporting directly to the Minister of Water and Environment. The unit will support the development of a regulating unit.

Human resources development

The TS conducted a study to set up a human resources development programme, where 30 training modules for professional job categories were developed. 140 short training courses were implemented to enhance the technical capacity of the urban water supply and sanitation staff. It is estimated that the ratio of professionals has increased from 10.8% in 2005 to 12.9% in 2007. Staff with technical background increased from 18% to 24.6% during the same period.

Conclusion

With technical and financial support from international donors including the GIZ, World Bank, and the Embassy of the Kingdom of the Netherlands (EKN), the urban water supply and sanitation sector in Yemen has undergone a major reform since early 1990's where operational and financial management has shifted from the central National Water and Sanitation Authority (NWSA) to several independent local corporations. This has been accompanied with redesign of the tariff structure, the introduction of regulation and an emphasis on cost recovery principles.

The experience has been generally successful with most of the urban users being currently served by LCs. Customer services have also improved. Level of technical competence among staff has increased as a result of an intensive programme of human resources development led by the GIZ. However, although most LCs were able to a recover operational and maintenance costs and few recover electromechanical depreciation, none have achieved full cost recovery due to very high capital investment and high prevalence of poverty.

References

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