Chinese Government and United Nations
Beijing High Level Conference on Climate Change

Technology Development and Technology Transfer
November 2008

Barriers and Obstacles:
Country Experiences and Lessons Learned

Renewable Energy & Technology to Avoid GHG Emissions

The case of Brazil

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World GHG Emissions and the Dominant Role of CO2

According to IPCC Forth Assessment Report [2007]

- While the world GHG emissions did grow up 70% from 1970 until 2004, CO2 emissions have increased 80% and they were 77% of anthropogenic emissions in 2004.

- So, CO2 remains as the main GHG from anthropogenic sources!

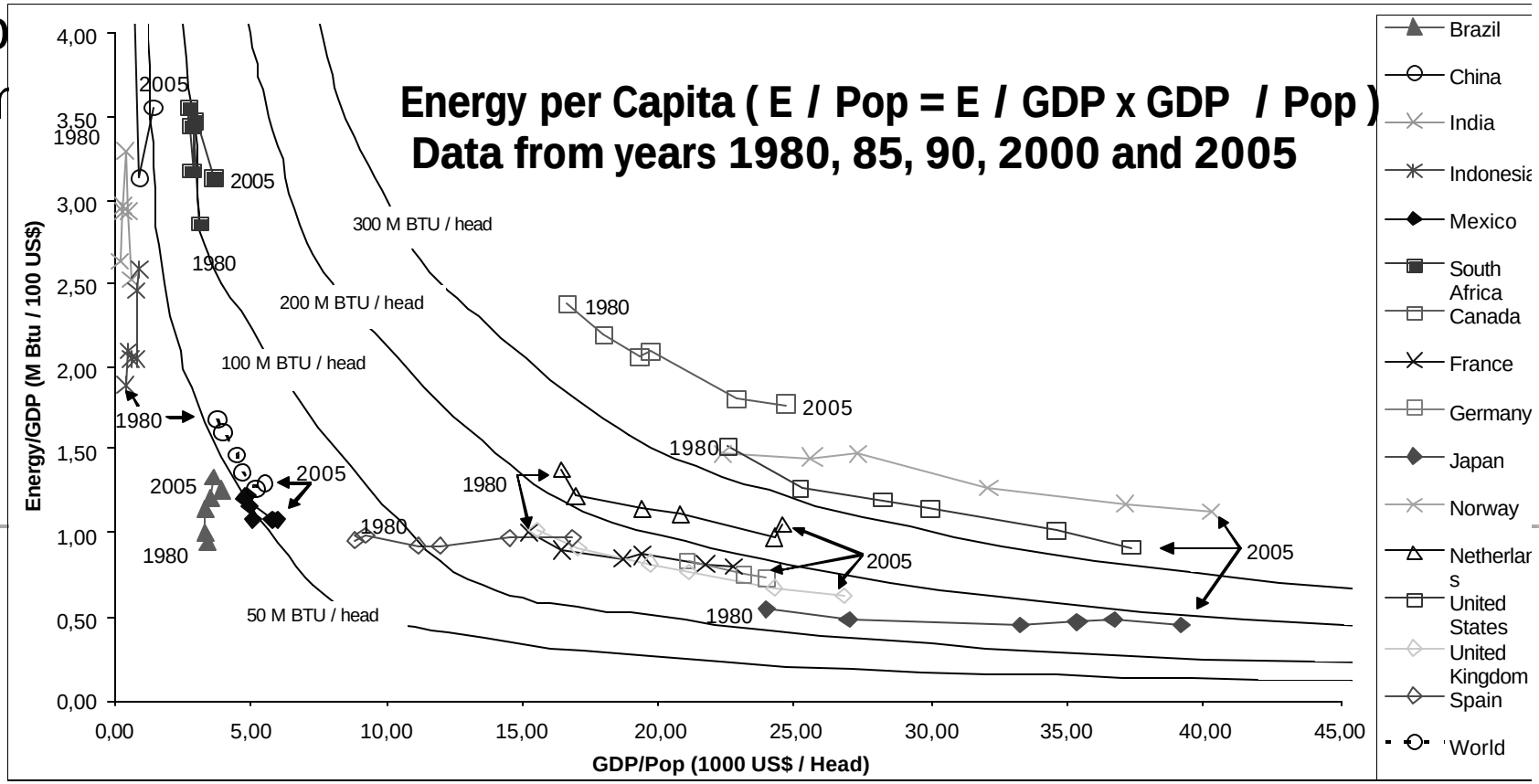
Growth of GHG emissions from 1970 until 2005

- electric energy system - 145%,
- transportation - 120%,
- industry - 65%
- change of land uses and deforestation - 40%.

Present situation in the World:

(1) Developed countries have not reduced up to now their emissions to reach the goals of the Kyoto Protocol, whose period of commitment did already start in 2008 and it will end in 2012;

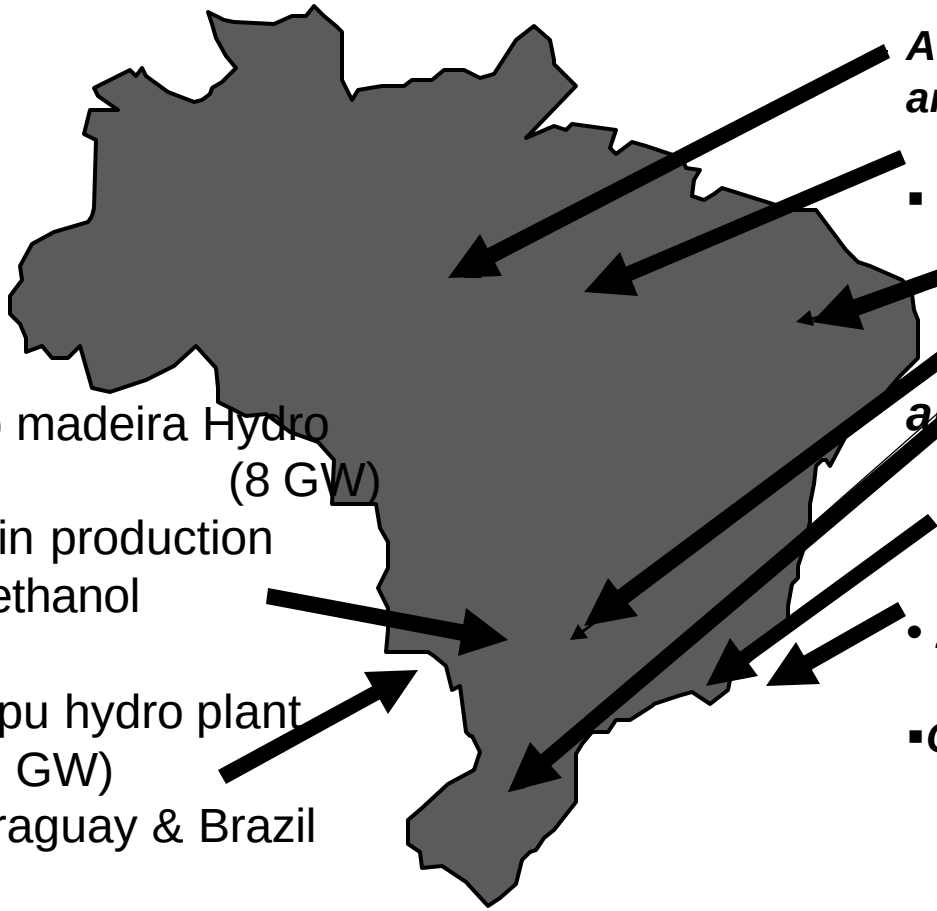
(2) Developing countries tend to increase their emission with the eco
consum



Latin American and Caribean Region

- 20 million km^2
- 519 million inhabitants < ½ of China
- 13% of terrestrial surface
- 26 inhabitants/km^2
- 34 countries
  - 14 small island states
  - 20 countries → 95% of population

Brazil – 180 millions inhabitants



Rio madeira Hydro
(8 GW)

Main production
of ethanol

Itaipu hydro plant
(14 GW)
Paraguay & Brazil

Amazon Region/North - half of the Country area

rain forest

- ***Tucurui Hydro (8 GW)***

***Northeast ***
Southeast ***Most populated areas***
South /

Most industrialized area → Southeast

- ***2 GW Nuclear Power Plant***

- ***Off shore oil & gas production***

More than 20 millions of Brazilians did improve
their social condition coming out from poverty after 2003

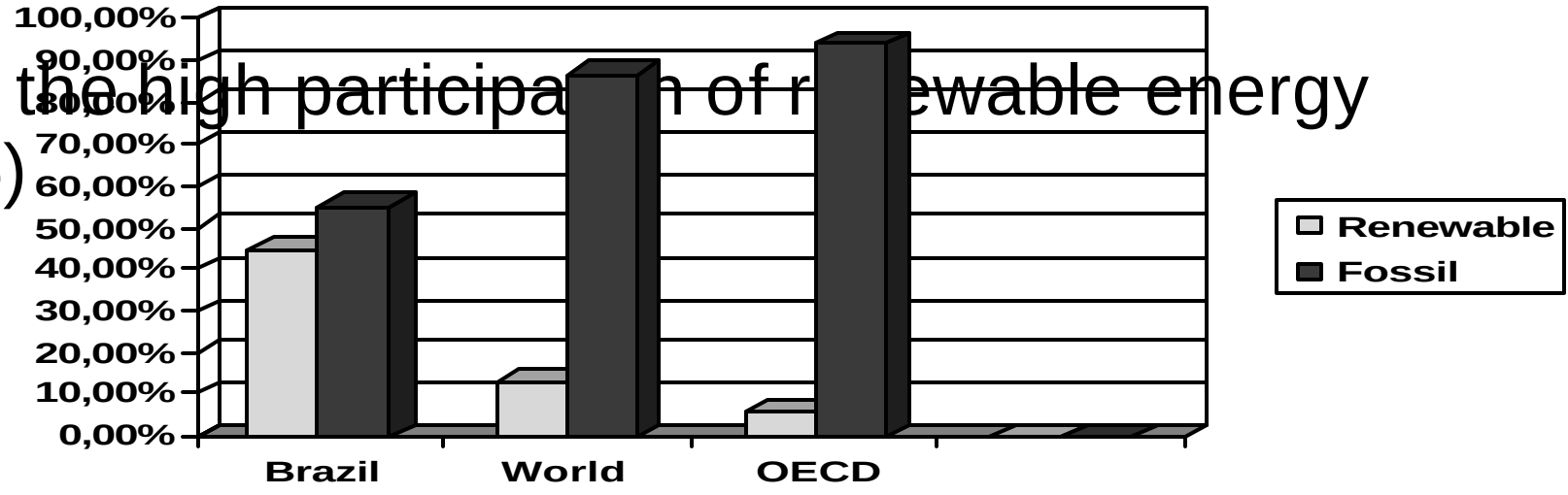
CHALLENGES of BRAZIL in GHG Emissions

Plan of Action on Climate Change to be anounced this year

Main GHG emissions are from deforestation (> 75% of CO2)

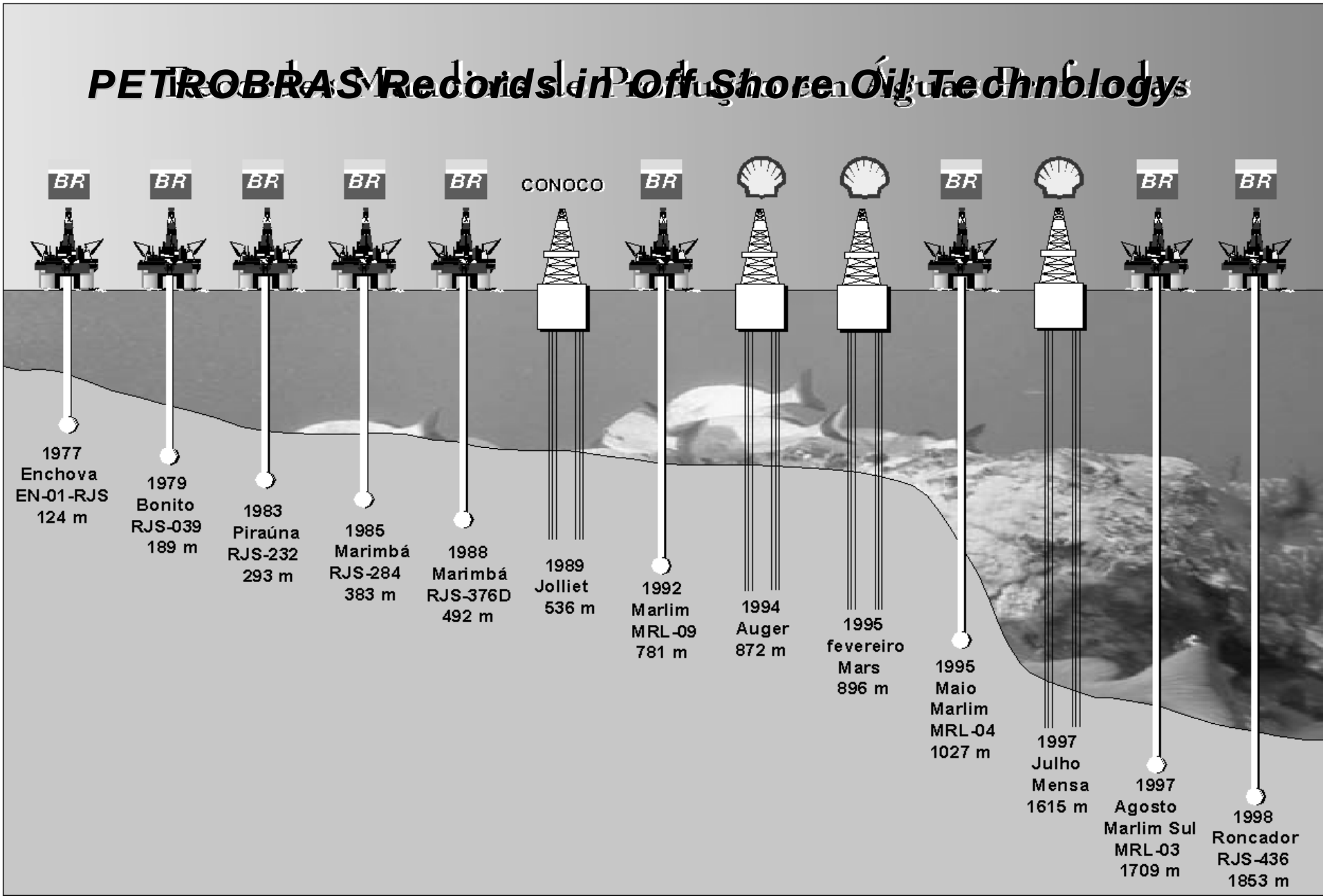
Role of CDM in specific cases (14.4% of World projects)

Maintain the high participation of renewable energy (>40%)



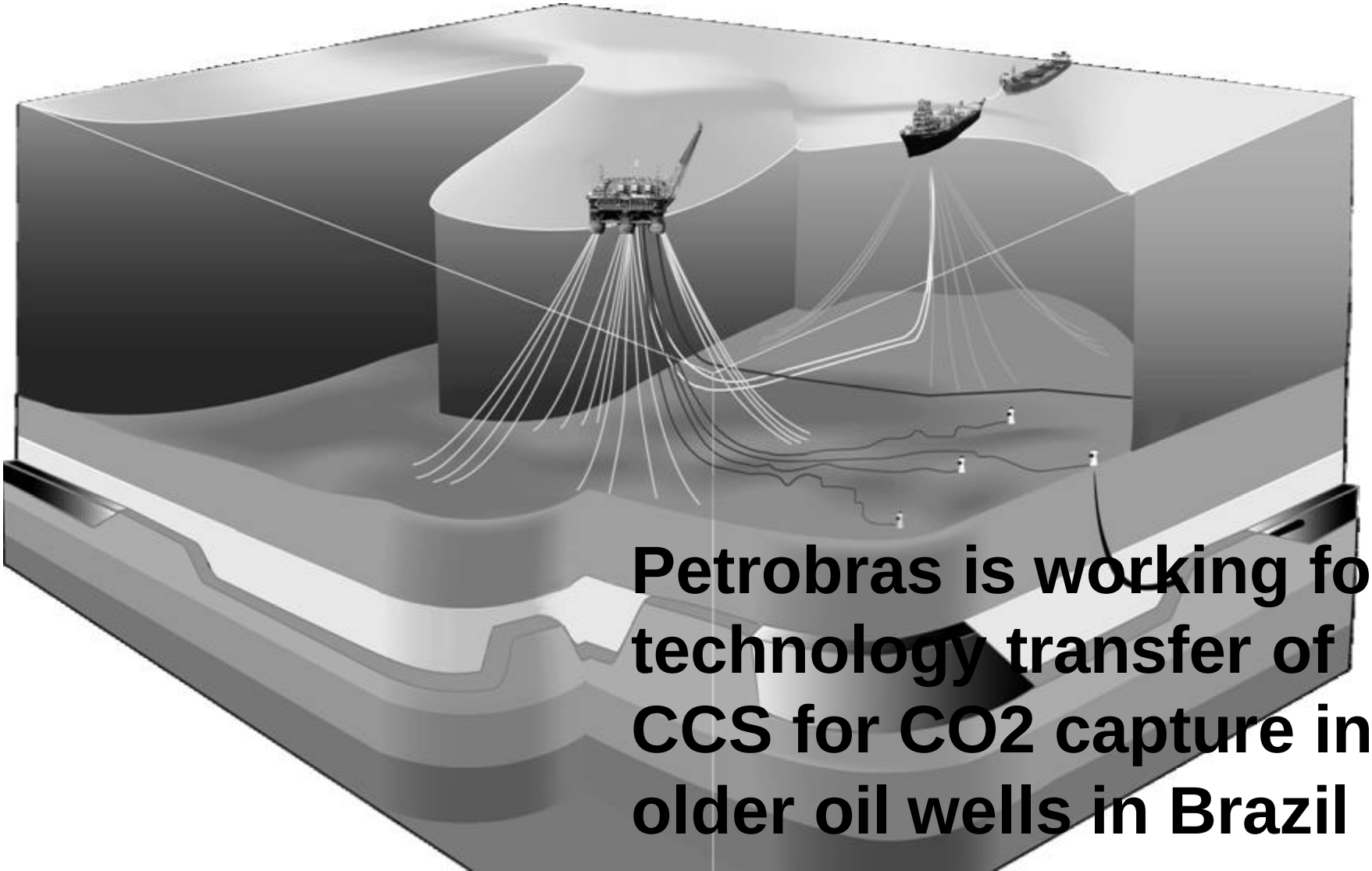
Oil & Gas
and
Electric Energy

PETROBRAS Records in Off Shore Oil Technology



Recent Discovery of Very Large Offshore Oil Reserves in Brazil at Very Deep Water (Pré-Sal)

From 30 t0 80 bb while present Brazilian Oil Reserves are 14 bb



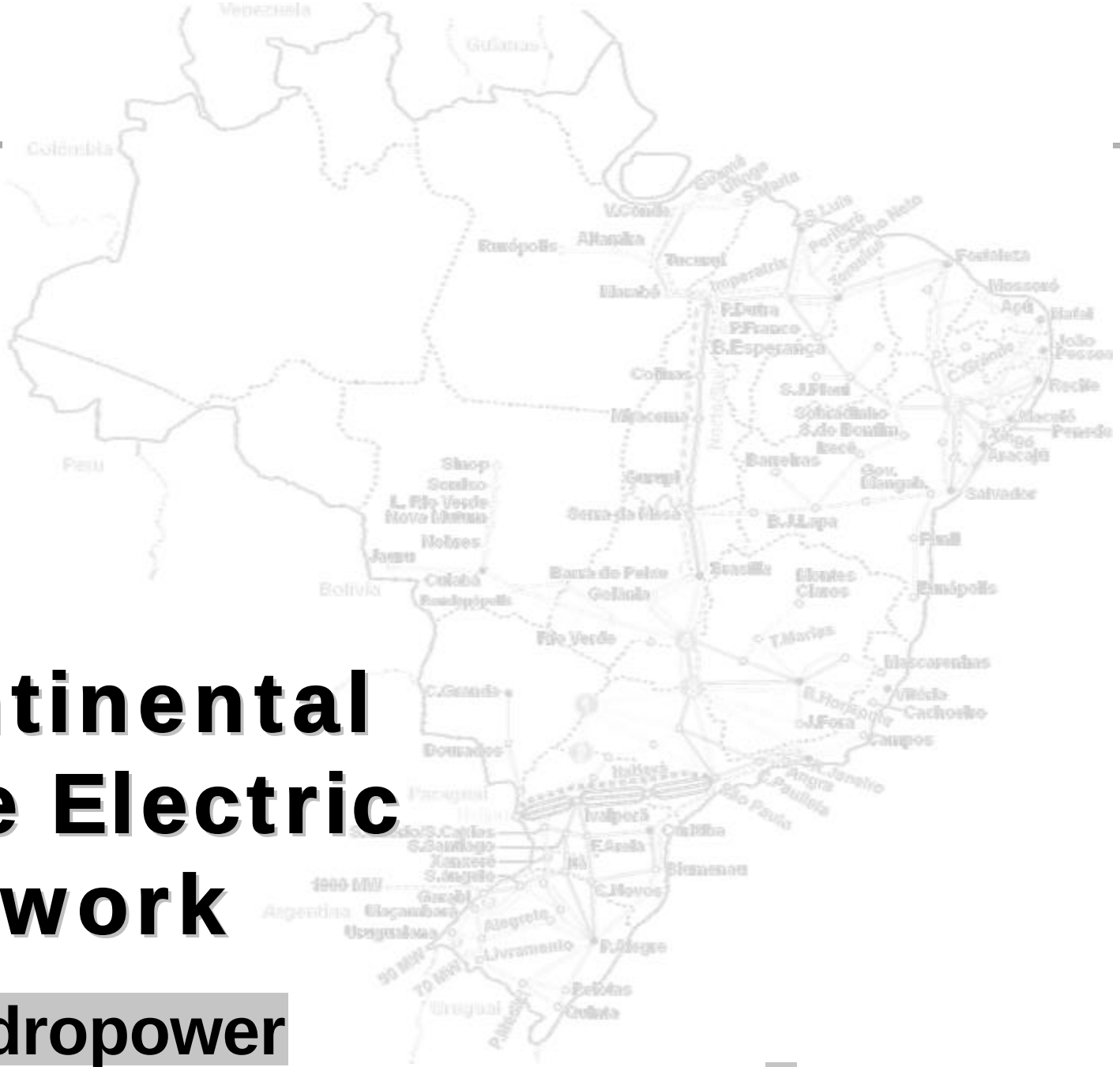
Petrobras is working for technology transfer of CCS for CO_2 capture in older oil wells in Brazil

Environment and Hydroelectric Power

Reduction of Reservoir Area → Flow of River

Brazil can transfer technology
of hydro-plants, including small hydro

4.000 kms

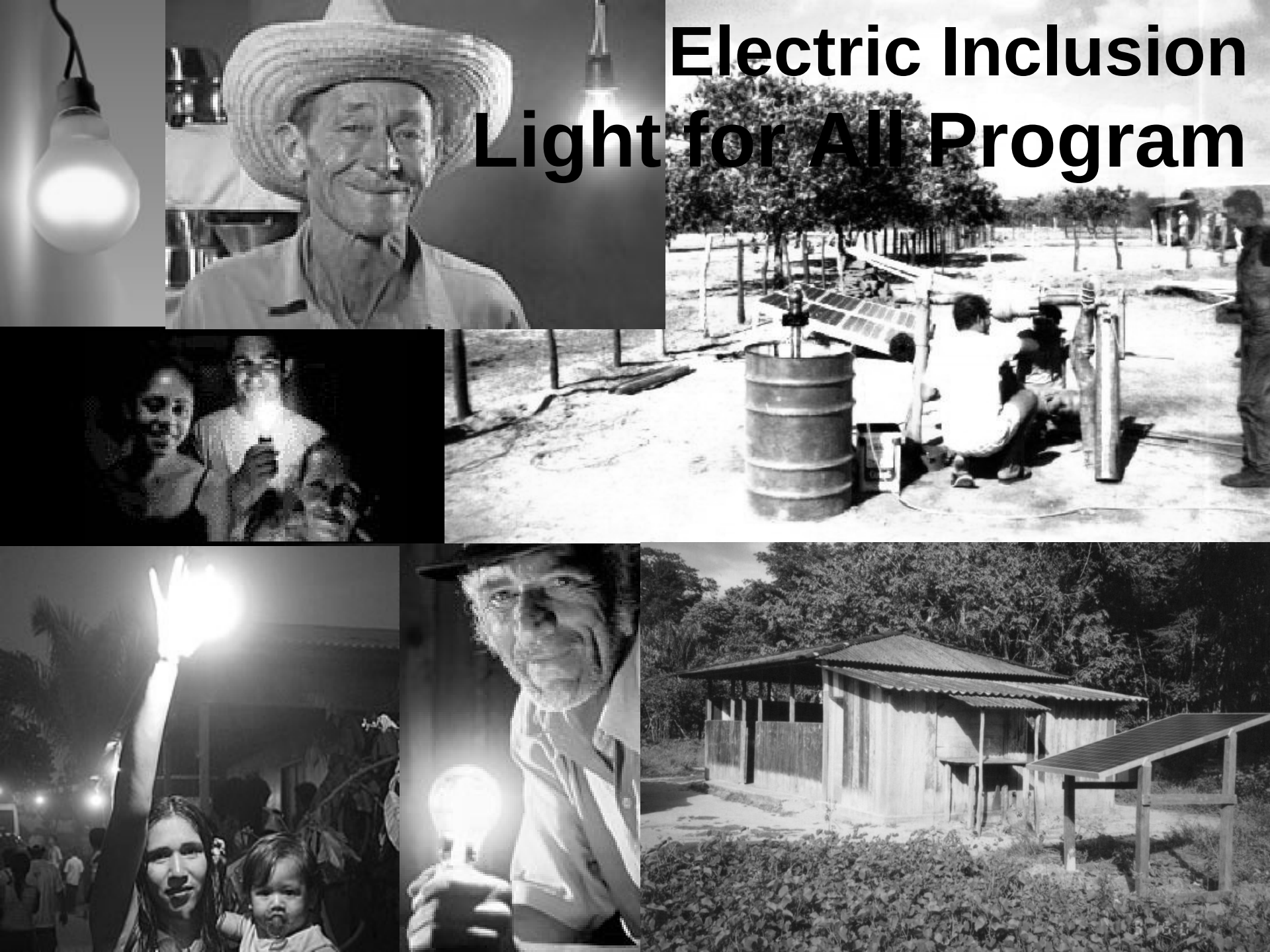


A Continental Size Electric Network

90% hydropower

Electric Exclusion

- 12 millions of persons did not have electricity in 2003.
- 88% are in rural areas
- 59% are in the North
- In the North there is not electric grid → isolated system using dieses oil
- Opportunity for renewable energy to avoid CO2


Electric Inclusion
Light for All Program

Biofuels:
Ethanol from Sugar Cane
Potential for Technolgy Transfer from Brazil

Uses of Bioenergy in Brazil

Technology	Biomass Raw Material	Products	Main Use	Fossil Fuels Substitution
Direct Combustion	Firewood Sugar cane bagasse and trash Wastes #	Heat	Cooking Industry Electric power	LPG Fuel oil Natural gas
Bioconversion: - ***Fermentation*** - Anaerobic digestion	***Sugar cane*** Wastes	***Ethanol*** Biogas	***Transport*** Potential use	***Gasoline**** Natural gas
Chemical and Thermal: - Pyrolysis -Gasification -Esterification - Cracking - Hbio*** Hydrolysis (2d generation)	 Wood Biomass Vegetable oil and others materials** Vegetable oil Vegetable oil Biomass	 Charcoal Synthesis gas Biodiesel Diesel Diesel Ethanol	 Industry Industry Transport R&D Pilot R&D	 Coal and oil Natural gas Diesel Diesel Diesel Gasoline*

Obs: (#) Includes urban solid wastes, lixivia from pulp and paper industry, wastes from rice and others; (*) – It can substitute also for diesel oil with some additive; in Brazil gasoline has 25% of ethanol as additive, besides the use of pure ethanol in flex fuel cars; (**) Including animal fat wastes, garbage and micro-algae (R&D); (***) – Technology of Petrobrás for processing vegetable oil in oil refineries

Ethanol

Car fuel consumption in Brazil = 45% gasoline + 55% sugar cane ethanol

as additive to gasoline in gasoline engine cars and
pure or mixed to gasoline in flex fuel engine cars

Competition with Food and Deforestation → that is not the case of ethanol in Brazil:

Sugar cane – 7 Mha → 3 Mha for sugar + 4 Mha for ethanol ←
For comparison: soya - 23 Mha 4/23 = 17.3 %

From the Brazilian Institute of Geography ans Statistics the Country has:

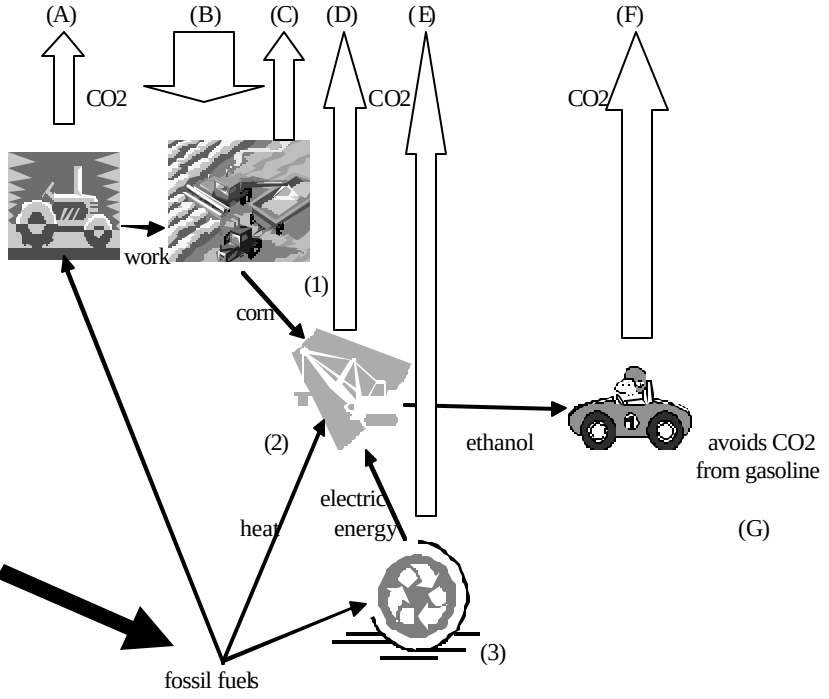
440 Mha of forest
177 Mha of pastures for cattle
152 Mha for agriculture, while **4/152 = 2.6%**
62 Mha are used for agriculture,
90 Mha to expand agriculture without deforestation **4/90 = 4.4%**

COMPARATIVE STUDY OF ETHANOL PRODUCTION

CORN ETHANOL

A – CO2 Emission in corn plantation
B – CO2 Capture in corn growth
C – Emission from soil
D – emission in ethanol distilation
E – emission in generation of electricity for the usine
F – Emission fro ethanol combustion

G = Avoided emission from gasoline
Balance: B = F
Net Avoided emission = G – A –C – D - E

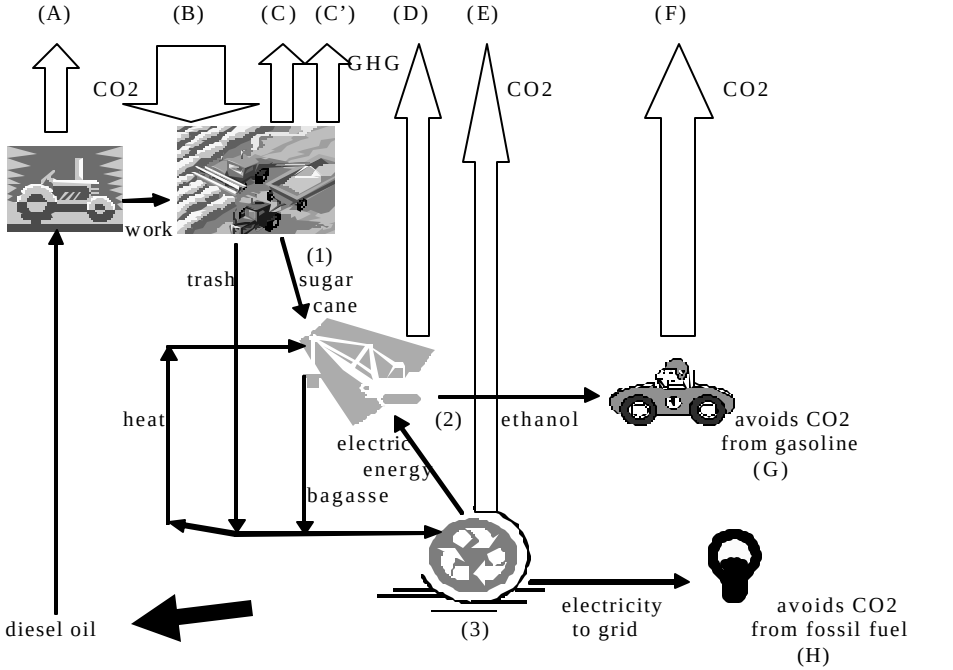


Legend: (1)– corn plantation; (2)– ethanol distillery; (3)– fossil fuel fuelled power plant in the grid

SUGAR CANE ETHANOL

A – CO2 Emission in cane plantation
B – CO2 Capture in cane growth
C – Emission from soil
C'- CO2 Emission from cane burning
D – emission in ethanol distilation
E – emission in generation of electricity in the usine
F – Emission from ethanol combustion

G = Avoided emission from gasoline
H = Avoided emission in electric generation in the grid
Balance: B = C'+ D + E + F
Net Avoided emission = G + H – A –C



Legend: (1) – sugar cane plantation; (2)– ethanol distillery: (3) – electric generation using bagasse (and trash) from sugar cane

Some Cases of Potential Technological Cooperation for GHG Mitigation

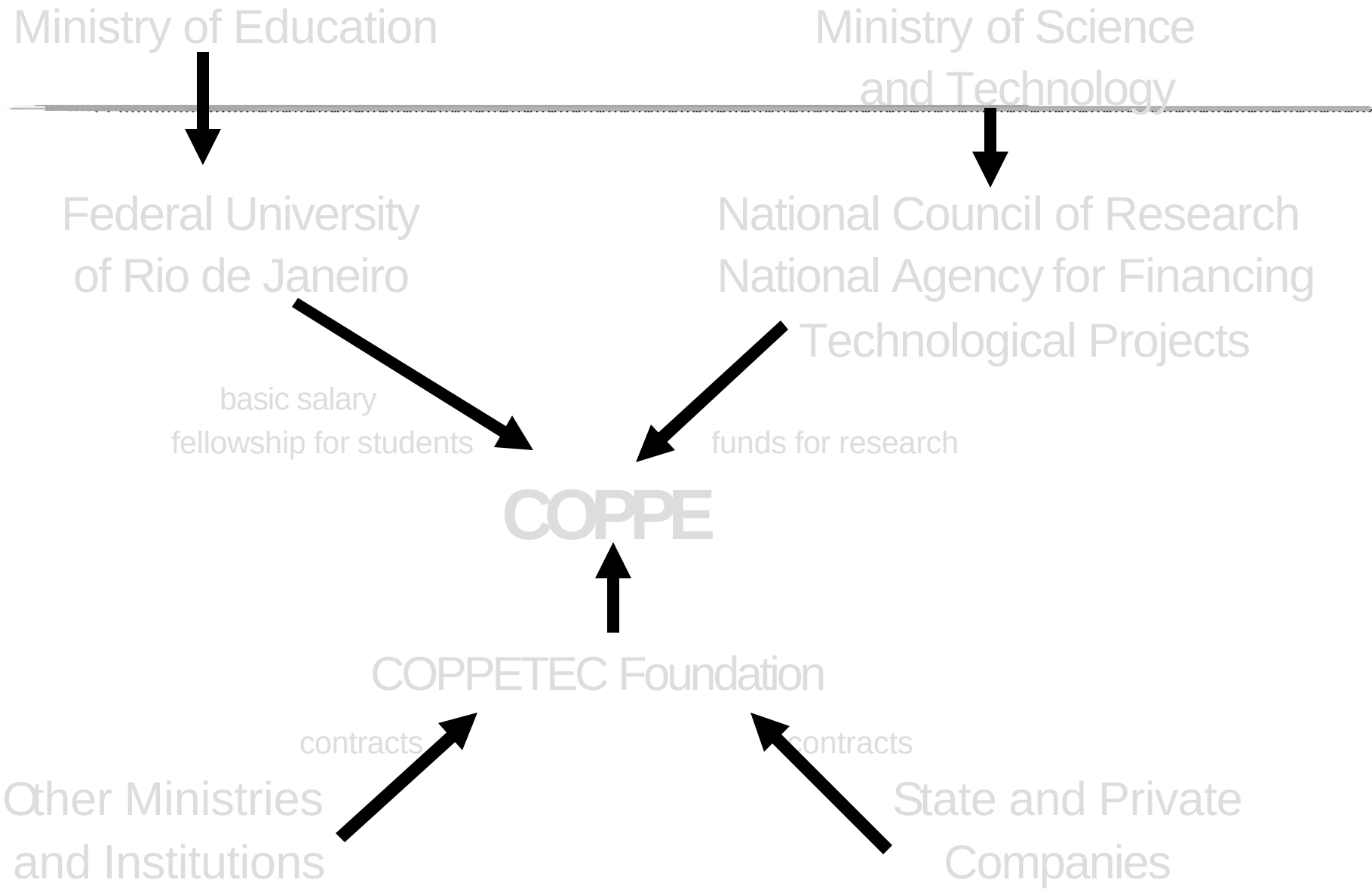
The experience of COPPE as an example

among several others

Universities and Resear

Institutes in Brazil

(USP, INPE, UNICAMP, e


Ministry of Education
Ministry of Science and Technology
Federal University of Rio de Janeiro
National Council of Research
National Agency for Financing Technological Projects
basic salary
fellowship for students
funds for research
COPPE
COPPETEC Foundation
contracts
contracts
Other Ministries and Institutions
State and Private Companies

SOME R&D&I PROJECTS in Energy and Environment

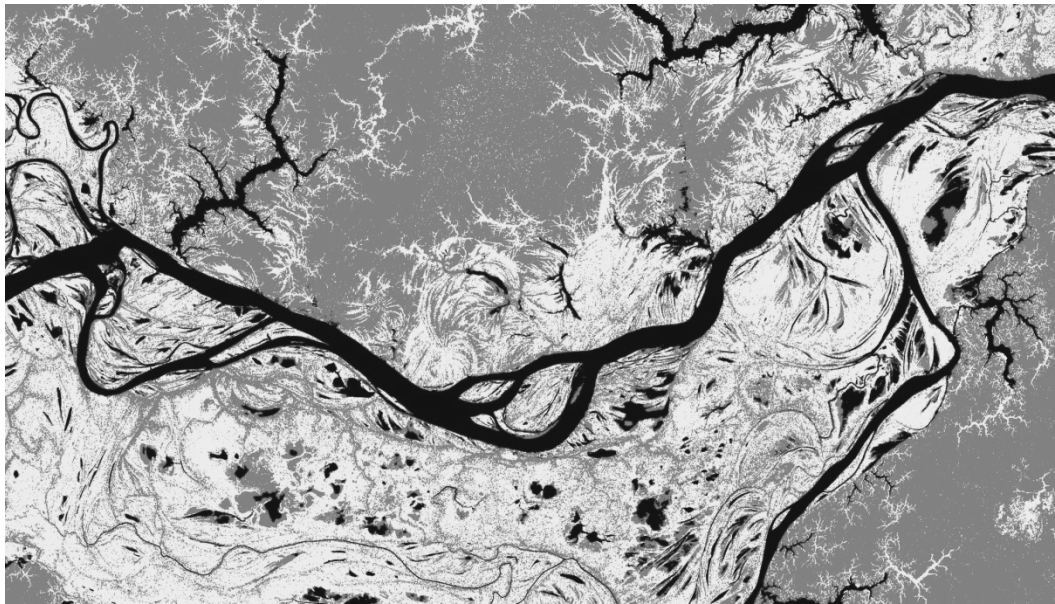
Technology for GHG Mitigation

Environmental sensitivity mapping of the Amazon with satellite technology

Project of COPPE for mapping the Amazonian region to identify possible impacts and environmental risks to the Amazon by the oil & gas industry.

The model takes into account flood seasonality and it helps Petrobras to produce oil & gas with low environmental risk in the Amazonian region.

By protecting the Amazon forest this project is a tool to avoid destruction of forest -- deforestation is the highest source of GHG emissions in Brazil.

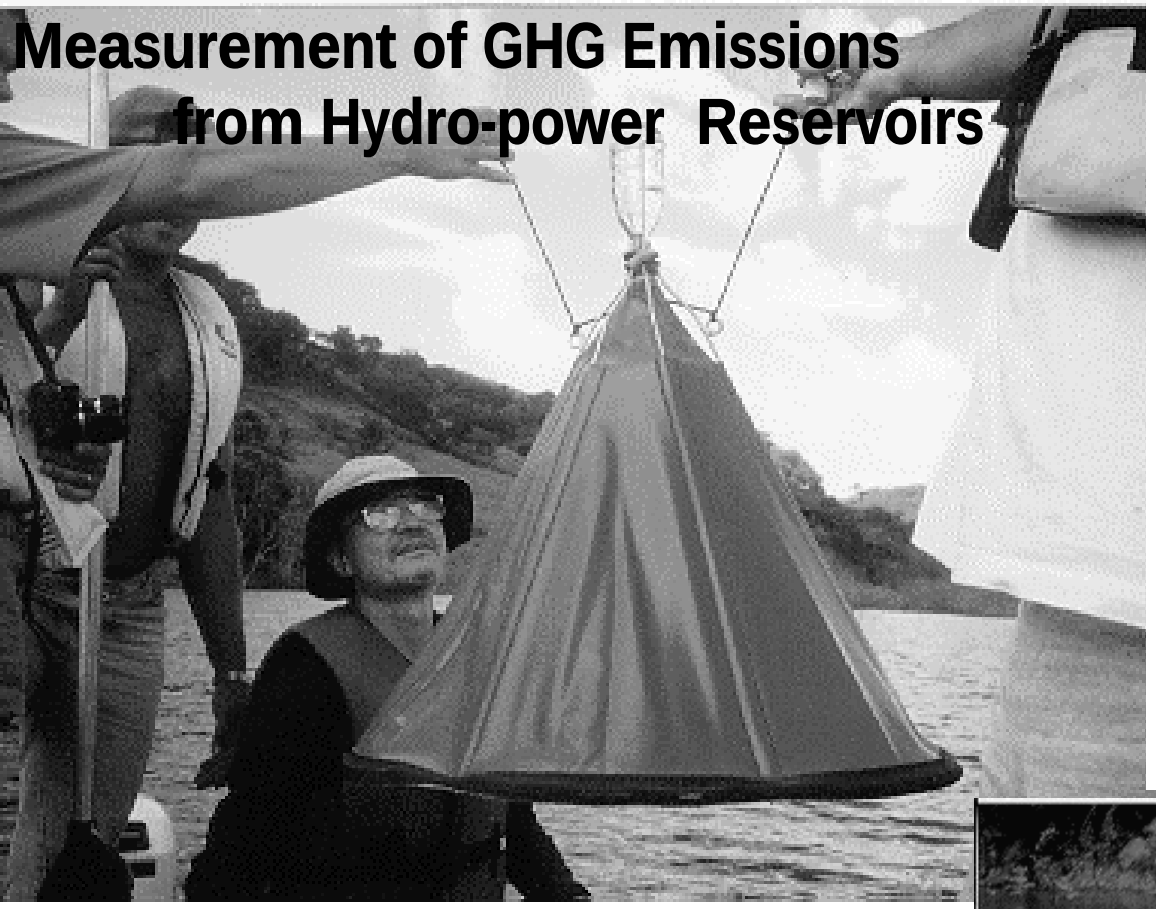


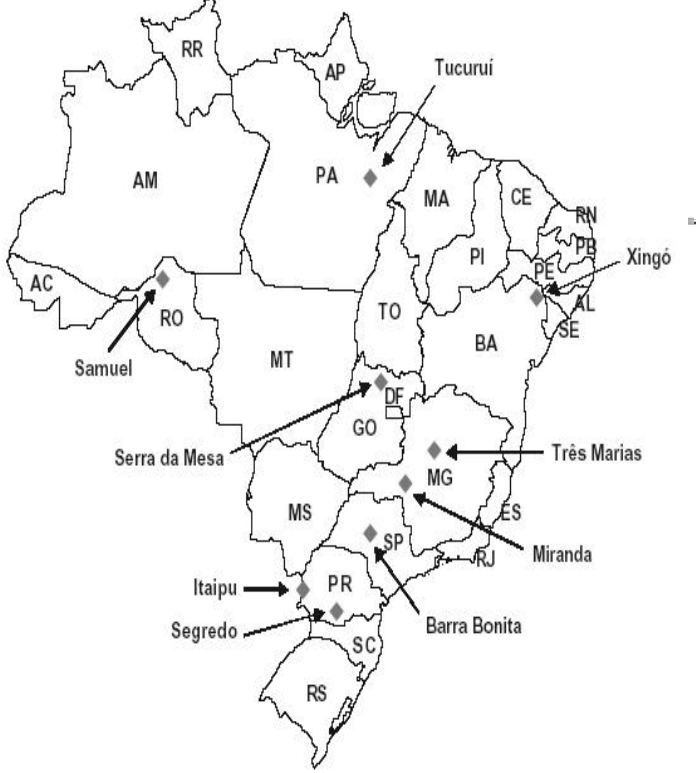
Method to calculate greenhouse gas emissions

COPPE developed a simple policy maker model to calculate the GHG delivered during the Rio de Janeiro Pan-American Games in 2007, and recommended actions by the Rio de Janeiro government to compensate the emissions with support of Petrobras.

As a first compensation measure the project suggested the planting of 100000 seedlings of Atlantic Forest trees, building a Green Corridor for capturing 12000 tons of CO2 from the atmosphere.

Measurement of GHG Emissions from Hydro-power Reservoirs





Funnel Bubble Collector

Ecological Concrete

COPPE developed a new kind of concrete that reduces CO2 from the cement industry, which is responsible for 7% of total CO_2 delivered into the atmosphere.

Ecological concrete can substitute up to 40% of common cement to prepare concrete.

The researchers successfully used materials such as sugar cane bagasse ashes, rice and ceramic wastes.

It can reduce the annual global CO_2 2.3 millions tons/year.

Environmental recovery of solid waste disposal sites

The first Brazilian project for the environmental recuperation of urban solid waste disposal sites was developed by COPPE's researchers performed in the Southern region of São Paulo city.

The disposal site, where 16.2 millions tons of waste material had been deposited, now has hundreds of tropical species of trees and many different species of plants, birds and small animals are observed in the area.

Alternative Energy in Transportation and Biofuels

Alternative Energy Sources

Hydrogen powered bus

In 2009 it will run the first hydrogen powered bus produced in South America. Designed by COPPE with support of Petrobras **the bus is for 80 passengers.**

It will have an autonomy of 300 km, using only the energy from a nationally manufactured hydrogen fuel cell and electricity from kinetic energy regeneration in breaking and from the grid accumulated in batteries.

The Project stands out because of its innovative engineering and low cost, nearly 50% less than the price of the European version.

Biodiesel

The Brazilian government implemented a National Biodiesel Policy, which allowed the addition of 2% to 5% of biodisel to diesel.

COPPE has a plant that can produce 4 to 6 thousand liters of biodiesel per day from vegetable oils and residues from cooking, animal fats and industry.

It is measured the influence of different vetable oils and residues on the quality of biodiesel.

Vale Company has tested 20% of biodiesel in the diesel supply of its locomotive fleet.

This initiative, associated with the planting by Vale of 30 thousand hectares of oil-producing vegetables will reduce in 1,1 million tons the CO_2 emitted to the atmosphere.

Alternative Energy for Electricity Generation

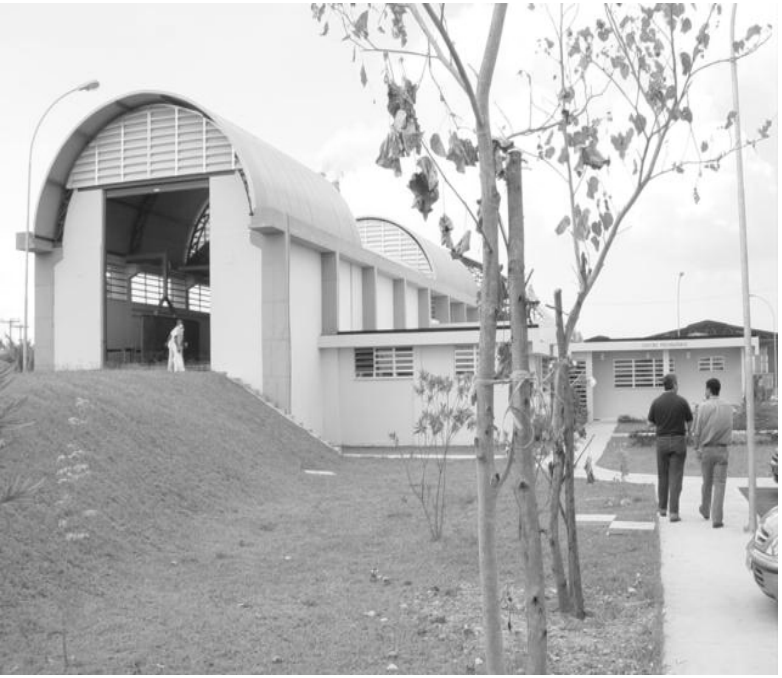
Generating electricity from waste

COPPE has accepted the challenge to convert waste into electric energy, at market-acceptable prices, developing and testing new technology.

An experimental unit was implanted in the university campus, called the GREEN-POWER PLANT, which uses waste incineration for electricity generation.

The researchers are performing tests to implant commercial facility that includes combined cycle using solid wastes and natural gas or biogas .

Electricity from Waste = **GREEN-POWER PLANT** at Federal University of Rio de Janeiro



Wave Power Plant

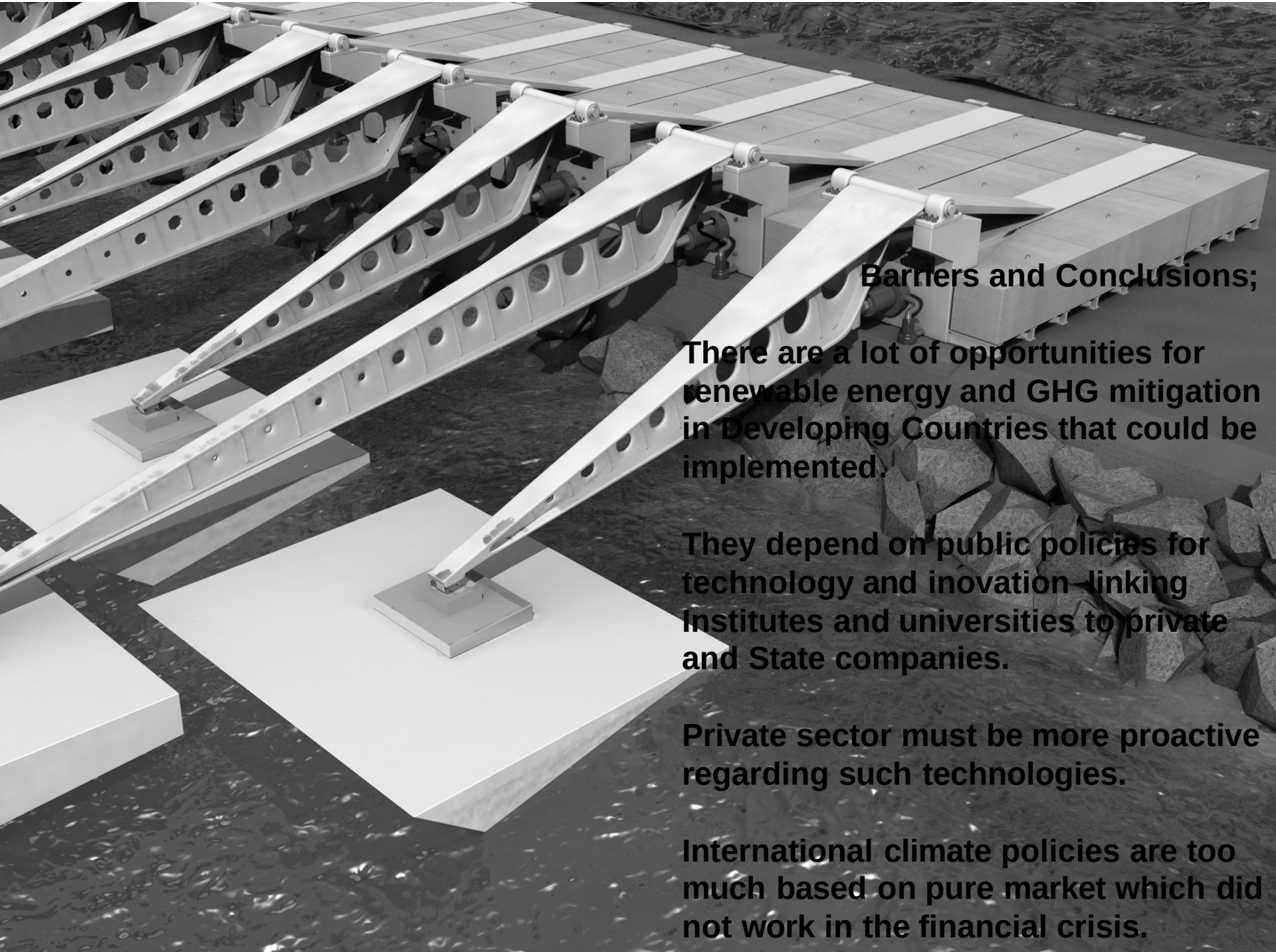
COPPE has developed a Project for the implantation of the first ocean wave power plant in South America. A pilot plant, capable of generating 500 kW, will be implanted in Ceará, in the Northeast Region of Brazil.

The pilot power plant design includes a hyperbaric chamber (an equipment developed in COPPE to simulate high pressure marine environments in offshore oil production) capable of producing water pressure equivalent to 500 meter high waterfall, like that of a hydroelectric power plant.

Initial studies show that the Brazilian coast has the potential for supplying 15% of the total of the electricity consumed in

With 8.5 thousand kilometers of co
Brazil has favorable conditions for
this source of abundant, renewab
and nonpolluting energy,
which avoids CO2 emissions.

Wave electric Generation in the laboratory of Off Shore technology



Barriers and Conclusions;

There are a lot of opportunities for renewable energy and GHG mitigation in Developing Countries that could be implemented.

They depend on public policies for technology and inovation -linking Institutes and universities to private and State companies.

Private sector must be more proactive regarding such technologies.

International climate policies are too much based on pure market which did not work in the financial crisis.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