Good Practices on Effective STI Policies to Promote Renewable Energy

- Indian experience in the promotion of renewable energy

Bibek Bandyopadhyay
Ministry of New and Renewable Energy
Government of India
New Delhi

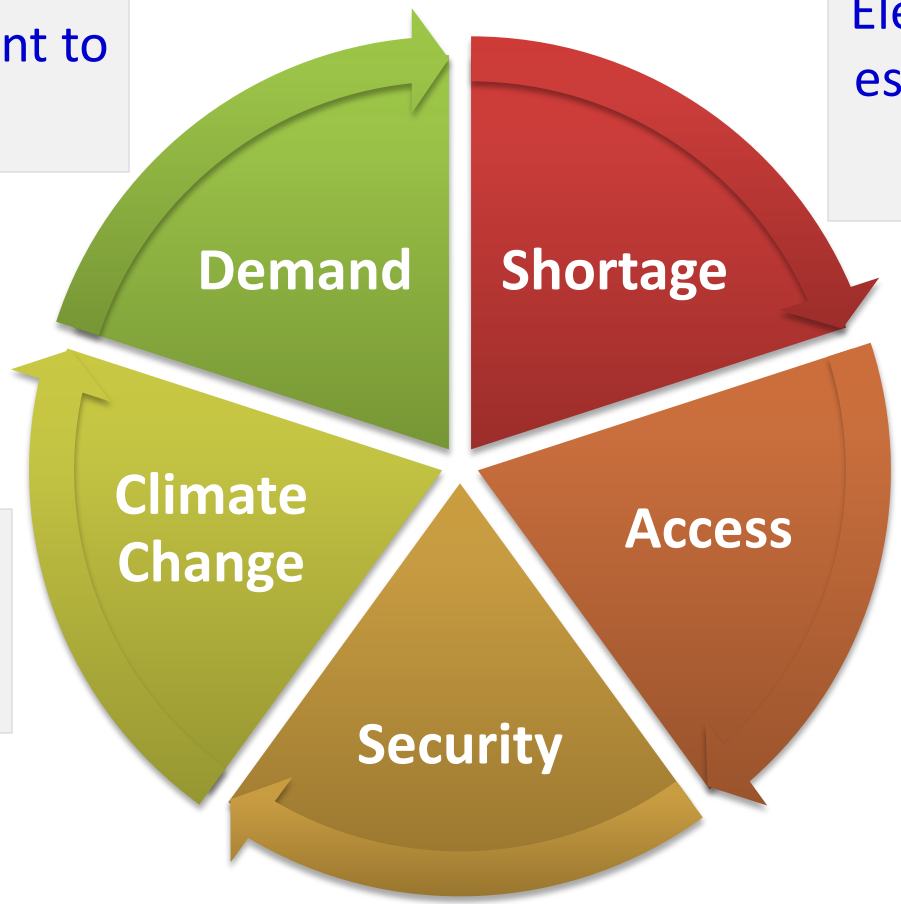
Regional Consultation Meeting on Science, Technology and Innovation for Promoting Renewable Energy Technologies for Sustainable Development in Asia and the Pacific

13 March 2013, United Nations Conference Centre
Bangkok, Thailand

India's Energy Challenge

In next 12 years India's electricity requirement to grow 2.5 times

Electricity shortage estimated at 25-35 GW



Climate Change is an important issue

Around 400 Million people still without access to electricity

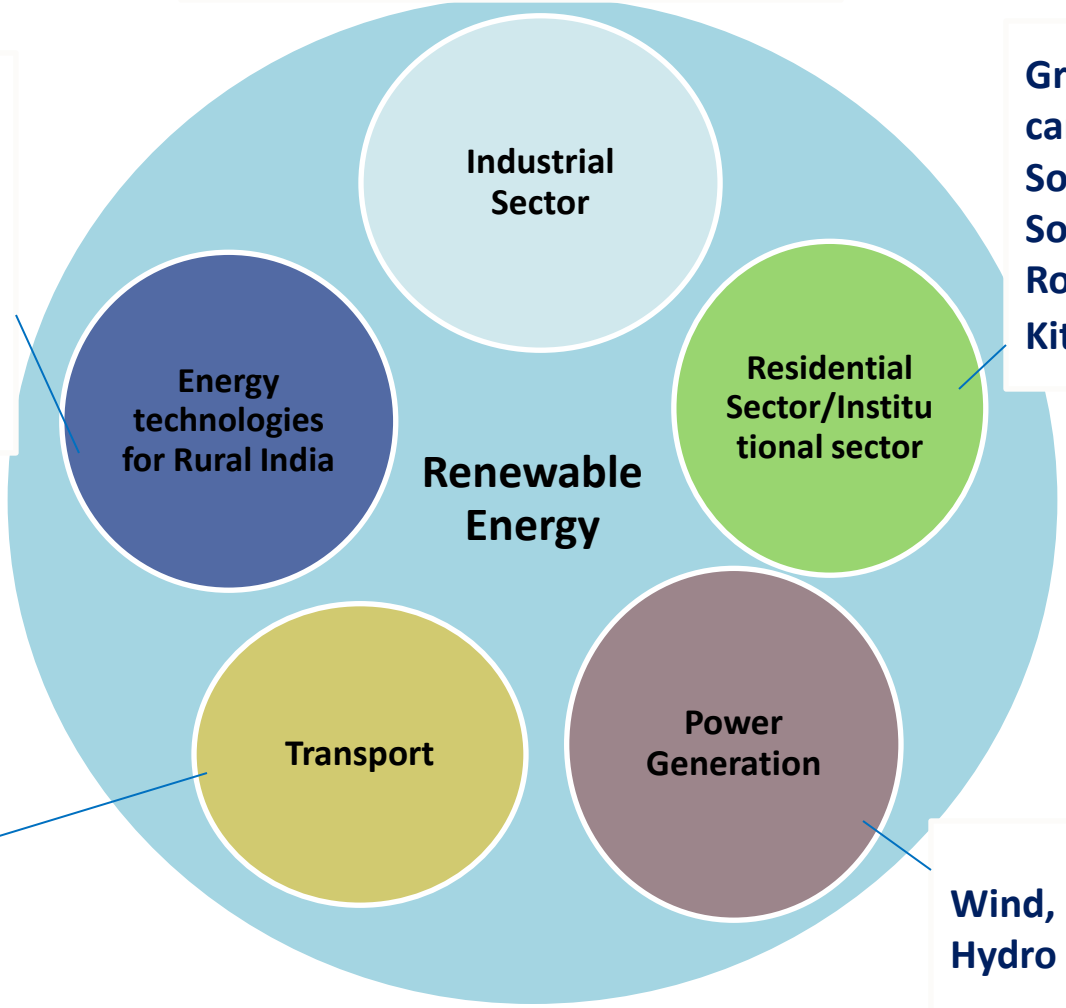
India is dependent on oil imports for 83% of its demand

RE in Different Sectors of Indian Economy

Solar water heaters, Solar PV, Process heat, Green buildings, Co-generation

Off grid technologies like Solar water pumps and lighting, biomass gasifiers, Biogas plants, efficient cook stove

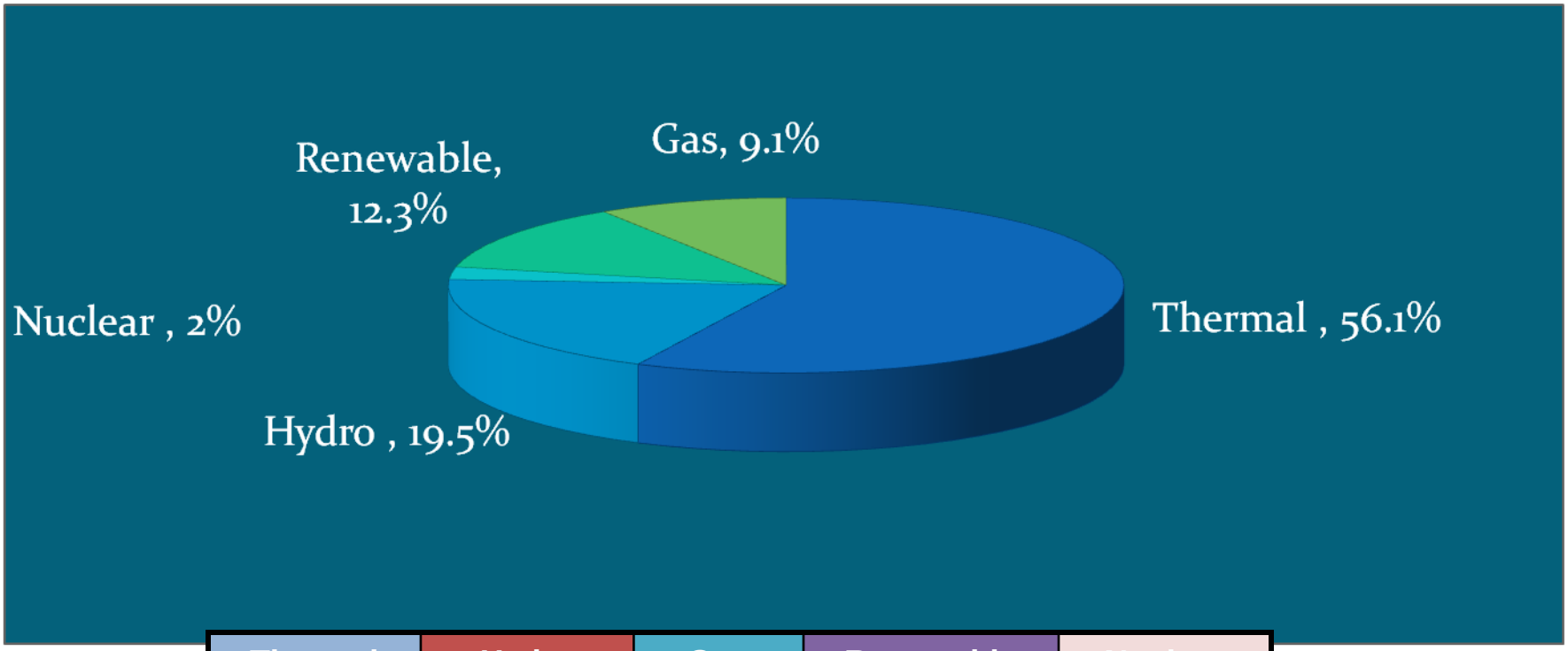
Green Buildings/ campus, Solar water heaters, Solar Cooking units, Rooftop solar, Kitchen waste



Biofuels and battery operated vehicles (in future)

Wind, Solar, Biomass, Hydro

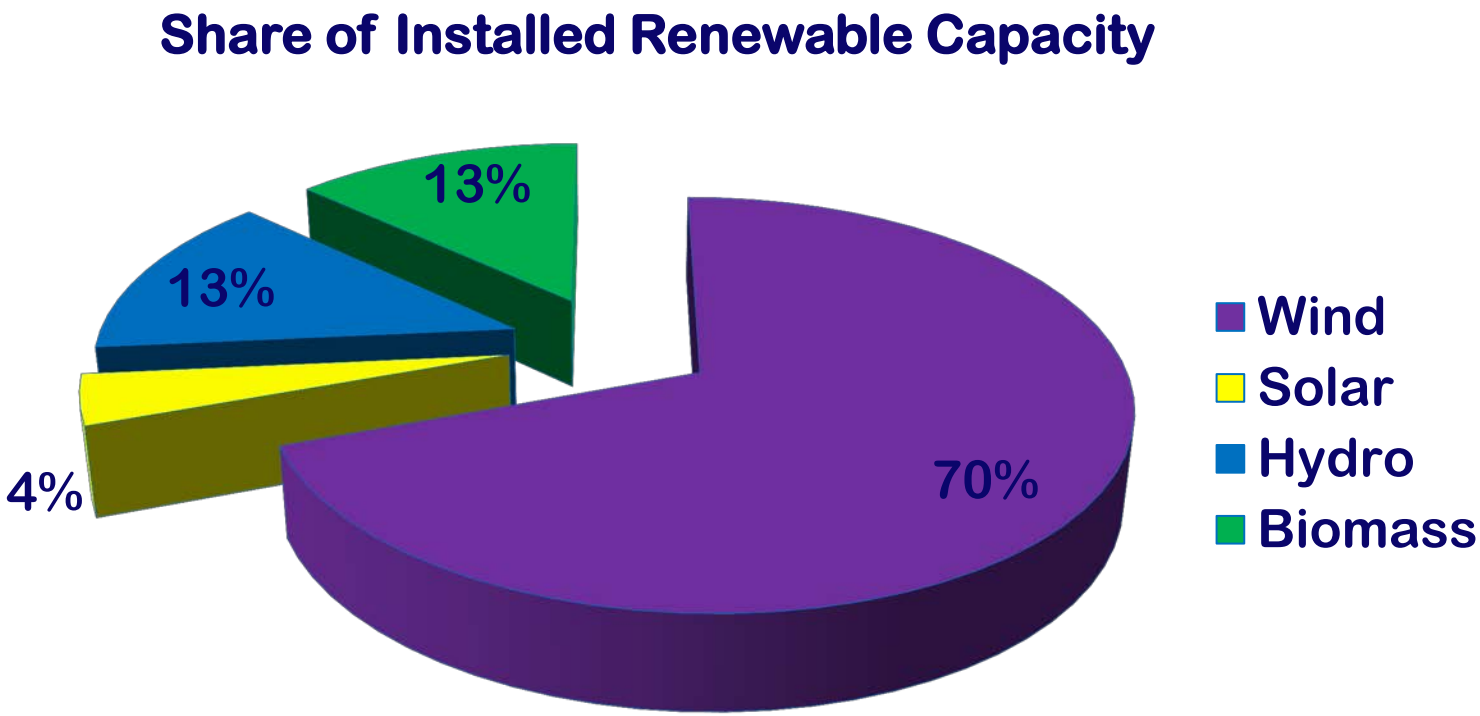
Indian Power Sector at a Glance



Thermal	Hydro	Gas	Renewable	Nuclear
1,21,303	39,291	18,903	26,368	4780

- **Total installed capacity : 2,10,645 MW**
- **Renewable contributes 26,368 MW – 12. 4%**
- **If we take large hydro under RE – 32%**

Renewable Power Sector in INDIA



- Total installed Capacity: 26,368 MW(upto Oct, 2012)

Technological self-reliance

- Research and development
- Resource assessment
- Technology development
- Technology validation
- Technology transfer and adaptation
- Manufacturing base
- Expanded skill base
- Large scale implementation of new technologies
  - decentralized off-grid applications
  - grid connected renewables

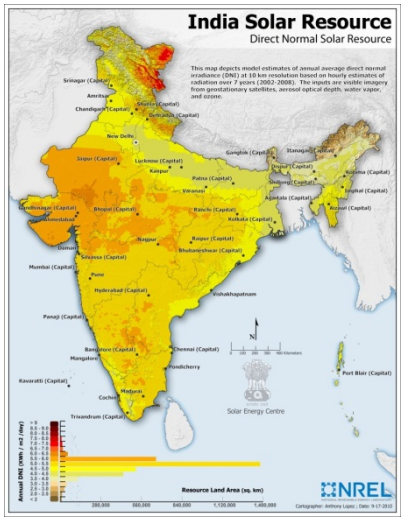
Institutions

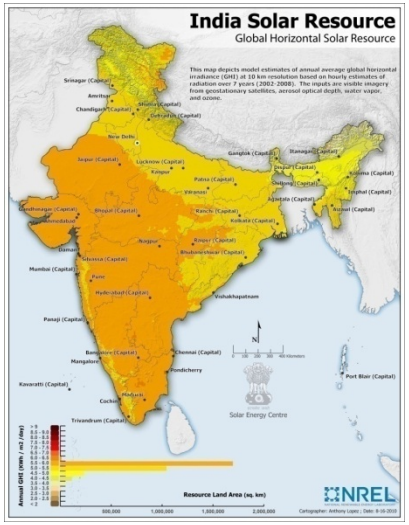
Scientific institutions

- Solar Energy Centre (SEC)
- Centre for Wind Energy Technology (C-WET)
- Alternate Hydro Energy Centre (AHEC)
- National Institute of Renewable Energy (NIRE)
- Solar Energy Corporation of India

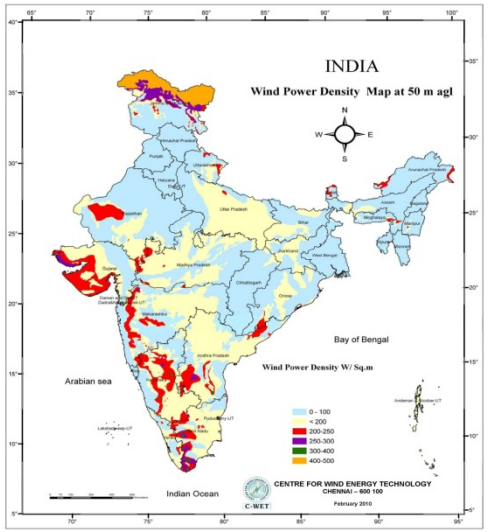
Financial Institution

- Indian Renewable Development Agency (IREDA)


India Solar Resource
Direct Normal Solar Resource
This map depicts model estimates of annual average direct normal irradiance (DNI) at 10 km resolution based on hourly estimates of radiation over 7 years (2002-2008). The inputs are visible imagery from geostationary satellites, aerosol optical depth, water vapor, and ozone.
Solar Energy Centre
Resource Land Area (sq. km)
NREL


India Solar Resource
Global Horizontal Solar Resource
This map depicts model estimates of annual average global horizontal irradiance (GHI) at 10 km resolution based on hourly estimates of radiation over 7 years (2002-2008). The inputs are visible imagery from geostationary satellites, aerosol optical depth, water vapor, and ozone.
Solar Energy Centre
Resource Land Area (sq. km)
NREL


Centre for Wind Energy Technology - CWET
Proposed Solar Irradiation 51 Sites
IMD Automatic Radiation Station Network


INDIA
Wind Power Density Map at 50 m agl
N
W
E
S
Bay of Bengal
Arabian sea
Indian Ocean
Wind Power Density W/ Sq.m
0 - 100
< 200
200-250
250-300
300-400
400-500
CENTRE FOR WIND ENERGY TECHNOLOGY
CHENNAI - 600 100
February 2010
C-WET

Renewable Power Potential in the Country

S. No.	Resource	Estimated Potential (In $MW_{eq.}$)
1.	Wind Power	49,000
2.	Small Hydro Power (up to 25 MW)	15,000
3.	Bio-Power:	
	Agro-Residues	17,000
	Cogeneration - Bagasse	5,000
	Waste to Energy: - Municipal Solid Waste to Energy - Industrial Waste to Energy	 2,600 1,280
	Sub-Total	89,880
4	Solar Energy	>100,000 30-50 MW/ sq. km.
	Total	>1,89,880

Energy Access

- Millions of energy deficient homes
  - remote and isolated villages and hamlets
- India has one of the largest decentralized, off-grid renewable energy programs
  - Solar lighting systems
  - Solar powered micro grids
  - Rice husk based gasifier systems
  - Small hydro plants
  - Biogas plants
  - Solar cooking systems
- Renewable energy technologies have been found to be
  - Excellent tool for providing energy access
  - Powerful driver of inclusive growth
- Our experiences reveals Energy Access requires:
  - Appropriate and affordable technologies
  - Trained manpower
  - Creative policies- policies aligned with health, education, gender, poverty alleviation

Applications

- Heating
- Drying
- Cooling
- Power generation

Solar Thermal System for Steam Generation at ITC Hotel, New Delhi

2.5 MW Unit of a 10 MW capacity project at Bikaner by ACME

Solar light in a tribal village home

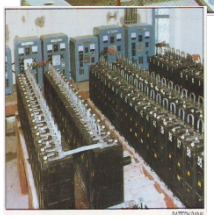
Solar system for microwave repeater system

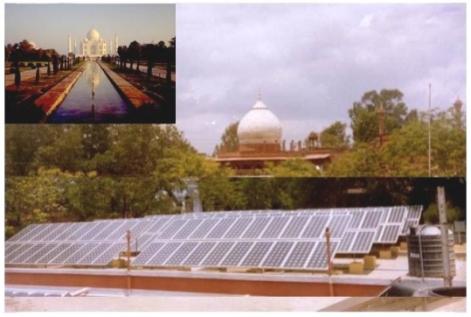
DECENTRALIZED ENERGY SYSTEMS

Applications

- Solar Lanterns
- Home and community lighting
- Village street lighting
- Water pumping
- Village power plants
- Vaccine refrigeration
- TV Sets
- Radio receivers

Applications





- Telecommunications
- Railways
- VLPTS for Doordarshan
- Battery chargers for Defence applications
- Unmanned Off-shore Oil Wellhead Platforms
- Power plants

Renewable Energy Growth Enablers

- **Enabling Legislations and Regulations**
  - National Action Plan on Climate Change
  - 15% Renewable Obligations by 2020
- **RE classified as Infrastructure sector**
- **Financial & Fiscal Incentives**
  - Tax concessions (Tax holiday, Accelerated depreciation)
  - Concessional customs and excise duty
  - Capital and Interest subsidy
- **Grid Connected Renewable Power Regulatory Framework**
  - Renewable purchase obligation (RPO)
  - Renewable Energy Certificate (REC)
  - Tariff Policy Amended
  - Feed-in-Tariffs
  - Energy buy back, wheeling & banking
- **National Clean Energy Fund**
  - Carbon tax on coal
- 100% FDI by automatic route permitted

Quality infrastructure

- Specifications
- Standards
- Test protocols

Bureau of Indian Standards

- Indian National Standards
- Alignment with international standards

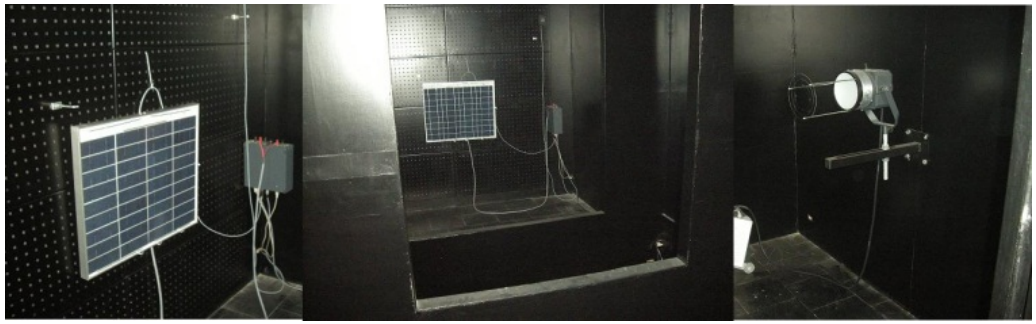
Testing organizations

Apex Test Centres

- Solar Energy Centre
- Centre for Wind Energy Technology
- Alternate Hydro Energy Centre
- National Institute of Renewable Energy
- Indian Institute of Science

Regional Test Centres

- Solar Thermal
- Solar Photovoltaics
- Biogas
- Improved Cook Stoves



Opportunities for employment generation

- A large number of persons employed for manufacturing, assembling, installation of off-grid RETs
- Maintenance of off-grid RETs, minimum one job is created in a village
- Nearly 40 people is generated during erection and commissioning of a 1-2 MW PV Project. This number increases by approximately 15 for every additional 1 MW capacity
- For solar thermal projects 500 personnel are employed in a 20 MW capacity power project
- For one to two persons are required per MW depending on project size.

Over 50,000 direct jobs are estimated to have been created in the last three years in off-grid & other applications in the New & Renewable Energy Sector

National Action Plan for Climate Change

Jawaharlal Nehru National Solar Mission

Application segment	Target for Phase I (2010-13)	Cumulative Target for Phase 2 (2013-17)	Cumulative Target for Phase 3 (2017-22)
Grid solar power incl. tail-end & roof top	1,000 MW 100 MW	4,000 MW	20,000 MW
Off-grid solar applications (incl. rural solar lights)	200 MW 2 million	1,000 MW 10 million	2,000 MW 20 million
Solar collectors (sq meters)	7 million	15 million	20 million sq

Objectives:

- **Achieve grid parity by 2022**
- **Increase domestic manufacturing capacity**
- **Develop eco system for solar industry**
- **Develop manpower**
- **Support R&D**

4.2 MW Wind Farm Project set up in Chitradurga District, Karnataka

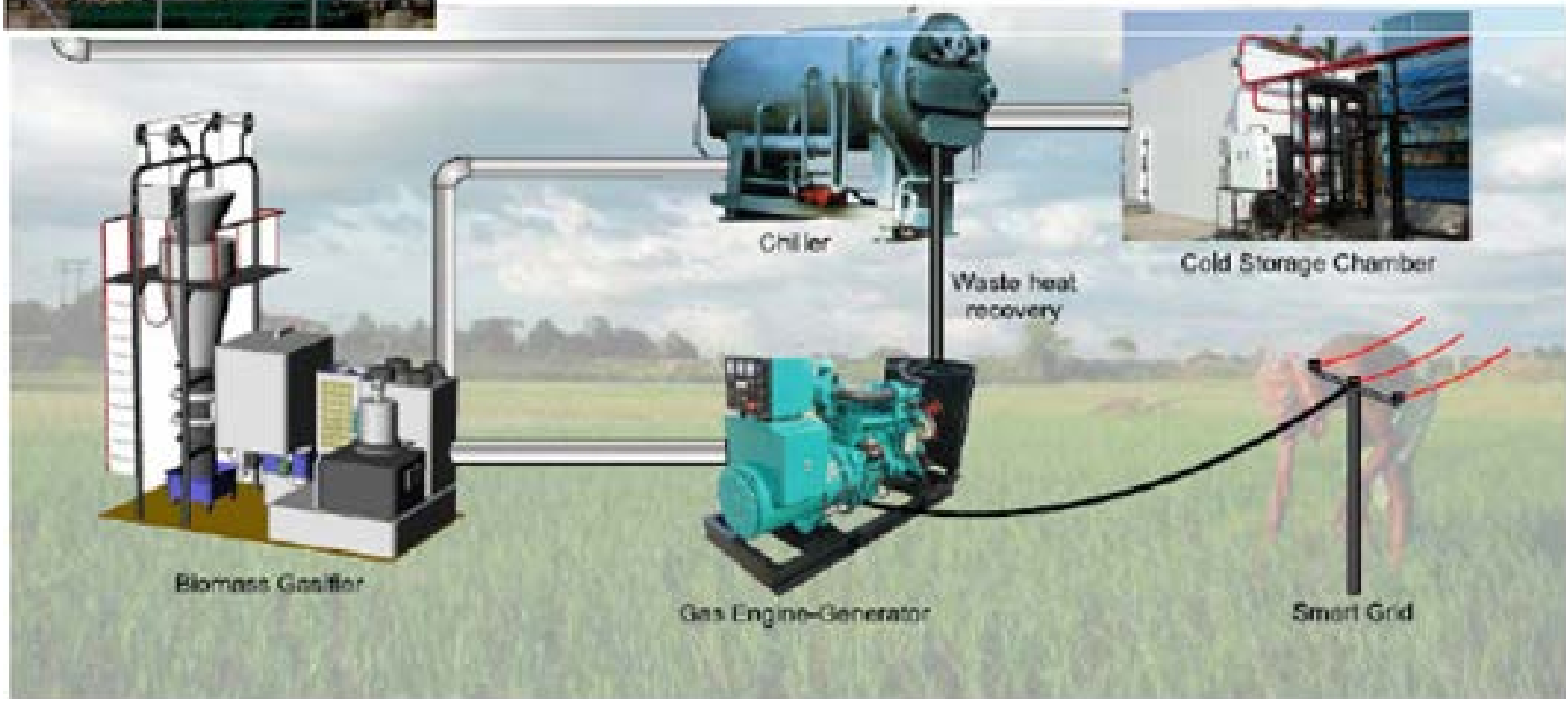
16.7 MW Bagasse Co-generation Project in A.P. using 87 ata Boiler

2 x 15 Kw Nguriangbung Power House

5 MWp Solar PV Plant at Khimsar

Electricity & Cold Storage for Remote Rural Applications (SEC, Thermax, TERI)

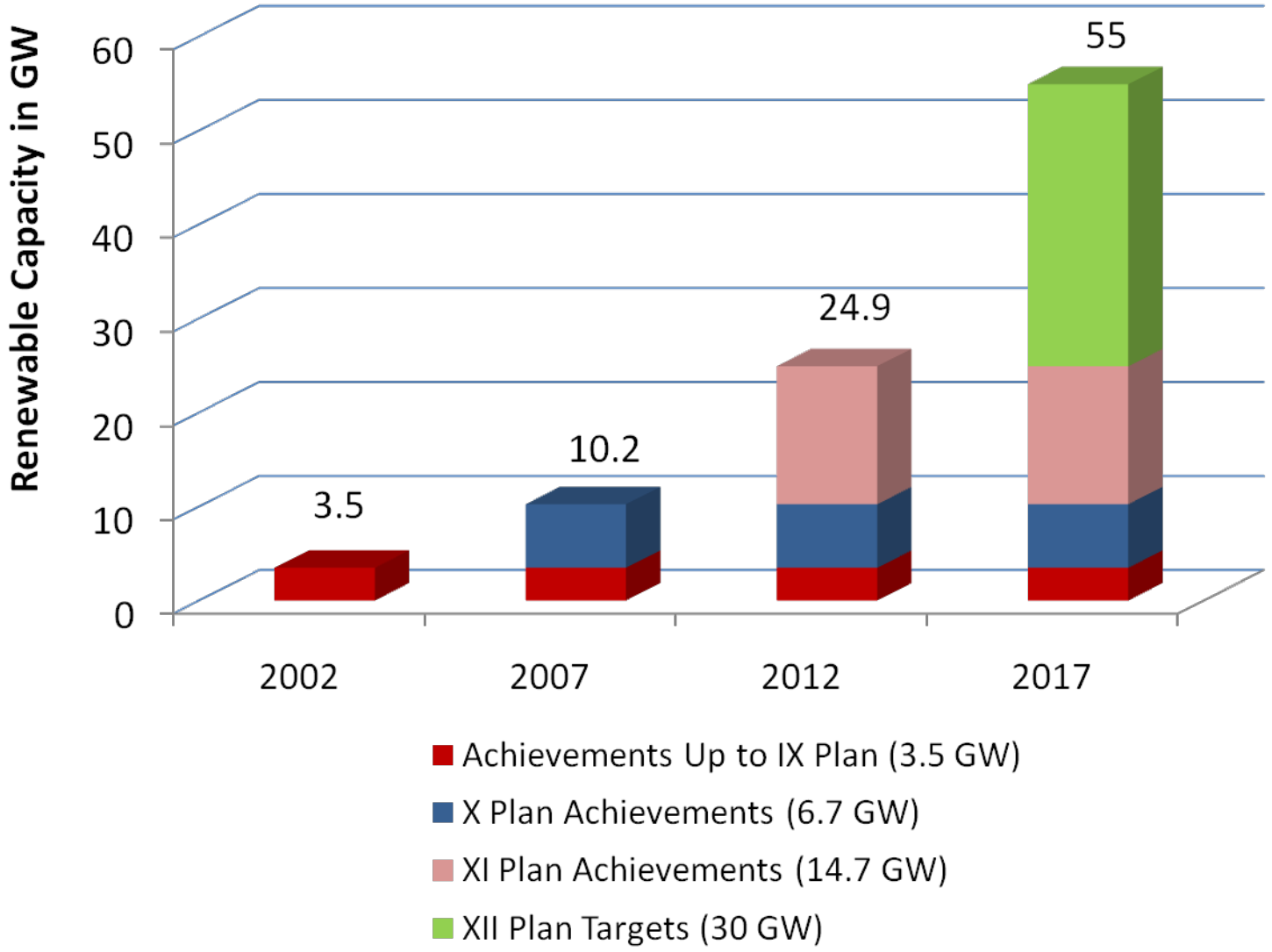
- Electricity from biomass gasifier
- Cooling from engine exhaust
- Solar concentrators during solar hours



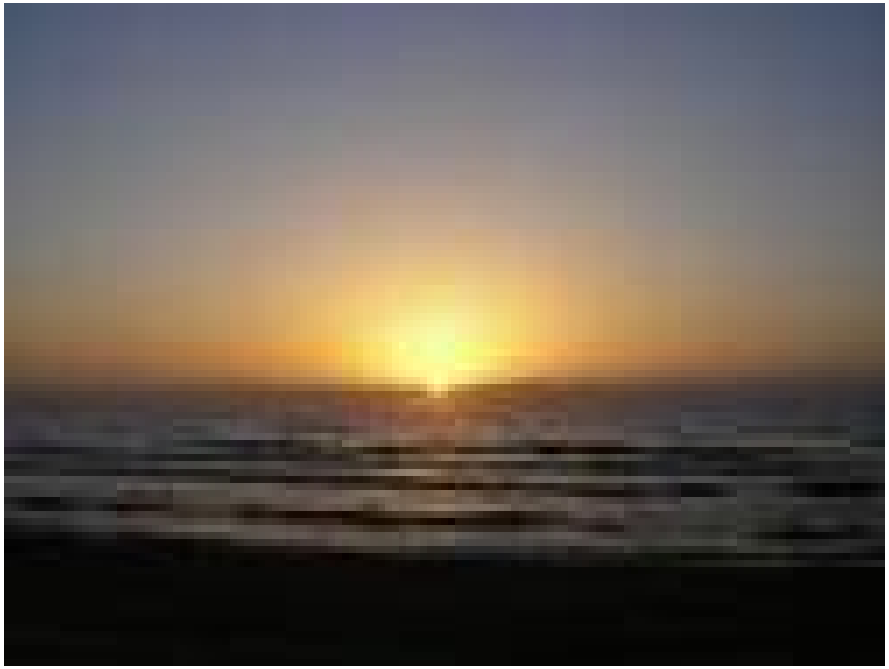
Recent developments

- 1000 villages completed under Village Electrification Programme
- Large scale deployment of decentralized off-grid systems
- Large size wind farms in low wind regime areas
- Around 1200 Mw capacity solar plants commissioned
- Dedicated transmission lines for evacuation
- Tariff based bidding for enabling market forces
- A number of Centres for Excellence established for specific R&D
- Solar Energy Centre being upgraded as an international centre

Plan-wise Renewable Capacity Addition



Thank You
for your attention



www.mnre.gov.in