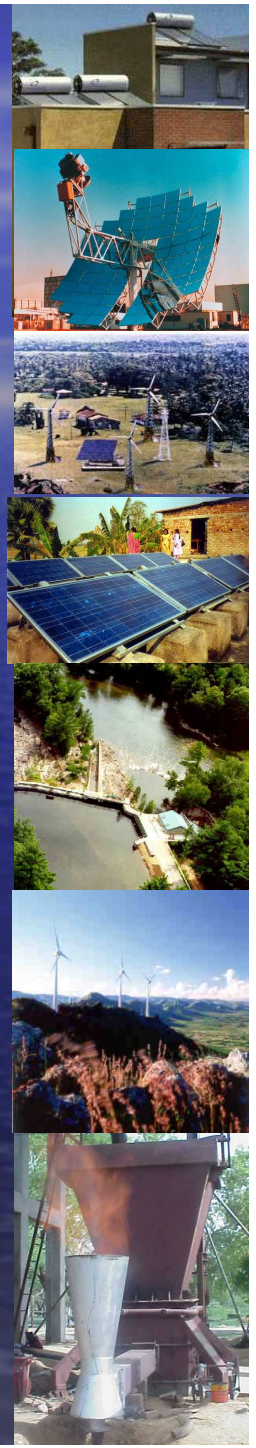
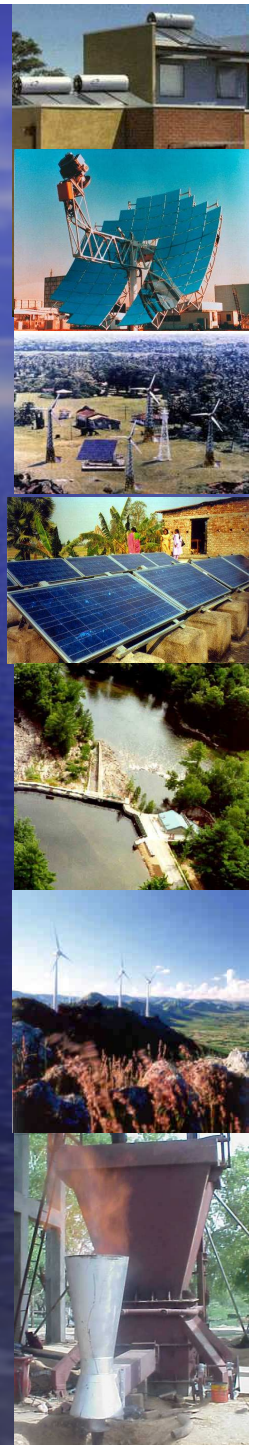
Renewable Energy Programmes in India

Amit Kumar
TERI, India



Outline

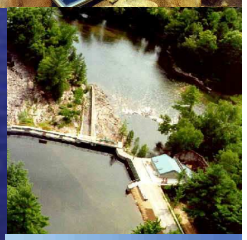
- Indian Energy Scenario
- Renewable Energy in India
  - Grid connected power
  - Distributed generation
  - Sustainable buildings
  - Bio-energy
- Policy overview
- Challenges
- Opportunities
- Conclusion



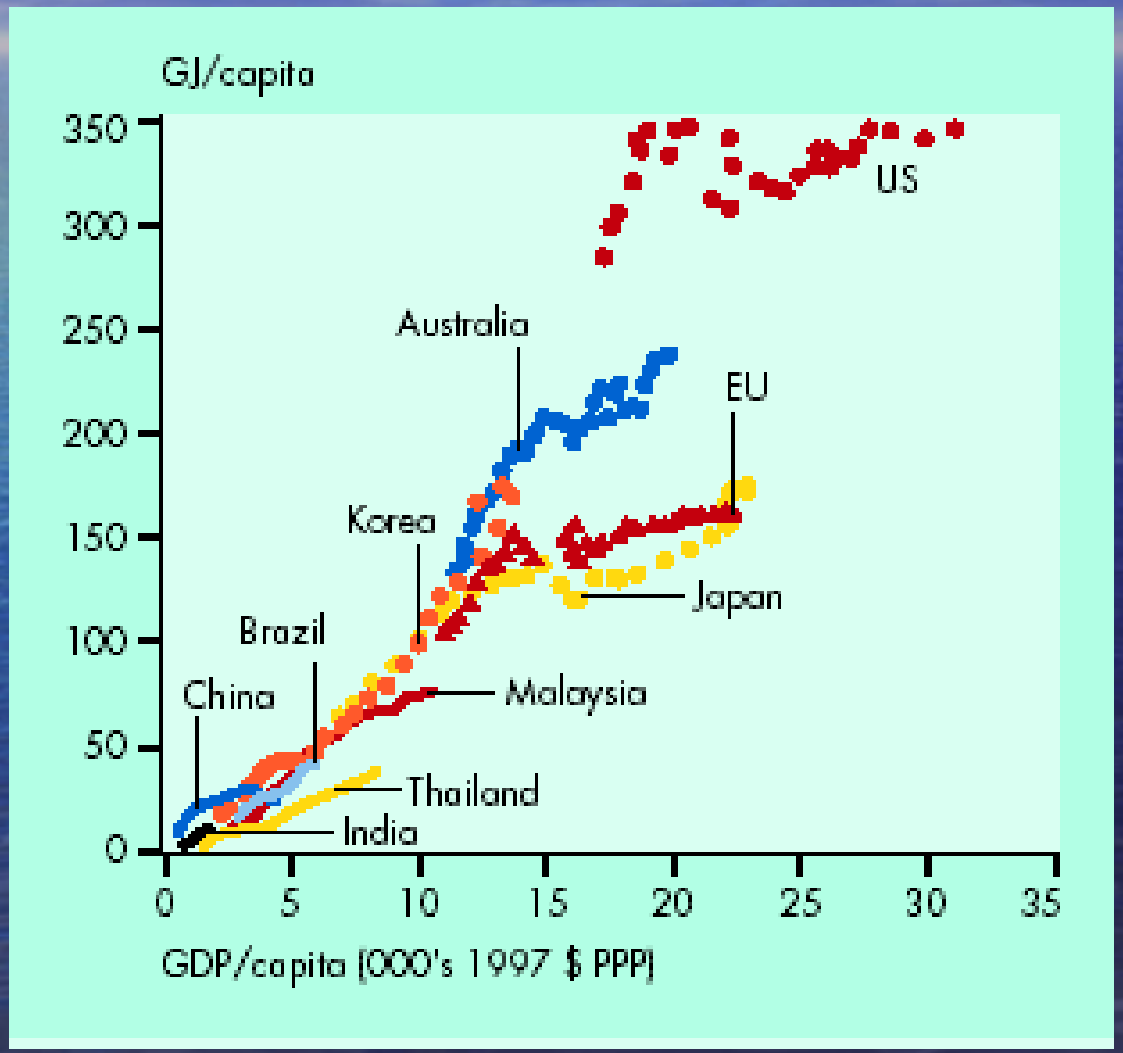
Energy Scenario in India

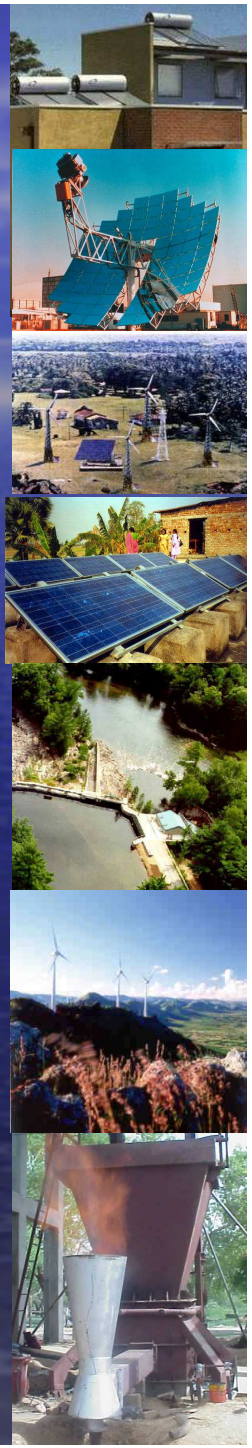




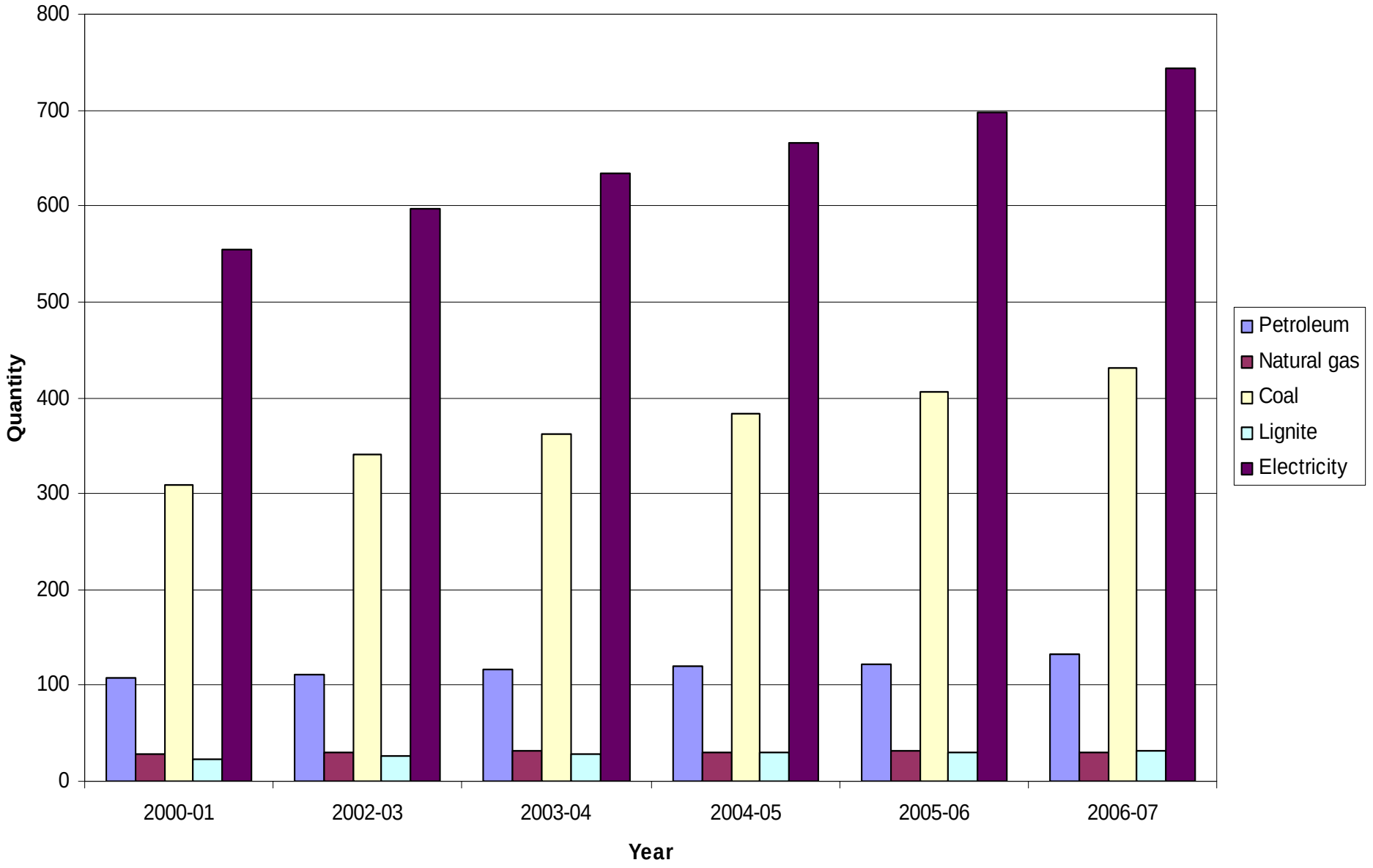


Low Per-Capita Energy Consumption



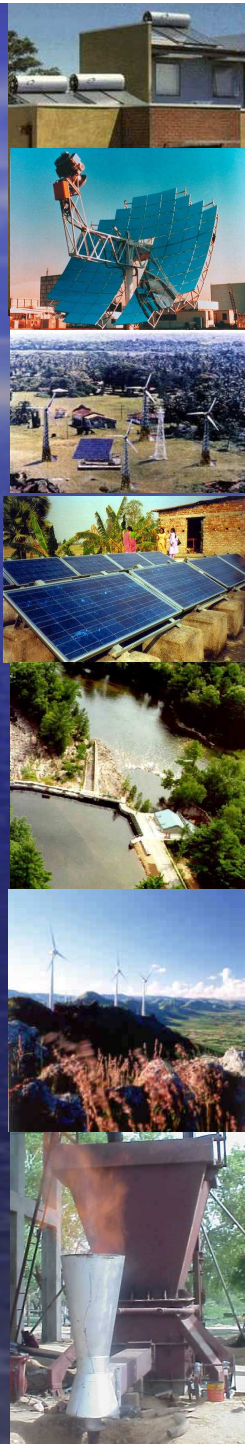


Primary Commercial Energy Consumption in India

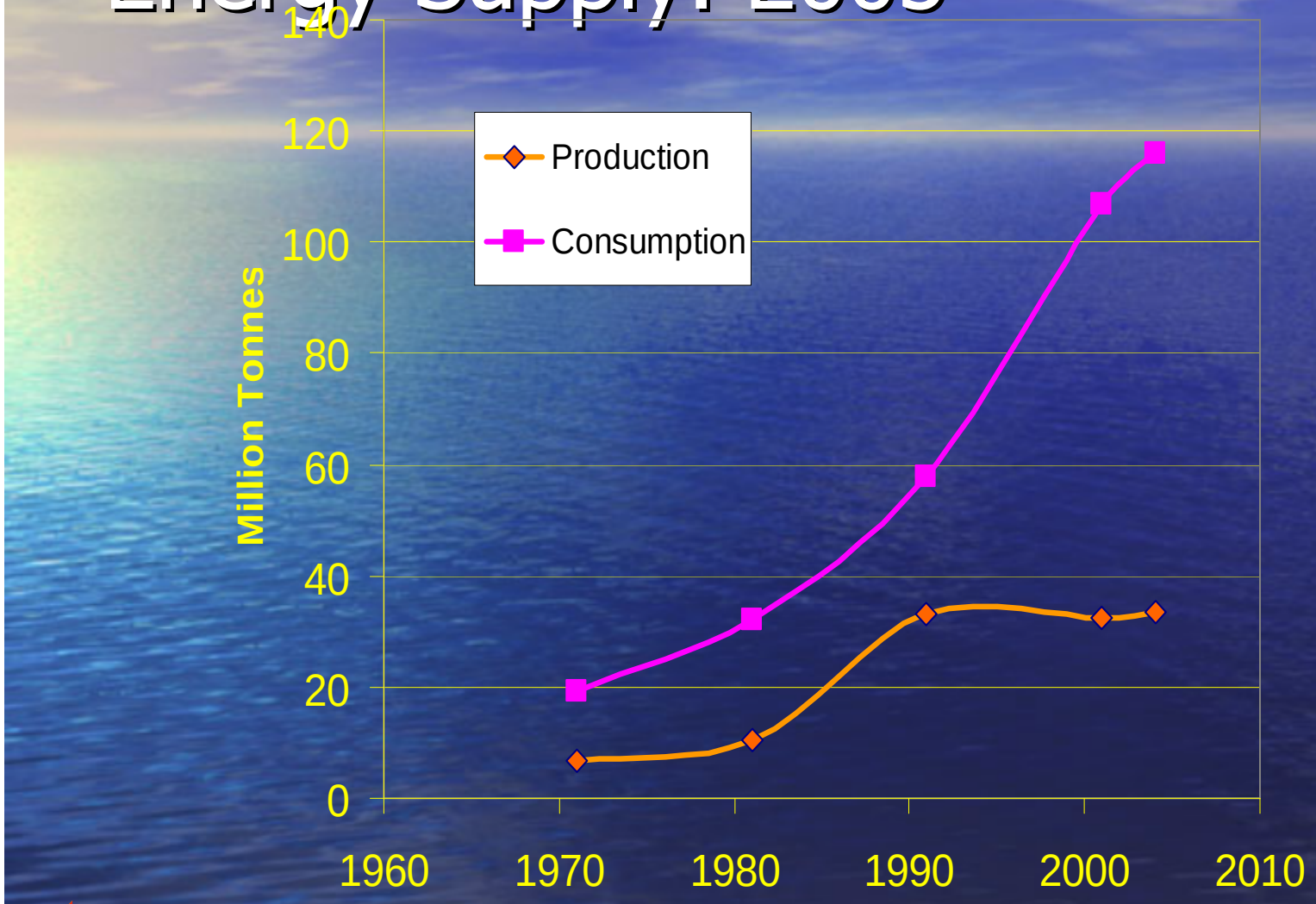


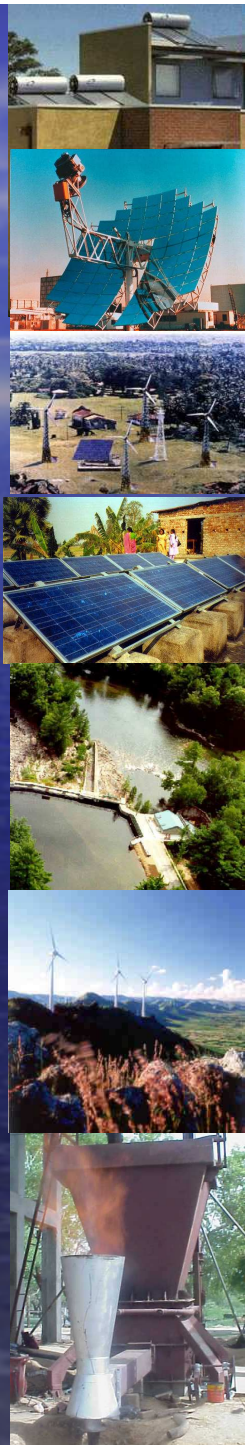
Energy Supply

- Coal:
  - Major energy source.
- Biomass:
  - Primary source of cooking energy in > 80% rural households.
- Electricity:
  - Peak shortage: 14.6 %
  - Energy shortage: 10.4 %
- Energy security concern:
  - Around 75 % of the petroleum supply is imported

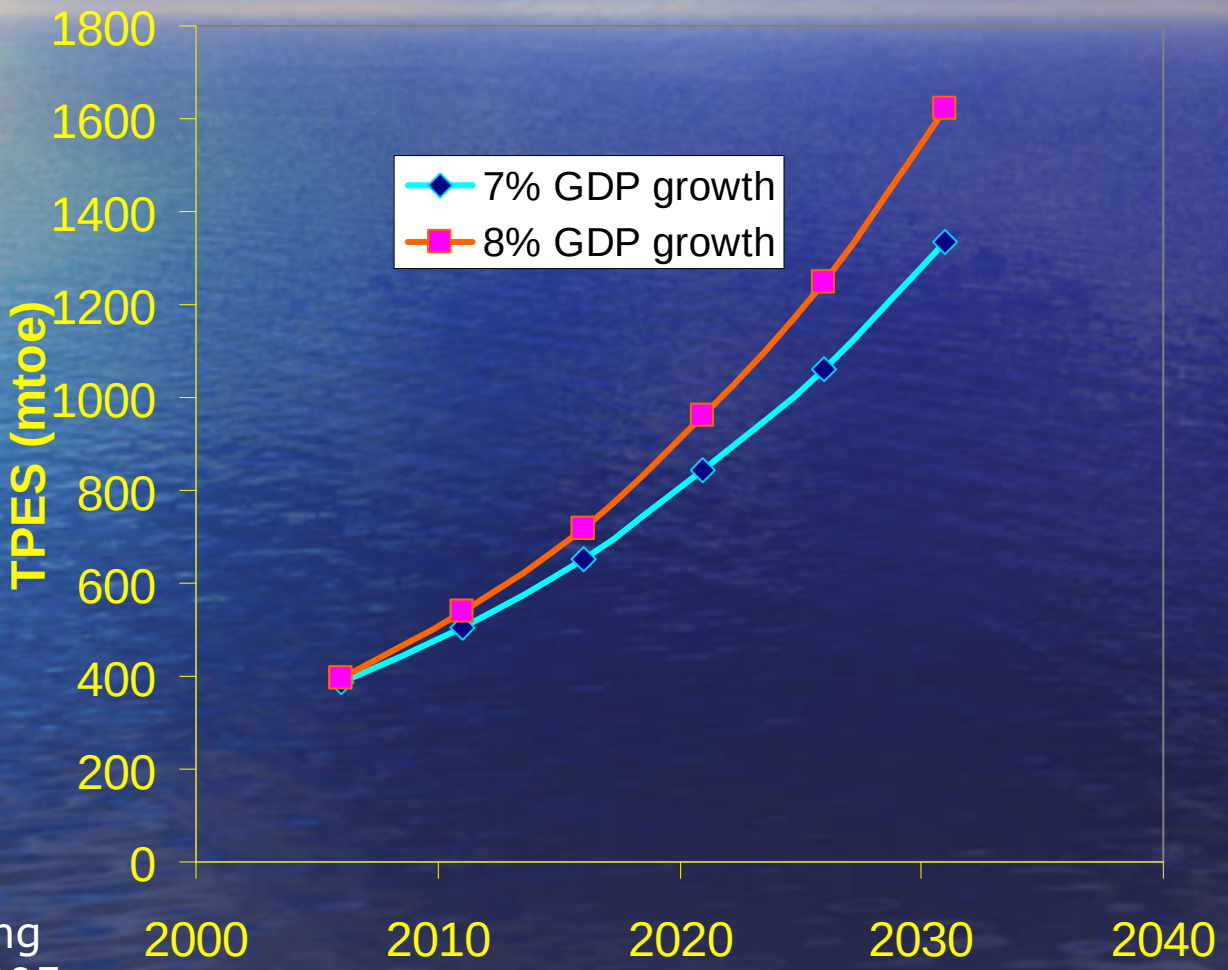


Energy Supply: 2005

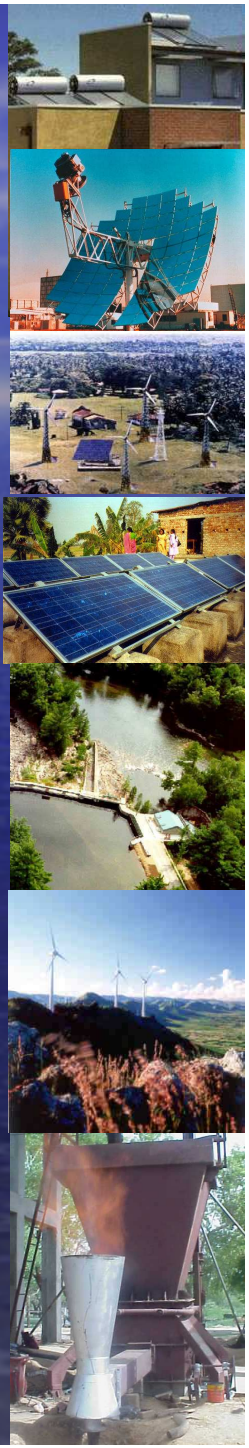




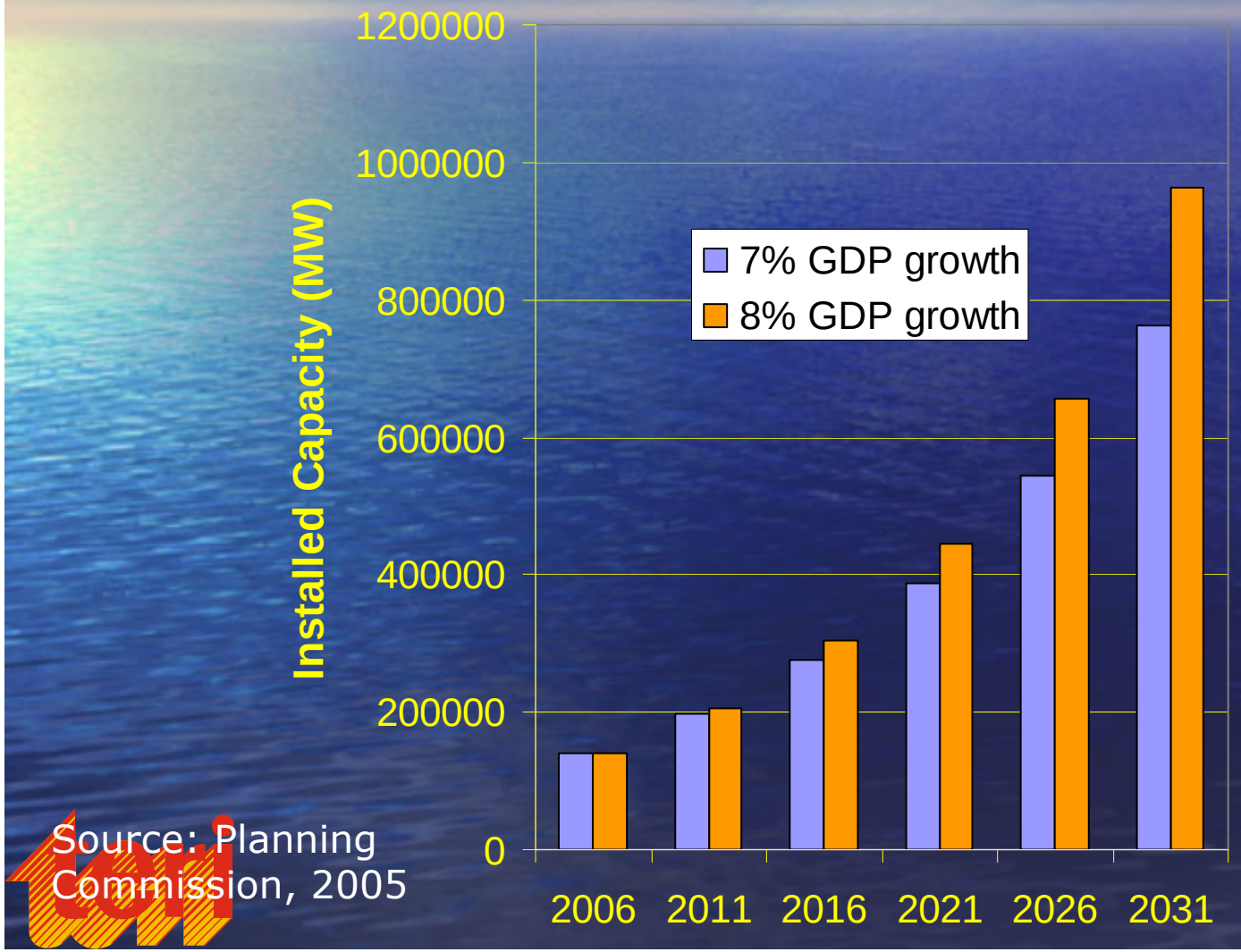
Estimated Growth in Primary Energy (2006 -2031)



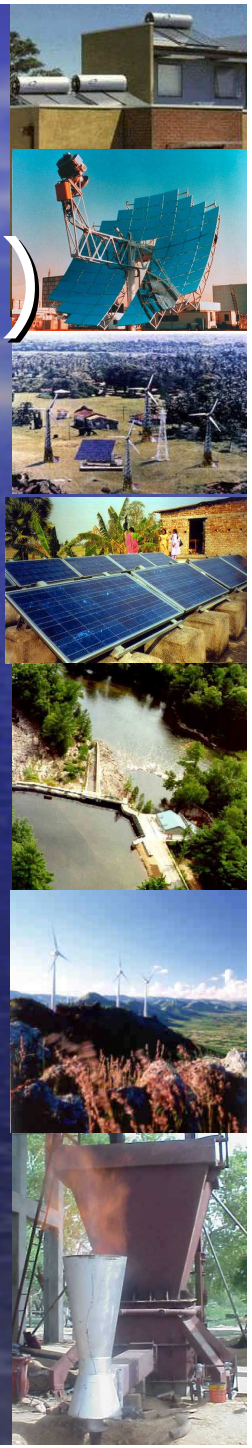
Source: Planning Commission,2005



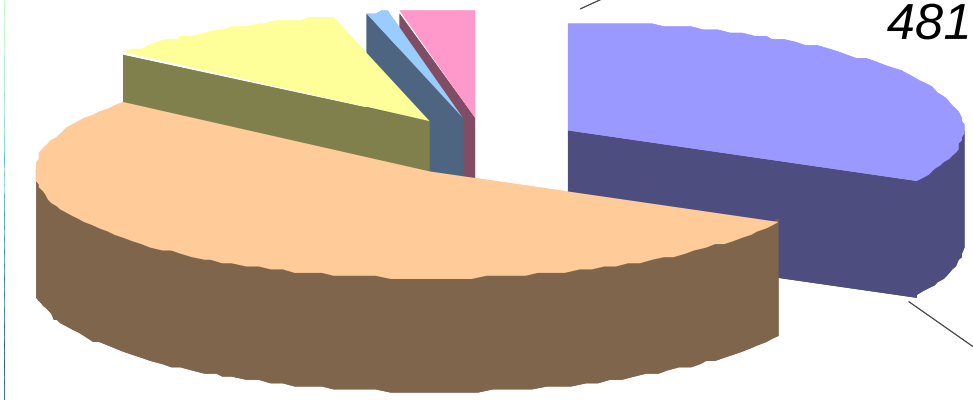
Estimated Growth in Electricity Generation Capacity (2006 -2031)

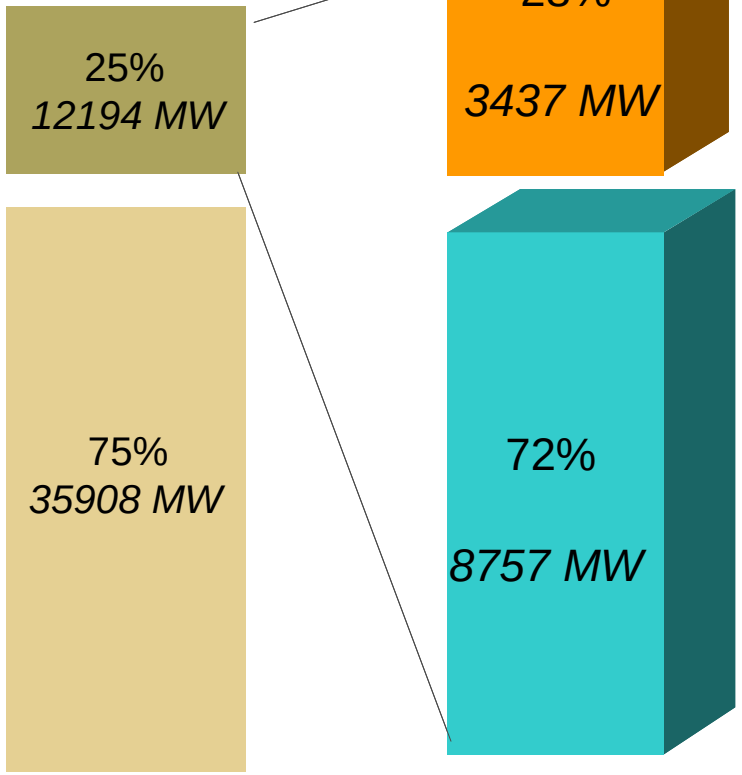


Source: Planning Commission, 2005



RE share in installed capacity





Other RE
Wind

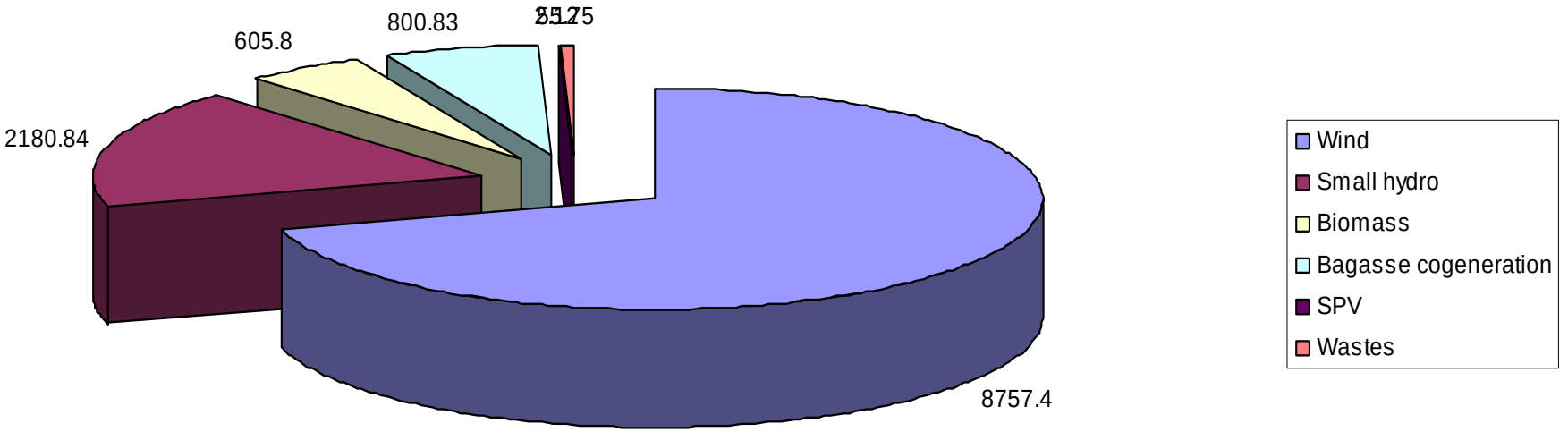
Total installed capacity as on 31.3.2008
144130.17 MW

Coal Gas Oil Nuclear Renewable

Hydro New Renewables

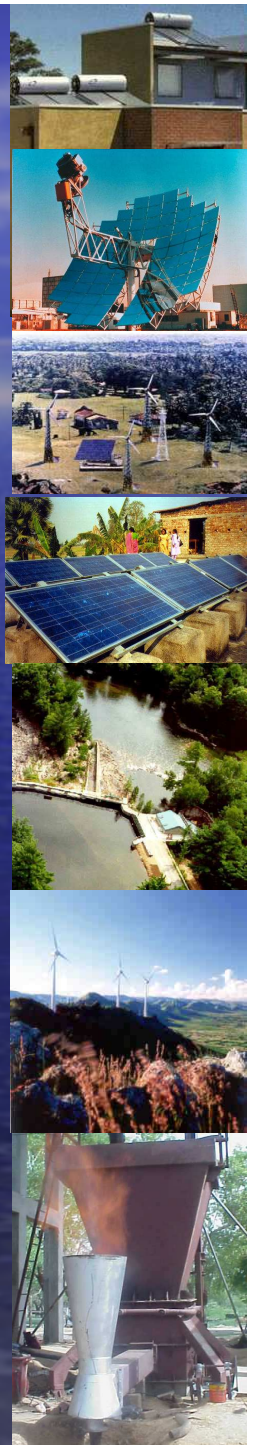
Grid connected RETs in India

(as on March 31, 2008)

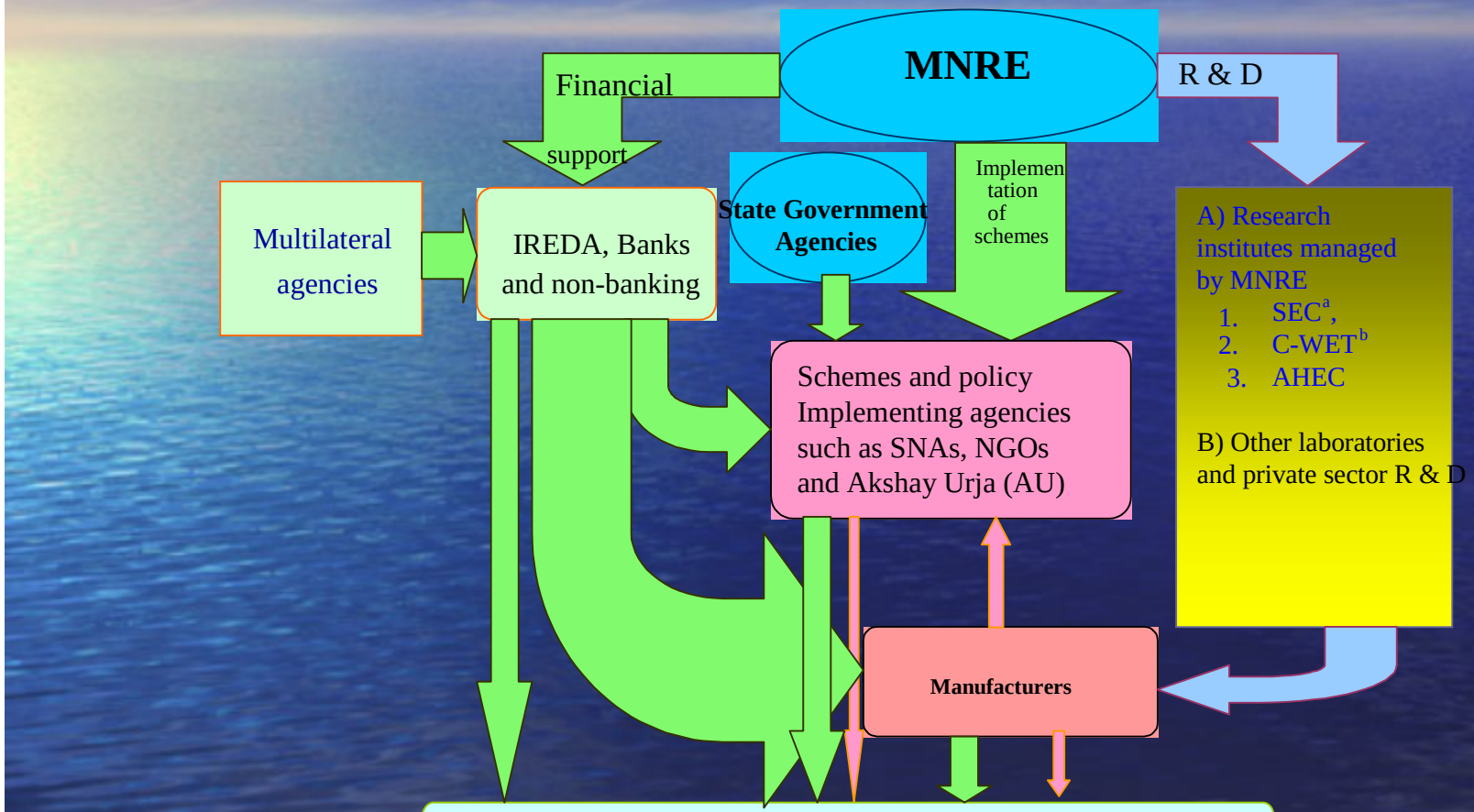


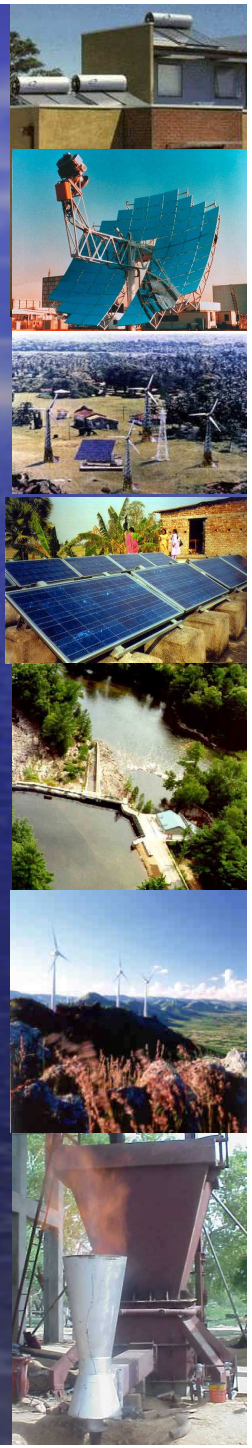
RE Development in India

- 1981- Commission for Additional Sources of Energy
- 1982- Department for Non-conventional Energy Sources (DNES)
- 1987- IREDA Established
- 1992- DNES upgraded to Ministry of Non-Conventional Energy Sources (MNES)
- 2006- MNES renamed as Ministry of New and Renewable Energy (MNRE)



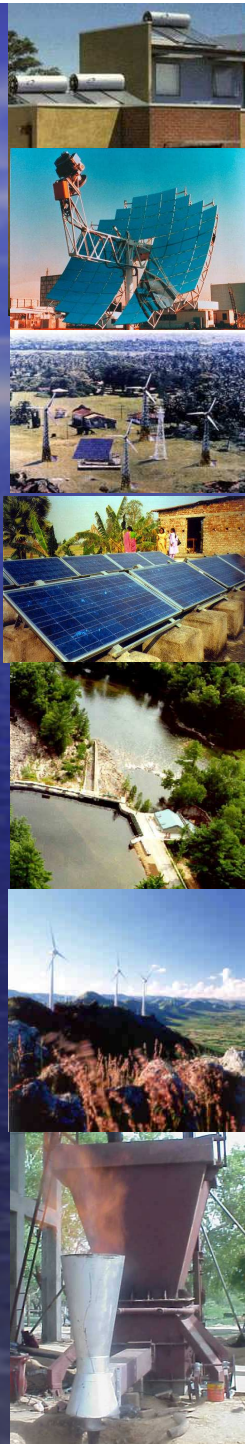
Institutional structure





Market Segments for Renewable Energy

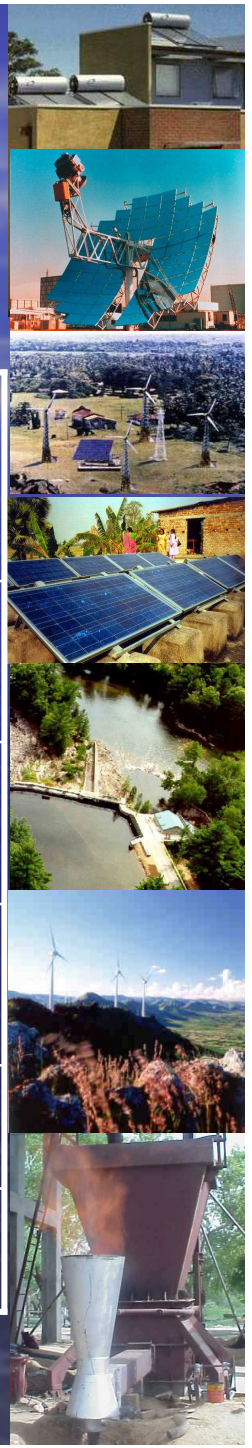
- Grid-connected Electricity
- Distributed generation of electricity and heat
  - Rural
  - Industrial,
  - Institutional, commercial and community
- Sustainable buildings
- Bio-fuels for transportation



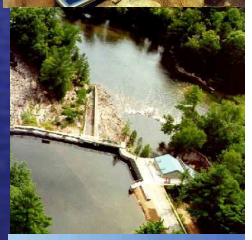
Grid-Connected Renewable Electricity

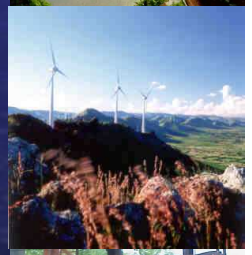
Source	Potential (MW)	Installed Capacity (MW) (March 31, 2008)
Wind	45,000	8757
Biomass power and bagasse co-generation	19,500	1405
Small Hydro (up to 25 MW)	15,000	2180
Solar		2.12
Waste to energy		55.75

Source: MNES, 2008



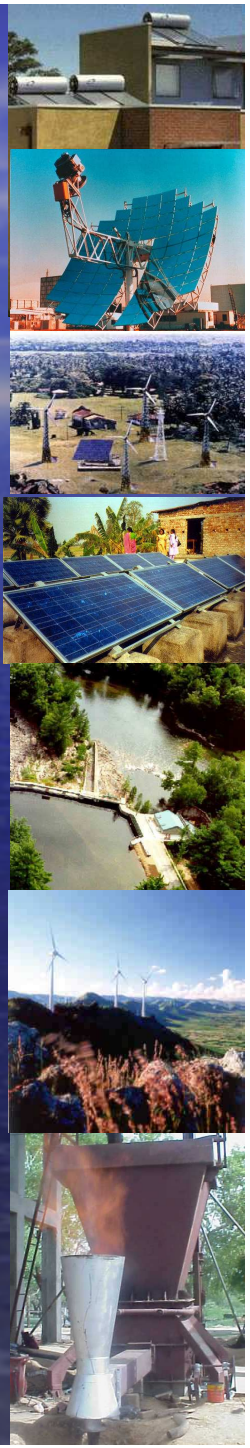
Grid Electricity



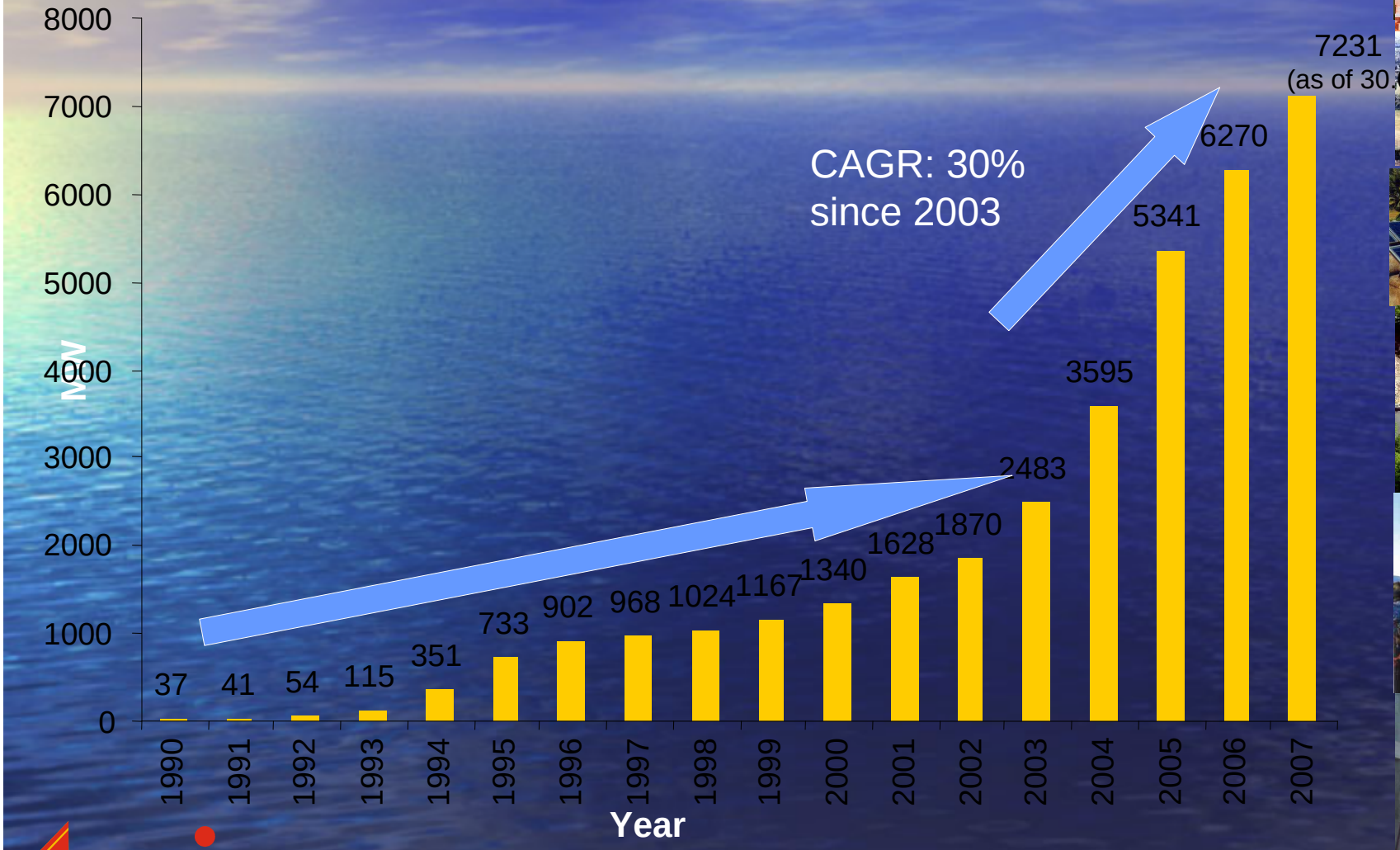


Wind Energy in India

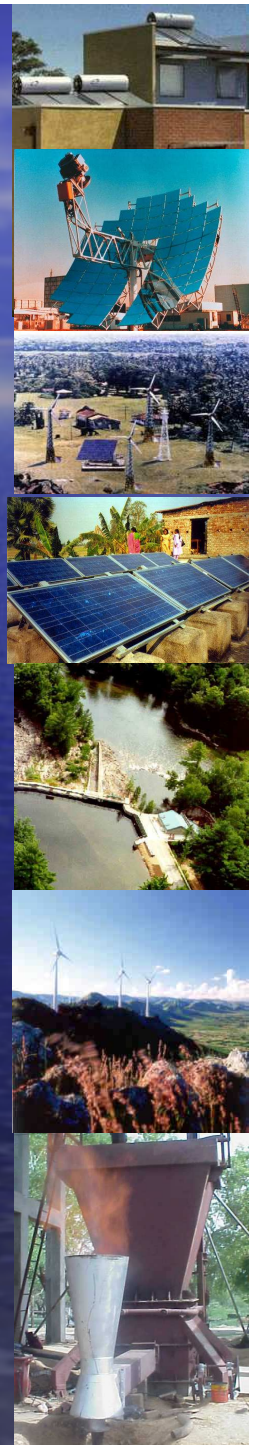
- Initiated by GoI in mid-80's
  - Private sector investments started in early '90s
  - Resource potential of 65,000 MW +
  - 4th largest market of the world
  - Steady growth in the past 5 years



Grid connected wind power projects in India

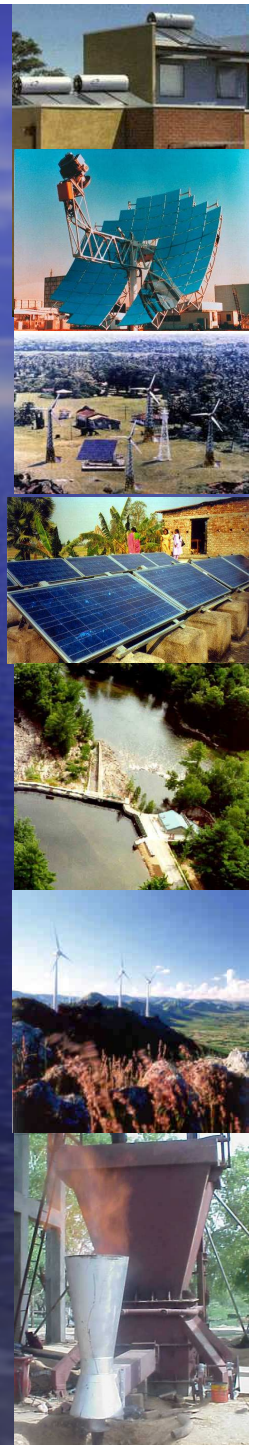


Distributed Generation of Electricity and Heat

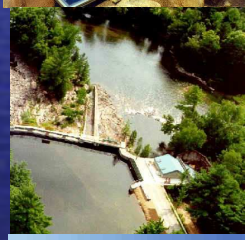


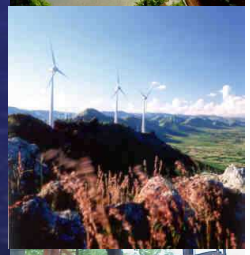
Off-grid rural electrification

- Poor Electrification Status
  - 84 million households in the country do not have access to electricity
  - 1,25,000 villages are un-electrified
  - Electricity supply situation is generally poor in even electrified villages
- Major Government programme targeted at provision of electricity to all by 2009-10.
- Around 10,000 villages through off-grid RE
  - Solar PV
  - Biomass gasification
  - Small hydro



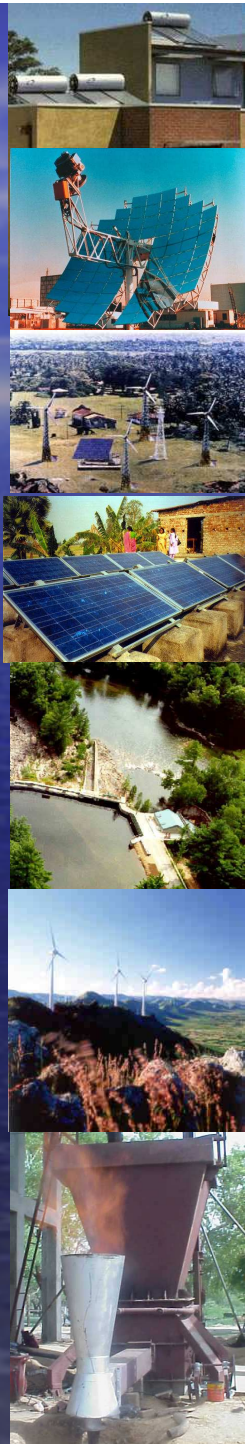
Village Electrification: Biomass Gasifier





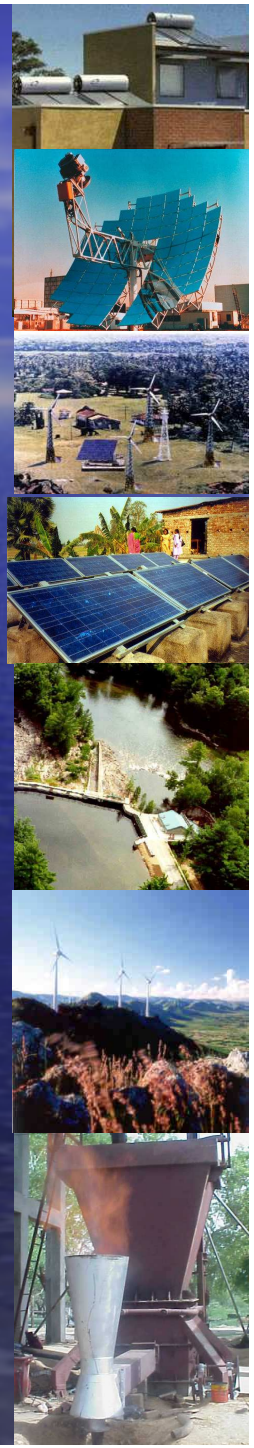
Distributed power generation

Source	Capacity
Biomass/non-bagasse cogen	95 MW
Biomass gasifier	99 MW equivalent
Energy from waste	26 MW equivalent
Solar PV Power Plants and Street Lights	7.72 MWp
Remote village electrification	3985 villages & 1142 hamlets



Distributed Generation in Industries

- Captive power generation
  - Currently 30,000 MW using fossil fuels
  - Industries looking at wind, biomass for captive power generation.
- Thermal energy
  - Hot air for drying
    - Spices, fish, tea leaves, tobacco, etc.
  - Hot water
    - Leather, dairies, textile, chemicals, etc.
- Co-generation
  - 15,000 MW potential
    - Sugar, breweries, caustic soda, rice mills, poultry, etc.

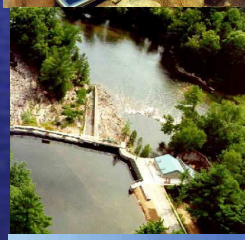
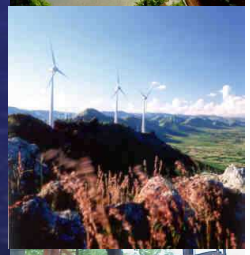


Decentralized energy systems

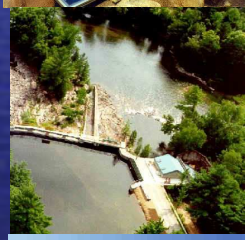
System	Numbers/capacity
Family type biogas plants	4 million
Solar water heating systems	2.30 million sq.m. collector area
Solar cookers	0.63 million
SPV systems	110 MWp

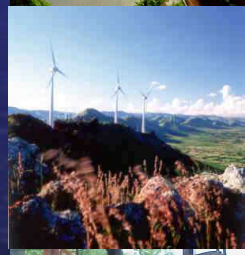




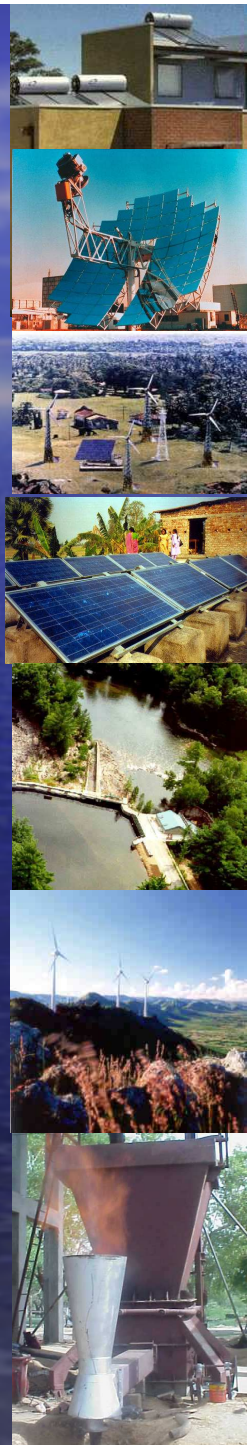

Solar Systems: Industrial Applications





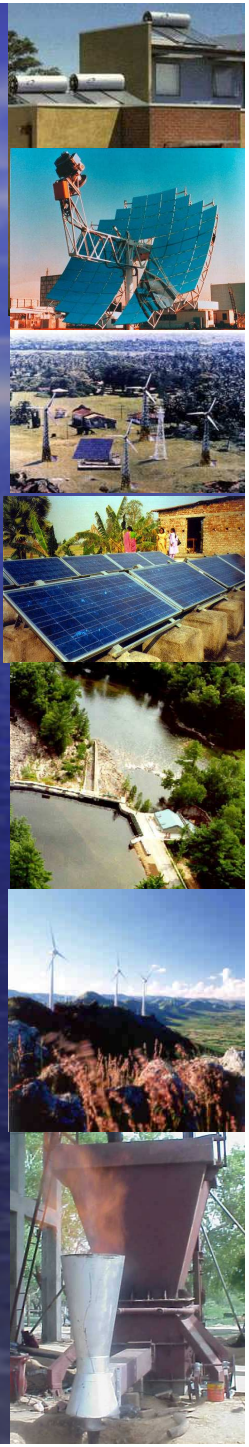
RE in Buildings and Urban Areas

- Solar City concept introduced
  - Energy efficiency
  - Renewable energy
    - Solar Water Heaters
    - Solar PV
    - Waste to energy/biomass energy
- Green buildings
  - Indigenous rating system "GRIHA"
  - Earth air tunnel, solar passive concepts, building integrated SPV, water conservation, waste minimization etc.



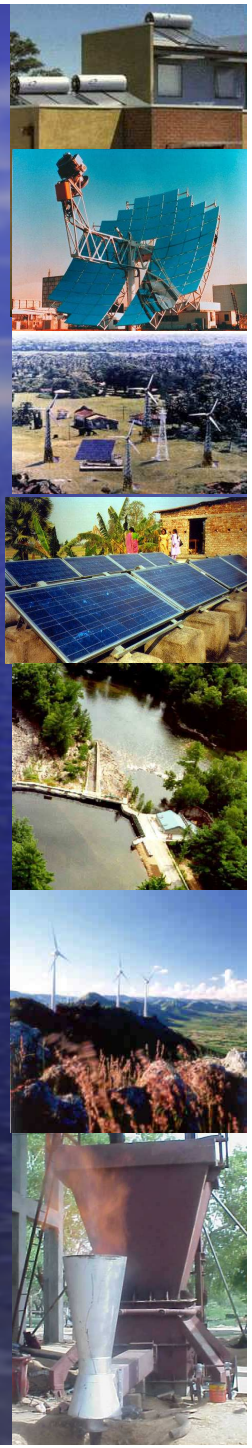
Bio-energy

- Large biomass resource base
  - > 600 million tonnes
- Modern biomass energy technologies
  - Liquid fuels (ethanol, bio-diesel)
  - Gaseous fuels (producer gas, bio gas)
  - Electricity (small-scale using gasification, large-scale using steam route)
- Social benefits
  - Employment in rural areas
  - Modern energy services to rural population
  - Potential to "green" waste lands



…Bio-energy

- National Bio-fuel Policy formulated
  - Aims at 20% blending in petrol/diesel by 2017
- Bio-diesel
  - 100,000 hectares plantations in last two years
  - 300,000 hectares plantations being planned
  - Big industry players: BP, Reliance, etc.
- Ethanol
  - Ethanol from sugarcane molasses
    - 5% ethanol blending in petrol mandatory
  - Ethanol production
    - Over 100 plants in private and cooperative sectors
    - Total installed capacity of > 1.2 million kl/year



Policy overview

1970s

- R&D programs initiated
- Focus on developing RE technologies and products
- Demonstration projects

1980s

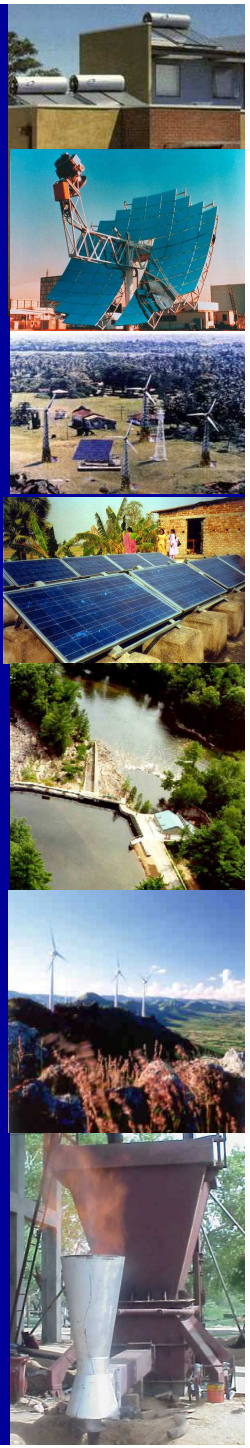
- Fiscal & financial incentives introduced (subsidy, tax incentives, etc)
- Increased role of Public Sector Undertakings
- Infrastructure development

1990s

- More emphasis on fiscal incentives
- Increased Private Sector Participation

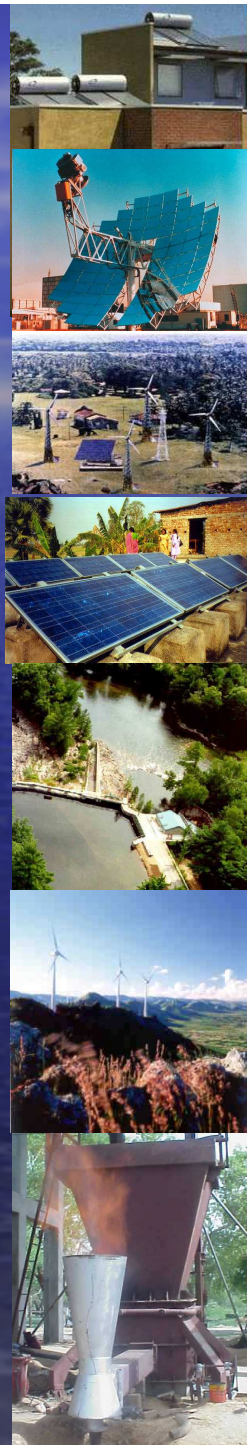
2000 Onwards

- EA 2003, NEP 2005, NTP 2006
  - Quota/Obligation system introduced
  - Preferential tariffs for RE
- Integrated Energy Policy 2006
- Generation based incentive for Solar PV/ Thermal
- National Biofuels Policy



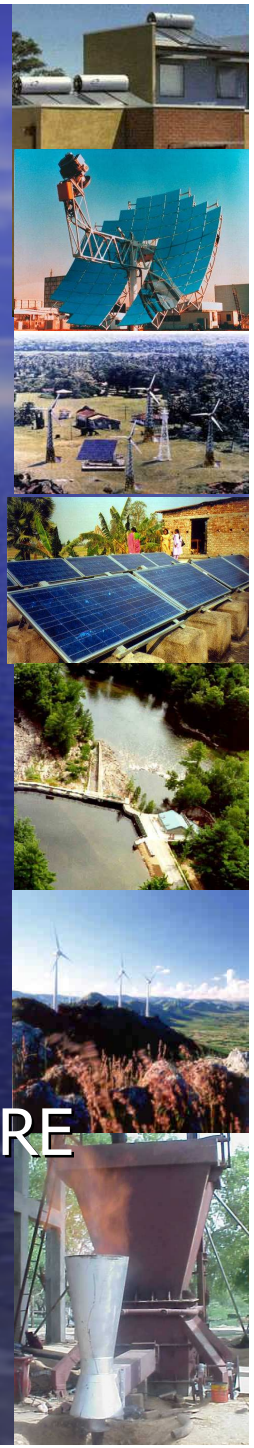
...Policy overview

- The broad objectives:
  - Meeting the minimum energy needs through RE
  - Providing decentralised energy supply in agriculture, industry, commercial and household sectors in rural and urban areas
  - 10% of additional grid power generation capacity to be from RE by 2012.



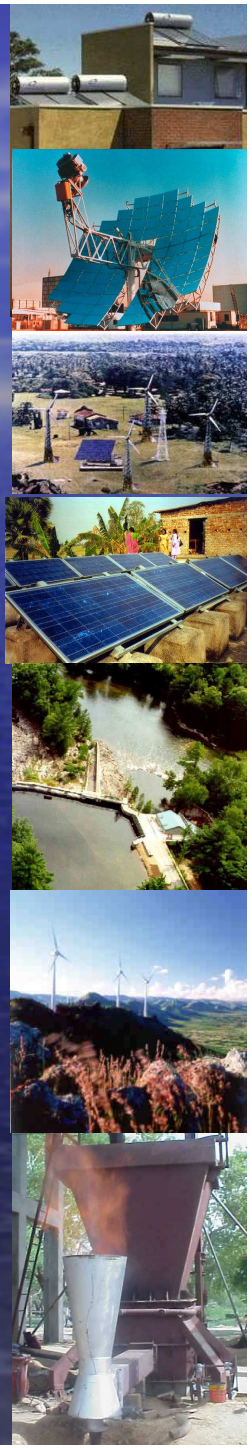
Enabling environment

- To encourage private investment in the sector; the Government provides many different types of incentives:
  - accelerated depreciation allowances
  - capital cost subsidies
  - interest rate subsidies
  - exemption or reduction in excise duty
  - exemption from central sales taxes
  - customs duty concessions on the import of material, components, and equipment used in RE projects.



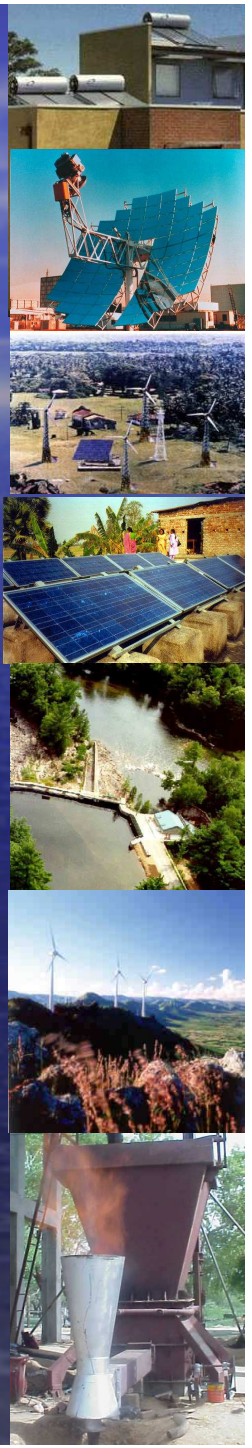
… Enabling environment

- Some of the salient features that encourage industrial development and foreign investments are:
  - Promotion of medium, small, and micro enterprises for manufacturing and servicing of various types of RE systems and devices
  - Industrial clearances are not required for setting-up of an RE industry
  - Profits earned from sale of renewable power are exempt from Income Tax for any 10 years out of the first 15 years of project's operation.
  - Soft loans are available through IREDA for RE equipment manufacturing



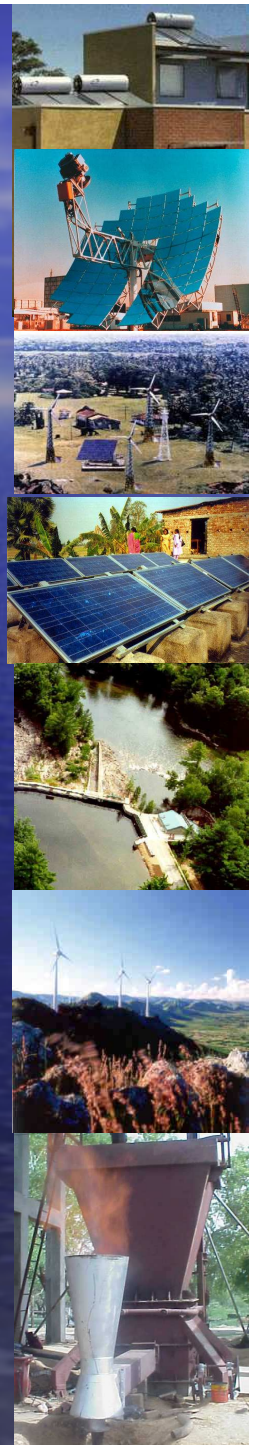
… Enabling environment

- Financial support is available to RE industries for R&D projects in association with technical institutions
- Private sector companies can set up enterprises to operate as licensee or generating companies
- Customs duty concession is available for RE spares and equipment, including those for machinery required for renovation and modernisation of power plants
- Reduced excise duty (or total exemption) on a variety of capital goods
- Foreign investors are encouraged to set up RE-based power generation projects on BOO basis



… Enabling environment

- Special incentive package for setting up state-of-art manufacturing units for solar cell, organic light emitting diode, photovoltaics: 20-25% of the capital investment.
- Facilitation to establish dedicated Special Economic Zones for production of equipment involved in the renewable energy generation sector by domestic as well as foreign investors.



Instruments for promoting RE Power

Generation based Incentives (kWh)

Supply Side

- Feed-in tariffs
- Tax benefits/ other fiscal measures
- Accelerated depreciation
- Tendering systems

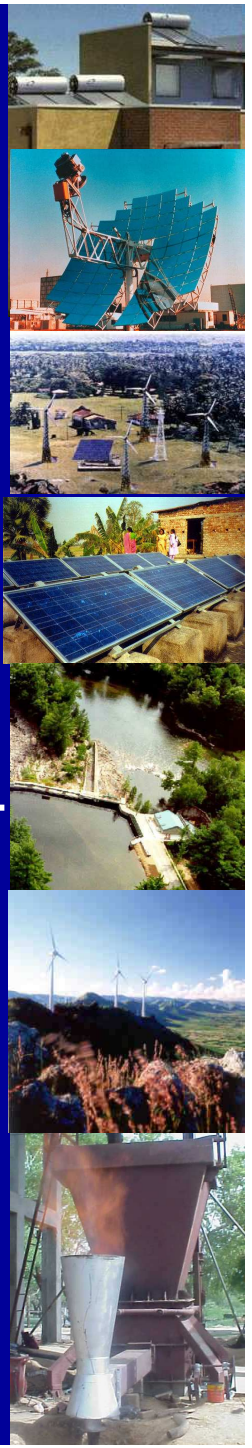
Demand Side

- Quota obligations / Green certificates
- Tax benefits/ other fiscal measures

- Investment subsidies
- Low interest loans
- Tax benefits/ other fiscal measures

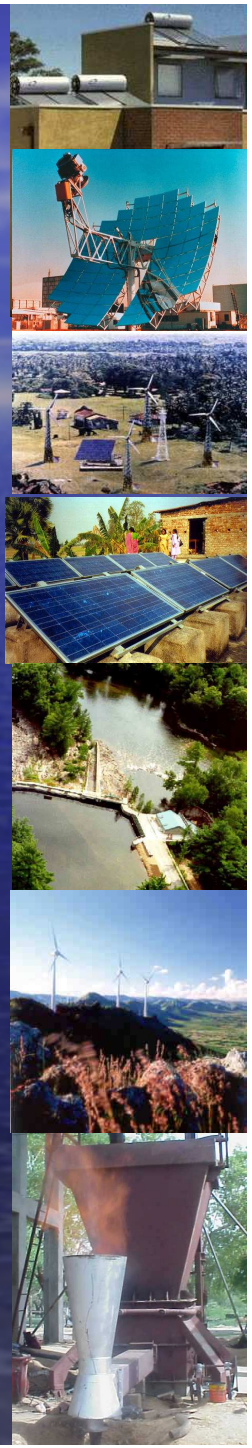
- Quota Obligations

Capacity based Incentives (kW)



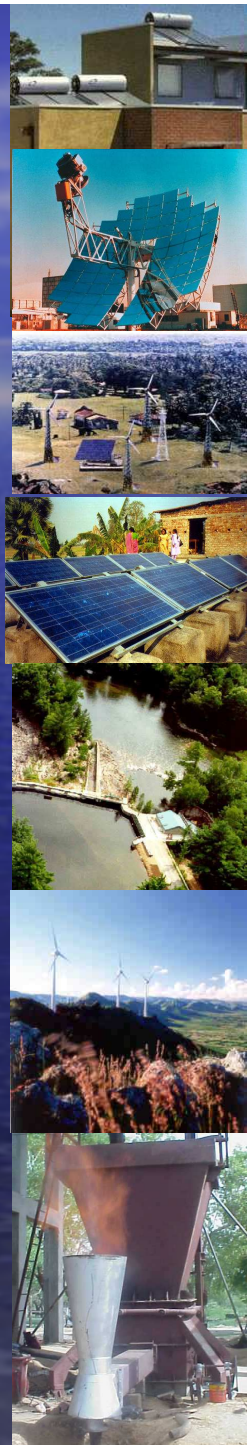
National Solar Mission

- Increase the share of solar energy in the total energy mix
  - 80% coverage for all low temperature applications (< 150°C)
  - 60% coverage for all medium temperature applications (150°C to 250°C)
  - 1000 MW of CSP
- Decentralized distribution of energy
- Creation of more affordable, more convenient solar power systems and storage
- Long term research on disruptive innovations
- Make solar energy competitive in the next 20 – 25 years



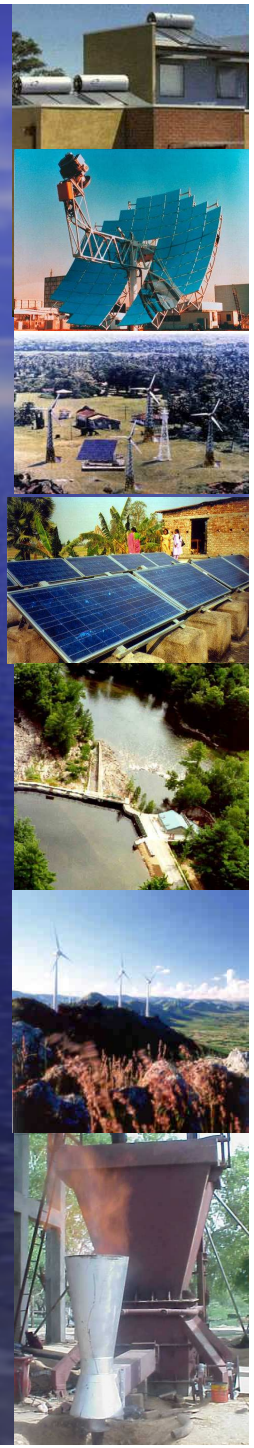
Challenges

- High upfront cost of many RETs
  - Realistic pricing of conventional fuels
- Access to financing, especially for small users and entrepreneurs
- Despatchability for intermittent RE resources
- Sustainable business models for rural energy systems
- Absence of complete market chains especially in the interior regions
- Long-term and consistent policy/regulatory framework
- Long-term R&D support and collaborative R&D



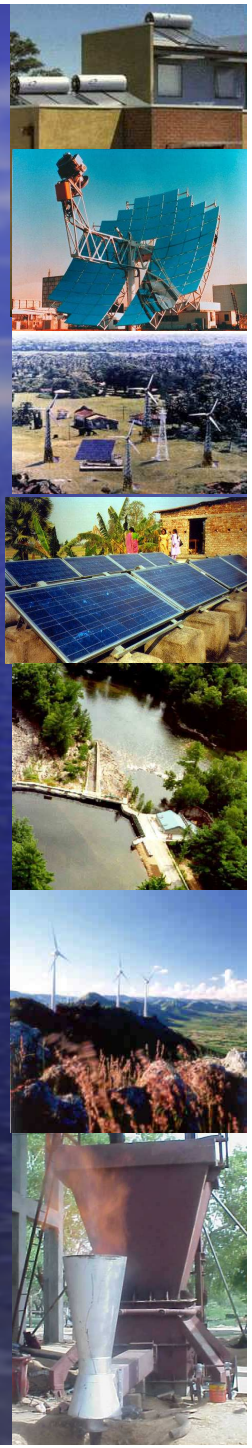
RE business opportunities

- Joint ventures/Indian subsidiaries
- Making India R&D and manufacturing hub for Asia and Africa
- Well established legal system and financial markets
- Large technically qualified and English speaking workforce
- Enabling policy regime



Conclusion

- India has a rapidly growing energy sector with a vibrant renewable energy market
  - Total investments in renewable energy projects > US$ 10 billion in next 3-5 years.
- There are significant opportunities:
  - Solar technologies
  - Bio-energy and bio-fuels
  - Distributed generation of electricity
  - Sustainable building solutions



Thank You

akumar@teri.res.in

www.teriin.org