RENEWABLE ENERGY IN INDIA: NOW & THEN

Oklahoma State University
Industrial Assessment center

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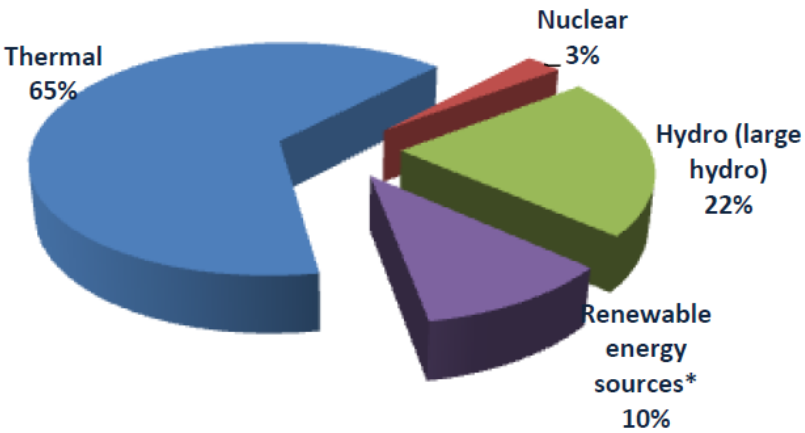
India today

- One of the top five economies in the world with population >1 billion
- Driven by domestic market; Expected growth rate of 9% for next 5 years
- Increased need of energy opts for renewable sources
- Ministry of New and Renewable Energy was started in 1992 which is the nodal Ministry of the Government of India for all matters relating to new and renewable energy.

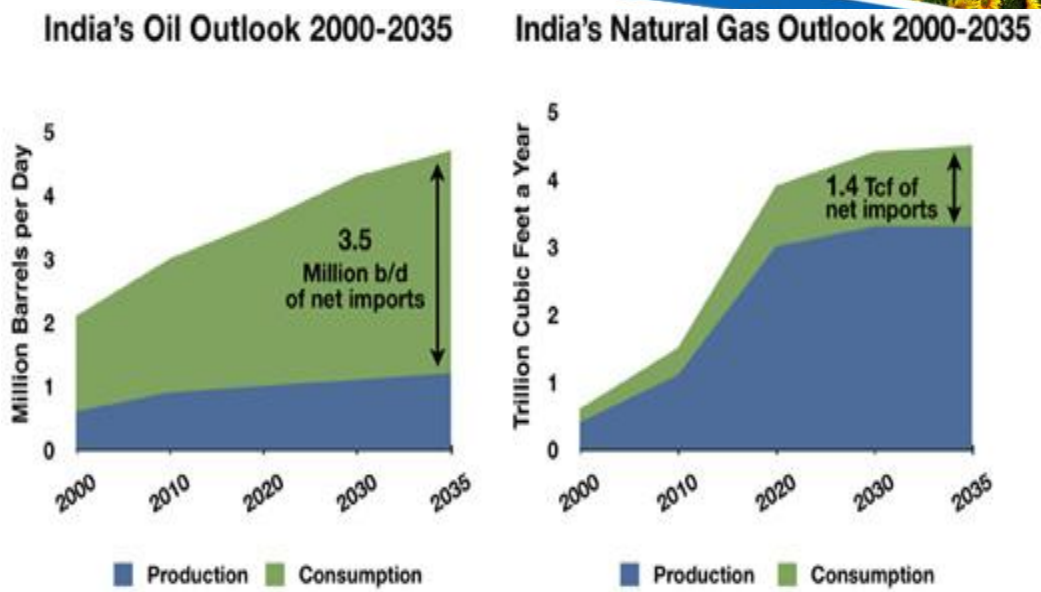
	Electricity	Crude Oil	Natural Gas
Domestic Production in 2010	175 GW	33.7 Million Tons	1.62 Trillion Cu Ft
Imports	18% Coal Import for Electricity Production	75%	28%

Current energy scenario

Total Electricity Installed Capacity: 176.9 GW (Jun2011)



*Source: CEA; *: excluding large hydro*



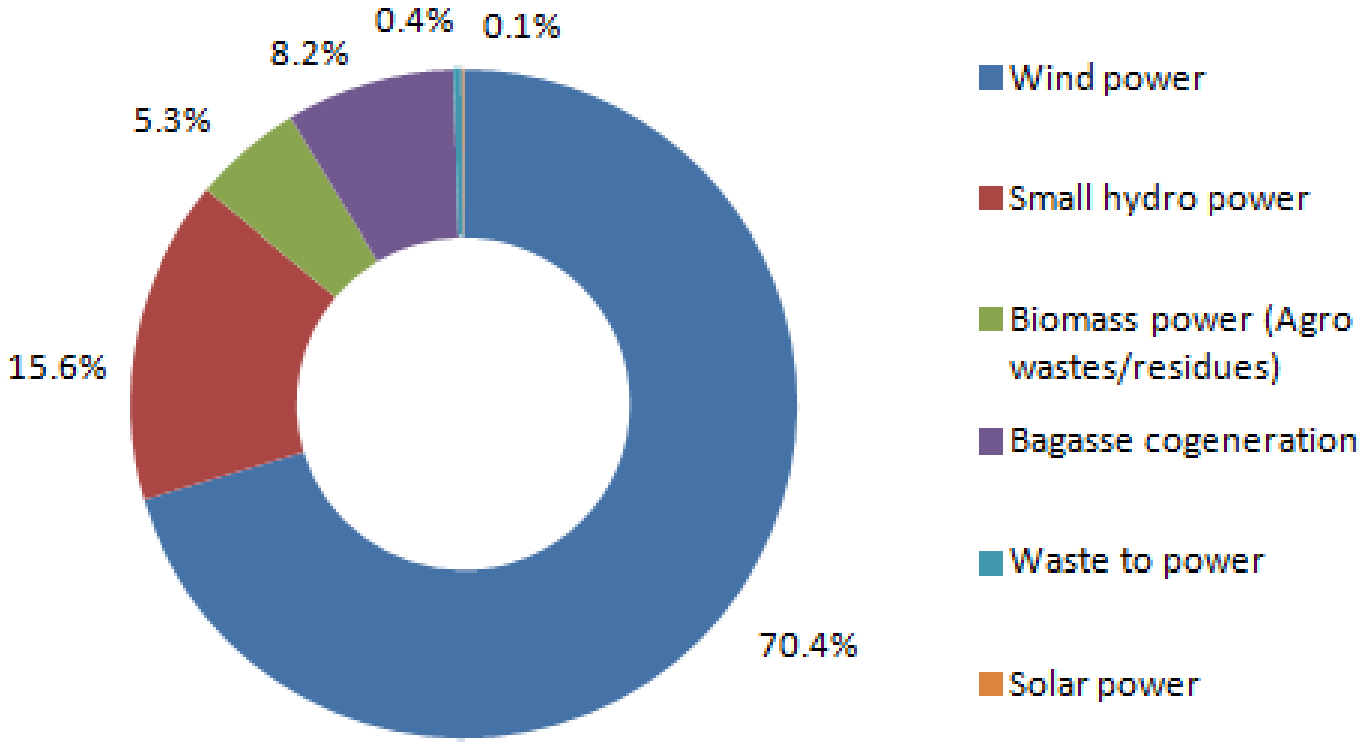
Source: developed from U.S. Energy Information Administration, 2010 data

Time period	Thermal (%)	Hydro (>25MW) (%)	Nuclear (%)	Renewable Power (%)
1.4.2002	59% 74429	26% 26269	2% 2720	2% 1628
1.4.2007	65% 87015	26% 34654	3% 3900	6% 10258
31.9.2010	64% 106518	22.4% 37328	2.7% 4560	10.90% 18,155

Key drivers for growth of renewable energy

- High growth rate in overall energy needs
- Increasing reliance on fossil fuel import
- Viable solution to rural electrification
- Huge energy demand supply gap and untapped potential of renewable energy
- Pressure on industry and polity to abate GHG emissions
- Increased focus on energy security
- Large supply-demand mismatches, with some areas without any access to electricity altogether
- Increasing sources of Government incentives and financing

Renewable sources: Current utilization



Source: www.eai.in

Solar PV in India

- **Total Potential:** Theoretically, 5000 trillion kWh/ annum (25% of world's electricity consumption)
- **Exploited Potential:** < than 150 MW & only 38-45.5 MW connected to grid
- **Projected capacity:** By 2013 – 2 GW and by 2020 – 20 GW
- **Challenges:** High capital costs, land scarcity in densely populated regions, difficulty in establishing the technology, difficulty in raising finance from banks
- **Cost of power generation:** Currently, 20-25 cents per kWh

Solar CSP in India

- **Exploited Potential:** Negligible with no projected capacity
- **Challenges:** High capital costs, need for scale (min 50 MW), technology still evolving and no certain funding or initiatives from Govt. of India.
- **Cost of power generation:** Currently, 18-22 cents per kWh

Source: www.eai.in

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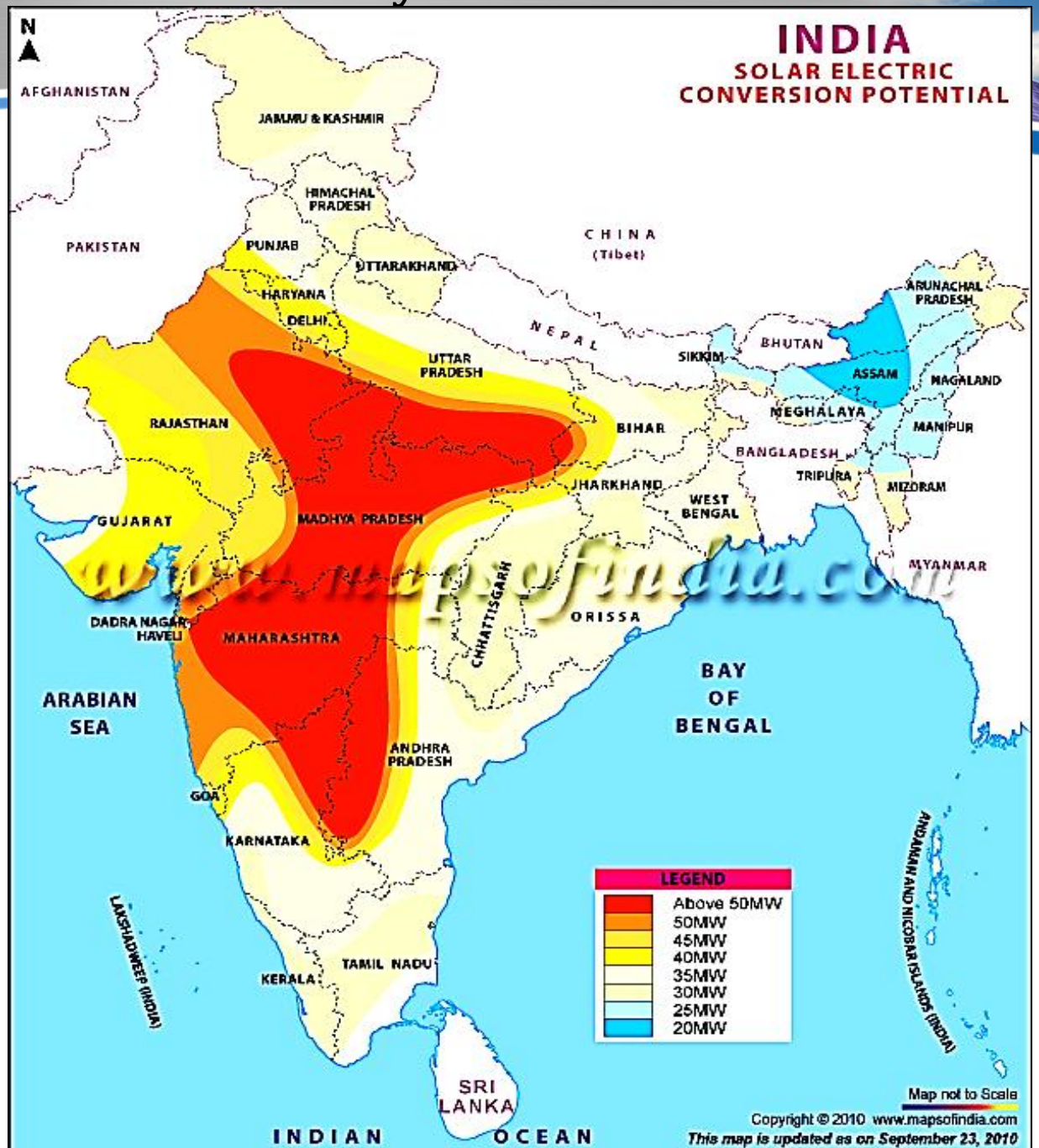

Wind Energy in India

- Fifth largest wind power capacity in the world.
- Accounts for 8% of India's total installed power capacity.
- India is yet to exploit any offshore wind resources.
- **Total Potential:** Onshore wind power in India could alone be over 100,000 MW
- **Exploited Potential:** 14,157 MW as of June 2011
- **Projected capacity:** Over 50,000 MW by 2020, implying an addition if about 3500 MW on average every year till 2020.
- **Challenges:** Incentive incentives – Feed in Tariffs need to be wind zone based; not state based

  Transmission challenges – connectivity to grid & evacuation infrastructure is poor

  Efficiency challenges – small wind efficiency low; MW wind efficiency varies w.r.t location
- **Cost of power generation:** Currently, 6-7 cents per kWh

Source: www.eai.in

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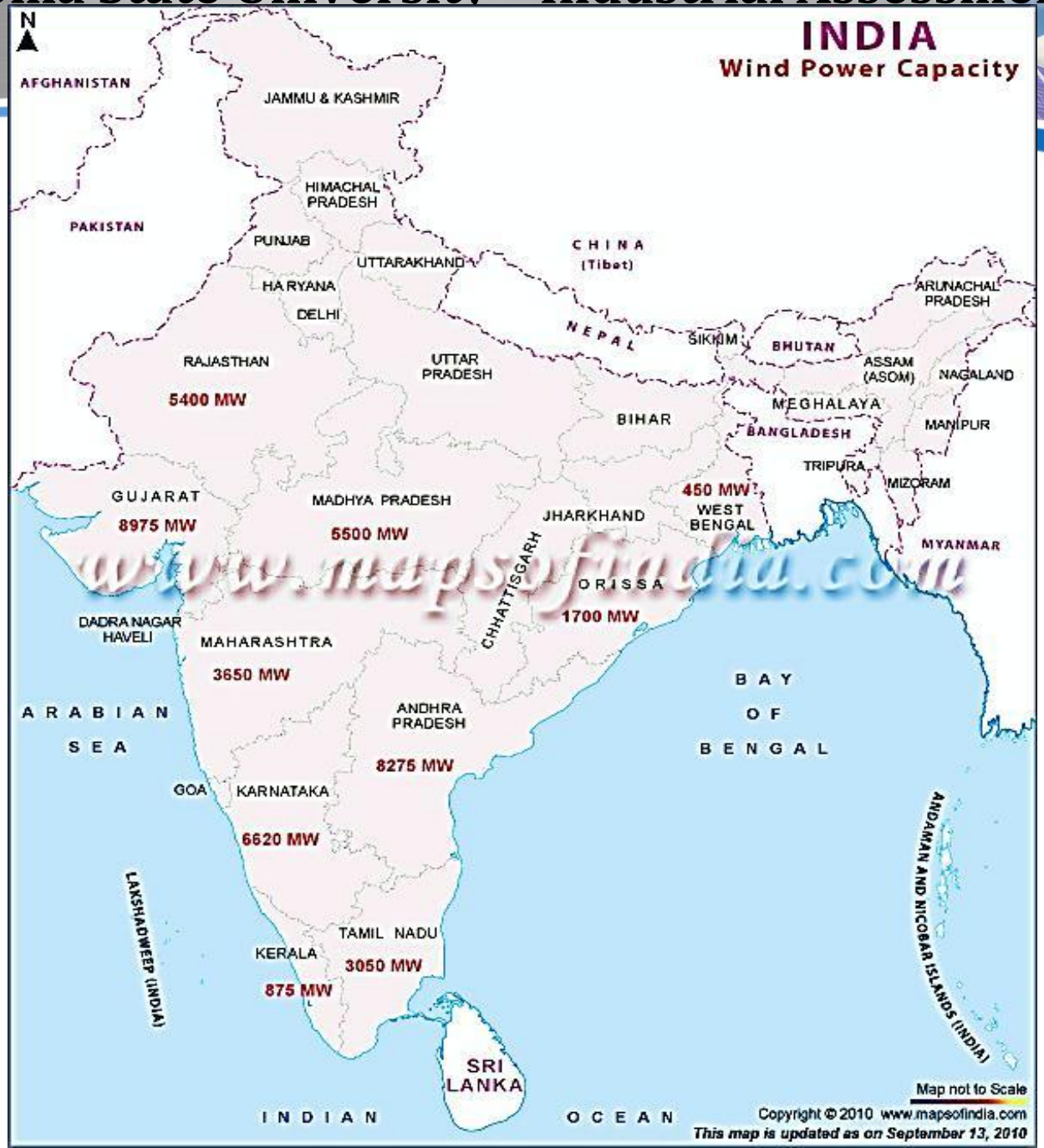


Biomass Energy in India

Parameter	Biodiesel	Ethanol
Production	Diesel equivalent biofuel from renewable biological materials like vegetable oils, animal fats, etc.	Alcohol made by fermenting sugar components of plant materials
Total Potential	17 million hectare	145 million tons of crop residues
Exploited Potential	90,000 tons	360 million liters
Projected Capacity	Dependent on collection/extraction mechanizations	2400 million liters
Cost of power generation	82 cents per liter	41 to 50 cents per liter

- **Challenges:**
  - Supply of feedstock security and price fluctuations for feedstock
  - Delay in implementation of Govt. biodiesel policy, lack of optimal policy framework that renders price of biodiesel unsustainable
  - Lack of seed collection/oil extraction infrastructure, no minimum support price for seeds
  - Low sugarcane yield per acre
  - Lack of utilization of advanced technology in ethanol manufacturing

Source: www.eai.in

Biomass based Power in India

- **Ways to produce power using biomass in India:**
  - Combustion
  - Gasification
  - Anaerobic digestion
- **Total Potential:** 23.7 GW
- **Exploited Potential:** 2,673 MW
- **Cost of power generation:** 6-8 per kWh

Parameter	Now (2011)	Future (2020)
Distributed electricity generation	Biomass power has minor 5.3% of total grid connected renewables; 86% off grid power	Estimated potential of 18,000-50,000 MW
Use in co-firing in power plants	Fewer than 1% of power plants use biomass	Larger proportion of plants expected to use biomass power
Use of feedstock	Primarily waste biomass and assorted	Dedicated energy crops
Related revenue streams	Some additional revenue streams already present	More established end user market for co-products
Standalone renewable power source?	Primarily standalone mode	Will be used in conjunction with other renewable energy sources

Hydro Energy in India

- Hydro energy is the second largest renewable energy contributor (after wind)

Parameter	Small Hydro Power	Large Hydro Power
Total Potential	15,000 MW	148,700 MW
Exploited Potential	3043 MW	38,106 MW
Projected Capacity	13% growth rate for 2010-2015	15,627 MW by 2012-2013
Cost of power generation	4.6 – 6 cents/kWh	4.6 to 6.6 cents /kWh

- **Challenges:**
  - Delays and long timelines for approvals
  - Transmission difficulties, geological & social uncertainties
  - High capex and large project gestation periods
  - Inter-state and inter-regional disputes, regulatory challenges
  - Uneven distribution of hydro resources and possible demand – supply mismatch

Source: www.eai.in

Geothermal and Tidal Energy in India

Parameter	Geothermal Energy	Tidal Energy
Production	Hot water, electricity, geothermal heat pumps	Electricity
Total Potential	10,000 MW	9,000 MW
Exploited Potential	None	None
Projected Capacity	None	No clear projections, but planned 3.75 MW coming up
Investments	So far, investments for 30 MW made	Negligible; but Govt. approved a 50 MW project
Challenges	• Long gestation periods in site prospecting, obtaining licenses & testing, • Technology still unproven in India • Lack of clear policy and inventive package from Govt. • Manpower and expertise for R&D and operations unavailable in India	• Long development timescales • High capital cost • Lack of infrastructure for grid connection, • Intermittent supply • Regional limitations
Cost of power generation	Global price of 6-7 cents/kWh	Global price of 13-15 cents/kWh

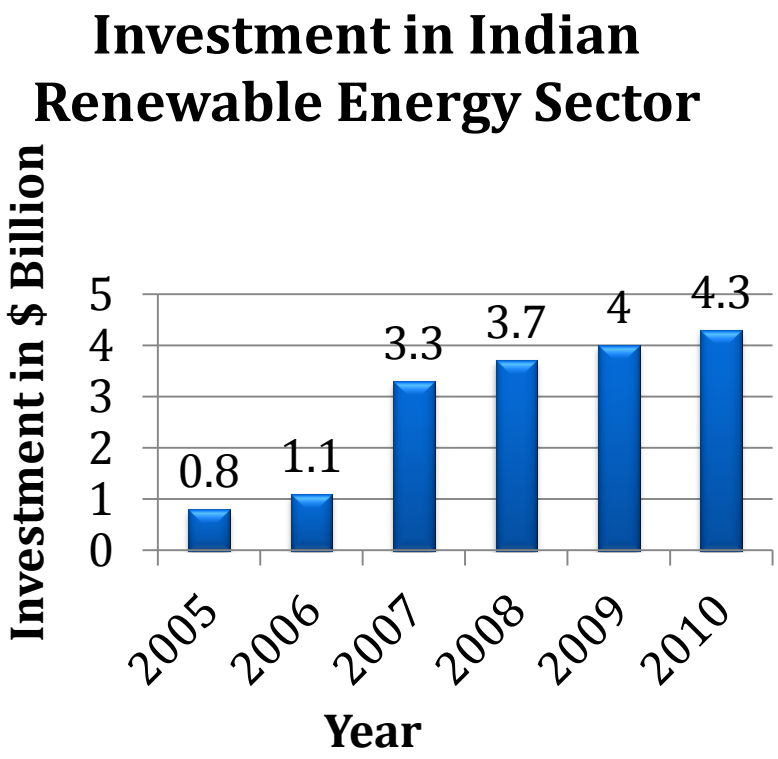
Waste to Energy in India

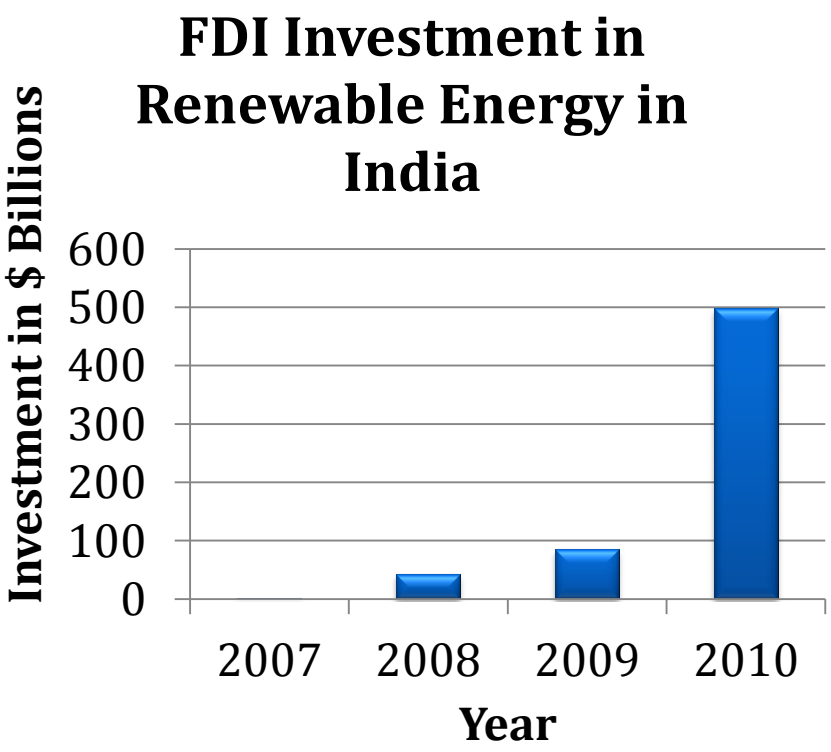
- Any organic waste from urban & rural areas, and industries is an energy resource through the use of waste – to – energy technologies.
- **Total Potential:** Estimated – 1500 MW from municipal waste; 225 MW from sewage waste;

  1050 MW from industrial wastes.
- **Exploited Potential:** 35 waste-to-energy projects with 70 MW installed capacity
- **Projected capacity:** No reliable estimates
- **Challenges:**
  - Lack of segregation for municipal solid waste,
  - Waste to energy is a poorly understood topic,
  - Lack of financial and institutional capability and lack of viable business models in the sector
  - High capital costs
  - Not yet proven technologies.
- **Cost of power generation:** If Govt. favors, the cost will be 7 to 12 per kWh

Source: www.eai.in

Investment in Indian Renewable Energy Sector





Source: www.eai.in

Measures undertaken by government to promote RE development:

The ministry is aiming for 10% share for RE or 10,000 MW in the power generation capacity to be added during the period up to 2012.

Regulatory Support for RE Development

- Electricity Act, 2003: Promoted generation of electricity from renewable sources.
- National Electricity Policy, 2005: The Policy emphasized on the full development of feasible hydro projects and laid down procedures for the speedy implementation of the same.
- Integrated Energy Policy, 2006: Emphasized use of renewables for reducing dependence on energy imports.
- Rural Electrification Policy, 2006: The Policy recognized that non-conventional energy sources can be utilized to make available reliable supply of electricity to each and every household.

Encouragement of Foreign Direct Investment

- 100% equity investment allowed with permission from FIPB, proposal to make it under the automatic route
- Foreign investors can enter into a financial/technical JV with an Indian partner
- Foreign investors can set up RE-based power generation projects on Build, Own and Operate (BOO) basis

Source: http://www.assocham.org/3rdasia/presentations/p24-04-08/Planery_Session/kuljit.pdf

Some of the companies present in the Renewable Sector

- Vestas Energy
- Tata-BP Solar
- IBC Solar
- BioGas Nord
- First Solar
- General Electric
- Suzlon

Source: www.eai.in

Incentives provided by The Indian Government

- **Solar Energy**
  - High feed-in tariffs for grid connected solar projects
  - Capital subsidies for off grid solar projects (Upto 30% for non-priority regions and 90% for priority regions)
  - Accelerated depreciation and soft loans
- **Wind Energy**
  - 10 year tax holiday
  - Low customs duty on imported components
  - Accelerated depreciation or Generation based incentive scheme
  - Additional incentive scheme for grid connected Wind Power projects under 49 MW

Source: www.eai.in

Incentives provided by The Indian Government

- **Biomass Power**
  - Capital subsidies (upto 30%)
  - Accelerated depreciation (upto 80%)
  - Exemption from sales tax, customs duty concessions on the import of material, components and equipment used
  - Preferential feed-in-tariff (varies from state to state)
- **Bio-fuels**
  - State incentives for bio-diesels
  - Support price of oil seeds
  - Incentives for raising commercial plantations
  - Credits and finance resources

Source: www.eai.in

Incentives provided by The Indian Government

- **Hydro-electric Projects**
  - Low interest loans to projects upto 25 MW
  - Enhanced capital allowances
  - Financial support for renovation, modernization and capacity up-rating of old stations

Source: www.eai.in

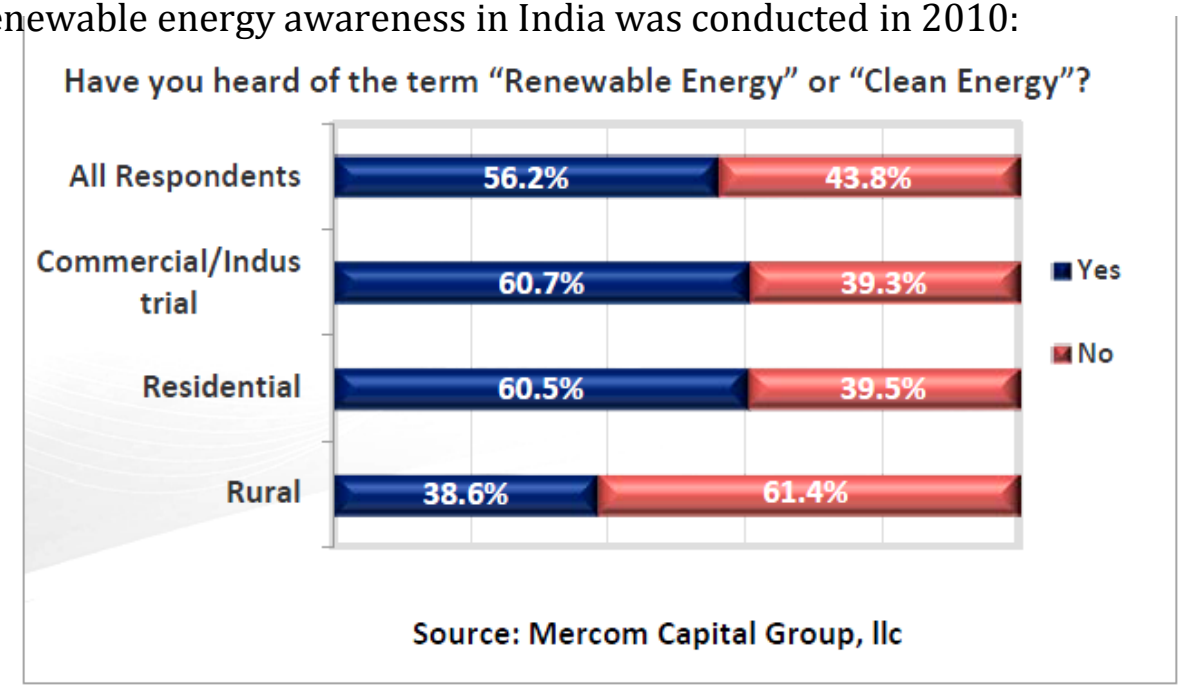
Future goals for Renewable Energy in India

Sources	Projected Installed Capacity (2032)	Cumulative Installed Capacity (2010)
Wind Power	45000	9521.8
Hydro Power	15000	2220.99
Biomass	16000	656.6
Solar Power	50000	2.12
Waste-to-energy	7000	55.75

Source: www.eai.in

Public Awareness

- A survey on renewable energy awareness in India was conducted in 2010:



- Lack of education as to the benefits of renewable energy is prevalent, especially among rural population.
- Ministry of New and Renewable Energy started '**Information and Public Awareness Division**' that aims to create publicity of the renewable energy technologies & systems; to disseminate information on technological developments and promotional activities, and to provide financial assistance/support.

Source: http://www.mnre.gov.in

Questions?

THANK YOU!