

# Clean Energy & Energy Efficiency in India



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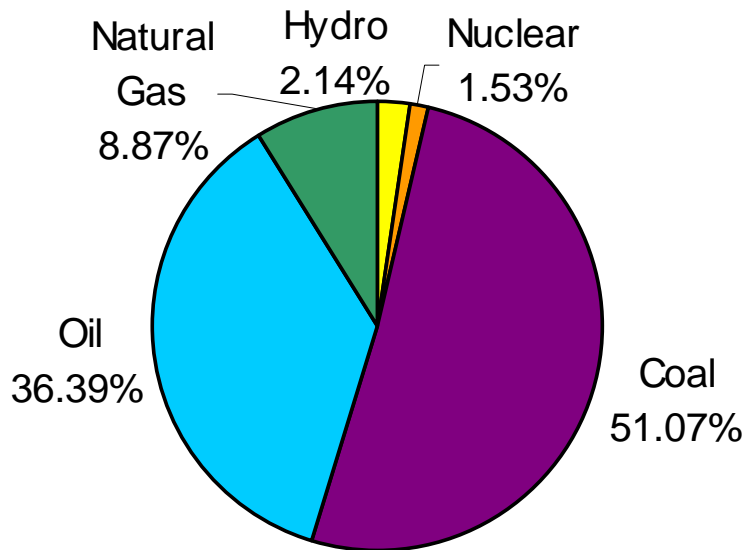
# Structure of Presentation

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- India's energy security concerns
- Renewable Energy
  - Policies
  - Barriers
- Energy Efficiency
  - Policies
  - Barriers
- Way forward

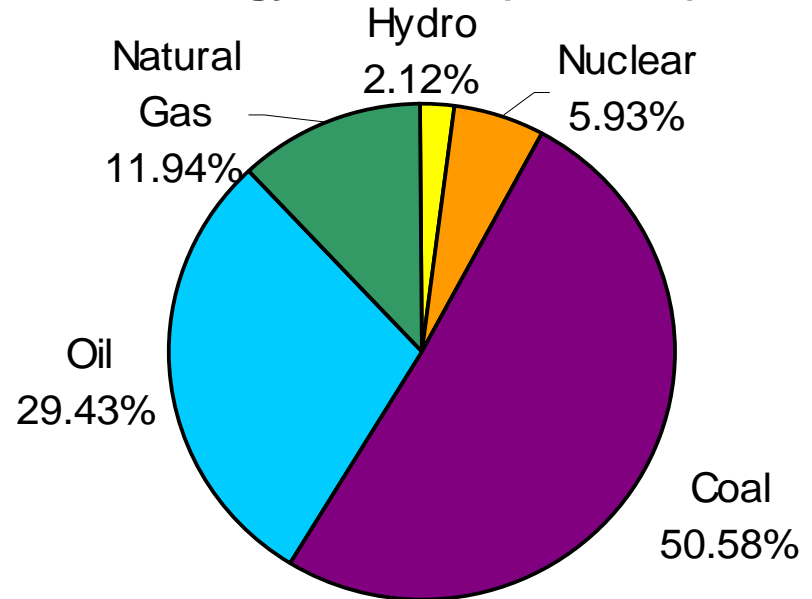
# Indian Energy Sector

**Total Primary Commercial Energy Demand (2003-04)**



**327 Mtoe**

**Total Primary Commercial Energy Demand (2031-32)**



**1858 Mtoe**

**Dominance of coal expected to continue under the BAU case**

# India's Energy Security Challenges

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- ❑ Dominance of coal in the energy mix
- ❑ High dependence on imported crude oil
  - Import of coal also increasing
- ❑ Persistent electricity shortages
- ❑ High network losses in electricity distribution
- ❑ Limited access to modern fuels of energy
- ❑ High level of inefficiencies in the existing energy use

# Renewable energy potential in India

Resource	<i>Potential (MW)</i>	<i>Installed capacity as on 31<sup>st</sup> March 2007 (MW)</i>
Wind	45000	7092
Small hydro	15000	1975
Biomass power / cogeneration	19500	1184
Solar	4-6 kWh/m <sup>2</sup> /day (20MW/sq.km)	2.74
Waste-to-Energy	2700	43

Source: MNRE

# RE Policies

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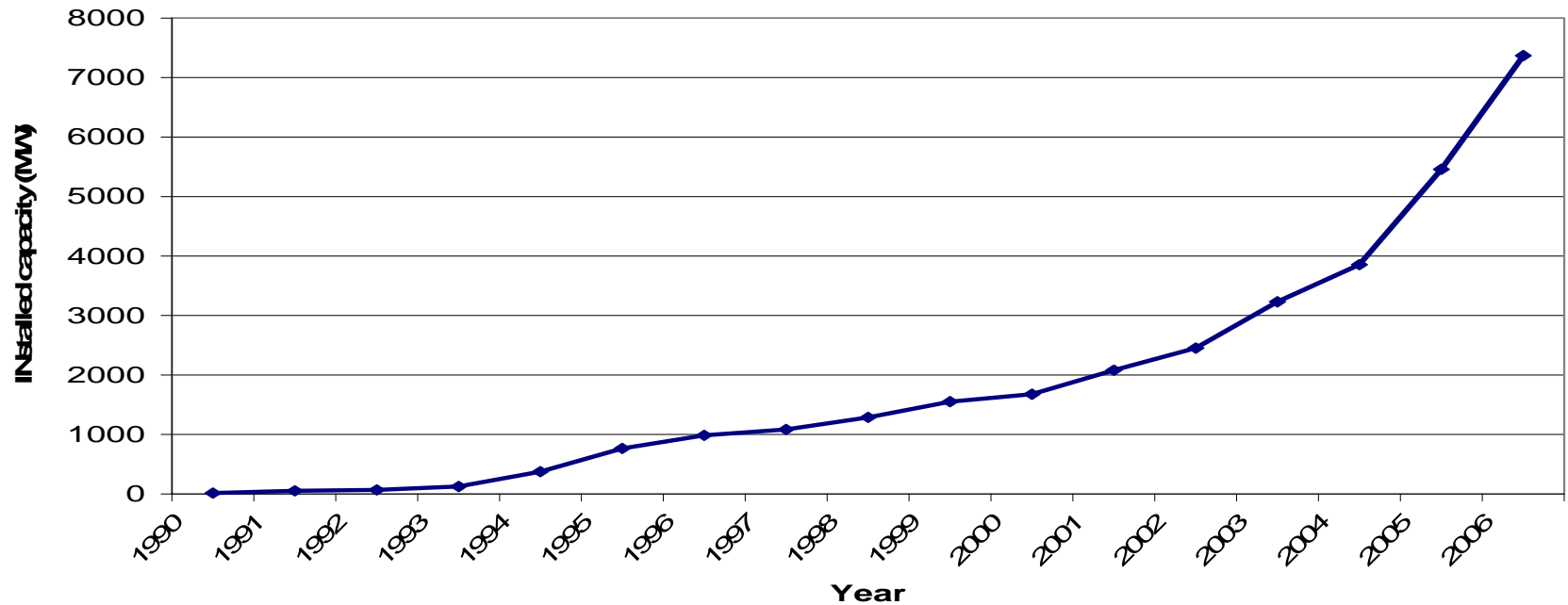
- ❑ Commission for Additional Sources of Energy was set up under Department of Science & Technology, Ministry of Human Development (1981)
  - Objective - Develop, and demonstrate RETs
- ❑ Department for Non-conventional Energy Sources created in Ministry of Power (1982)
  - Later upgraded to the Ministry of Non-Conventional Energy Sources (1992)
- ❑ Phased development of policies in the sector
  - At the start focus was on research and demonstration of RETs especially through financial support (subsidy)
  - IREDA established in 1987 to finance renewable energy projects

# RE Policies

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- Electricity Act 2003
  - Recognizes the role of RETs for supplying power to the utility grid and in stand-alone systems
  - mandates the state regulatory commissions to specify a percentage, of total power consumed, to be purchased from renewable energy sources
- National Tariff Policy also supports introduction of minimum renewable energy quotas and procurement of clean power
- The quotas have been fixed by most of the SERCs in the country
  - Range from 1%-2% to 20% of the total energy supplied
  - Certain states have mentioned technology wise quotas

# Increasing share of RETs



Fiscal incentives



Guidelines for purchase of power from RETs



EA 03 (Quota for renewable power)



# Renewable Energy Resources in Transport Sector

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- ❑ Transport sector– dominated by use of petroleum products
- ❑ Policies/strategies for diversification of fuel basket
  - Use of natural gas for public transportation
    - ❑ Delhi experience
  - Mandatory doping of petrol with ethanol
  - Proposed blending of diesel with bio-diesel

# Barriers

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- ❑ Lack of long term vision of developing RETs in the country
- ❑ Lack of clarity about role and coordination among different institutions
- ❑ High level of subsidies on conventional sources of energy

# Technology Wise Barriers (1)

Technology	Barrier	Expected Action
Solar Photo Voltaic	High Capital Cost	Market development & Economics of scale in manufacturing; Appropriate Technology Transfer
	Low efficiency	Move towards 3 <sup>rd</sup> Generation PV; concentrated system
	Low capacity Utilization	Efficient storage cells & advanced electronics for system interfacing
	Regulatory	Appropriate feed-in tariff or setting renewable energy portfolio standards

# Technology Wise Barriers (2)

Technology	Barrier	Action
Solar Thermal	High Capital Cost	(a) Local manufacturing (can bring down cost by 40 to 50%) (b) Appropriate technology transfer
	Technology reliability & performance	(a) Demonstration project (b) Joint R&D
	Low Capacity Utilization factor	Adoption of Thermal storage system can operate as a base load plant
	Regulatory	Appropriate feed in tariff / or setting of RPO

# Technology Wise Barriers (3)

Technology	Barrier	Action
Biomass Gasification	Demonstration of system $\geq 1$ MW	(a) Joint R & D (b) Availability of engine for producer gas (c) Hot gas Clean-up system
Bio-diesel	Land availability	Improve oil yields & seed yields
Bio-ethanol – Ist Generation	May not be carbon neutral	
Second Generation	Low yields	R&D and appropriate technology transfer

# Energy Efficiency Policies

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- Energy Conservation Act, 2001
  - Setting of minimum energy standards for, and affixing energy-consumption labels on appliances and equipment
  - Promulgation of Energy Conservation Building Codes
  - Energy use monitoring, verification and reporting by large energy users, and the establishment of energy consumption norms for these consumers
  
- BEE also promotes:
  - Demand-side management by distribution companies
  - Enhancing energy conservation in existing buildings, especially through Energy Service Companies (ESCOs)
  - Outreach and awareness programmes

# Demand Side Interventions- Potential and Opportunities

<b>Sectoral Intervention</b>	<b>Potential Energy Savings</b>	<b>Likely Investments</b>
Agriculture+	60 b KWh	USD 7 billion
Municipalities*	3.7 b KWh	USD 0.4 billion
Buildings*	3.52 b KWh	USD 0.3 billion
Industry*	98 b KWh	USD 6 billion
Lighting+	70 b KWh	USD 10 billion

+ Source: BEE, Ministry of Power, Government of India

\* ADB (2004)

# Measures Initiated

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- ❑ CFL programmes in States
- ❑ Standards and Labeling program
- ❑ Energy Efficiency programmes in existing buildings
- ❑ Energy Conservation Building Codes (ECBC)
- ❑ Capacity building of SDAs
- ❑ Demand Side Management in Agriculture
- ❑ Designated Consumers and implementation of EC Act

# Energy Conservation Building Code (ECBC)

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- ❑ Covers new commercial buildings
  
- ❑ Building components included
  - Building Envelope (Walls, Roofs, Windows)
  - Lighting (Indoor and Outdoor)
  - Heating Ventilation and Air Conditioning (HVAC) System
  - Solar Water Heating and Pumping
  - Electrical Systems (Power Factor, Transformers)
  - Potential to save 1.7 billion units annually on mandatory application
  - Expected reduction in XI plan 500 MW

# Barriers

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- Technological
  - Availability of reliable power supply – limits usage of technology
  - Segregation of coverage area
  - Supply chain of energy efficient equipments – includes availability, maintenance, etc.
- Financial
  - First cost is higher than those of energy-inefficient options
  - Costs and benefits accrue to different people
  - Uncertainty of operating costs, performance and reliability, especially of new technologies
  - Low incentives of Utilities to intervene
- General
  - Lack of Awareness
  - Lack of willingness to shift from current energy habits
  - Comparative energy use information is unavailable

# Way Forward

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- ❑ Re-allocation of subsidies favoring RE & EE initiatives
- ❑ Focus on Grid-interactive RE systems
- ❑ Need to build a long-term policy vision for developing RE
- ❑ Need to introduce more innovative financing mechanisms
  - Energy Conservation fund needs to be established at the earliest
- ❑ Concerted efforts need to be made in the agriculture sector for improving energy efficiency
- ❑ Move towards integrated land use planning
- ❑ Implementing the National Action Plan for Climate Change
  - National Solar Mission
  - National Mission for Enhanced Energy Efficiency
  - National Mission for Sustainable Habitat