Energy in India

General information on India

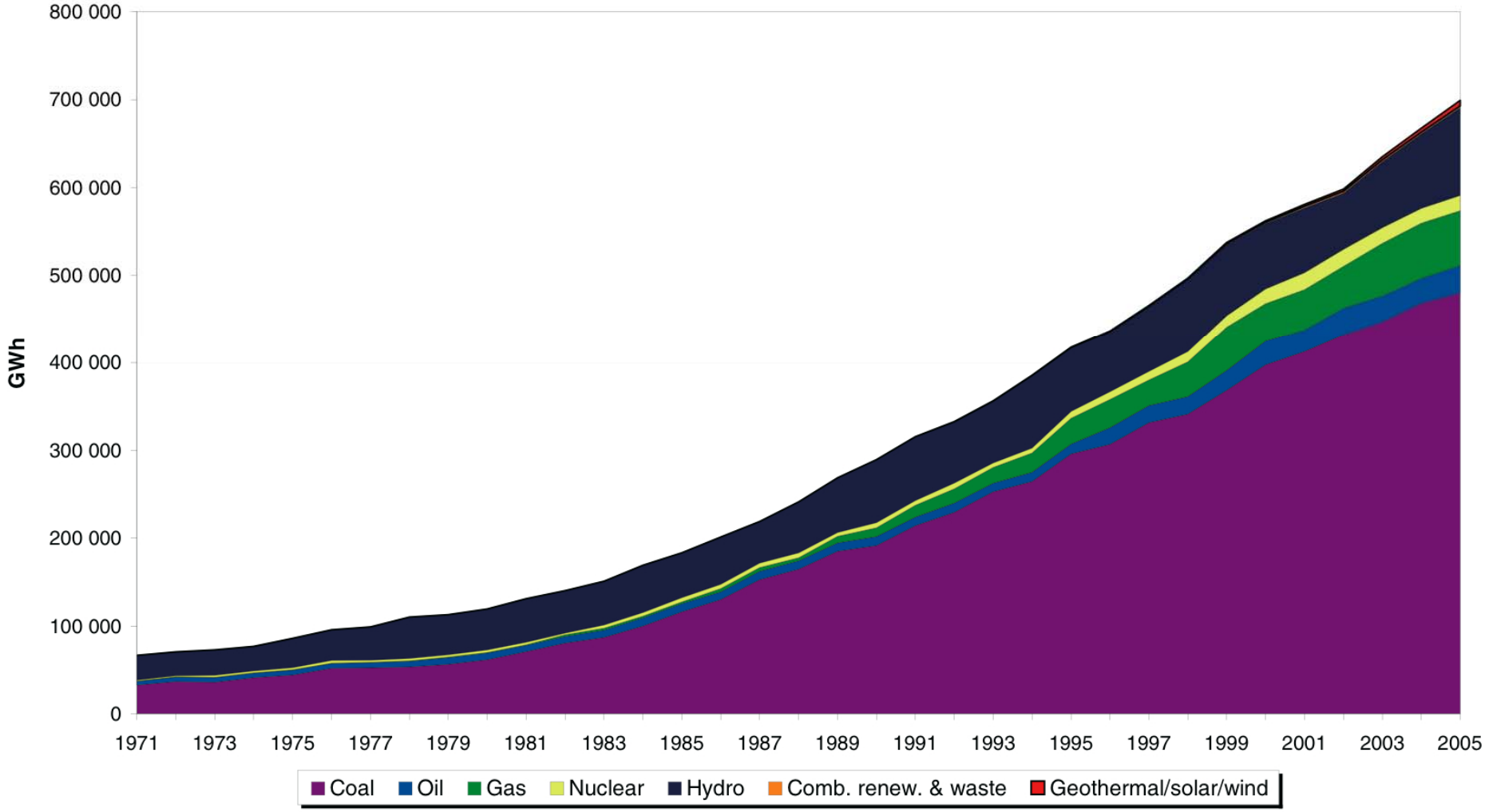
- India has the fourth-largest economy in the world, after the United States, China and Japan
- India is home to around 1.1 billion people, about 17% of the world's population and is the world's second most populous country, after China. It is expected to have the largest population in the world starting in 2030.
- More than 70% of the population live in rural areas – a higher proportion than in most other Asian countries.
- India is a federal republic made up of 28 states and seven union territories. Independent since 1947, it is the largest democracy in the world.

Energy sector

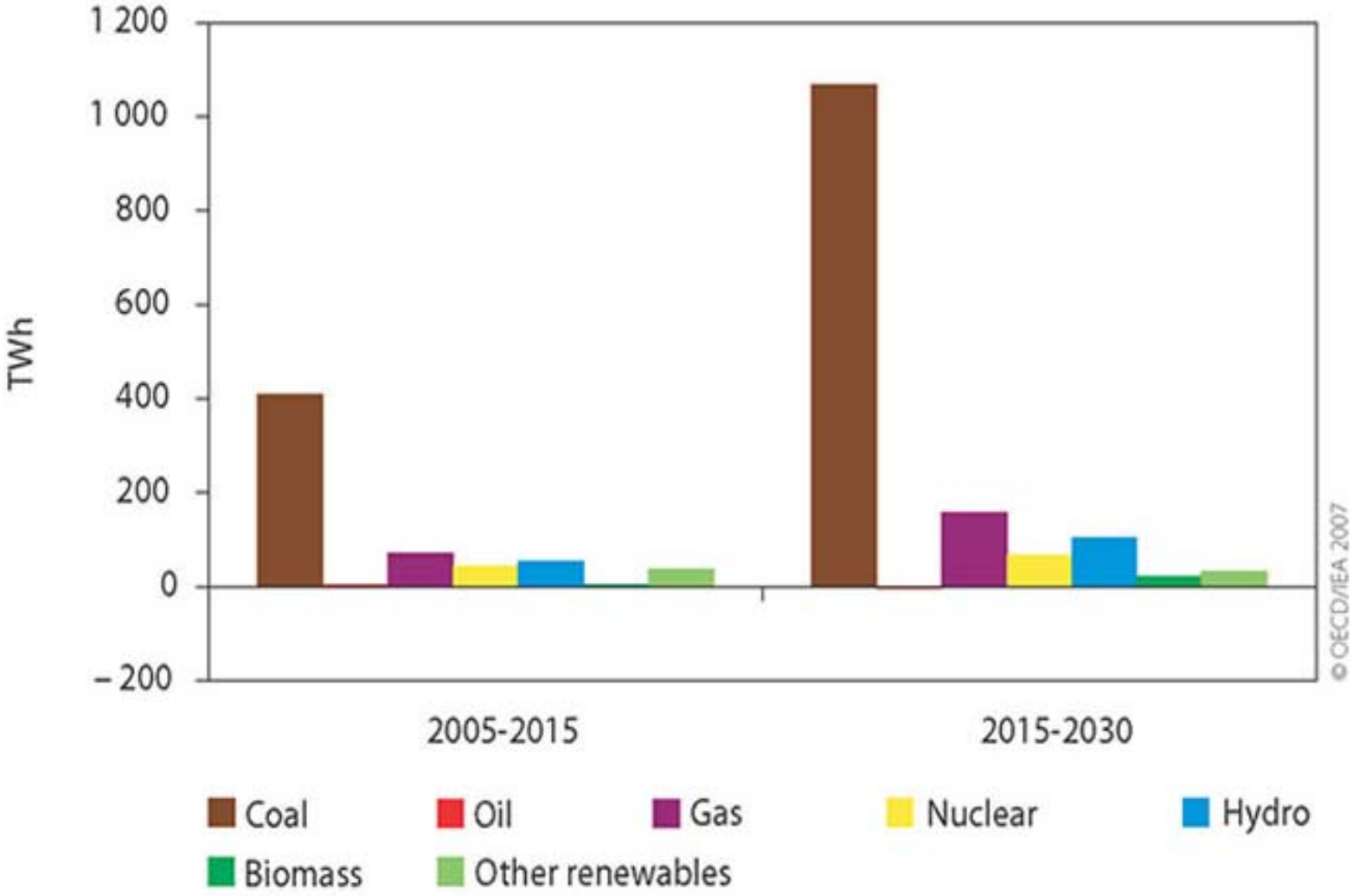
- Mainly coal for electricity; oil for transport.
- Energy demand growing at a rate of about 6% a year
- India has high energy intensity compared to other Asian developing countries (China, etc) but this rate is dropping

Evolution of Electricity Generation by Fuel from 1971 to 2005

India

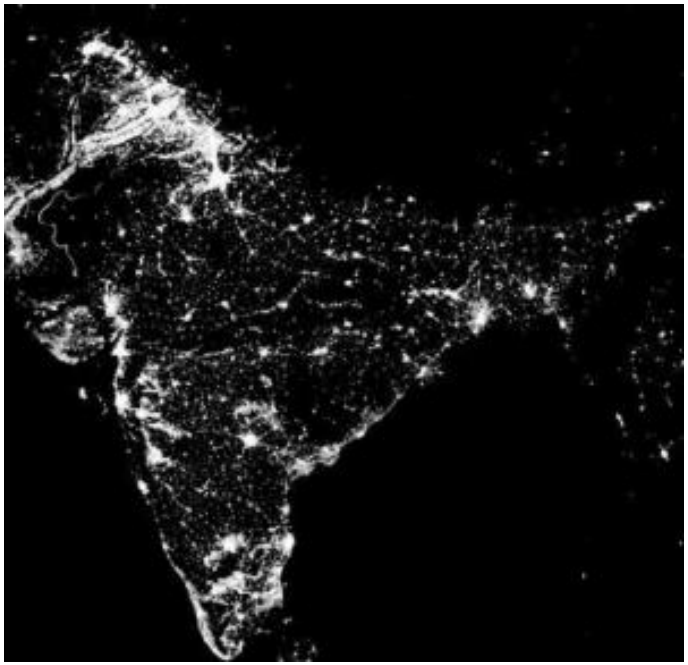


World Energy Outlook (WEO) projection for India's electricity generation



Challenges to the energy sector

- Energy for industry and growth
- Energy security
- Corruption in energy markets
- Emissions regulation/pollution issues
- Electricity access for the country/reliable access
  - While economic growth has reduced poverty levels in India, it is estimated that there are still some 412 million people without access to electricity.
  - The number of people in India relying on fuelwood, dung and agricultural residues for cooking is estimated to be about 668 million (World Energy Outlook)
  - More than 75% of rural and 22% of urban households depend on wood as the primary source of energy for cooking (Indian Ministry of Energy)



Renewable Energy in India

Renewable energy policy

- **1972** - R&D Activities Initiated By Department of Science & Technology in Government of India
- **1981** - Commission For Additional Sources of Energy (CASE) Set up as National Policy Making Body
- **1982** - Separate Department of Non-conventional Energy Sources Set up to Provide Thrust for the industry
- **1987** - Indian Renewable Energy Development Agency, a non banking financing institution was set up nationally with offices in each state to support to renewable energy promotion
- **1992** - Full Fledged Ministry of Non- conventional Energy Sources (MNES)
- **2006** - Ministry Renamed as Ministry of New And Renewable Energy (MNRE);
- **August 2009** New Delhi approved a national solar energy policy that aims to generate 20,000 MW of solar power by 2020. The US$20 billion plan is still in draft stage, but is supposed to begin in November. If realized, it will generate 10 percent of the country's total power.

Estimated Renewable Energy Potential and Cumulative Achievements in India, 2007

Connected to grid	Est. potential (MW)	Online (2007)
bioenergy	66,881	1,255
wind power	45,195	7,660
small hydro (25MW)	15,000	2,014
waste-to-energy (urban & industrial)	2,700	56
large-scale solar	-	2
Decentralised		
household biogas (cooking, lighting)	1.2 million units	394,000 units
home photovoltaic	-	2,2MW (peak)

Source: Ministry of New and Renewable Energy, India

- Of the total 14,795 MW of energy from renewable energy, wind contributes almost 70%.
- Next biggest contributor is the small hydropower with 16% share. There is only 2.12 MW of solar energy connected to the grid.
- The 2.12 MW does not take into account the solar energy which is not connected to the grid and from the huge market of decentralized energy systems. A total of 120 MW is estimated to be generated through this system. This is not an exact estimate but derived from the following things :
  - 70474 solar street lighting systems
  - 450,000 home lighting systems
  - 730,000 solar lanterns
  - 8 MW Solar power plants
  - solar cookers
  - Solar water heating system covering 2.9 million square meters.
- Most of the solar power is decentralized

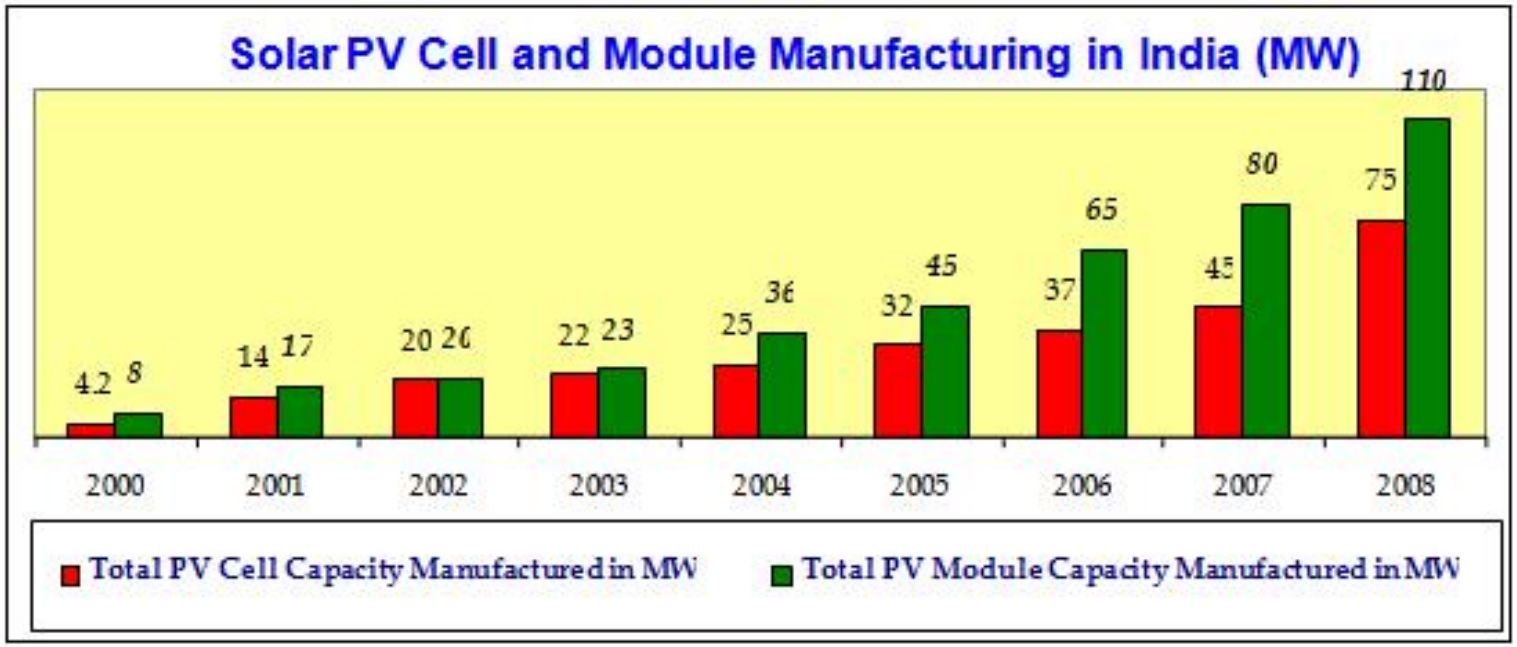



India’s Goals for the Promotion of Renewable Energy

- Budgetary support for research, development and demonstration of technologies
- Financial Incentives, including for renewable energy applications in rural areas
- Promoting private investment through fiscal incentives, tax holidays, depreciation allowance and remunerative returns for power fed into the grid.
- Finance for renewable energy: IREDA

Renewable Energy Industry

- Industry growing quickly—especially solar manufacturing industry (average growth rate is 35% in the last 2 years)
- Quick search 82 wind manufacturing companies; 378 solar manufacturing
- Some large corporations: Suzlon Energy Ltd, Tata Solar, some joint ventures, mainly need financing



Rural Energy in India

(From a presentation by the Director of MNRE on the most important rural energy needs in the country)

Non-commercial fuel such as agro waste, fuel wood, dung cake etc. constitute around 30% of the total primary energy supply. This is mainly used for cooking purposes by over 84% of the rural population

Lighting

- Around 45% rural households in the country still use kerosene as primary source of lighting despite of having grid in the most of these areas. For lighting, RE is the best possible option for remote villages

Cooking

- LPG connection for providing energy in the rural areas is very limited. In view of the significant cattle population in the country biogas has a potential to meet cooking energy needs of around 25% of the rural population
- Significant scope for solar cooking

Options to increase sustainable energy use in rural India

- Electricity and heating/cooling:
  - Solar home systems (electricity)
  - Solar water heating
  - Bio-diesel (converting existing plants from fossil fuel to diesel)
  - Small biomass-based systems for rural use
  - Small wind (up to 25 kw)
  - Co-generation for lighting, heating, and cooling
  - Solar water pumping
- Lighting:
  - Solar lanterns (LED)
- Cooking:
  - Biogas
  - Solar Cookers

Issues presented by using RE in rural applications

- Low per capita income
- Non-availability of upfront capital
- Lack of micro-finance mechanisms
- Remote locations—infrastructure for initial installations not always available
- Availability of skilled persons for operation and maintenance
- Project transparency