

# The World's Energy Resources and Needs\*

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## Power Sector in India

Certain facts about the energy situation in the world are well known. The world's population crossed the 6 billion mark in the year 1999. It is estimated that the population will touch 9 billion by the middle of the century and all this increase will take place largely in the developing countries. Since employment in urban areas is available with comparative ease, the increase in population is accompanied by migration from rural to urban areas. At the same time the inequality in the living standards is widening and continues to be worrisome. The inequality can be seen in the per capita income, in the level of education, in primary energy consumption, in electricity consumption and in all similar parameters. While the world average per capita electricity consumption is about 2500 kWh per annum, for OECD countries the corresponding number is about 8000. This large inequality is undesirable and needs to be addressed in a manner that is sustainable from the point of view of continued availability of energy resources and burden on the environment.

I would like to touch upon the scene in India in some detail. First, I'll give some key facts and statistics about the power sector in India.

- The total generation capacity of India stands at about 111 GW. Of this, the major share – 78 GW – or 70 per cent is thermal. The share of hydro is

about 26 per cent. The remaining is nuclear (2.5 per cent) and wind power (1.5 per cent). Ten years ago, the installed capacity was 77 GW, but the per cent distribution by fuel type was almost the same as at present.

- The average PLF (plant load factor) is 72.7 per cent. It was as low as 60 per cent ten years ago.

- Captive power capacity in India is also quite large – about 30 GW and operates at a capacity factor of about 40 per cent.

- The all-India average energy shortage is 8.8 per cent, while the all-India average peaking shortage is 12.2 per cent.

- Households with access to electricity – a key focus area for the government – are also a low 55 per cent.

- Use of non-commercial energy sources (firewood, charcoal, agricultural and animal residues and derived fuels etc.) continues to be very high – 29 per cent and is worrisome because of associated inefficiencies and health hazards, apart from loss of tree cover.

- Of the 586,000 villages in the country, about 120,000 are yet to be electrified. Biofuels are used by 90% of the rural households for cooking. As a result, women in the rural households, who are engaged in cooking, are exposed to Respirable Suspended Particulate Matter for long hours and suffer from respiratory and eye diseases.

- After accounting for captive power and non-commercial energy, the ratio of electricity to total primary energy in India is about 40 per cent.

- The power policy in India has three main missions: power availability for all by 2012, electrification of all vil-

lages by 2009, and access to electricity for all households by 2012. This entails a capacity addition of 100 GW by the end of the Eleventh Five Year Plan that is by the year 2012, integrating the regional grids into the national grid with 30 GW of interregional transfer capacity, and access to power for the remaining 45 per cent of households.

- This is targetted to take the installed capacity to 145 GW by the end of the Tenth Five Year Plan that is by the year 2007. But it is unlikely that the 41 GW capacity addition target for the Tenth Plan (2002-2007) will be achieved. The capacity addition target for the Eleventh Plan is an even more ambitious 65 GW.

- Under the 50 GW Hydro Initiative by 2017, 162 potential hydro sites have been identified. Feasibility reports for about 68 projects worth about 27 GW reveal that many of these projects can deliver power at a reasonable cost.

- Broadly, it is estimated that total investments worth around \$180 billion will be required till 2012. Half of this would be for generation, while the other half would be for transmission and distribution and rural electrification.

- Coal fired thermal plants are the main stay of the power sector in India, but inadequate coal supplies are creating a problem. These are due to several reasons including inadequate mining capacity and problem of coal transportation over long distances. Also many coal bearing areas are under protected forest.

- By the middle of the century, India's population could rise to 1.5 billion. Annual generation of 8000 TWh (corresponding to an installed capacity of 1250 to 1350 GW) would provide only a little above 5000 kWh per capita per annum. While 8000 TWh may sound as very large, in the context of India, it is on the low side.

The plans for the power sector by the Government of India are very am-

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bitious. And the power sector is looking up. The Electricity Act-2003 has a lot to do with it. It has introduced competition in every segment, - in generation, transmission and distribution. It has provided viable options to independent power producers. The act provides for open access. An independent power producer can sell electricity to any customer of choice. The Government has also made policy provision for captive coal mining for power producers to alleviate coal shortages. The Government is also open to coal imports. However, the landed price of coal is much higher than the domestic coal and would add to the cost of electricity.

However, all this is not enough. If a populous country like India expands installed electricity capacity based on coal fired plants to reach a level of per capita electricity consumption comparable to OECD countries, the effect on environment at the local as well as at the global level could be staggering. Keeping in view the environmental consequences, it is desirable that India goes in for nuclear energy in a big way and meets at least a quarter of its electricity requirements from nuclear power plants. This would correspond to an installed nuclear capacity of about 275 GW. Considering its large electricity requirements and modest uranium resources, India is pursuing a closed cycle approach and has launched the construction of a fast reactor only a few months back. This is accompanied by intensifying research on development of fuels having short doubling time to enable a rapid increase in installed nuclear capacity. Cooperation amongst all countries, on a bilateral basis or multilaterally facilitated by the IAEA is desirable to ensure that nuclear power development takes place in an economical manner with due regard for safety and sustainability.

## RO Desalination Plants set up by BARC in Tsunami affected area for providing drinking water



Capacity : 5000 Litres/ day  
Place : General Hospital  
Nagapattinum,  
Tamilnadu

Capacity: 5000 Litres/ day  
Place: Chandrapadi village  
(Near Chinnurpet),  
Nagapattinum, Tamilnadu



## Indian Astronomy Olympiad Programme

The Indian Astronomy Olympiad Programme (IAOP) encourages students with good foundations in physics and mathematics and an interest in astronomy, to pursue further studies in this field. To achieve this, the Homi Bhabha Centre for Science Education (HBCSE) of the Tata Institute of Fundamental Research, in collaboration with the National Council of Science Museums (NCSM) and the Indian Association of Physics Teachers (IAPT) organizes nationwide tests and about 50 selected students are then invited to the Training Camp.

The best of the students in the camp then represent India at the International Astronomy Olympiad (InAO) which is conducted by the Euro-Asian Astronomical Society of the Russian Academy of Sciences.

The nationwide efforts in India began when about 35 students were selected to participate in the First Indian Astronomy Olympiad Training Camp held in Mumbai in 1999. This year approximately 14,000 students from all over India appeared for examination/test. The tests were conducted in 800 centres by the IAPT. After two steps of examination and elimination rounds, 45 students were selected who were given intensive coaching under the auspices of TIFR-Homi Bhabha Centre for Science Education (HBCSE). TIFR-HBCSE is the nodal agency for conducting all Science Olympiads in India except the Olympiad in Information Technology.

On 20th May, the coaching camp came to an end. The selected 5 students will represent India in the Astronomy Olympiad scheduled to be held at Beijing, China, in November 2005.