

# **Renewable Energy Efforts - Special Focus on reduction of Global Warming**

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## **Abstract**

India is a vast country with over 1 billion population and over one crore vehicles. Most of these vehicles use fuel energy from petroleum products. At present around 74% of Indian fuel requirement is taken care by import. Steep rise in crude oil prices is affecting the country's economy severely and it is in turn increasing the cost of living and transport.

Last five years have seen the doubling of crude oil prices. This has grossly affected the economic condition of farmers, as they are unable to ferry their crop products to markets, which fetch them better prices. Local sales fetch them nominal and uncertain returns. The cost of cultivation and farming is in the increasing side with uncertain revenue from the crops.

A sustainable and environment friendly Hydrogen fuel for vehicles can be a wonderful solution for the current situation.

Most part of India receives heavy rains during monsoon season. Rivers, lakes are also available in large number in India. Abundant water availability will be an advantage for Hydrogen Energy. The technology commercialization and sustainability will bring stability to fuel prices. Once the financially viable and continuous supply of fuel is ensured, it would be possible to increase the produce per given area and farmers can live with assured returns.

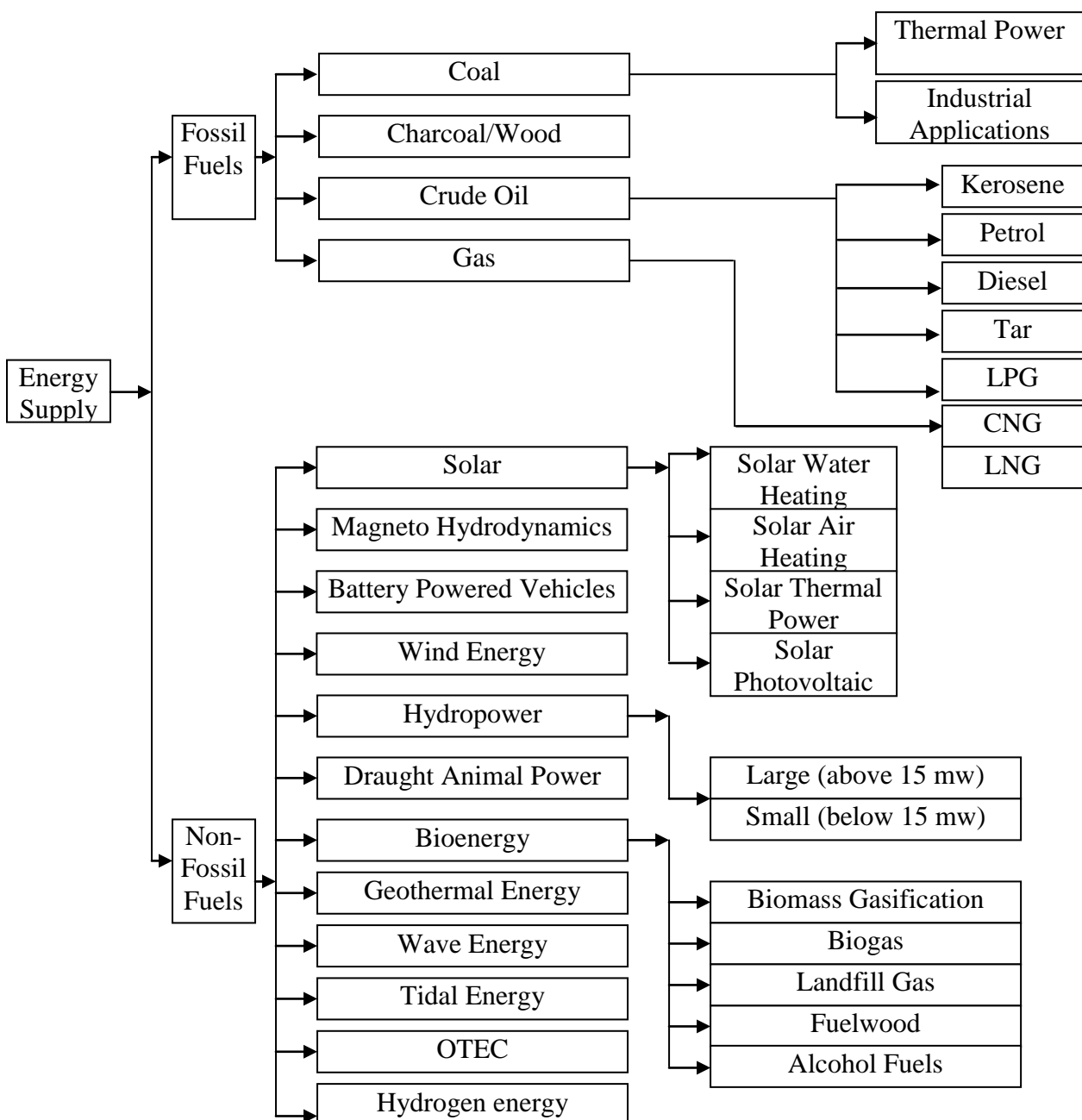
The paper will provide the statistics related to fuel status as of today, the corresponding trends and the future options.

## **Introduction**

Energy is the backbone of technology and economic development. Indian Energy requirements have increased in the years following the industrial developments. This rapid increase in use of energy has created mismatch in the demand and supply. The more serious concern is the depletion of fossil resources, which are likely to last for another century when the demand is likely to reach multifold than the existing requirement.

## Present Energy Availability Options

India is a vast country with different geographical conditions, which are conducive for variety of types of non-conventional energy generations. The power generation projects, which should take care of raising demands, are not being executed resulting in the widening gap between demand and supply. The energy conservation and energy savings and their significance is being discussed and implemented for this purpose so as to optimize the use of energy within every organization. In India the awareness is already created among the general public as well as industrialists as a result of which alternative to the fossil fuels are already being worked in the areas of solar, wind, biogas, biomass, biodiesel, tidal, nuclear and hydrogen energy. Different levels of research are in progress in all the areas with some matured technology in the areas of solar heating, cooking, rural electrification etc. However the attempts at present are inadequate to meet the raising demands of energy requirements.



### Conventional energy supply scenario:

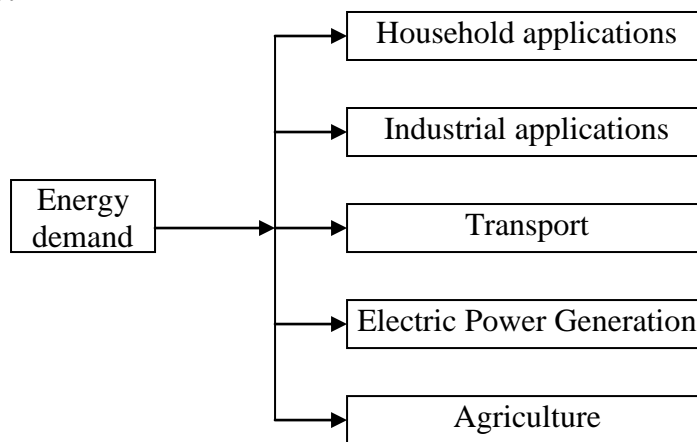
Although there is increasing interest in alternate energy sources such as solar, wind, biomass etc. a major of the energy comes from fossil fuel, oil and natural gas.

Following tables shows the demand and supply forecast for all the conventional energy sources mentioned above.

### Existing Electrical Energy generation status in India:

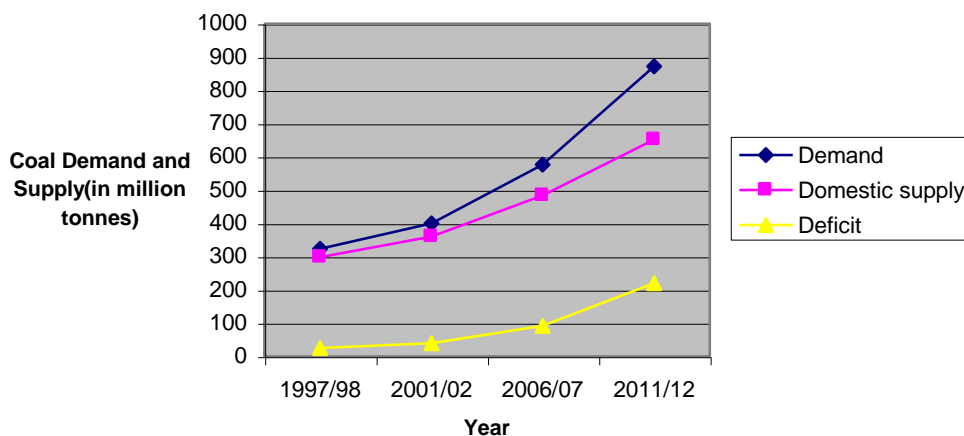
Thermal	70%
Hydro Power	24%
Nuclear	2.50%
Renewable Sources	3.50%

### Demand:



**Table 1 : Coal demand and supply forecasts for India (million tonnes)**

	1997/98	2001/02	2006/07	2011/12
Demand	323	400	576	872
Domestic supply	298	360	484	652
Deficit	25	40	92	220

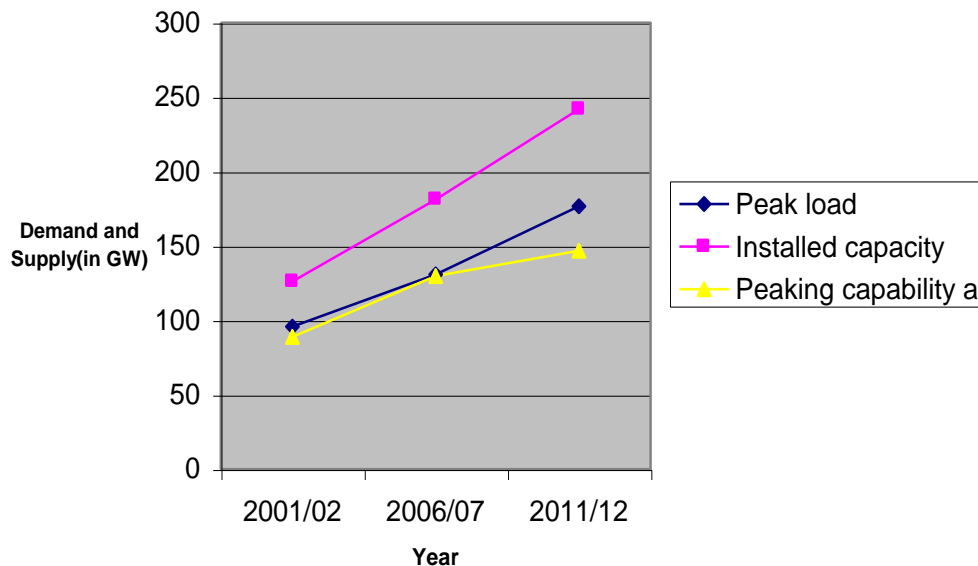


## Load Shedding Technique used to overcome Electric supply deficit in India

Present Electric Energy Supply since last two decades has affected all the states of the country. Urban and rural areas are subjected Load shedding to overcome this deficit. The Load shedding normally continues for 4 to 6 Hrs/ Day depending on the situation. This resulted in the use of available alternative at such areas to avoid the inconvenience. The Metro cities which are the industrial hubs and major consumers of electricity were earlier spared from these power cuts. However since last year the situation has further worsened with no new power generating units getting added to the supply side, even the metro cities have starting facing load shedding of 1-2 hrs/day. This is bound to affect the production at industries. This may also result in the negative growth in the economy. Hence to improve this situation many steps are being undertaken by the Energy Ministry of the government of India as well as the Ministry of Non-Conventional Energy Sources.

**Table 2 : Demand and supply forecasts for power in India (GW)**

	2001/02	2006/07	2011/12
Peak load	95.76	130.94	176.65
Installed capacity	126.04	181.10	242.00
Peaking capability a	88.92	129.82	146.67

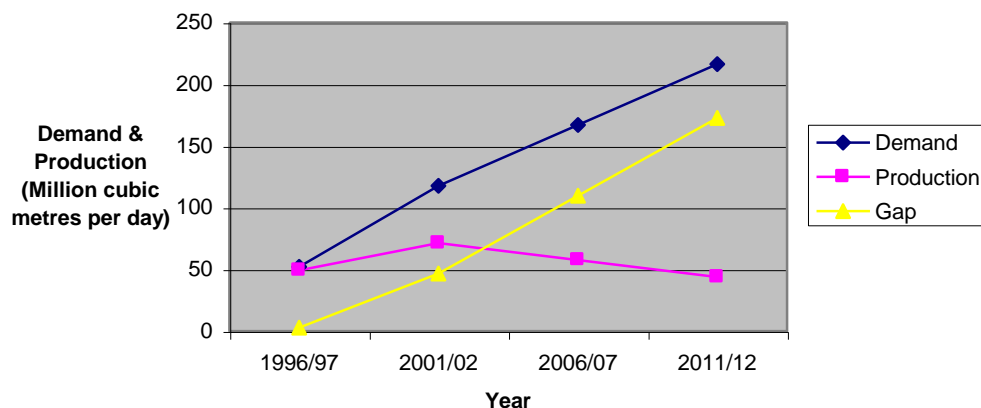


## The Fuel Situation

This is another area, which will face difficulty in future. The cost of fuel is increasing on one side and the vehicles on the road are also increasing. The cost of transport fuel has increased by around 20% in the last couple of years, which is a huge rise. As this is likely to become major concern, it is essential to find alternative to petroleum fuels. The use of Biodiesel has provided some useful results, however as on date this is still a non-viable option & still in the research stage. The present vehicle fuels apart from being expensive they increase the pollution level to a great extent resulting in the health hazards for the populations. In this connection matured hydrogen technology, as a fuel in future can be an excellent alternative.

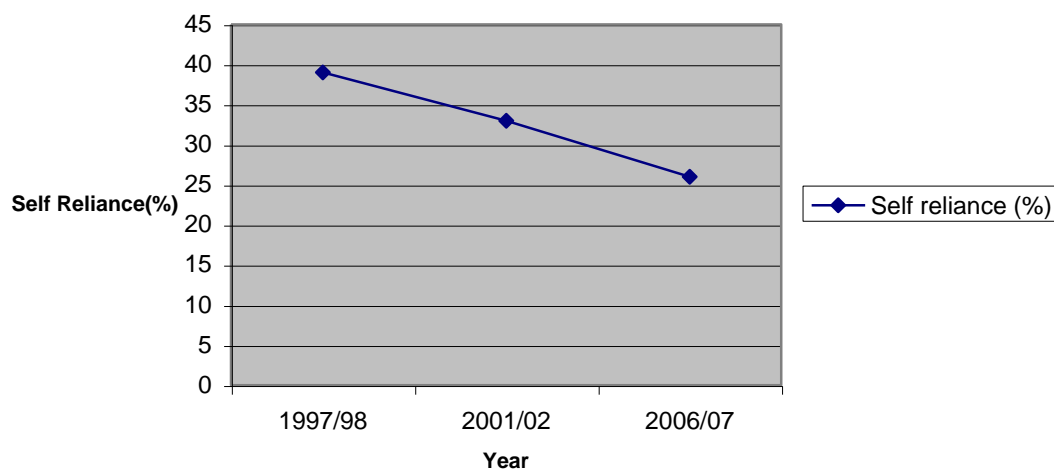
**Table 3 : Natural gas demand and supply in India (million cubic metres per day)**

	1996/97	2001/02	2006/07	2011/12
Demand	52.1	117.8	167.1	216.4
Production	49.3	71.2	57.5	43.8
Gap	2.8	46.6	109.6	172.6



**Table 4 : Oil demand and supply in India (million barrels per day)**

Year	Crude production	Crude imports	Petroleum products demand	Self reliance (%)
1997/98	0.69	0.62	1.68	39
2001/02	0.74	1.57	2.10	33
2006/07	0.80	2.20	2.89	26
2011/12	0.90	3.31	4.06	21



## **Renewable Energy Options**

### **Solar Energy**

Solar power, a clean renewable resource with zero emission, has got tremendous potential of energy which can be harnessed using a variety of devices. With recent developments, solar energy systems are easily available for industrial and domestic use with the added advantage of minimum maintenance. Solar energy could be made financially viable with government tax incentives and rebates.

An exclusive solar generation system of capacity of 250 to KWh units per month would cost around Rs. 5 Lacs, with present pricing and taxes. Most of the developed countries are switching over to solar energy as one of the prime renewable energy source. The current architectural designs make provision for photovoltaic cells and necessary circuitry while making building plans.

### **Wind Energy**

Wind power is one of the most efficient alternative energy sources. There has been good deal of development in wind turbine technology over the last decade with many new companies joining the fray. Wind turbines have become larger, efficiencies and availabilities have improved and wind farm concept has become popular. It could be combined with solar, especially for a total self-sustainability project.

The economics of wind energy is already strong, despite the relative immaturity of the industry. The downward trend in wind energy costs is predicted to continue. As the world market in wind turbines continues to boom, wind turbine prices will continue to fall. India now ranks as a “wind superpower” having a net potential of about 45000 MW only from 13 identified states.

### **Hydro Electric Power**

India has a huge hydropower potential, out of which around 20 % has been realized so far. New hydro projects are facing serious resistance from environmentalists. Resettlement of the displaced people with their lands becomes major issue.

### **Biomass Energy**

Biomass energy can play a major role in reducing India’s reliance on fossil fuels by making use of thermo-chemical conversion technologies. In addition, the increased utilization of biomass-based fuels will be instrumental in safeguarding the environment, creating new job opportunities, sustainable development and health improvements in rural areas. Biomass energy could also aid in modernizing the agricultural economy. A large amount of energy is expended in the cultivation and processing of crops like sugarcane, food grains, vegetables and fruits which can be recovered by utilizing energy-rich residues for energy production. The integration of biomass-fuelled gasifiers and coal-fired energy generation would be advantageous in terms of improved flexibility in response to fluctuations in biomass availability with lower investment costs.

Waste-to-energy plants offer two important benefits of environmentally sound waste management and disposal, as well as the generation of clean electric power. Waste-to-energy facilities produce clean, renewable energy through thermochemical, biochemical and physicochemical methods. Moreover, waste-to-energy plants are highly efficient in harnessing the untapped sources of energy from a variety of wastes.

## **Decentralized Energy Generation in India**

Microgeneration, also called “micropower”, is the generation of zero or low-carbon electrical power by individuals, small businesses and communities to meet their own needs. The most widely-used micro generation technologies include small wind turbines, solar power photovoltaic or biomass conversion systems that have been promoted for decades as alternative sources of renewable energy. Because of technological advances, micro generation now includes handheld solar and wind-power recharging devices for personal electronics, as well as advanced photovoltaic, biomass and wind-turbine systems for domestic and industrial power generation.

Traditional “megapower” production of electricity is insufficient today because of exponential industrial growth and high living standard. Micro generation can act as a catalyst for cultural changes in consumer attitude, and provides evidence of the important impact that microgeneration has on consumers’ attitude and behavior regarding energy production and use. Microgeneration is both a serious form of clean energy production and also a cultural movement that is gathering momentum worldwide. Microgeneration technologies include small wind turbines, biomass gasifiers, solar power, micro-hydro, or a combination of these technologies. Prima-facie renewable energy may appear a bit costlier than the conventional source of energy, but looking at the benefit of continuous power availability and great contribution against global warming, it is worth.

Industrialized countries, like USA, Australia, Japan, have formulated action plan to foster sustainable energy to make judicious use of renewable energy resources. For example, USA has announced massive renewable energy program, to generate large share of total energy requirement from renewable energy sources by 2025, which will create 5 million new job opportunities in various areas of Renewable Energy.

### **Proposed Guidelines for Power Consumers in India**

- ❑ Explore all possibilities to set-up an independent power plant making use of renewable resources like solar, wind and biomass.
- ❑ Use of government / utility electricity supply, only in case of emergency. Energy savings by using low wattage / high luminous lamps (CFL / LED).
- ❑ Use of power factor improves.
- ❑ Regular maintenance and servicing of electrical equipments.
- ❑ Avoidance of inverters and large storage batteries (except emergency).
- ❑ Intelligent power factor correctors to minimize energy losses in capacitor at lower load conditions.
- ❑ Frequent energy audits

### **Proposed Guidelines for Policy Makers in India**

- ❑ Vigorous promotion of renewable energy by government agencies, corporate, public sector, academic institutions etc.
- ❑ Establishment of national-level body to increase awareness of renewable energy at grass-root level
- ❑ Financial support and sponsorship for research and development in renewable energy technologies.
- ❑ Ambitious goals and targets for power generation non-conventional sources.
- ❑ Installation of solar / wind / biomass power generation systems and energy saving in every government office to encourage and inspire people.
- ❑ Restriction on using large battery energy storage systems.

- ❑ Compulsory installation of solar water heating systems for all urban residential and commercial establishments.
- ❑ Mandatory renewable energy systems provision for new residential, commercial and industrial buildings.
- ❑ Attractive incentives and subsidies for installation and successful operation of renewable energy equipment.
- ❑ Abolishing duties / taxes on import of small-scale renewable energy generating equipment
- ❑ Cultivation of energy crops on marginal and degraded land
- ❑ Use of biofuels in vehicles.
- ❑ Soft loans for setting up renewable energy enterprises.
- ❑ Additional incentives for buyers and manufacturers of renewable energy equipments in rural areas.

### **Guidelines for Research Professionals**

- ❑ Development of comprehensive educational and awareness modules for renewable energy systems.
- ❑ Development of cost-effective, high-efficiency and long-lasting photovoltaic cells.
- ❑ Development of high efficiency wind turbines, ranging from 300 W – 10 kW, to generate energy even at low wind velocity.
- ❑ Development of small-scale, low maintenance biomass gasifiers to make use of abundant biomass resources in rural areas for cogeneration.

### **Special Focus on Global Warming Reduction**



It is in this context Kyoto Protocol was held in the year 1997 in Japan and almost all the countries of the world discussed the issues related to Global Warming for 10 days and came to the conclusion that all the Industrialized nations should reduce their greenhouse gas emission level to less than the emission level of 1990 by 5.2% and the task has to completed by the year 2008 to 2011. This task was assigned to only the developed countries. For developing countries like India it was not mandatory. The level of emission right of the Industrialized countries was also fixed under the Protocol. Incidentally, it maybe mentioned that the Industrialized countries are responsible for 80% Green House Gas emission of the world. Carbon trading was also agreed too under the Protocol. The Green House Gases responsible for Global Warming are:

Sr. No.	Green House Gases	Responsible for Global Warming
1	Carbon Dioxide (CO <sub>2</sub> )	49%
2	Methane (CH <sub>4</sub> )	18%
3	Chloro Fluoro Carbon (CFC)	14%
4	Nitrous Oxide (N <sub>2</sub> O)	6%
5	Water vapour	13%



## Renewable Energy in India

India started Renewable Energy activities in the year 1982 under then Ministry of Energy. This was converted in 1992 into a full-fledged Ministry. During the last 25 years, significant progress in technological developments and production of renewable energy devices and systems has taken place in our country. India has fixed up a target to achieve a minimum 10 percent share, on around 24,000 MW from

Renewable Power in the overall power generation capacity to be added by 2012. The current installed capacity from renewable sources is about 11,000 MW. Wind power generation alone accounts for 7,660 MW, small hydro projects for another 2,015 MW and 692 MW from Biomass resources. More than 14 lacs stand-alone PV systems aggregating to about 65 MW have been installed in the country.

Renewable Energy Potential in India		
Sr. No.	Source	Potential
1	Solar Power	6,00,000 MW
2	Wind Power	45,000 MW
3	Small Hydro Power (upto 25 MW)	15,000 MW
4	Biomass Power	16,000 MW
5	Waste to Energy	2,700 MW
6	Bagasse Cogeneration	5,000 MW
	<b>Total</b>	<b>6,83,700 MW</b>