

# INDIAN POWER SECTOR

**Measured  
growth  
for a  
sustainable  
future**

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Indian power sector has been at the center of much attention recently. As the demand for power increases, the government has been forced to ensure steps to increase productivity. Due to the exhaustive nature of natural resources, renewable energy is being seen as a potential option to achieve the desired level of growth within the next 10 years. However, the desired effects are yet to be fully realised.

**E**nergy, in whatever form it may come, is critical for the survival of living beings. It plays a vital role in the socio-economic development of a country. It is widely known as a 'strategic commodity' and any kind of uncertainty regarding its supply can hamper the functionality of an entire economy. Therefore, 'energy security' is a term that Indian development planners look upon seriously. Energy efficiency is also going to be critical for the country in order to meet the Millennium Development Goals (MDGs). MDGs are plans undertaken by the United Nations Development Programme, which include eight goals framed to address the world's major development challenges.

India currently accounts for about five percent of the world's total primary energy consumption, which is expected

to go up to six percent by 2025. Even though the per capita energy consumption in the country at present is among the lowest across the world, it is expected to catch up Japan's present level by 2030.

As far as reserve energy sources are concerned, the country has about 90 years of fossil fuel reserves with quite a significant amount located under forest land. With a total installed generation capacity of 56 percent, coal has been the most important fuel in electricity generation, successfully highlighting the need to diversify and develop more environmentally sustainable sources of energy.

The Indian government has undertaken various steps and initiatives in order to ensure that the growth of the energy sector in India is not hampered in any way. The Indian electrical equip-

ment industry has proposed to prepare a Mission Plan 2012-2022 to achieve the desired level of growth within the next 10 years.

### **A MARKET OVERVIEW**

The unprecedented growth of the Indian economy has been a major demand generator for the energy market in India. The country today is the ninth largest economy in the world, driven by a substantial GDP growth of 8.7 percent in the last five years. This high order of sustained growth has put enormous demand on the energy resources. However, there continues to remain a serious imbalance between energy demands and supply, thereby requiring serious



efforts from the Indian government to augment energy supply as the country is expected to witness possible severe energy supply constraints.

A country's state of preparedness for energy generation can be judged by the indicators of the overall installed capacity and capacity utilization. The power sector in India has an installed capacity of 236.38 GW as of March 2012, registering a record 14 percent increase over that of March 2011. The captive power plants generate an additional 36.5 GW of power. While thermal power plants constitute 66 percent of the total installed capacity, hydroelectric comprise about 19 percent, and the rest includes wind, small hydro-plants, biomass, waste-to-electricity plants and nuclear energy. India was able to generate about 855 billion units (BU) of energy during 2011-12.

As of March 2012, the total per capita power consumption in India was estimated at 879 kWh. India continues to remain one of the most active markets in terms of renewable energy usage, especially wind energy. India had an installed capacity of 24.9 GW of new and renewable technology-based electricity by the end of 2012-13.

Reports of the Eleventh Five-Year Plan (2007-2012) show that nearly 55,000 MW of new power generation capacity was created during this period. Yet, the overall deficit hovered somewhere around 8.7 percent and there was a peak-shortage of nine percent. Resources that have been allocated to the energy supply are not sufficient to meet the gap between energy needs and energy availability.

The reports also suggested that during the 2011 census, 55.3 percent

rural households had access to electricity. The National Service Scheme results show that during 1993-94, nearly 62 percent rural households in India were using kerosene as the primary source of lighting. This was gradually replaced by electricity and during 2009-10 about 66 percent households were found using electricity for lighting. The rate of adoption has been significantly high during the intervening years, with the 2009-10 fiscal witnessing an 11 percent electricity adoption. Even though there was a temporary lull for about 7-8 years from 1999-2000, with merely 8 percent households using electricity, it picked up again in 2006-07 with nine percent rural households using electricity.

As the economy moves towards a higher trajectory, the issue of resolving energy bottlenecks continues to be one of the major concerns. Moreover, the high crude oil import figures make it imperative to have an optimal energy mix that will allow achieving the country's goal of sustainable development.

## A SNAPSHOT

### Petroleum and Natural Gas

The estimated figures of crude oil in India during 2011-12 stood at 759.59 million tonnes. There was a 0.29 percent increase in the estimated reserve of crude oil for the country in that fiscal.

As far as natural gas is concerned, the estimated reserves for natural gas in India as on March 31, 2012 were 1330.26

billion cubic meters. However, there are certain issues regarding the production of natural gas. Natural gas production decreased by 8.9 percent to

47,549 Million Cubic Meter (MCM) during the 2012 fiscal compared to 52,222.1 MCM in the previous financial year, due to lower than anticipated production by both public and private sectors. The gap between natural gas demand and supply is further expected to grow as the requirement for gas in the power sector has been forecasted to be 100 MMSCMD in 2017. The unfavorable demand/supply ratio of hydrocarbon in India has forced the government to encourage national oil companies to pursue equity oil and gas opportunities abroad, besides exploring shale gas deposits.

As far as government effort is concerned, the Petroleum and Natural Gas Regulatory Board Act 2006 has provided a legal framework for the development of natural gas pipelines and cities with its local gas distribution networks. The National Electricity Policy, 2005 prioritizes the need to have hydropower. It highlights the need for increased use of natural gas and nuclear power, with the pledge to make thermal power less polluting by the use of low-ash coal. The policy also gives recommendations for improving transmission and distribution of power.

### Fossil Fuel

The demand created from power generators outstrips the domestic consumption of fossil fuel (including coal and gas). In



Estimated Reserve for Crude Oil in India as on 31.03.2012





With an overall installed wind capacity of **1167 MW**  
India has been described as a **“Wind Superpower”**



an attempt to counter this, 27.6 Million Metric Tonnes (MMT) of coal was imported during the 2012 fiscal. The generation losses due to shortage of coal supply mounted to 8.82 TWh against 7.0 TWh reported during the 2011 fiscal. What is more alarming is the fact that India's energy requirement is expected to grow four times the current level to 2.0 BMT/year by 2031. As a result, the domestic coal production has to be increased by 7-9 percent. During the Twelfth Five-Year Plan (2012-2017), thermal power plants are expected to need 842 MMT coal, whereas the estimated domestic availability is going to be 604 MMT. Imports are therefore expected to meet the shortfall of 238 MMT.

As far as lignite is concerned, the estimated reserve for lignite as on March 31, 2012 was 41.96 billion tonnes against 4.91 billion tonnes on March 31, 2011. The increase during the 2011-12 fiscal was 1.22 percent, with Tamil Nadu accounting for the maximum increase of 2.99 percent.

### Renewable Energy Sources

Renewable energy sources have the potential of curbing a substantial proportion of the overall energy demand in India. Renewable energy can come from various sources including wind, solar, biomass, small hydro and cogeneration



bagasse.

The total potential of renewable power generation in India as on March 31, 2012 was estimated to be around 89774 MW. This includes the likes of wind power with a potential of 49130 MW (54.73 percent), small hydro-power with a potential of 15399 MW (17.15 percent), Biomass power 17,538 MW (19.54 percent) and bagasse-based cogeneration in sugar mills 5000 MW (5.57 percent).

In terms of geographical segmentation, Gujarat has the highest share of renewable energy production of 13.91 percent (12,489 MW), followed by Karnataka with 12.3 percent (11,071 MW) and Maharashtra 10.69 percent (9596 MW). Wind mostly dominates these potentials.

### Wind Energy

India has been described as a “wind superpower” with an overall installed wind capacity of 1167 MW. It has also been able to feed about 5 BUs of electricity to the national grid so far. A total of 13 states in India have a net potential

of 45000 MW. Installed wind energy capacity in India has grown at a CAGR of 19 percent with states like Tamil Nadu, Maharashtra and Gujarat being the leaders in this category. The Ministry of New and Renewable Energy (MNRE) estimates wind to constitute approximately 70 percent of overall renewable capacity, translating to 2-3 GW of new capacity every year till 2020.

Endeavors are being made on a larger scale for the development of low cost, low speed mills for irrigation purposes of small and marginal farms. The developments are mainly being targeted on water pumping wind mills that can operate within a speed range of 8 to 36 kmph.

### Solar Energy

Solar energy has the potential of becoming one of the most important sources of energy supply when the other sources of energy have been depleted. The solar power received at the earth's surface is 1016 W whereas the total demand of all needs of civilization is 1013 W. Therefore, the sun gives us almost 1000 times more energy than we need. If we even use five percent of the total solar energy, it will be nearly 50 times of what the world requires.

The National Solar Mission launched by MNRE aims to increase the solar



# The National Solar Mission launched by **MNRE aims** to increase the solar power capacity to **22 GW by 2022**



power capacity to 22 GW by 2022. By the first phase of 2013, 500 MW Large Thermal power is to be installed. States like Gujarat and Rajasthan are pushing their own solar policies and incentives. Tariff policies have been changed to include solar specific Recovery Point Objective with a target of achieving three percent of total solar energy production by 2022. The government also plans to connect 10,000 MW grid and 2000 MW off-grid.

### Bio-mass

In a country like India, biomass is certainly going to become one of the major sources of renewable energy, given the kind of benefit it offers. Approximately 32 percent of the total primary energy usage in India is still derived from biomass and about 70 percent of the population still depends on it for its energy requirements. MNRE has stressed on the role of biomass energy, having realized its true potential. A number of programmes have been initiated for the promotion of efficient technologies and its use in various sections of the economy. India draws an investment of INR 600 crore every year in biomass power generation, thereby generating 5000 million units of electricity on a year-on-year basis and a yearly employment of more than 10 million man-days in rural areas.

The current availability of biomass in India is approximately 500 million metric ton per year. MNRE study reports has estimated the surplus biomass availability at about 120-150 million metric tonnes per annum, covering agricultural as well as forestry residues corresponding to a potential of about 18,000 MW. Another 5000 MW of additional power can be generated through bagasse based cogeneration for extracting power from the bagasse produced by them.

### Government policies and programmes

Programmes for the promotion of biogas began as early as the 1940s. It was later during the 1970s that the National Biomass Policy was initiated. Other recent policies initiated include 80 percent accelerated depreciation, concessional custom duty, tax holiday for 10 years, and excise duty exemption, among others.

### Bio-diesel

Biodiesel completely lowers the carbon dioxide outburst, thereby helping the environment significantly. Biodiesel



can be used as an alternative fuel for furnaces and other industrial applications as it emits no black smoke at all. The sulphur content in biofuels is

less than 10 mg and when compared to diesel, it is pretty environment friendly. There are quite a few companies doing well in this segment, such as the Indian Oil Corporation and Bharat Petroleum Corporation Limited among public sector players, and Naturol Bioenergy Ltd and Global Mace Corporation among private players.

### Small Hydropower Plants

The biggest advantage of hydropower is that it provides a steady and secure source of electricity and has the power of countering the intermittency of other renewable energy sources like wind power and solar PV cells. MNRE has taken up the task of developing Small Hydro Power projects mounting to 25 MW station capabilities. The estimated potential for power generation through hydropower in the country is more than 15,000 MW. A database of potential sites of small hydropower has been enlisted with an aggregate capacity of 14,305.47





MW for up to 25 MW projects.

There are Large Hydro Power projects as well. The Himalayan states continue to have the highest potential of power generation through hydropower due to the intensity of the rivers there.

### Cogeneration Bagasse

Bagasse-based cogeneration gained momentum since 1993, followed by the report submitted by MNRE. Tamil Nadu was the first state where full-fledged cogeneration plants were commissioned and synchronized. The first plant had an installed capacity of 18.68 MW, which was commissioned in November 1995. The biggest of these plants with an installed capacity of 30 MW was commissioned in 1997. Bagasse is being used widely nowadays as an attractive feed-stock for bioethanol production.

### Nuclear Power

One of the fastest growing sources of power in India is the nuclear power, which is expected to supply at least 25 percent of electricity by 2050. The country is also aiming to have 14,600 MWe of nuclear capacity by 2020.

Fuel and foreign technology are expected to boost India's nuclear power plans substantially as the coun-

try expects to become a world leader in nuclear technology. This can also be largely seen as a result of the country's vast expertise in fast reactors and thorium fuel cycle.

Nuclear power has successfully supplied 20 billion kWh of India's overall electricity in 2011. The present fuel situation in the country, largely due to the shortage of fossil fuel, has led to increased investment in nuclear energy. The government had planned to provide 20 GWe of electricity through nuclear power by 2020. But in 2007, the Indian Prime Minister described this target as 'modest' and described the country as being capable of doubling up the capacity by opening the international corporation.

### EXPERT SPEAK

However, in order to assess the real scenario of the Indian power sector, it is important to have an inside view of what the industry feels about the existing policies and norms. According to Mr. Nimish Saraogi, Chairman, Mace Global Corporation, "There has been a widespread use of conventional sources since many years now, and it took the authorities a lot of time to realize the limited availability of the same. A considerable amount of

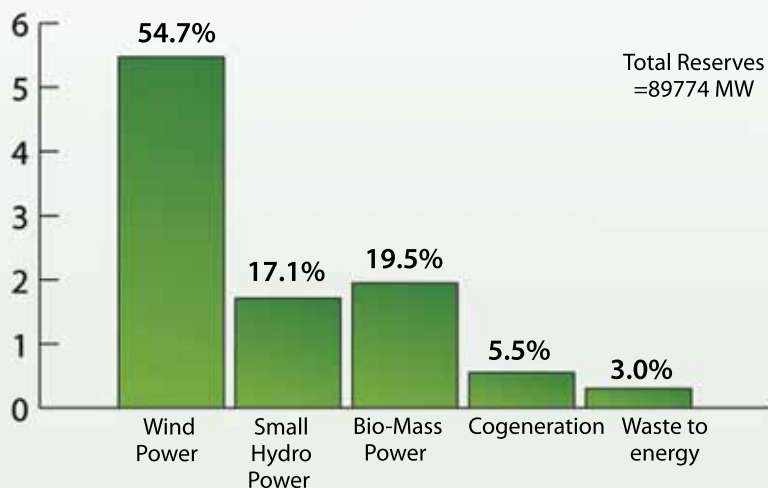
time was needed to focus on renewable energy as well. At the moment, India is doing pretty good on renewable energy migrations or cogenerations. India is now considered as one of the top destinations for solar power. However, in terms of fuel, the country is still not aware about the growth in the biofuel segment. Wind and hydropower are the ones that India has developed at a very good margin".

"Even though India is a claimed to be a 'wind superpower', there is more than 5000 MW potential still untapped. There are dams made on many rivers which harness the waters, totaling more than billions of units. The solar sector is the next big thing, with amazing policies by the government. Many of these policies are in their second phase. India is now among the leading destinations for foreign investments in renewable energy."

Mr. Saraogi adds, "There are certain challenges that have hampered the growth of the renewable energy sector. Renewable energy attracts a lot of capital. Setting up a solar power plant is hugely cost intensive in terms of acquisition of equipments and land banks. Shortage of imminent policy approvals and delays had put the brakes on growth



Source-wise estimated Potential of Renewable Power in India as on March 31, 2012



last year. Wind is a developed sector here and is still growing. However, environmental factors, suitability of land and resources, along with the huge capital involvements as compared to conventional sources do discourage people to openly invest in India. It takes more than INR 8 crore to build up 1 MW of a solar plant (apart from land acquisition). Similarly, it takes around INR 1 crore to build a thermal power plant of the same capacity."

## GOVERNMENT EFFORTS AND INITIATIVES

The Planning Commission had set a target of 78,700 MW of capacity addition during the Eleventh Five-Year Plan. This comprised of 59,693 MW of thermal power, 15,627 MW of hydropower and 3,380 MW of nuclear power.

Generation expansion planning studies have been carried out for the Twelfth Five-Year Plan period by using the Electric Generation Expansion Analysis System. This was meant to gauge the requirement of additional generating capacity during 2012 to 2017. Based on the studies, a capacity addition of 75,715 MW has been estimated, which is to be added during the next five years. Keeping with the need to maintain a Low Carbon Growth Strategy, renew-

able energy sources like hydropower and nuclear energy has been prioritized. Accordingly, a compatible 9,204 MW of hydropower capacity addition and 2,800 MW of nuclear power capacity addition have been planned. The detailed plan for capacity addition has been enlisted below:

The government is also planning a grid interactive renewable capacity addition of about 18,500 MW during 2012-17, which comprises of 11,000 MW of wind, 1,600 MW of small hydro, 2,100 MW of biomass power and 3,800 MW of solar power.

## THE DEMAND FOR COAL

Availability of coal still remains a concern

for the government during the Twelfth Five-Year Plan. As per industry reports, the likely system energy requirement planned to be fulfilled by coal based plants during 2016-17 is going to be 1095 BUs. Moreover, the estimated power generation from hydro stations is going to be 30 percent less than their design energy.

## NEW AND RENEWABLE ENERGY SOURCES

Power generation from new and renewable energy sources like sun, wind, small hydro and biomass is going to be extremely critical, given the importance that environmental sustainability has gained today. The total estimated medium-term potential (until 2032) for power generation from renewable energy sources like wind, solar, hydro, waste to energy and biomass is going to be 1,83,000 MW.

MNRE has been facilitating the adoption and implementation of programmes with broader spectrum including the use of renewable energy for lighting up rural areas. Attempts have also been made to use renewable energy in urban, industrial and commercial applications and alternate fuels and applications.

The entire set-up has been divided into eight broad groups, namely:

- Bio-Energy
- Research and Development and TIFAD (Technology Information Forecasting, Assessment and Databank)
- Solar Energy and Remote Village Applications

## Capacity Addition Requirement during Twelfth Plan (MW)-Base Case

Type of Capacity	Demand corresponding to 9 % GDP growth & 0.9 Elasticity
Thermal(Coal, Gas)	63781
Hydro	9204
Nuclear	2800
Total	75785

### Sector-wise Break-up of 12th Plan Capacity (Figures in MW)

Sector	Hydro	Coal	Lignite	Gas	Total Thermal	Nuclear	Total
Central	5632	10600	0	826	11426	2800	19858
State	1456		0	260	12340	0	13796
Private	2116	40015	0	0	40015	0	42131
Total	9204	62695	0	108	63781	2800	75785

- › Biomass and Wind Power
- › Energy for Urban, Industrial and Commercial Applications
- › Small Hydro and Information and Public Awareness
- › Hydrogen Energy
- › Administration and Coordination

MNRE also has an integrated Finance Division that functions under the Special Secretary and Financial Adviser.

### PRESENT RESPONSIBILITIES

The present responsibilities of the MNRE include:

- › Formulation of policies and programmes for the development of new and renewable energy sources
- › Ensure the implementation of the government's policies in regard to all matters concerning new and renewable sources of energy
- › Coordinating and intensifying all the research and development activities from the new and renewable sources of energy.

### INCREASING THE COMPETITIVENESS OF THE ELECTRICAL INDUSTRY

Enhancing the competitiveness of the domestic power industry continues to be the major concern for planners. The aim is to equip the industry in such a way that it is naturally able to thwart any kind of competition in both domestic and foreign markets. Some of the strategic initiatives include:

- › Upgrading the technology levels to bring them at par with the global benchmarks
- › Secure the supplies of critical input materials
- › Enhance customer centricity
- › Develop manpower skills to adequately support the industry's future requirement
- › Introduce and implement policy changes to create a level-playing field for the Indian electrical equipment manufacturers
- › Develop and strengthen the support infrastructure

### CONVERTING THE LATENT DEMAND FOR ELECTRICAL EQUIPMENTS TO REAL DEMAND

Even though there is significant demand for electrical equipments in India at present, it is somehow not getting converted into real demand. Some strategic initiatives have been undertaken to solve these problems:

- › Improving fund availability for the power sector
- › Accelerating renovation and modernization activities
- › Providing fuel linkages and faster regulatory clearance for timely execution of power projects
- › Effective deployment of rural electrification schemes
- › Implementing best-in-class procurement policies

With the government aiming to add about 76,000 MW of electricity during the Twelfth Five-Year Plan, which is mostly supposed to come from renewable energy sources, it's high time that the Indian consumer also becomes aware of the potential of renewable energies. Industrialists can accept their mistakes of not being able to promote them well. But the process of making them understand has started and they seem to understand it. Without the cooperation of the population, these possibilities will just remain constant. Therefore, experts sincerely hope that the hype that this industry is receiving at this stage does not go in vain, and this commemorates a new dawn of a renewable revolution worldwide. There is a sense of confidence that with the mass awareness, India will be successful in accomplishing its energy targets ■

