ANALYSIS OF POWER SECTOR IN INDIA

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Abstract

"Power is the power of all the nations"

Power or electricity is one of the most critical components of infrastructure affecting economic growth and well-being of nations. The existence and development of adequate infrastructure is essential for sustained growth of the Indian economy. The utility ***electricity sector in India*** *had an installed capacity of 271.722 GW as of end March 2015. Renewable Power plants constituted 28% of total installed capacity and Non-Renewable Power Plants constituted the remaining 72%. The gross electricity generated by utilities is 1106 TWh (1106,000 GWh) and 166 TWh by captive power plants during the 2014–15 fiscal. The gross electricity generation includes auxiliary power consumption of power generation plants. India became the world's third largest producer of electricity in the year 2013 with 4.8% global share in electricity generation surpassing Japan and Russia. The Indian power sector is one of the most diversified in the world. Sources for power generation range from conventional ones such as coal, lignite, natural gas, oil, hydro and nuclear power to other viable non-conventional sources such as wind, solar, and agriculture and domestic waste. The demand for electricity in the country has been growing at a rapid rate and is expected to grow further in the years to come. In order to meet the increasing requirement of electricity, massive addition to the installed generating capacity in the country is required.*

Keywords: *power sector, power generation, transmission and distribution, power trading, smart grid*

Introduction

Power or electricity is one of the most critical components of infrastructure affecting economic growth and well-being of nations. The existence and development of adequate infrastructure is essential for sustained growth of the Indian economy

The power sector provides one of the most important inputs for the development of a country and availability of reliable and inexpensive power is critical for its sustainable economic development. To sustain GDP growth rate of around 8-9 %, it is imperative that the power sector also grows at the same rate. During the year 2014-15, the per capita electricity consumption in India was 1010 kWh with total electricity consumption (utilities and non-utilities) of 938.823 billion kWh. Electric energy consumption in agriculture was recorded highest (18.45%) in 2014-15 among all countries. The per capita electricity consumption is lower compared to many countries despite cheaper electricity tariff in India.

Even after the considerable growth in the power sector infrastructure and the supply of electricity, many parts of the country continue to face severe power shortages as consumption by commercial and industrial consumers has been increasing at much faster rate than electricity supply.

Power is one area of infrastructure where India lags far behind even in comparison to other developing countries. The per capita annual consumption of electricity in India is one of the lowest in the world at approximately 734(2008-09) kwh

The **power sector** in India is mainly governed by the Ministry of Power. There are three major pillars of power sector these are Generation, Transmission, and Distribution. As far as generation is concerned it is mainly divided into three sectors these are Central Sector, State Sector, and Private Sector.

History

The first demonstration of electric light in Calcutta was conducted on 24 July 1879 by P W Fleury & Co. On 7 January 1897, Kilburn & Co secured the Calcutta electric lighting license as agents of the Indian Electric Co, which was registered in London on 15 January 1897. A month later, the company was renamed the Calcutta Electric Supply Corporation. The control of the company was transferred from London to Calcutta only in 1970. Enthused by the success of electricity in Calcutta, power was thereafter introduced in Bombay. Mumbai saw electric lighting demonstration for the first time in 1882 at Crawford Market and Bombay Electric Supply & Tramways Company (BEST) set up a generating station in 1905 to provide electricity for the tramway. The first hydroelectric installation in India was installed near a tea estate at Sidrapong for the Darjeeling Municipality in 1897. The first electric streetlight in Asia was lit on 5 August 1905 in Bangalore. The first electric train ran between Bombay's Victoria Terminus and Kurla along the Harbour Line, in 1925.

Sector-Wise All India Installed Capacity

In India's effort to add electricity generation capacity over 2009–2011, both central government and state government owned power companies have repeatedly failed to add the capacity targets because of issues with procurement of equipment and poor project management. Private companies have delivered better results

Sector	Thermal (in MW)	Hydel (in MW)	Nuclear (in MW)	Renewable (in MW)	Total	% of Total
Central Govt.	52,500.54	9,717.4	4,780.00	-	66,997.94	28.64%
State Govt.	59,627.93	27,482.00	-	3,726.77	90,836.70	38.83%
Private	47,665.52	2,694.00	-	25,735.78	76,095.30	32.53%
Total	***159,793.99***	***39,893.40***	***4,780***	***29,462.55***	***233,929.94***	***100.00%***

Generation

India has the fifth largest generation capacity in the world with an installed capacity of 152 GW as on 30 September 20091, which is about 4 percent of global power generation. The top four countries, viz., US, Japan, China and Russia together consume about 49 percent of the total power generated globally. The average per capita consumption of electricity in India is estimated to be 704 kWh during 2008-09. However, this is low when compared to that of some of the developed and emerging nations such US (~15,000 kWh) and China (~1,800 kWh). The world average stands at 2,300 kWh2. The Indian government has set ambitious goals in the 11th plan for power sector owing to which the power sector is poised for significant expansion. In order to provide availability of over 1000 units of per capita electricity by year 2012, it has been estimated that need-based capacity addition of more than 100,000 MW would be required. This has resulted in massive addition plans being proposed in the sub-sectors of Generation Transmission and Distribution.

Electricity Generation Performance

The electricity generation target for the year 2015-2016 was fixed as 1137.5 Billion Unit (BU). i.e. growth of around 8.54% over actual generation of 1048.673 for the previous year (2014-2015). The generation during (2014-15) was 1048.403 BU as compared to 967.150 BU generated during April-March 2014, representing a growth of about 8.43%.

Programme, actual achievement and growth in electricity generation in the country during 2009-10 to 2015-16

Year	Target	Achievement	% of target	% of growth
2009-10	789.511	771.551	97.73	6.6
2010-11	830.757	811.143	97.64	5.56
2011-12	855.000	876.887	102.56	8.11
2012-13	930.000	912.056	98.07	4.01
2013-14	975.000	967.150	99.19	6.04
2014-15	1023.000	1048.673	102.51	8.43
2015-16*(Upto April 2015)	91.781	86.695	94.46	-0.52

ELECTRICITY TRANSMISSION AND DISTRIBUTION

Transmission

The current installed transmission capacity is only 13 percent of the total installed generation capacity3. With focus on increasing generation capacity over the next 8-10 years, the corresponding investments in the transmission sector is also expected to augment. The Ministry of Power plans to establish an integrated National Power Grid in the country by 2012 with close to 200,000 MW generation capacities and 37,700 MW of inter regional power transfer capacity. Considering that the current inter-regional power transfer capacity of 20,750 MW4, this is indeed an ambitious objective for the country.

Distribution

While some progress has been made at reducing the Transmission and Distribution (T&D) losses, these remain substantially higher than the global benchmarks, at approximately 33 percent. In order to address some of the issues in this segment, reforms have been undertaken through unbundling the State Electricity Boards into separate Generation, Transmission and Distribution units and privatization of power distribution has been initiated either through the outright privatization or the franchisee route; results of these initiatives have been somewhat mixed. While there has been a slow and gradual improvement in metering, billing and collection efficiency, the current loss levels still pose a significant challenge for distribution companies going forward.

Installed transmission (circuit km) and distribution capacity (MVA) up to end of March 2015

Capacity	Substation (MVA)	Transmission lines (c.km)	c.km/MVA ratio
± 500 kV HVDC	13,500	9,432	0.699
765 kV	121,500	18,644	0.153
400 kV	192,422	135,949	0.707
200 kV	268,678	149,412	0.556

Problems with India's Power Sector

India's electricity sector faces many issues. Some are:

1. **Inadequate last mile connectivity** is the main problem to supply electricity for all users. The country has already adequate generation and transmission capacity to meet the full demand temporally and spatially. However, due to lack of last-mile link-up with all electricity consumers and reliable power supply (to exceed 99%), many consumers depend on DG sets using costly diesel oil for meeting unavoidable power requirements. The distribution companies should focus on providing uninterrupted power supply to all the consumers who are using costly DG set's power. This should be achieved by laying separate buried power cables (not to be effected by rain and winds) for emergency power supply in addition to the normal supply lines. Emergency supply power line shall supply power when the normal power supply line is not working. Emergency power supply would be charged at higher price without any subsidy but less than the generation cost from diesel oil. Nearly 80 billion KWh electricity is generated annually in India by DG sets, which are consuming nearly 15 million tons of diesel oil.
2. A **system of cross-subsidization** is practiced based on the principle of 'the consumer's ability to pay'. In general, the industrial and commercial consumers subsidize the domestic and agricultural consumers. Further, Government giveaways such as free electricity for farmers, partly to curry political favour, have depleted the cash reserves of state-run electricity-distribution system. This has financially crippled the distribution network, and its ability to pay power to meet the demand. This situation has been worsened by government departments of India that do not pay their bills
3. The **residential building sector** is one of the largest consumers of electricity in India. Continuous urbanisation and the growth of population result in increasing power consumption in buildings. Thus, while experts express the huge potential for energy conservations in this sector, the belief still predominates among stakeholders that energy-efficient buildings are more expensive than conventional buildings, which adversely affects the "greening" of the building sector.
4. **Key implementation challenges** for India's electricity sector include new project management and execution, ensuring availability of fuel quantities and qualities, lack of initiative to develop large coal and natural gas resources available in India, land acquisition, environmental clearances at state and central government level, and training of skilled manpower to prevent talent shortages for operating latest technology plants. **Shortages of fuel**: despite abundant reserves of coal, India is facing a severe shortage of coal. The country is not producing enough to feed its power plants. Some plants do not have reserve coal supplies to last a day of operations. India's monopoly coal producer, state-controlled Coal India, is constrained by primitive mining techniques and is rife with theft and corruption; Coal India has consistently missed production targets and growth targets. Poor coal transport infrastructure has worsened these problems. To expand its coal production capacity, Coal India needs to mine new deposits. However, most of India's coal lies under protected forests or designated tribal lands. Any mining activity or land acquisition for infrastructure in these coal-rich areas of India has been rife with political demonstrations, social activism and public interest litigations.
5. **Poor pipeline connectivity and infrastructure** to harness India's abundant coal bed methane and shale gas potential.
6. The giant new offshore natural gas field has delivered less fuel than projected. **India faces a shortage of natural gas**.
7. **Hydroelectric power projects** in India's mountainous north and north east regions have been slowed down by ecological, environmental and rehabilitation controversies, coupled with public interest litigations.
8. **Theft of power**
9. **Losses in the connector systems/service connections** leading to premature failure of capital equipments like transformers

10. **India's nuclear power generation potential** has been stymied by political activism since the Fukushima disaster in Japan.
11. **Average transmission, distribution and consumer-level losses** exceeding 30%, which includes auxiliary power consumption of thermal power stations, fictitious electricity generation by wind generators & independent power producers (IPPs), etc
12. Over 300 million (300 million) people in India have **no access to electricity**. Of those who do, almost all find electricity supply intermittent and unreliable.
13. **Lack of clean and reliable energy sources** such as electricity is, in part, causing about 800 million (800 million) people in India to continue using traditional biomass energy sources – namely fuel wood, agricultural waste and livestock dung – for cooking and other domestic needs. Traditional fuel combustion is the primary source of indoor air pollution in India, causes between 300,000 to 400,000 deaths per year and other chronic health issues.
14. **India's coal-fired, oil-fired and natural gas-fired thermal power plants are inefficient** and offer significant potential for greenhouse gas (CO_2) emission reduction through better technology. Compared to the average emissions from coal-fired, oil-fired and natural gas-fired thermal power plants in European Union (EU-27) countries, India's thermal power plants emit

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