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ENERGY SECTOR REFORMS IN INDIA – A REVIEW

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ABSTRACT
Indian economy has been growing at a rate of 6-8 % annually during the 10th plan period (2002-07), which requires growth of basic infrastructural facilities at a still higher rate. Power sector is one of the major components of infrastructure development, which requires a growth rate of 9-10 % during the 11th and 12th plan periods (2007–2016). This requires huge amount of investments and restructuring of power sector, for which Government cannot fund the entire amount independently. Hence, private participation is necessary either as an independent venture or through public-private partnership (PPP). Electricity Act 2003 is a step in the direction of reforms by creating an environment for private participation in the generation, transmission and distribution of power in the country. The main aim of this Act is to implement proper steps for efficient and optimum use of energy resources available in India and to supply quality power at good reliability and optimum cost to the Indian consumers. However, one of the major constraints faced by the power sector is the lack of adequate R&D support. This paper attempts to throw a light on present status of Indian power sector with respect to generation, transmission and distribution of electricity.

KEY WORDS
Power sector, Reforms, Generation, Transmission, Distribution, Energy.

1. Introduction

India is one of the developing countries in the world, whose economy is growing at a faster rate compared to many other countries. As economy is growing at a faster rate, there is a demand for more infrastructure facilities and services to support the economic growth. Power sector is one such major area, which plays a critical role in the economic growth of any country. The growth in energy generation has been 3.2 %, 5.1 %, 5.2 % and 5.2 % during 2002-03, 03-04, 04-05 and 05-06 respectively. As per the Integrated Energy Policy (IEP), report of Planning Commission electrical generation would be required to grow at 9 % p.a. during the 11th plan period[1]. The required generation has to be collectively met by Central and State sector utilities, captive plants and from non-conventional energy sources[2]. Hence, in next 6 to 7 years additional capacity of around 84,000 MW is needed to meet the projected demand. This requires huge investment in the power sector[3,4]. Therefore, to generate and provide funds for power sector Power Finance Corporation Limited (PFC) was established in 1986. Indian power sector is in the process of reforms in every element of the electricity value chain.

2. Power Generation

At present (as on June 2007) the total installed capacity in India is 1,34,717 MW. India is facing energy deficit and peak power deficit of 8 % and 12.2 %, respectively[5]. However, to meet the objectives of NEP to increase the per capita consumption to 1000 units by the year 2011-12, the requirement of generation works out to 1210 BU, assuming a population of 121 crores in 2011-12 as per projections of Census 2001. The inter-regional power transmission capacity is planned to be increased from 16,500 MW at the end of the 10th plan to 37,000 MW by 2011-12.

2.1 Available Resources

The resources available in India for power generation are shown in Table 1. As observed from Table 1, the thermal and nuclear energy are major sources for generation of electricity in India. As most of these resources are non renewable, they must be efficiently used. Figure 1 shows the electricity generation in the country, as per the available resources. In India, coal is available in abundance and almost about 69 % of energy is generated from coal alone. Coal will continue to contribute about 60 % of power generation in India. It is estimated that the coal reserves at current consumption rate should last for another 240 years. Indian coal reserves have low sulphur content, but contain high percentage of ash, as high as 40-50 %, which increases the net transportation and overall coal beneficiation plant cost.

In India, power is generated by Central government agencies, State owned electricity boards and Private sector. Figure 2 highlights the sector wise power generation in the country. As hydroelectric power

generation is pollution free, more and more emphasis is given to the development of hydro potential projects. Only around 34 GW hydro potential has been used so far out of about 150 GW expected potential.

Thermal power generating stations running with coal and lignite are the major source of electricity. Super thermal power stations with capacity of about 2,000 MW and above are planned to increase the capacity of installed generation plants. Total nuclear capacity in India is about 3,900 MW. It is expected that cumulative nuclear power capacity will be around 20,000 MW by 2020.

Table 1
Identified energy reserves of India

Source	Total reserve
Coal	186 billion tonnes
Lignite	5,060 million tonnes
Crude Oil	728 million tonnes
Natural Gas	686 billion Cu-m
Uranium	78,000 tonnes
Thorium	3,63,000 tonnes
Hydro	84,000 MW at 60 % PLF
Renewable Biomass	6,000 MW
Renewable Wind, Solar etc.	20,000 MW

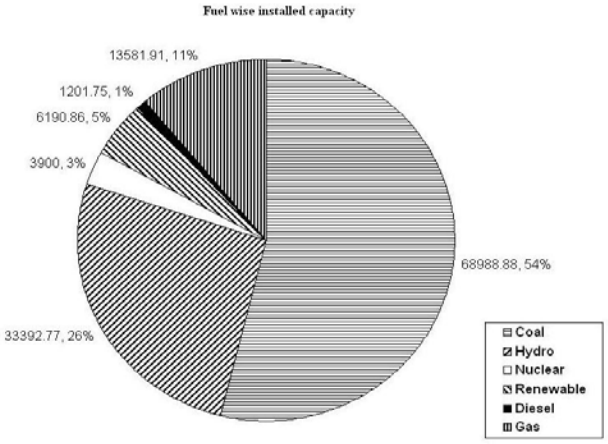

Figure 1. Electricity generation as per the resources

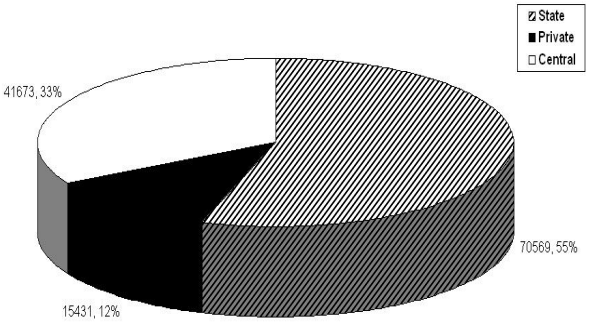

Figure 2. Sector wise power generation in the country

3. Renewable Energy Sources

India has significant potential for generation of power from renewable energy sources. The renewable energy power sector includes wind power, solar power, small hydro, biomass power and bio mass gassifier. It is made mandatory for all power utilities to procure 5 % of their supplies from renewable energy sources.

3.1 Solar

There are about 300 clear sunny days in a year in most parts of India. This is equal to over 5,000 trillion kWh/year, which is far more than the total energy consumption of the country in a year. The daily average solar energy incident over India varies from 4 to 7 kWh/m^2, depending upon location. About 66 MW aggregate capacity (about 10,80,000 individual Photo Voltaic (PV) systems and power plants) units have been installed for various applications. In addition, PV products of 55 MW aggregate capacities have been exported under Ministry of Non-conventional Energy Sources (MNES) PV programme and around 8.20 lakh systems have been installed aggregating to about 29 MW. This includes 5,09,894 solar lanterns, 2,56,673 home lighting systems, 47,969 street lighting systems and 5,000 water pumping systems.

3.2 Wind

In India there is a gross wind potential of 45,195 MW, however the technical potential is only about 13,000 MW. At present the total installed capacity is around 1,870 MW and targeted capacity in next five years is about 1,500 MW. Capital cost of wind power projects ranges from Rs. 4.5 to 5.5 crore per MW. Cost of generation is estimated to be Rs. 2.25 to 2.75 per kWh (depending upon the site).

3.3 Small Hydro

Hydro Power is one such source and is to be accorded priority also from the consideration of energy security. However, execution of hydro projects requires thorough survey and investigation and it would take about five years to execute a project after the work is awarded for construction.

It has been recognized that small hydro power projects can play a critical role in improving the overall energy scenario of the country and in-particular in remote and inaccessible areas. At present 420 small hydropower projects up to 25 MW station capacities with an aggregate capacity of over 1,423 MW have been set up in the country. Keeping in view the preparedness of various hydro projects, a capacity addition of 15,585 MW is envisaged for 11th Plan.

3.4 Biomass Power

India is one of the largest producers of cane sugar. There exists an established potential of 3,500 MW of power generation through biomass based co-generation in sugar mills. A capacity of 537 MW has so far been commissioned and 536 MW is under installation.

3.5 Biomass Gassifier

Biomass gassifiers capable of producing power from a few KW up to 1 MW capacity have been successfully developed indigenously. A total capacity of 55.105 MW has so far been installed, mainly for stand-alone applications.

4. Transmission of Power

Due to uneven location of generation resources in the country, the hydro in the northern and north-eastern states and coal being mainly in the eastern part, it is necessary to develop a strong National Grid so as to ensure reliable supply of power to all. The planning and operation of the transmission system has thus shifted from regional to national level[6]. As on today, the inter-regional transmission capacity of 11,450 MW is existing and inter-regional exchanges of more than 12 billion kWh in a year is taking place contributing to optimum utilization of generation capacity.

The Indian power system is operated as five regional grids, as shown in Figure 3. The main objective of interconnections is to enable transfer of power from one region to another and for optimum utilization of energy resources, and to improve reliability, economy and quality of power supply.

At present Western Regional Grid (WR), Eastern Regional Grid (ER) and North Eastern Regional Grids (NER) are operated in synchronous manner. Northern Regional Grid (NR) and Southern Regional Grids (SR) are operating asynchronously and are connected to other neighbouring grids through HVDC back-to-back links. The country's transmission perspective plan for tenth and eleventh plan focuses on the creation of a National Grid in a phased manner by adding over 60,000 ckm of transmission network by 2012.

The Phase I High Voltage Direct Current (HVDC) interconnections were established between regions, which was completed in year 2002, achieving an inter-regional transfer capacity of 5,000 MW.

The Phase II inter regional connectivity will be strengthened with hybrid system of high capacity AC (765 KV and 400 KV) and HVDC links. This phase is likely to be completed in year 2007, with cumulative inter regional capacity of about 23,000 MW.

In Phase III further strengthening of National Grid is envisaged through 765 KV AC lines and HVDC lines. This phase is planned to be implemented by 2012. This will enhance cumulative inter regional transmission capacity to 30,000 MW.

5. Distribution of Power

In India over the years distribution of power has been with State Electricity Boards (SEB). Due to low tariffs, over staffing, power thefts, poor revenue collection and increasing costs the performance of state electricity boards is poor. Most of SEB are running in loss.

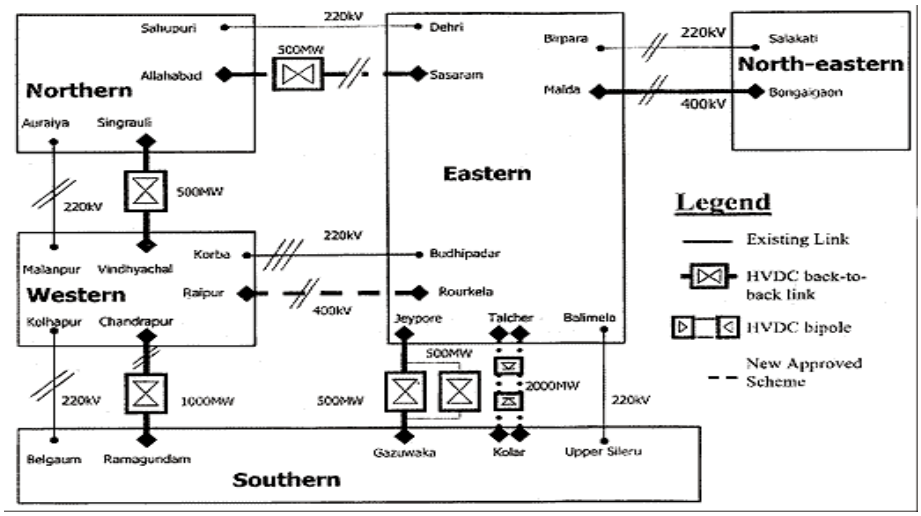

Figure 3. Five regional power grids in the country

The distribution reform was identified as the key area to bring about the efficiency and to improve the financial health of the power sector. At present, 29 states have signed the memorandum of understanding with the ministry to take various steps to undertake distribution reforms in a time bound manner. Subsequently, 24 states have constituted SERCs and 20 have issued tariff orders in the direction of rationalizing the tariffs.

6. R&D in Power Sector

The power sector in India, which envisages adding around 84,000 MW during the 11th plan, can only be possible through a robust R&D support in every element of the electricity value chain. IGCC (Integrated Gasification Combined Cycle) technology for Indian coals needs to be upgraded to a commercial scale. Super critical boiler technologies need to be aggressively used for achieving the higher efficiencies. Nano technology applications in generation and transmission would potentially deliver higher efficiencies and provide cost reduction opportunities[7]. The priority given for R&D funding currently is highly inadequate and requires higher contributions, perhaps in the private-public partnership mode.

6.1 Accelerated Power Development And Reform Programme (APDRP)

Financial health of SEB become a matter of grave concern considering when their losses have reached an alarming level of Rs. 26,000 crores during 2000-2001, which was equivalent to about 1.5 % of GDP. Aggregate Technical and Commercial (AT&C) losses are in the range of 50 – 60 % which is very high. Accelerated Power Development and Reform Programme had been undertaken from the year 2000-01 as a last report for restoring the commercial viability of the distribution sector.

The objectives of APDRP are

- Reduction of AT & C losses to around 10 %
- Increasing reliability and quality of power supply
- Improving financial viability of state power utilities
- Improving customer satisfaction

In APDRP, initiatives have been undertaken for bringing about commercial viability of SEB/Utility. The major steps that are being taken are:

- Energy meters on DTs and consumers
- Energy audit and accounting at all levels
- Energy meters on feeders
- 100 % metering (tamper proof)
- Installation of capacitor at all levels
- Computerization of billing

7. Conclusion

Since independence, development of power sector has primarily been the responsibility of the Government. However, considering the large requirement of funds for the sector, it is not possible to mobilize adequate financial resources by the Government alone. Electricity Act 2003 encourages private participation in power generation and throws open for competition, which in turn puts the power sector in the path of reforms.

To exploit unevenly distributed energy resources in India, efficiently and in an optimum manner, the formation of national power grid with large capacity of inter-regional power transfer is necessary. Transmission Super Highways are necessary for the formation of high capacity National Power Grid.

Major problem lies in reforms of distribution sector. Proper implementation and execution of APDRP will result in overall improvement in distribution and supply of good quality power at optimum cost.

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