National Journal of Multidisciplinary Research and Development
ISSN: 2455-9040
Impact Factor: RJIF 5.22
www.nationaljournals.com
Volume 3; Issue 1; January 2018; Page No. 275-278

Evolution of Indian power sector at a glance

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Abstract
This paper gives a glance into power sector of India. It encompasses all three sectors of power: generation sector, transmission sector and distribution sector. In all three sectors, industry has seen a major change, firstly from private sector to public sector then back to private sector. Though, the dominance is with public sector only in todays' world. This work focuses on the present status of Indian power sector along with its evolution. Dominance of SEBs over transmission sector is discussed with their reason of shortfall. The current potential of generation, transmission and distribution sector has been showcased here. Observing the present status, it seems that power sector needs more advancement & development to thrive further boosting the economic development of the country.

Keywords: power sector, generation capacity, SEBs

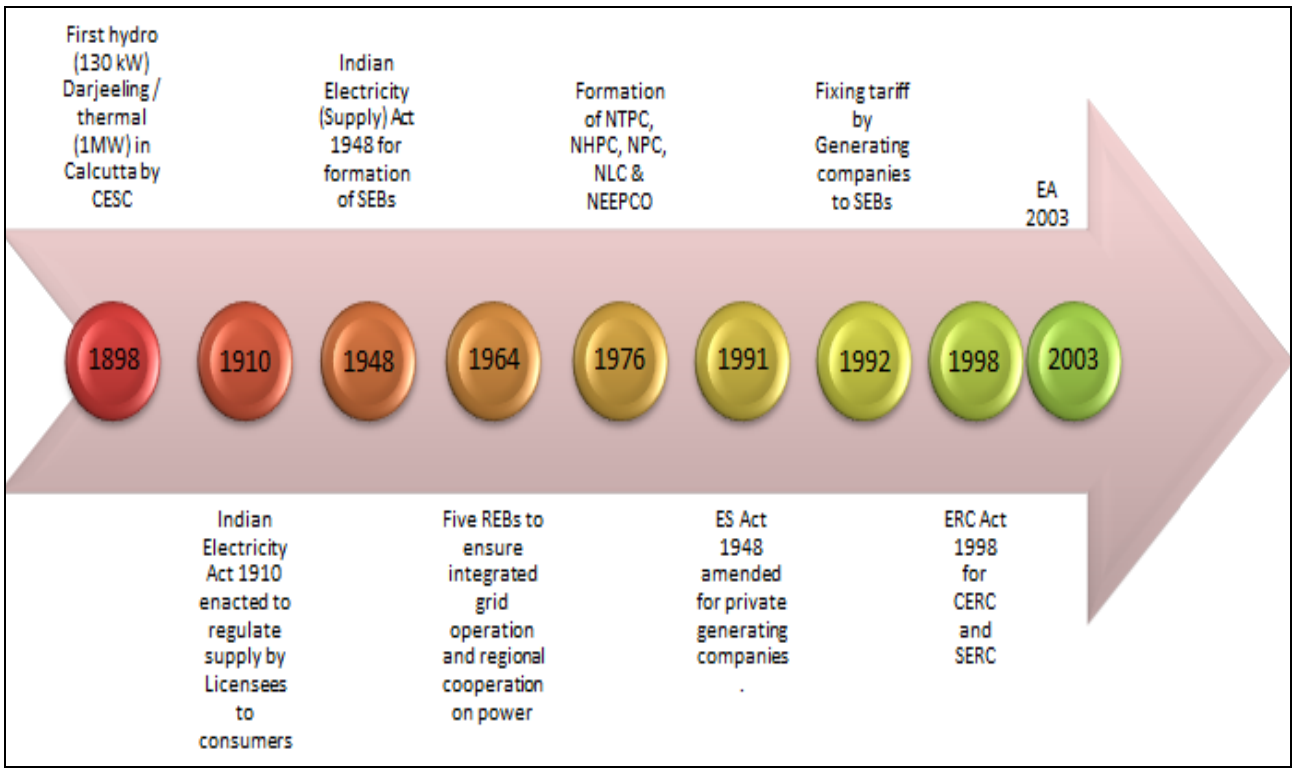
Introduction

Power sector is one of the pillars of growth of the country. The country can't sustain even a single minute without power. Power sector has the onus of the sustainable growth of all other industries also (Bhattacharyya, 2007) [1]. Power sector in India works under the Ministry of Power. Power sector is composed of three main sectors, which are generation, transmission and distribution. Further, generation sector is run by Central sector, State sector and Private sector (Singh *et al*., 2016) [17]. As continuing from the time of independence, power sector was being run purely as a government sector by State Electricity Boards (SEBs). These companies never recognized the importance of the sound commercial exercise and need of applicability of service marketing concepts in their processes to progress leaps and bounds. They were being operated with stagnant growth. But in 1991, era of power sector reforms came which brought some private companies into the field. Government permitted some of the Multi-National Corporations (MNCs) like Enron to create their own power generating stations.

Arrival of private players in the field of power sector lowered down the gap between demand and supply. Their arrival infused the competition in the market regarding the cost and quality of power (Saini, 2018[a], 2018[b], 2018[c], 2018[j], 2018[k]; Beniwal, 2018[a], 2018[b]) [9, 10, 11, 22, 23, 24, 25, 28]. The competition put emphasis on the service quality as the key parameter to be considered for the growth of power sector and enhancing the accessibility of people to electricity (Saini, 2018[d], 2018[e]) [12, 13]. Moreover, smart power system came in vogue with various benefits (Kumar 2018[a], 2018[b]; Sumit, 2018; Saini, 2018[l]) [25, 27, 26, 9, 10, 29]. And analysis of quality of supply also became the point of research for many researchers (Kapoor, 2011, 2007, 2013; Saini, 2018, 2017, 2013) [2, 3, 6, 8, 18, 26]. Consumers became more aware regarding their rights to be supplied good quality and quantity of electricity (Saini, 2018[f]) [14].

After independence, power sector in India has witnessed a momentous development. At the time of independence in 1947, the country started with power generating capacity of Meagre 1362 MW. Whole power generation was dependent on hydro and thermal sources. The entire sector of generation of electricity and its distribution had been ruled by private players. One of the notable private utilities that are still in existence is Calcutta

Electric. During that era, electricity was made available to only some urban areas, depriving the rural areas and villages of electricity. With the time, all power generation, transmission and distribution sector started to cater the needs of both urban and rural areas. Those companies were under the ambit of State and Central Government administration. State Electricity Boards came into existence. The public sector progressively laid emphasis on nuclear power in late sixties but still nuclear power development remained at slower pace. The concept of operating the power sector on a regional basis rather than state wise was infused in the power sector during early sixties for better coordination in overall power sector in India. Despite the several advancements, Indian power sector still lags in covering the gap between power supply and its demand.

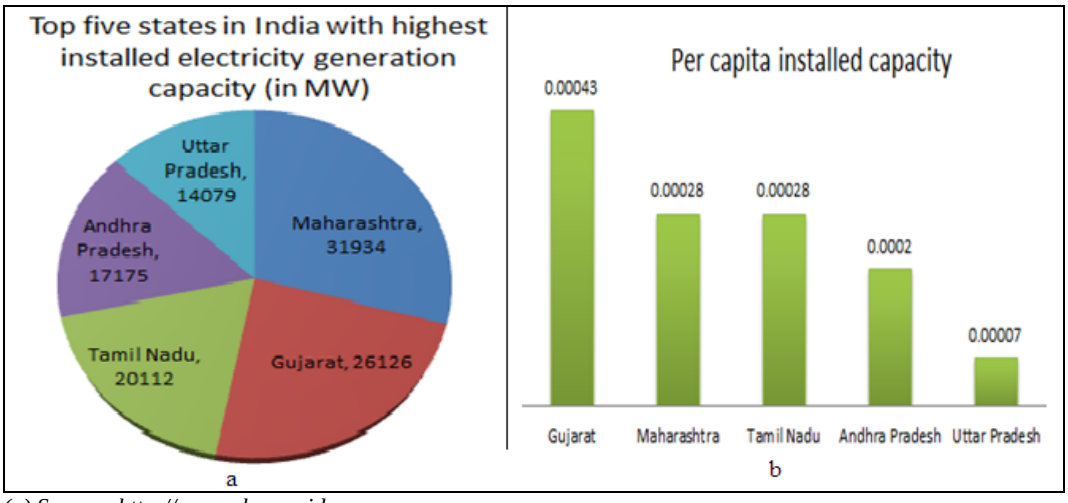


***Source*:** http://www.powersector.in/market-dynamics

Fig 1: Milestones achieved in the power sector

2. Evolution of Power Sector

Electricity is mainly a product of scientific and engineering developments of eighteenth and nineteenth century. There were many electro-scientific findings in starting of nineteenth century, when the major engineering research was made resulting in the development of electrical machines. This innovation made the production and distribution of significant amount of electricity possible. Immediately, the generation of electricity became feasible at power stations which made the dream of extensive electrification a reality.



(a) Source: http://greencleanguide.com
(b) Source for population data: Census 2011

Fig 2: Indian States having maximum installed generation capacity (a) Installed capacity (b) per capita installed capacity

P.W. Fleury & Co. gave the first demo of electric light in Calcutta in 1879. Electric lighting was seen in Mumbai for the first time in 1882 at Crawford Market. In India, Crompton & Co. set up first hydro-electric installation for the Darjeeling Municipality in 1896. On the other hand, Bombay Electric Supply & Tramways Company (B.E.S.T.) established an electric power station in 1905 to offer electricity for the tramway. In November, 1931, the meter device track between Madras Beach and Tambaram was electrified.

Indian power sector has seen many regulatory acts in the last

century. Prominent ones are shown in Figure 1. The Indian power sector was first governed by the Electricity Act, 1910. The Electricity Act 1948 was implemented after country got independent, but no significant results were there. Performance of power sector was deteriorating, developing the need to reorganize the Indian electricity sector. Numerous administrative changes were prepared since 1991, which brought dramatic changes in the power industry.

The evolution of electricity industry in India is categorized on the basis of government's regulations and policies into two categories: pre-reform and post-reform. Whereas, pre-reform phase (up to 1991) can be further divided into pre-independence (before 1947) and post-independence (after 1947 upto 1990) and post-reform phase (Prakash, 2009) [15]. In post-independence era, the Indian Government transferred the authority of power sector to the State Electricity Boards to uplift the power sector by adopting certain measures, for instance, growing the transmission cables network which were under-developed before that, and improving the generation capacity. But SEBs were performing miserably and started suffering losses due to many factors like political interference in SEBs' operation by their individual governments, misconduct, poor industrial relations, etc. (Kannan *et al*., 2000) [16].

3. Current Scenario

In today's context, power sector has achieved many heights but still couldn't reach the expected. Generation sector has progressed more as compared to transmission and distribution sectors. The share of different sources of energy in the electricity generation in India is as follows: 65% by thermal power plants, 22% by hydroelectric power plants, 3% by nuclear power plants and rest 10% by other different sources like solar, wind, biomass etc. 53.7% of India's commercial energy demand is met through the country's huge coal reserves.

The top five states with the highest installed electricity generation capacity are Maharashtra, Gujarat, Tamil Nadu, Andhra Pradesh and Uttar Pradesh. Their generation capacity has been shown in Figure 2(a). Maharashtra stands first in installed electricity generation capacity in India with 31,934 MW. Gujarat has second position having 26,126 MW generation capacity followed by Tamil Nadu, Andhra Pradesh and Uttar Pradesh. Further division of the total installed capacity into various sources of energy is presented below in Table 1. The total installed generating capacity can also be further categorized into State sector, private sector and central sector, as given in Table 2.

The State of Gujarat, Maharashtra and Tamil Nadu are industrially well developed. Consequently, electricity demand is also higher in these States as compared to other States. The per capita installed capacity shows the installed capacity corresponding to the population of the respective states. Gujarat is at the highest position in per capita installed electricity generation capacity followed by Tamil Nadu, Uttar Pradesh, Maharashtra, and Andhra Pradesh. All these five states contribute around 48% of complete electricity generation capacity. Still, there are many States which are lagging in the domain of power generation and distribution (Singh, 2006) [17]. In the distribution sector, companies are grappling with severe losses which are putting strain on financial stability of the companies (Saini, 2017, 2018[g], 2018[h], 2018[i]) [18-21]. There are many regulatory schemes, for instance, Rapid Accelerated Power Development and Reform Programme, UDAY scheme, 24*7 Power for All scheme, DDUGJY, IPDS and many more. Strict implementation of all the regulatory acts and rules has become the need of the hour for the incessant growth of the power sector.

Table 1: Share of sources of energy for States with highest installed generation capacity (In MW)

Type	Maharashtra	Gujarat	Tamil Nadu	Andhra Pradesh	Uttar Pradesh
Coal	19,939	15,738	8,476	8,573	10,523
Gas	3,476	4,979	1,026	3,370	550
Diesel	–	17	412	37	–
Nuclear	690	559	524	276	336
Hydro	3,332	790	2,182	3,735	1,847
RES*	4,497	4,042	7,491	1,184	824
Total	31,934	26,126	20,112	17,175	14,079

*Renewable Energy Source

Table 2: Different power sector areas for States with highest installed generation capacity (In MW)

Sectors	Maharashtra	Gujarat	Tamil Nadu	Andhra Pradesh	Uttar Pradesh
State	12,269	6,887	7,594	9,050	5,472
Private	13,038	15,590	8,687	4,968	3,649
Central	6,627	3,650	3,830	3,157	4,958
Total	31,934	26,126	20,112	17,175	14,079

4. Conclusion

Power sector is one of the sectors which are elementary for the growth of country. The power sector in India has achieved many milestones since its inception. The power sector was earlier in the hands of private players but after independence, the power sector in the country came under public sector. SEBs were established to make the power sector achieve new heights. But the political dominance, obsolete management and many other factors lead to decline in the growth of the power sector. This led to emergence of regulatory reforms in the power sector which brought new concepts in this field, say, private investments, management aimed at better service quality, more accessibility to power, high competition in the market, etc. All these regulatory changes upgraded the power sector and today many States in India are having the well strengthened power sector. Due to some reasons, even today there is less accessibility to the power in few areas which demands the enforcement of different regulatory policies enacted by the State and Central Government.

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