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DEVELOPMENT OF POWER SECTOR IN INDIA: A BIRD'S EYE-VIEW

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ABSTRACT

The electricity is one of the most vital infrastructure for national economic development particularly for a developing country like India. The pace of growth and development of our economy depends very much on the development of electricity generation. The demand for electricity in our country has been enormous and it is increasing year after year. The growth of our economy and the living standards of our people are ultimately measured by the quantum of electricity consumed. It is an important index of the economic development of our country as various sectors such as agriculture, industry, service, health, transportation, education etc. heavily depend upon it. Therefore, the government has to do its best constantly to improve the supply system of electricity, as in turn it would decide the future growth of our country. The production of Electricity is a basic indicator of a country's size and level of development in all spheres. Some countries are exporting electricity on a massive scale and others are importing it on a large scale. People's standard of living depends on their use of energy in general and access to electricity in particular. It is a major factor on which the policy-makers have to seriously focus their attention and direct their efforts. Compared with several other countries of the world, India is lagging behind many in terms of production as well as per capita consumption of energy. The present paper reveals that, the development and capacity addition of power sector plan wise from independence to till date.

KEYWORDS

living standards, economic development, agricultural sector, electricity generation.

INTRODUCTION

The Development status of power sector in India is presented briefly in the present article. It covers the power generation system in the country, its installed capacity, additions to the installed capacity, generation of power, the supply demand gap and the strategies for the development of power in our country. Accelerating economic growth to achieve higher standards of living depends, among other things, upon the availability of adequate power and its supply at an affordable price. Unlike other commodities, electricity cannot be stored and preserved for future use. In other words, its generation and consumption have to be simultaneous and instantaneous. It is noteworthy that within the fraction of a second of clicking the power-switch, the consumer puts into motion an intricate transaction involving a power generation company (like the NTPC), a power transmission company (like the POWERGRID), and a bulk power-purchaser and retail distributor (like the DVB). The unique features of power as a commodity or service make the dynamics of its supply and demand difficult to manage. Installing, power generation, transmission and distribution, together form a complex, time consuming and expensive process.

Power is among the most capital-intensive of infrastructure sectors. It is an essential input for economic as well as human development. We cannot imagine the development of any economy or its economic prosperity today without power. It has become indispensable to our everyday life. The Government of India has been assiduously trying to foster its development by realising the paramount importance of the power sector in the present day complex world. Several measures have been taken up in that direction during the last 6 decades since dawn of independence to our country. Greater care has been taken to provide policy as well as financial support to the power sector development. It falls much short of the demand for it, which has ever been increasing though power generation has been considerably augmented with lot of investment year after year. Increasing the installed power capacity from 1362MW at the time of independence to over 1,00,000 MW and electrification of more than 5,00,000 villages is certainly an impressive performance, but much less than what is required. It is a matter of some concern that the annual per capita consumption of power in India is about 350 KW, which is among the lowest in the world.

A large number of villages still remain without the power facility even after 60 years of independence. Those who have the facilities of electricity, they face a lot of problems. The problems are because of the following factors:

1. Inadequate power generation capacity;
2. Failure in optimum utilization of the generation capacity;
3. Lack of inter- regional transmission linkages;
4. Age-old substations and inadequate transmission and distribution network;
5. Outdated power storage and supply systems, which cause frequent power cuts and failures;
6. Indiscriminate and irrational tariff structure;
7. Widespread theft of power and leakages in its distribution;
8. Crawling rural electrification;
9. Lack of proper grid discipline and,
10. Irrational use of electricity by the consumers of all categories.

All the above factors are widespread in our country crippling the economy. These Problems have persisted despite the several measures by the government to improve the existing system. No doubt the government of India has developed appropriate strategies to mitigate the problem as much as possible and eliminate them altogether.

PLAN-WISE ELECTRICITY INSTALLED CAPACITY

The electricity installed capacity in India plan-wise is presented in Table No 1.1. The table reveals that during the pre plan period the major share of the installed capacity were held by the Thermal power sector accounting for 67.37 per cent followed by the Hydro 32.65 per cent. In the fourth plan end the Thermal sector accounted for 54.36 per cent followed by the hydro 41.80 per cent and Nuclear 3.84 per cent. It is clear from the below table that the installed capacity of the Thermal is increasing during the period.

TABLE NO 1.1: ELECTRICITY INSTALLED CAPACITY IN INDIA PLAN-WISE (in MW)

Plan	Thermal	Nuclear	Hydro	Total	Growth Rate
31.12.50	1153(67.35)	0	559(32.65)	1712	-
1 st Plan End	1825(63.23)	0	1061(36.77)	2886	68.57
2 nd Plan End	2736(58.80)	0	1917(41.20)	4653	61.22
3 rd Plan End	4903(54.31)	0	4124(45.69)	9027	94.00
4 th Plan End	9058(54.36)	640(3.84)	6965(41.80)	16663	84.59
5 th Plan End	15207(56.99)	640(2.41)	10833(40.60)	26680	60.11
6 th Plan End	27030(63.47)	1095(2.57)	14460(33.96)	42585	59.61
7 th Plan End	43764(68.77)	1565(2.46)	18308(28.77)	63637	49.43
8 th Plan End	61912(72.16)	2225(2.59)	21658(25.25)	85795	34.82
9 th Plan End	76057(72.39)	2720(2.58)	26269(25.03)	105046	22.44
10 th Plan End	83266(71.57)	2720(2.33)	30335(26.10)	116321	10.73
11 th Plan End(MTA)	50757(81.37)	3380(5.42)	8237(13.20)	62374	53.36

Source: Ministry of Power, Govt. of India

TRENDS IN ELECTRICITY CONSUMPTION**PER CAPITA CONSUMPTION**

The per capita utilization of power in KWH. (Kilo Watt Hours, popularly known as Units) is one of the important measures of development of a country. Higher level of per capita consumption of power not only indicates higher growth rate but also higher production and consequently, prosperity. India with a per capita consumption of 300 ranks ninth among the zones in the capita consumption. The zones above India with per capita consumption of power (mentioned within brackets) are North American (12,800), Western Europe (5,400), Eastern Europe (4,200), Latin America (1,500), Far East (1,400), South-East Asia and Pacific (1,200), Africa (500), Middle East and South Asia (500). The Per capita consumption of developed and developing countries in units/KWH is presented in Table 1.2 given below.

TABLE NO.1.2: PER CAPITAL CONSUMPTION OF POWER IN DIFFERENT COUNTRIES

Developed Countries	K.W.H	Developing Countries	K.W.H
Canada	15666	Brazil	1,783
Sweden	15679	South Korea	1,649
United States	12878	Mexico	1,486
Luxemburg	10,880	Egypt	787
Australia	9643	China	719
Japan	7432	Algeria	680
France	7,126	Pakistan	636
Germany	6,513	India	599
England	5,843	Kenya	189

Source: Ministry of Power

It can be observed from the Table that developed countries have a per capita consumption of above 5,000 KWH. Just as India is way behind the developed countries in per capita income, in per capita consumption of electricity is also behind them. The Per Capita consumption of power in the different States of India is presented in Table No. 1.3. In per capita consumption, Andhra Pradesh has taken the 8th place in the country. This level is just above the national average of 567 units. It goes without saying that there is needed to improve the per capita consumption further to achieve a better place of progress in the state.

TABLE 1.3: PER CAPITA CONSUMPTION - STATE WISE AS ON 31-3-2003 (in KWh)

Rank	State	Per Capita Consumption KWh
01	Delhi	1426
02	Punjab	1227
03	Gujarat	1193
04	Haryana	997
05	Maharashtra	848
06	Tamil Nadu	815
07	Chandigarh	676
08	Andhra Pradesh	673
09	Karnataka	611
10	Himachal Pradesh	559
11	Jammu & Kashmir	592
12	Rajasthan	566
13	Madhya Pradesh	520
14	Orissa	470
15	Jarkhand	468
16	Uttaranchal	464
17	Kerala	378
18	West Bengal	367
19	Meghalaya	336
20	Utter Pradesh	316
21	Mizoram	300
22	Sikkim	247
23	Tripura	227
24	Manipur	206
25	Assam	160
26	Nagaland	139
27	Arunachal Pradesh	132
28	Bihar	82
	All India Average	567

Source : Ministry of Power.

TABLE 1.4: PATTERN OF ELECTRICITY CONSUMPTION – ALL INDIA (%) (1960 to 2004)

Year	Domestic	Commercial	Agricultural(L.T+H.T)	Industry	Others
1960-61	10.80	5.16	9.08	72.76	2.20
1970-71	8.17	5.83	18.44	65.44	2.12
1980-81	10.70	4.23	18.44	63.07	2.59
1990-91	12.79	3.16	38.62	39.03	4.22
2000-01	21.71	4.54	40.78	22.84	6.74
2001-02	22.89	4.78	41.53	20.94	6.57
2002-03	22.06	4.85	39.42	21.39	8.43
2003-04	21.12	4.87	37.07	25.90	8.30
2005-06	24.30	8.70	21.90	36.80	8.30
2006-07	24.40	8.80	21.70	37.60	7.50
2007-08	24.00	9.20	20.60	37.50	8.70
2008-09	24.70	10.20	20.40	37.10	7.60
2009-10	24.90	10.40	21.00	36.70	7.00

Source: Ministry of Power

The electricity consumption pattern in India is presented in Table No. 1.4 given above. It gives a clear picture of the consumption pattern of power among various categories of consumers in the state. During the year 1960-61 the lion's share of power was consumed by the industry, accounting for 72.76 per cent followed by the agricultural sector 9.08 per cent, Domestic 10.80 per cent, commercial 5.16 per cent and the others 2.20 per cent. During these 40 years of existence of the power sector, there is a lot of change in the pattern of power consumption. During the year 2003-04 the lion's share went to the agricultural sector accounting for 37.07 per cent, followed by domestic 21.12 per cent, industry 25.90 per cent etc. Though the major share of power was consumed by the agriculture sector, it brought little revenue as power supplied to it was subsidised. Arrears are pending from the consumers, despite the concession shown.

POWER SUPPLY MECHANISM

The electricity is distributed to consumers through High Tension and Low Tension power lines just as water is distributed by local bodies from water tanks and reservoirs to consumers through pipelines and taps. The water can be stored and supplied at one's convenience, whereas the power generated has to be consumed simultaneously and there can be no storage of power. Distance between the generation station and distribution point should not be more than 600kms to minimise transmission losses. Hence, power plants have to be located at different geographical areas, and near to load centres.

CAPACITY ADDITIONS

The table No. 1.5 reveals that the target fixed for capacity addition during April 2011-15th January 2012 period and the actual achievement during the same period. The target fixed for the hydro sector was 1990.00 MW and its achievement was only 1181.00 MW. The target fixed for the thermal sector was 13611.00 MW, but it reached 11026.70 MW. The total capacity addition for all the sectors together was fixed at 17601.00 MW, but they could reach only 12207.70 MW. Very obviously, the target actually reached was just 69.4% a little above half of the target fixed, discouraging all concerned.

TABLE NO. 1.5: ALL INDIA CAPACITY ADDITION (TARGET AND ACHIEVEMENT) DURING APRIL 2011-15TH JANUARY 2012

Sector	Thermal		Hydro		Nuclear		Total		% to target
	Target	Actual	Target	Actual	Target	Actual	Target	Actual	
Central	3070.0	2820.0	655.0	0.0	2000.0	0.0	5725.0	2820.0	49.3
State	4101.0	1537.2	165.0	81.0	0.0	0.0	4266.0	1618.2	37.9
Private	6440.0	6669.5	1170.0	1100.0	0.0	0.0	7610.0	7769.5	102.1
Total	13611.0	11026.7	1990.0	1181.0	2000.0	0.0	17601.0	12207.7	69.4

Source: Annual Reports of Ministry of Power, Govt. of India.

POWER GENERATION CAPACITY

Table No. 1.6 presented below gives detailed information about the electricity generating capacity of thermal, hydro, and nuclear sectors during 2008-09 to 2011-12 (April-December).

TABLE 1.6: ELECTRICITY GENERATING CAPACITY IN INDIA (Billion KWh)

Category	2008-09	2009-10	2010-11 (April-Dec)	2011-12 (April-Dec)	Growth (Per cent)
Power generation	771.551	811.143	598.244	653.446	9.23
Hydroelectric#	106.680	114.257	90.169	107.513	19.23
Thermal	640.876	665.008	484.860	517.116	6.65
Nuclear	18.636	26.266	17.854	23.790	33.24
Bhutan Import	5.358	5.610	5.360	5.028	-6.19

Source: Annual Reports of Ministry of Power, Govt. of India.

Excludes generation from hydro stations up to 25 Mega Watt (MW)

As the table shows, the generating capacity of the thermal sector shot up from 640.86 Billion KWh in 2008-09 to 598.244 Billion KWh in 2011-12. The hydro sector went up to 107.513 Billion KWh in 2011-12 from 106.680 Billion KWh in 2008-09, and the nuclear sector was slight declined 5.028 Billion KWh in 2011-12, starting from 5.358 Billion KWh 2008-09.

ALL INDIA PLANT LOAD FACTOR (PLF) AND T&D LOSS LEVELS

All India plant load factor and T&D loss levels in percentages is presented in Table No.1.7 covering from 2001-02 to 2009-10. It is observed that PLF as well as T&D loss level remained at unacceptable levels over the entire time period. The utilities were able to bill only one third of the energy purchased from various sources. It may be noted that T&D loss figures are taken from what was reported by the respective utilities, though the actual losses are much higher, as observed by many ERCs. Moreover, low recovery of des was also reported as a serious problem.

TABLE NO. 1.7: ALL INDIA PLANT LOAD FACTOR AND T&D LOSS LEVELS (%)

Year	Plant Load Factor (in per cent)	T&D Loss Level (in percent)
2001-02	70.00	34.00
2005-06	73.60	30.00
2006-07	76.80	29.00
2007-08	78.60	27.00
2008-09	77.20	25.00
2009-10	77.48	25.00

Source: Ministry of Power

The efforts of the Government of India are clearly visible when a close look is taken at the various parameters of power development in our country. It has already been noted more than once that accelerating economic growth and achieving higher standards of living depend upon the availability of adequate power at an affordable price and its reliable supply. Unfortunately, unlike other commodities, electricity cannot be stored to be used at a later date. Its generation and

consumption, as pointed already, have to take place simultaneously and instantaneously. Once the consumer switches on, he puts into motion an intricate transaction involving at the same time the power generation company, the power transmission company, and the bulk power purchaser and the retail distributor. Because of its unique features the dynamics of power supply and demand is anything but easy to manage.

The entire process of installing power generation, transmission and distribution is a complex exercise, time-consuming and expensive. Power has been placed in the list of concurrent subjects under the Indian Constitution with the Centre and the States both having jurisdiction over it. In the early years of independence, State Electricity Boards (SEBs)/State Electricity Departments were the sole utilities (except a few licensees in the private sector) responsible for generation, transmission and distribution of electricity. To supplement the efforts of the states in bridging the yawning gap between demand and supply of power, it was decided, in the mid-seventies, to set up generating stations and associated high/extra high voltage transmission lines in the Central Sector. Today, the states control about 60 per cent of the country's generation capacity, 70 per cent of the transmission network, and almost 100 per cent of the distribution system through well linked distribution network.

PROBLEMS CONFRONTING THE POWER SECTOR

Despite several measures taken by the Government, the Power sector continues to have its pressing problems. Though it has increased to installed power capacity from 1362 MW to over 100,000 MW since independence, and electrification of more than 500,000 villages, it is a matter of concern that the annual per capita consumption is at about 350 KW, which is among the lowest in the world. There are many households and a large number of villages even now which have no access to electricity as yet. The end users of electricity like households, farmers, commercial establishments, and industries etc, experience frequent power cuts, both scheduled and unscheduled. Power cuts, erratic voltage levels and wide fluctuations in the frequency of supply are among the several 'power woes' of consumers. They are resorting to captive power supply arrangements of various types ranging from 300 Mega Watts (industry) to 250 Watts (households). Almost every shop in an urban marketplace has a generator set. Most establishments have battery-operated inverters and diesel generation sets. Most urban households have voltage stabilizers for different appliances. In fact, the money spent by the domestic consumer on these standby power supply (DG sets/Inverters) and power-conditioning (stabilizers) arrangements could be among the highest in the world. The same money could be more gainfully invested through corporate investments in power generation, transmission and distribution with assured returns on investments.

The major reasons for inadequate, erratic and unreliable power supply in the country are the following:

1. Inadequate power generation capacity;
2. Lack of optimum utilization of the existing generation capacity;
3. Inadequate inter-regional transmission links;
4. Inadequate and ageing sum-transmission & distribution network leading to power cuts and local failures/faults;
5. Large-scale theft of power and skewed tariff structure;
6. Slow pace of rural electrification; and
7. Inefficient use of electricity by the end consumer.

Notwithstanding these inadequacies and shortcomings, the power sector has certain positive aspects, which have to be fully utilised. The following are the strengths and opportunities in the sector, which deserve to be given, serious attention:

- Abundant coal reserves in the country (enough to last at least another 200 years), to generate thermal power;
- Vast hydroelectric potential (150,000 MW);
- Large pool of highly skilled technical personnel;
- Impressive power development in absolute terms (comparable in size to those of Germany and UK).
- Expertise in integrated and coordinated planning (CEA and Planning Commission);
- Emergence of strong and globally comparable central utilities (NTPC, POWERGRID);
- Wide outreach of state utilities;
- Enabling framework for private investors;
- Well laid out mechanisms for dispute resolution;
- Political consensus on reforms; and
- Potentially, one of the largest power markets in the world.

The Central Government which has been endeavoring against odds to meet all the power needs of the country has set for itself the following objectives:

- To provide 'Power on Demand by 2012';
- To make the sector commercially sound and self-sustaining;
- To provide reliable and quality power at an economic price;
- To achieve environmentally sustainable power development; and
- To promote general awareness to achieve consensus on the need for reforms.

STRATEGIES

In order to achieve the above mentioned objectives, and also to tone up the performance of the power sector as it is at present, the Centre has designed and initiated certain viable strategies which have been evolved after a comprehensive, integrated and realistic assessment of the strengths of the sector and of all the challenges confronting it. The process has led to a range of mutually interdependent and complementary strategies to counter the challenges and exploit the strengths/opportunities available.

The strategies integrate the imperatives of supply with those of managing demand, short and medium term measures with long-term action plans, operational measures within situational and structural changes. The objectives laid down can be realized only if all stakeholders in the power sector effectively implement the plan. Power is a concurrent subject under Indian Constitution. The States have the greater share of generation and transmission assets and almost the entire distribution under their control. They would need to play a very proactive role in effecting institutional and result oriented changes. Many strategies outlined in the document are inter-linked and are mutually supportive in terms of addressing the problems faced. However, they are classified subject-wise for the purpose of this document.

GENERATING AFFORDABLE POWER

With increasing prices of fuels and cost of installations, the cost of power generation has significantly increased. While attending to the stupendous task of doubling the country's generation capacity by 2012, high priority is to be given to reduce the cost of power to enable the different segments of population and the economy to effectively utilize power as an input. In order to recommend suitable strategies to reduce the cost of power, an Inter-Disciplinary Group of Experts was constituted. The Group has submitted its Report. The implementation of a number of strategies outlined in the Report would help in cost reduction efforts and provide affordable power to the consumer. Benchmarking in project costs, adoption of best practices, and choosing least cost options in capacity addition are going to be promoted. Competitive bidding will be adopted as a transparent and cost reducing approach. Already the Ministry has ensured that its PSUs post all their tenders on websites. Some State power utilities have also done so.

SUSTAINABLE POWER DEVELOPMENT

Concern felt regarding pollution and the none-too-easy disposal of the large amount of ash from coal-based power stations, which are the mainstay of the country's power generation, are being addressed through strategies to promote environmentally sustainable power development. The useful recommendations of the Fly Ash Mission of the TIFAC are to be implemented. The Ministry is taking steps for making the use of fly ash mandatory for road and bridge construction, as well as for construction of Government buildings. Fiscal incentives to supplement the market mechanism for taking up production and promotion of fly ash products are also envisaged. All Central utilities have been advised to adopt ISO 14001 standards. Afforestation is being given major

emphasis and a Special Purpose Vehicle (SPV) is being set up for afforestation. Introduction of super critical technology and clean coal technologies is also planned to generate power with maximum efficiency and minimal pollution. The Ministry is taking environmental initiatives in keeping with global developments and mechanisms. Thus, the Ministry is striking a fine balance between power development imperatives and the emerging concern for environment.

UPGRADING TECHNICAL EFFICIENCY

To make the power sector truly efficient and competitive in the changing scenario, steps have already been taken to impart greater thrust to research and development, the training of human resources in the power sector and adoption of progressive management practices and tools (including IT). The Personnel in the sector are also being educated about their changed roles in the power reform setup. Commercialisation of the sector is also being emphasised.

A Standing Committee on Research and Development has been constituted to draw up a Perspective Research and Development Plan to ensure optimum utilisation of the infrastructure and provide a standing forum for R&D activities in the power sector. Another Committee has been set up to formulate a 'National Training Policy for Power Sector' and to develop a national level action plan for training of the power professionals to align their skills and mindset to the changing requirements. Integration of training facilities available in the sector is also planned to optimize their utilization. The Ministry is planning to recast the role of the Central Electricity Authority (CEA) to enable it to effectively perform the role expected of it in the new environment

CONCLUSION

The pace of growth and development of our economy depends very much on the development of electricity generation. In India most of the power consumption is by the agriculture sector, where the rate of revenue is very low. Expanding the supply of electricity to meet the growing demand of ever increasing urbanized Indian economy without incurring unacceptable costs, is a major challenge to it. After independence, the government operated the power supply industry in India. Given the essential nature of service and its applicability to all sections of society, political groups took active interest in the sector and influenced the policy and decision-making process. It was noted that the utilities lacked professionalism and a commercial outlook. Though government allocated adequate budget to increase installed capacity however, no adequate attention was rendered to increase operational efficiency in the pre-reform period. High T&D losses, low recovery of dues, highly subsidized consumer tariff resulted into huge revenue losses and ultimately led to financial. Regular supply of power with required quality would in fact gain the confidence of consumers and facilitates overall economic development of the country in various dimensions.

The power sector reforms were initiated to overcome the technical and financial problems.

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