

# Study of Indian Power Sector for Planned Power Capacity

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**Abstract -- Indian Power Sector is consistently facing multiple challenges of fund availability, fuel linkages, land acquisition, environmental clearances, poor management practices of erstwhile State Electricity Boards, delivery schedule for the equipments, inadequately trained manpower. The power sector role in the overall growth of the economy is increasingly becoming important and critical. Any slowdown in its performance severely impacts GDP growth of the country as a whole.**

This paper critically analyses various factors for failures to achieve capacity addition targets from the first five year plan to eleventh five year plans which have adversely affected the growth of power sector and recommends effective measures to be initiated in terms of efficient governance of this sector as a whole so as to put back the power sector on the fast track of development with efficiency and effectiveness. To have an economic growth of 8-10%, it is essentially required that electricity sector too correspondingly grow in the range of 6-8 % y-o-y. The current slowdown in the economy which is the slowest in the last decade is also driven by poor electricity sector performance as a whole. The Power Sector is plagued with mounting commercial losses due to various inefficiencies, high aggregate technical & commercial losses and increasing subsidy burden on the states. These issues have had a very detrimental effect on the overall economic growth of the country.

*Keywords:* .Planned Generation Capacity, Power Sector Growth Challenges

## I. INTRODUCTION

THE first legislation regarding electricity sector came in 1887. The Act was to regulate the Generation, Supply & use of electricity and provided protection of person and property from injury and risks from electric supply and use of electricity for lighting & other purposes. This Act was repealed by Electricity Act 1903 and subsequently to a more comprehensive Indian Electricity Act 1910 which became the basic framework of the Indian power sector.

Shortly after independence Electricity Act (1948) was introduced. This act governed the development of electricity on a regional basis and provided for the rationalized of generation and supply of electricity. State Electricity Boards \*(SEBs and Central Electricity Authority (CEA) was established.

The development of Generation, Transmission and Distribution was entrusted to SEBs whereas the CEA was to formulate Policies for the power Sector. The acts of 1910, 1948 and the electricity Regulatory Commission Act 1998 were repealed by the Electricity Act 2003 enacted in June 2003. Electricity Act, 2003 was enacted to consolidate the laws relating to generation, transmission, distribution, trading and use of electricity and for development of electricity industry by promoting competition, protecting consumer interest and supply of electricity to all areas, rationalization of electricity tariff, ensuring transparent policies with regard to subsidies and promoting of efficiency. Major areas where transformation is sought and impacts are expected: power trading, role of regulator in the new regime, issue of open access, empowerment of the consumers and the environmental issues.

The Indian electricity sector is governed by both the states as well as the Central Government being in the concurrent list at entry no. 38, list III of 7th schedule of the constitution of India. Therefore, both the state and central government are equally responsible for bringing the desired interventions in policies and regulations so as to ensure growth of this sector as a whole.

## II. PLAN WISE GROWTH IN INSTALLED GENERATION CAPACITY

A study of the plan wise actual installed capacity vs target set indicates that there have been repeated failures in achieving the targets:

*First Plan 1951-56:* The total installed generating capacity in the country at the beginning of the First Plan stood at 2.30 million kW. 0.63 million kW in State-owned public utilities, 1.08 million kW in company-owned public utilities and 0.59 million kW in industrial establishments having captive power stations.

During the First Plan, the aggregate installed generating capacity increased by about 49 per cent, the actual addition being 1.12 million kW, as against the target of 1.40 million kW. The capital cost per kW of installed capacity of 120 MW units is about 20 percent cheaper than for 30 MW units. The overall efficiency of thermal power stations was 19.5 percent because many of the units were small and old.

TABLE 1 - INSTALLED CAPACITY

Five Year Plan	Target (MW)	Achievement (MW)	Installed capacity (MW)	Per Capita Consumption (KWH)
1st (1951-56)	1300	1100	2886	30.9
2nd (1956-1961)	3500	2250	4653	45.9
3rd (1961-1966)	1040	4520	9027	73.9
4th (1969-1974)	9264	4519	16664	126.2
5th (1974-1979)	12499	10202	26680	171.6
6th (1980-1985)	19666	14226	42585	228.7
7th (1985-1990)	22245	21401	63636	329.2
8th (1992-1997)	30533	16423	85795	464.6
9th (1997-2002)	40245	19015	105046	559.2
10th 2002-2007)	41110	21130	132329	671.9
11th 2007-2012)	78000	54964	199877	884

*Second Plan (1956-1961):* During the Second Plan, generating capacity increased by about 67 per cent from 3.42 million kW to 5.70 million kW. Against the initial target of 3.48 million kW, the actual addition was 2.28 million kW.

The shortfall was because of foreign exchange difficulties that arose during the early years of the Second Plan and also because of delays in the execution of the projects such as Rihand, Bhakra-Nangal and Hirakud.

*Third Plan (1961-1966):* To avoid conditions of severe power shortage in the early years of the Third Plan, measures were taken to arrange and provide foreign exchange for implementing the remaining power schemes of the Second Plan, which had earlier been classified as "non-core" projects. Work was also taken up on a few additional power schemes which were not originally included in the Second Plan with a view to meeting increased demands that arose in certain regions during the Second Plan. Preliminary work commenced on selected Third Plan schemes during the last year of the Second Plan.

The target for the Third Plan was 12.69 million kW capacity addition. However the actual capacity commissioned was 10.17 million kW. The outbreak of war and in 1962 and 1965 and other factors delayed the implementation of the projects. Power supply at the end of the Third Plan remained unsatisfactory. During the three Annual Plans priority was accorded for the completion of the projects which were in advanced stages of construction.

*Fourth Plan (1969-1974):* During the 3rd plan, average annual growth rate of generating capacity was 12.5 % and 12.6 % during the three Annual Plans

A. Number of schemes of power generation fell behind schedule during the Second and Third Plan periods.

Against a target of 6.9 million kW of capacity addition for 1960-61, the actual capacity commissioned was 5.65 million kW. This led to power cuts and a staggering of loads in some regions.

B. About 4.12 million kW of generating capacity, nearly equal to the total added during the Third Plan, was added between 1966 and 1969. This appreciable addition, coupled with a slower rate of growth in demand, has made the power position at the beginning of the Fourth Plan on the whole satisfactory except for marginal shortages in some areas. Arrangements were made to transmit surplus energy from the adjoining States to the deficit areas.

*Fifth Plan (1974-1979):* In the 4th Plan an additional 4280 MW of generating capacity was added, taking the installed capacity to 18456 MW. In the first two years of the 5th Plan 3524 MW were added. Out of the projects which were under implementation, generating capacity of about 6000 MW was still under construction at the end of the 5th Plan.

Experience indicated that management and techniques of construction and monitoring, were needed to be considerably improved. In finalizing the 5th Plan for Power, emphasis was placed on the completion of on-going schemes as expeditiously as possible. The power position in northern and eastern regions was comfortable. But western and southern regions were facing both peaking and energy deficits.

In recommending outlays, the latest cost of each generation project, status of progress of major items of works, delivery schedules for the equipment and any other constraint likely to be faced in implementation were all taken into account. Particular consideration was also been given to infra and inter-State transmission lines, setting up and strengthening of regional load dispatch centers, and investments on distribution.

Transmission and distribution losses were expected to be reduced. The need of schemes covered by external assistance was kept in view.

*Sixth Plan (1980-1985):* At the end of March 1980, generating capacity totaling 29,665 MW had been sanctioned and the projects were in different stages of construction. Of this, 19,666 MW was commissioned during the period 1980-85 comprising 13,846 MW of thermal, 5130 MW of hydro and 690 MW of nuclear units. .

As would be apparent from these figures, the bulk of the addition was thermal by the end of the Sixth Plan, the proportion of thermal units in the total installed capacity increased to 65%. The commissioning programme was predicated on the maintenance of delivery schedules by the manufacturers and availability of cement, steel, etc. Arrangements for monitoring the progress of the projects and flow of materials were made.

Considering the deleterious impact of power shortage on the productive sectors of the economy, the objective had been to achieve a balance between supply and demand in as short a time as possible. The all-India consumption of electricity in 1984-85 was estimated at 148 TWh compared with the actual generation of 112 TWh in 1979-80. The average annual growth rate was 11.3 per cent during the Plan period. Considering the gestation lags in the construction of power projects, advance action had been taken to meet the power demand anticipated to arise during the Sixth Plan period.

The proportion of thermal generating units in the total installed capacity increased to 65 %. Over the years, the trend had been to install thermal generating units of increasingly larger capacity in order to take advantage of higher thermal efficiency and accelerate the rate of addition of new capacity. During the Sixth Plan, the overwhelming bulk of new thermal capacity accounted for by units of 210 MW each.

*Seventh Plan (1985-1990):* 80% of electricity was consumed in energy-intensive industries, such as aluminum, iron and steel, chemicals, fertilisers, cement, paper, textiles and collieries. The consumption of electricity per unit of product in the above industries is much higher than that in developed countries. Transmission and distribution losses were about 21 % whereas these were of the order of 6 % to 12% in the developed countries. As regards the power sector, poor capacity utilisation of the thermal plants vitiated the working of most utilities. There were also time and cost over-runs in implementing projects. The stabilization period tends to get elongated when Stations are handled by inadequately trained personnel.

The transmission and distribution facilities had not increased to the extent of additions to the installed capacities. Excessive manpower, huge inventories, high oil & coal consumption and

heavy arrears were indicative of poor management practices in the State Electricity Boards.

A decision was taken by the Government to set up an Energy Conservation Fund. The proceeds of this fund were utilised for carrying out conservation measures through studies, training, education and providing assistance in the implementation of different schemes

*Eighth Plan (1992-1997):* Direct use of coal in industry, household sectors etc. had been considered, excluding coal used in power generation. About 65% of the total quantity of coal consumed in the country was used as fuel for thermal power generation. In terms of primary energy consumption, the relative share of coal still continues to be significant.

The Eighth Plan programme envisaged a capacity addition of 30,538 MW. As against this, 16422.6 MW was added during the Eighth Plan.

The actual capacity addition of 16,422.6 MW during the Eighth Plan is about 46 % less than the targeted addition and 23.26 percent less than the capacity added during the Seventh Plan. The slippages in the case of hydel capacity were as high as 73.8% of the target. The sector-wise percentage slippages were: Central 36.6%, State 54.0 % and Private 49.4%. The achievement of 16422.6 MW during the Eighth Plan period represented an addition of 3284.6 MW per annum, compared to the targeted growth rate of 6108 MW per annum.

The main reasons for the shortfall in capacity addition were inadequate funding of the State as well as the Central sector projects, procedural delays mainly in land acquisition and environmental clearances, unresolved issues in fuel linkages, contractual failures, suspension of World Bank support and problems/delays in entrusting the projects to the executing agencies.

A number of improvements were suggested by an Expert Committee constituted immediately after the formulation of the Seventh Plan to facilitate increased coal production from Bihar and West Bengal. These included the setting up of captive power plants in the coal mining areas in the region. These projects which were to be commissioned in the Seventh Plan had slipped into the Eighth Plan.

*Ninth Plan (1997-2002):* The actual capacity addition during the Ninth Plan was 19,015 MW against a target of 40,245 MW. The other major reasons for shortfall in the capacity addition were delayed in land acquisition and environmental clearances, unresolved issues in fuel linkages, contractual issues, resettlement and rehabilitation (R&R) issues and law and order problems.

*Tenth Plan (2002-2007)*: As far as the Tenth Plan is concerned, the Working Group Report on Power had envisaged a capacity addition requirement of 46,939 MW during the Plan period. However, the Planning Commission assessed that a capacity addition target of the order of 41,110 MW (comprising 18,659 MW from on-going, 9,193 MW from projects cleared by the Central Electricity Authority (CEA) and 13,258 MW was feasible.

The Tenth Plan priorities included the achievement of a more optimal primary energy mix for the country. Hence the Tenth Plan proposed to raise the share of power sector investment in hydro, nuclear and renewable energy resources from the Ninth Plan levels.

The setting up of large hydel and thermal plants necessitated clearing of large tracts of land, affecting the lives of people, flora and fauna. Since displacement of people becomes unavoidable, the Government had evolved compensation measures.

Further where the States and Financial Institutions were in agreement about the need for development of IPPs, they were to work together to achieve financial closure at the earliest. Other actions as follows were also taken:

1. The Centre would facilitate the finalization of reforms based multi-parties agreements.
2. The evolution of a National Grid for inter-regional transfer of power needs to be taken up on priority.
3. Some provisions of the Forest Conservation Act were revised for expeditious completion of power and other projects

*Eleventh Plan (2007-2012)*: The Target capacity addition was 78000 MW, out of that power generation capacity added in the Eleventh Plan is 54964 MW as against the total capacity addition of 56618 MW in the 8th, 9th and 10th Plans taken together. In the year 2011-12, capacity addition of 20502 MW exceeded the target of 17601 MW, which is the highest ever annual capacity addition and is nearly equal to capacity added in the Tenth Plan. The issues of Fuel linkages, land acquisition, contractual problems, Power Purchase Agreements, Environmental and forest clearances and Financial closure were identified for slippage.

### III. CONCLUSION

The major reasons for not achieving the capacity addition targets include delay in the placement of orders for main plant equipment, delay and non-sequential supply of material for main plant and Balance of Plant, slow progress of civil works, contractual disputes between project developer and contractor and their sub-vendors / sub-contractors, poor geology, flash flood, delay in land acquisition, environmental concern,

shortage of manpower, law and order problems and difficult climate conditions.

Fuel availability has emerged as the biggest risk faced by thermal Power projects in India. Coal production has not kept pace with Power capacity addition in the current Plan and developers have been forced to import coal at a time when international coal prices have shot up. Lack of clarity on financing this extra cost as well as added transport costs for plants in the interior have led to uncertainty and reduced investments in Power. There is a need to remove uncertainties in the regulations to overcome these problems.

With coal-based capacity addition expected to account for over 50 per cent of total capacity additions in the upcoming 12th plan, the issue of acute shortage of domestic coal in the country and its impact on project economics due to higher prices of imported coal needs to be urgently addressed.

Poor Operational and Financial Efficiencies in Distribution sector is required to be addressed through bringing Competition in the sector by adoption of the distribution franchisee route, entry of private players and the public private partnership model and reduce AT&C losses by automation and IT Backbone development.

There is need to update tariff policy for moving towards cost-reflective tariffs free from governmental interferences. The Electricity Regulatory Commissions working needs to be independent in letter and spirit for ensuring their effectiveness.

An analysis of the actual growth in per capita real GDP and electricity generation estimated from the time series data since 1990-91 shows that elasticity of electricity consumption with respect to GDP is around 1.06 compared to 1.30 for the period since 1980-81 (Integrated Energy Policy, 2006) and is likely to reduce further during the forthcoming 12th, 13th Plan and 14th Plan as is the trend in other countries.

However, for India, the energy elasticity of GDP growth will fall very substantially as rising income levels will foster life style changes that are more energy intense. This means that 8% GDP growth will not be possible unless annual growth in electricity generation is around 8 % during the 10th - 14th Plans. This puts more challenges on policy makers for bringing the desired interventions for ensuring good governance, reduction in AT & C losses, Fuel supply linkages, faster and time bound clearances, incentives to investors, removing obstacles in land acquisition.

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