Changing Role of Central Generating Stations in Indian Power Sector

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1. INTRODUCTION

When India became independent in 1947, the country had a meagre power generating capacity of **1,362 MW**[1]. This increased to 1713 MW[1] as on 31.12.1950 consisting of 560 MW from Hydro and 1153 MW from Thermal Capacity (including coal and diesel). Only Hydro power and coal based thermal power were the main sources of generating electricity during those times. Power was available only in a few urban centers, rural areas and villages did not have electricity. The number of electrified villages stood at only 3061 as on 31.12.1950[1] and the per-capita consumption was just 18.17 kWh in 1950[1].

Power propels the growth of a nation. Realising this, Government of India laid great emphasis on the development of the power sector and kept in the concurrent list as enunciated in the Constitution of India with the States given the primary responsibility of power development in their jurisdiction. The **Electricity (Supply) Act, 1948**, provided an elaborate institutional frame work for the development of the power sector on a regional basis known as 'GRID SYSTEM'. The Act envisaged creation of Semi-autonomous bodies like State Electricity Boards (SEBs) for planning and implementing the power development programmes in their respective States. The Act permitted Generating Company formed by the Central Government or by any State Government or jointly by the Central Government and one or more State Governments. The private sector participation was subject to license which was provided by State Governments to operate in designated areas. The **Central Electricity Authority** constituted under the Act was assigned the responsibility of power planning and monitoring at the national level[2]. All the generation schemes were submitted to the Authority for Techno Economic Clearance. The erstwhile Planning Commission used to allocate funds for execution of these projects.

The development of this crucial infrastructure sector has been programmed in Five Years Plan periods. Five Year Plan sets out the programmes of development and also outlines general proposals and policies in each field of development giving weightage to different sectors of economy as per the demand of the situation. Corresponding fund and resource requirement were estimated and government policies and machinery were oriented to achieve the Planned targets.

State Governments were assigned the primary responsibility for the growth of power sector by setting up of State Electricity Boards, Generating companies, and their own distribution network.

2. DEVELOPMENT OF GENERATION CAPACITY IN INDIA

There has been a significant growth of Installed capacity (IC) since 1950. The IC has increased to 3,07,278.28 MW (as on 31.10.2016) [1] from meagre 1713 MW (as on 31.12.1950). The private sector has the highest contribution in the generation i.e. 42% as on 31.10.2016. The growth in IC has been predominantly from thermal power stations (Both Coal and Gas though aggressively from Coal based plants). Thermal capacity addition grew from mere 1153 MW in 1950 to 2,12,468 MW as on 31.10.2016[1]. The share of Hydro Capacity in the total Installed capacity has decreased to 14.03 % (as on 31.10.2016) from 32.69 % in 1950[1]. The contribution of Private sector has been dismal in the Hydro Power Capacity installation compared to State and Central Sector.

Sector-wise growth of IC over the different plan periods are depicted in Chart-1:

Sector-wise Growth of Installed Capacity over different Plans

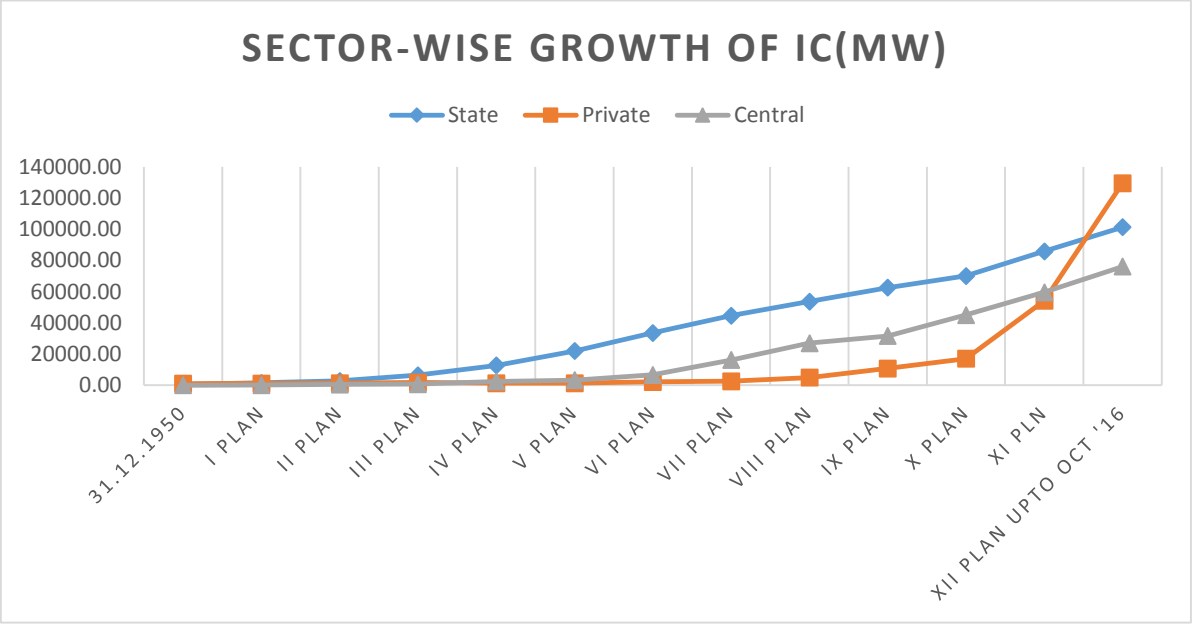

Chart 1: Capacity Addition during (I –XII) Five Year Plans

SOURCE: CEA

a. Growth during Initial years (I – IVth plan)(1951-1974)

As seen from Chart 2, capacity addition during the (I –IV) Five Year Plans, State sector played a leading role in Generation capacity installation. Electricity(Supply) Act,1948, had enabled such a scenario where State Electricity Boards were responsible for the overall development of power sector in each state and ensured Generation Capacity addition by setting up of power plants on their own. It can also be seen that private sector investment in power sector had almost dried up due to the license regime enabled by Electricity(Supply) Act ,1948.Central sector investment in previous years of II and III Plans had begun to yield benefits as well but played a secondary role in Capacity Installation.

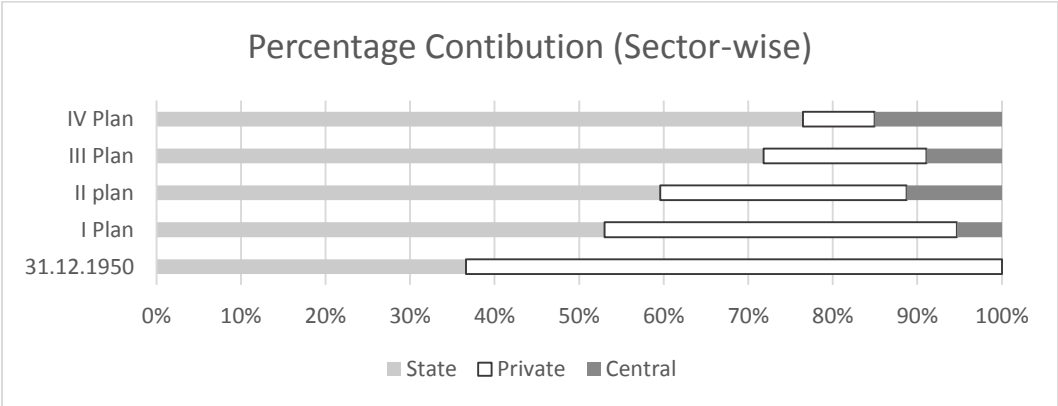

Chart 2: Capacity Addition during (I –IV) Five Year Plans

Despite a stellar performance by State sector in Capacity Installation, the peak and energy deficit remained almost constant. For India to grow at a higher rate, it was felt that Generation capacity needed to be augmented so that the per-capita energy availability could be increased and energy deficit could be brought down. The performance as well as problems faced by SEBs were analyzed. It was felt that the large Generation Capacity addition requires dedicated resources and huge fund requirement which were difficult for the SEBs to arrange due to their financial position.

b. Growth during Middle years (V – IXth plan)(1974-2002)

The recognition of inadequate resources in the State led to setting up Central Generating Companies to supplement the effort of State Governments to meet their power requirement. The National Thermal Power Corporation (NTPC) was formed for setting Thermal Power Plants, National Hydro Power Corporation (NHPC) was formed for setting Hydro Power Plants in 1975 and for the development of North Eastern Region NEEPCO was formed in 1976. As represented in the Chart(below), the share of Central Sector in the total Installed Capacity had started growing at a rapid pace after end of IV Five Year Plan(after establishment of NTPC,NHPC) as compared to the previous plan periods. Subsequently two more power generation corporations were set up in 1988 viz. Tehri Hydro Development Corporation (THDC)[5] and Satluj Jal Vidyut Nigam(SJVN)[6]. NPCIL was registered as public limited company in 1987 [7] with the objectives of operating atomic power plants and implementing atomic power projects for generation of electricity in pursuance of the schemes and programmes of the Government of India under the Atomic Energy Act, 1962[4] .The Central Sector share increased to around 30 % share from 15% at the end of IX plan.

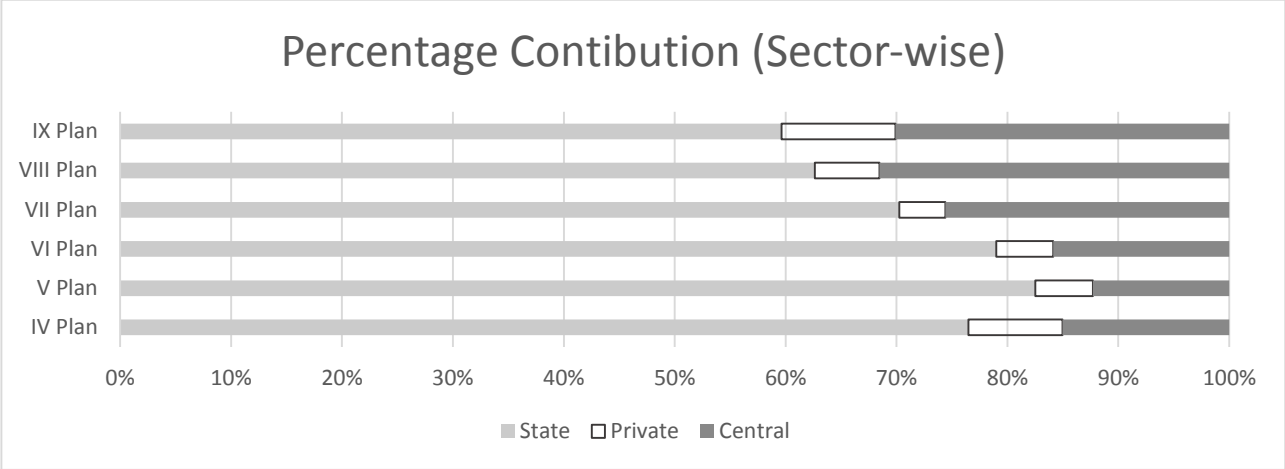

Chart 3: Sector-wise Share of Installed Capacity during(IV-IX) Five Year Plans

c. Growth during recent years X – XIIth Plan (2002-till 31.10.2016)

As represented in the Chart(below), the share of Private Sector in the total Installed Capacity has increased to around 42.18% during XII Plan (as on 31.10.2016) from 11% at the end of IX plan. This was due to enabling provisions of Electricity Act,2003 in which setting up of thermal power plants was delicensed. The dominance of Central Sector Generating stations in the power generation sector got reduced substantially.

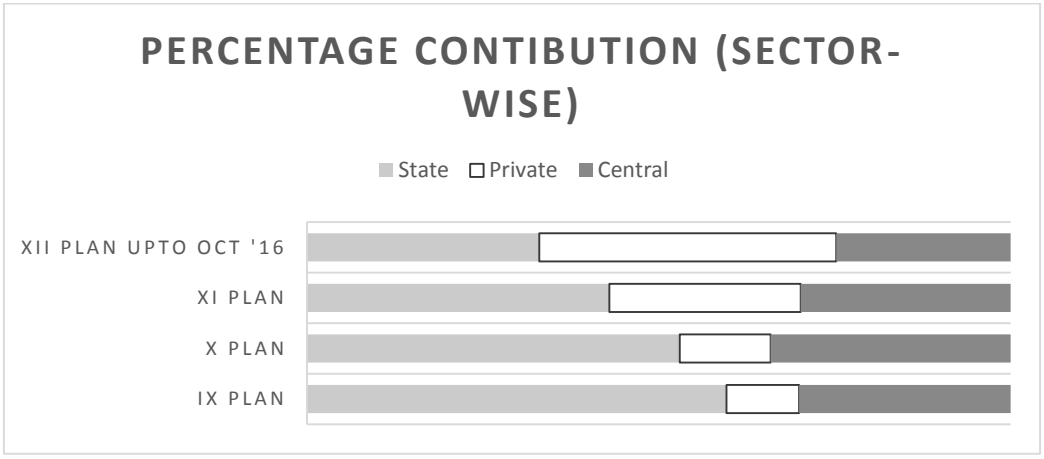

Chart 4 : Sector-wise Share of Installed Capacity during(IX-XII till Oct'16) Five Year Plans

3. CENTRAL GENERATING STATIONS

a. Demand of Power from Central Generating Stations

In order to optimally utilize the dispersed and scarce sources of power generation, the Generation projects of the Central Generating companies were conceived as a regional project to achieve regional self-sufficiency. Based on the availability of resources vis-à-vis land, coal and water etc., Central Generating Stations (CGSs) of large capacities were setup. The beneficiaries of the power from CGSs are the States/UTs connected with the regional grid. The power from the Central Sector Projects was allocated to the States/UTs based on the formula evolved in late seventies, in case of thermal and nuclear Stations and early eighties in case of hydro power projects. The firm allocation of power from the CGSs was based on a formula which considered Central Plan Assistance and Energy Consumption of the states within a region for the last five years. Central Power Utilities were supported by budgetary allocation of Central Government or by external agency. The formula was treated as guidelines from April, 2000. There was a huge demand for allocation of power from CGSs to the States as it was cheap and reliable. States used to forward various proposals requesting Central Government for enhanced allocation of power from the CGSs.

Following were the primary reasons for the demand of power from the Central Sector projects:

- Consistent Power deficit (state-wise and All India basis).
- Lack of resources and fund available with the States for setting up of power plants.
- Lack of suitable Coal Linkages for Power Plants.
- Requirement of Cheap and Reliable Power.

b. Challenges Faced by Central Generating Companies before EA,2003

The constraints witnessed after setting up of Power plants were the lack of intra-region transmission network and lack of interconnection among the regional grids. This was realized after setting up Power plants of large capacities within a region where the demand availability gap was not huge. There were several cases where Power within a region got bottled up but could not be transmitted to other deficit regions. This led to the requirement of inter-connectivity among the grids and strengthening of Transmission network. Consequently, Powergrid Corporation of India(erstwhile NPTC) was set up by pooling the transmission resources of the Central Utilities.

Another problem witnessed was the default in payments by SEBs to the Generating Companies. This led to lack of liquidity and financial crisis like situation for the companies. The Single Point tariff structure was not conducive both for SEBs and Generating Companies as it was in violation of sound economic principles of market. It led to excessive financial burden over SEBs for electricity charges as low PLF of a station led to exorbitant cost of its electricity generation. It was felt that suitable tariff regulations needed to be framed to ensure the financial viability of Power Generating Companies and SEBs. A two-part tariff for electricity generation was introduced as per the recommendations of KP Rao Committee in 1992. The tariff structure was based on the concept of Plant Availability which provided for linking of incentivizing or disincentivizing the plant based on its availability for generation in the grid[8].

Further, to make the power sector more economical and efficient, an independent tariff regulator for the power sector i.e. CERC was established in 1998. Setting up of CERC was considered a first major reform in the power sector.

Various regulations were framed in the coming years for reviving the Generation Companies by CERC. ABT (Availability Based Tariff) was introduced in 2000 to bring more responsibility and accountability in power generation and consumption through a scheme of incentives and disincentives. The scheme was meant to regulate flow of power so as to ensure short-term and long-term network stability as well.

4. POST ELECTRICITY ACT, 2003

Electricity Act,2003 (EA,2003) aimed at promoting competition along with protecting interest of consumers and rationalization of electricity tariff. It led to delicensing for establishing power plants and promoted transparency and economically sound policies, constitution of CERC and SERCs. The policy was meant to boost the private sector participation in the power sector substantially.

CERC was mandated to regulate the tariff of power from inter-state power stations and Central Generating Stations. CERC brought out multi-year tariff regulations 2004-09 to ensure reasonable rate of return on equity (ROE=14 %) for Generating Companies and fixed payment cycle[9]. This was a great boost for generating companies for setting up of power plants and garner a handsome Return on Equity(ROE) on their capital.

As mentioned in Section 3 (1) EA 2003, National Tariff Policy was formulated and published in 2006.The Policy envisioned competitively determined tariff structure by open and transparent bidding. Section 5.1, of National Tariff Policy,2006[11] mandated that future requirement of Power shall be met by power procured competitively. It provided for an exception for state controlled/owned plants for which the regulator would determine the tariff based on laid down norms. For public sector projects also, the policy mandated that tariff of such projects should be decided on basis of competitive bidding but provided for a time duration of 5 years in its implementation.

Therefore, for all the future power projects, power procurement was to be carried out by means of competitive bidding by DISCOMs. Actually, Electricity Act 2003 was aimed at ushering a scenario where private sector was given level playing field to compete with state sector. Earlier, CGSs were totally shielded from market influences as the beneficiaries of power from CGSs were bound to accept the allocation of power and pay for the electricity. This situation was about to change with the introduction National Tariff Policy 2006 but Central Generating Stations were given a window period of 5 years to adjust to a new scenario of transparency and competitive bidding[11].

In the wake of such a regulation, Central Generating Companies conceived a large number of projects in the coming five years and signed PPAs with the States on the basis of tentative Power Allocation from those projects. On analyzing, it can be drawn out that Central Generating Companies wanted to be exempted from going for competitive bidding so as to ensure fixed ROE for its stations. NTPC signed PPAs for around 61,000 MW for which existing formula of allocation may be applicable. States willing to accept the power signed the PPAs in advance so as to ensure dedicated power and reduce their energy and peak deficit.

CERC also raised the ROE for Generation and transmission projects to 15.5% to attract funds in power sector as per tariff regulation 2009-14[10]. This proved to be a shot in the arm in the efforts to mobilize funds for the Power sector.

Another important regulation framed was regarding the surrender of firm allocation by a beneficiary [10]. It stated that a beneficiary may propose to surrender a part/full of its Central Sector Allocation. The liability of Capacity Charges lies with the original beneficiary till the re-allocation of surrendered power to a willing entity is made by Ministry of Power as per tariff regulations 2009. This regulation insulated Central Generating Companies (NTPC and NHPC) from ensuring losses even when the beneficiary is not willing to consume its Power.

5. PRESENT SCENARIO:

a. Performance of Central Generating stations

Central Generating Stations (specially NTPC) have been at the forefront performance-wise being assessed on the basis of Plant Availability and Plant Load Factor. Only few state and private sector plants have been able to perform better than NTPC plants. CGSs have therefore contributed significantly in improving the energy deficit situation on All India basis. Following chart depicts the average PLF of Central and state sector year-wise. It can be inferred that Central Sector has consistently performed better over the last two decades.

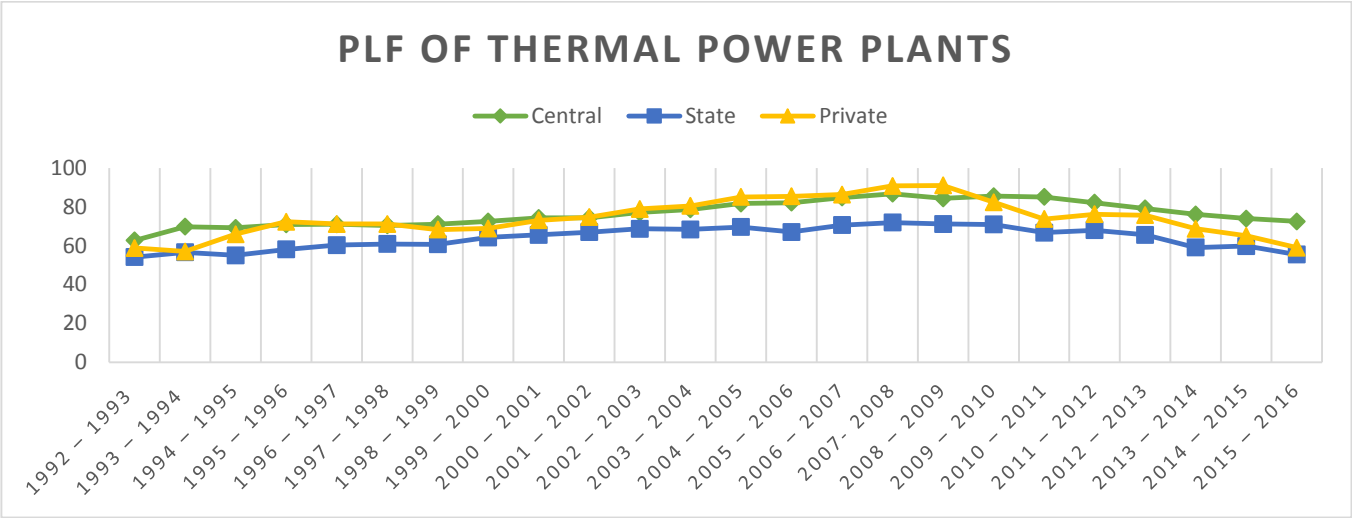

Chart 5: Comparison of Central v/s State v/s Private Sector Source: CEA

b. Tariff of CGSs vs Power Exchange

Initially when the power trading started at Power Exchanges during the later half of the first decade, the power tariff discovered at Power Exchanges used to be very high. Gradually, with the strengthening of transmission networks and increase in the number of players, power tariffs have reduced significantly. This is shown in chart below:

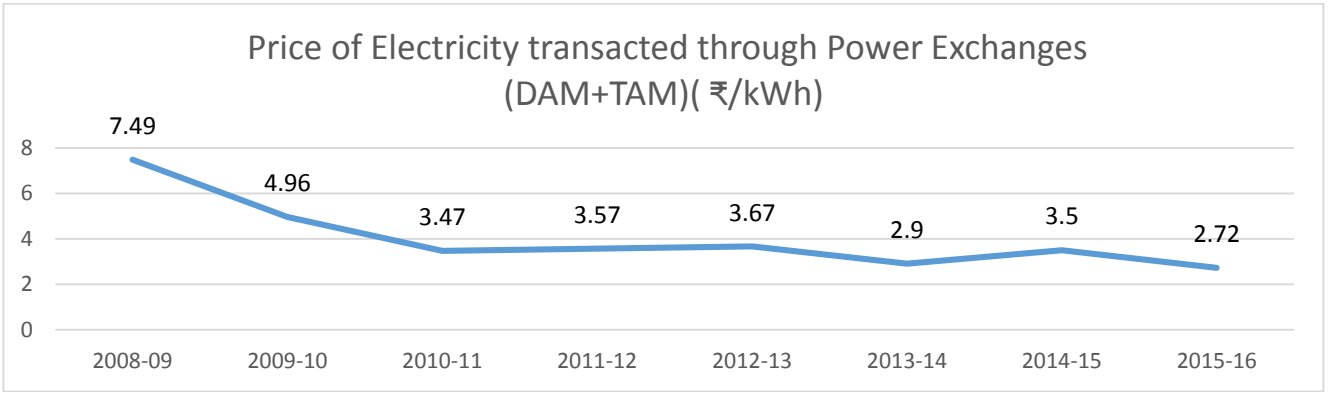

Chart 6: Price Trend of Per-unit of Electricity at Power Exchange Source: CERC

As per CERC report 2015-16, of the total electricity procured in India in 2015-16, the short-term power market comprised 10%. The balance 90% of generation was procured mainly by distribution companies through long-term contracts and short-term intra-state transactions. Volume of power traded over the years has surged over the last few years.

The weighted average price of electricity transacted through power exchanges was ₹ 2.72/kWh for short-term power contracts and 4.11/kWh through trading licensees in 2015-16. In fact, long-term levelised tariff for power available from power projects bid in the year 2014-15 under Case I bidding varied in the range of ₹ 3.60 per kWh to ₹ 4.29 per kWh. While, the tariff of CGSs which have been in existence for more than 15 to 20 years and located at pit head is considerably low (for Example, Korba: ₹ 1.63 per kWh, Singrauli : ₹ 1.80 per kWh, Talcher STPS(St-II): ₹ 2.25 per kWh), the tariff of non-pit head stations have been quite high(for example, Barh STPS (St-II): ₹ 6.21 per kWh, Mauda STPS (St-I): ₹ 8.24 per kWh, Badarpur TPS: ₹ 5.89 per kWh ,NCTP Dadri (St-II): ₹ 5.46 per kWh, Farrakka STPS (St-III): ₹ 4.80 per kWh).Similarly, tariffs for Hydro power stations recently setup have also been very high(Tehri Stage-I: ₹ 6.05 per kWh, Sewa-II : ₹ 4.05 per kWh, Chamera –III: ₹ 4.13 per kWh)

The tariffs for non-pit head CGSs is high when compared with tariff discovered by competitive bidding. This has been realized by several Discoms and State Distribution companies and other large consumers are finding it economical to purchase power through power exchanges. Substantial increase of private sector capacity along with increase in state's own generating capacity has resulted in a situation of surplus power for many states. Consequently, there has been an increase in the number of proposals submitted by states for surrendering of power being allocated to them from CGSs having high tariffs.

The scenario where power from CGSs used to be in high demand, has begun to change. A capacity amounting to almost 3890 MW has been surrendered by various States till date and several other proposals are in line.

Government of Sikkim has requested to surrender its share of power from Darlipalli STPP (3200 MW) in Odisha. Government of Madhya Pradesh has also requested to surrender its share of power from Khargone STPS (1320 MW) and Mauda-II STPS (1320 MW) amounting to 660 MW and 211.6 MW respectively. Further, it has also been requested by Govt. of M.P. to reduce the allocation of power from 1980 MW to 990 MW from Barethi STPS (3960 MW). The list of surrendered capacity in MW by beneficiaries is given as below in Table 1:

Beneficiary	Quantum of Power(MW)
Odisha	769
DVC	95.8
Himachal Pradesh	62.01
Rajasthan	9.75
Meghalaya	53
Sikkim	9.96
Delhi	2255
Punjab	336.18
Jharkhand	112
Manipur	31.4
Madhya Pradesh	156.41
Total	**3890.51**

TABLE 1 (*Source:www.powermin.nic.in*)

One of the reasons for relinquishment of CGSs power may be the actual energy and peak demand of states have not grown as projected in the 18th Electric Power Survey carried out by CEA. Also, Government of India has started focusing on energy generation from Renewable Energy Sources and set an ambitious target of 175 MW capacity achievement target by 2022. National Tariff Policy, 2016 has been aimed at promoting renewable generation sources. The Policy has provision for 8 percent of solar RPO by the year 2022 and States are required to absorb additional power from RES sources.

Several proposals of enhancing the capacity of existing plants (brown field projects) have been conceived by Central Generating companies in recent years. They have been aggressive in installing new capacities at sites of their brown field projects as enhancing the existing capacities of older plants have been granted the exemption of participating in the open competitive bidding and are assured of their sale of power. In this manner, these companies have been in pursuit of assured return on their finance capital without due attention to their competitiveness in the market. Beneficiaries of the project are bound to pay the fixed capacity charges if they are allocated firm share of power from the project. Additionally, in case of no demand of power from the States, CGSs are free to sell their power in the open market. This has become a win-win situation for Central Generating Companies to setup more plants. Other factors like availability of land, water, connectivity and coal linkage at the existing site also contributed in enhancing the capacity of already existing plants.

6. FUTURE CHALLENGES FOR CGS

The future poses mainly two challenges as far as CGSs are concerned:

i. In imminent future, supply of electricity shall outstrip the demand. It means that the traditional market of shortage electricity shall be replaced with surplus availability of electricity. The traditional sellers' market

would be transformed into buyers' market. Discoms/states shall have a variety of options to procure electricity. Intense competitions among the generators are expected in future. There would be tendency among the beneficiaries of the CGSs to surrender costly CGS power and explore market through medium-term and short-term contract through knowledge driven decision making process.

ii. Government of India has taken an ambitious capacity addition program from RES. By March,2022, the total IC of RES is expected to be 175 GW. Of this, 100 GW would be from solar and 60 GW from wind. The variability and uncertainty associated with the generation from solar and wind shall pose serious challenges in grid integration. This challenge has to be met in technical, legal, commercial, regulatory and operational fronts. The generation available from RES shall substantially reduce the requirement of generation from conventional sources. It has been estimated that, in 2021-22, RES would contribute around 20% of the electrical energy requirement of the country. As the thermal plants are the predominant conventional source of power, they would be affected most. As a result, the PLF of the thermal plants would come down depending upon the extent of infusion of the RES into the grid. Further, the traditional ways of operation of the plants of conventional sources needs to undergo radical changes. Thermal plants which normally operate as base load plant, would be required to operate as flexible plants. During the period when the solar generation and/or wind generation is maximum, the thermal plants may need to back down to 50% or below. There may be frequent start –stop operation including two shift operation. Further, they must possess adequate ramping capability to cope up with the changing load pattern. Similarly, for the hydro plant, there may be separate tariff for peak and off-peak. In future, all the hydro plants must take advantage of this and should also participate in the balancing market.

The tasks before the CGSs are manifolds:

i) Existing thermal plants must explore the feasibility of retrofitting so as to operate as flexible plants.
ii) Old and inefficient plants may be retired and replaced with efficient plants.
iii) Thermal plants in CGSs particularly NTPC plants should take full advantage of the approved methodology of diversion of coal from less efficient plants to the efficient plants to bring down the cost of generation.
iv) Hydro plants need to provide a) peaking support ii) balancing support to compensate the variability and uncertainty of RES generation.
v) With infusion of RES into the grid, new regulatory frameworks and market mechanism would be in place. This would offer opportunities to the CGSs to align themselves to reap the maximum benefits.
vi) CGSs need to undertake re-engineering to bring radical changes in the way the organizations function. To be cost competitive, the organization must be lean and agile.
vii) To mitigate the future risk, CGS may have to explore developing a balanced portfolio of different categories of generators. For example, NTPC, though dominantly a thermal based company, is venturing into Solar generation and Hydro generation.

The track record of performance of CGSs are highly commendable. CGSs have outperformed their peers in performance and ensuring reliable power. In terms of operation and maintenance, CGSs have set new benchmarks for others to follow. But future offers a lot of challenges and threats. CGSs have to take proactive action to transform this threats into opportunities and maintain their dominant role in the Indian power sector.

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