POWER GENERATION REQUIREMENT AND SHORTAGE IN TAMILNADU

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Abstract-An electrical power station is a place where electricity is produced on a large scale for transmission and distribution. The total electrical power installed capacity in Tamil Nadu is 14638.28 MW out of which 49.4% is thermal, 14.9% is hydro, 4.7% is nuclear and 31.1% is renewable energy. During the 11th Five Year Plan, capacity addition of about 46563 MW coal-based thermal power plant is planned. In order to improve the environmental conditions, 6 numbers of 660 MW each unit supercritical power plants are under advanced stage of construction. In addition 36 No. of 800 MW each supercritical units have been planned to be commissioned during the 11th and 12th Five Year Plans of which 8 units are planned to be commissioned during the 11th Five Year Plan. Under private sector participation, the Govt. of India has also planned to develop 5 ultra mega power projects of 4000 MW capacity each. During the 11th Five Year Plan, capacity addition of about 46563 MW coal-based thermal power plant is planned. In order to improve the environmental conditions, 6 numbers of 660 MW each unit supercritical power plants are under advanced stage of construction. Under private sector participation, the Govt. of India has also planned to develop 5 ultra mega power projects of 4000 MW capacity each.

Keywords: Generation, power station, Thermal power, wind power, deficit, utilization

I. INTRODUCTION

Tamil Nadu has ranked the Second-largest economy freedom in India. This ranking is based on the three parameters: the size of the government, legal structure and security of property rights, and regulation of business and labor. Gujarat is India's most economically free State, with an index score of 0.65 whereas Tamil Nadu remains in the second position with an index score of 0.54 according to the survey in 2013. Basically Tamil Nadu has historically been an agricultural state, with its advances in other fields transformed like industrialization and innovation the state becomes economic freedom state number second. The state of Gujarat is at the top position for the installation of electricity generation capacity. Tamil Nadu installation capacity is followed by Gujarat and Maharashtra. The state’s daily average electricity consumption demand is 15,000 MW to 17,000 MW, it gets 14% of its energy needs from renewable and it varies depends upon the season.

II. PORTFOLIO OF TAMILNADU

- 2nd longest coastline in India
- 4 large and 22 minor seaports
- 4 International & 2 Domestic Airports
- 5,324 km of National Highways.
- 11,830 km of State Highways.
- 46,496 km of District roads.
- 1,49,446 km of Rural roads
- 14.8 Tbps of available bandwidth
III. POWER GENERATION THROUGH THERMAL POWER STATION IN TAMIL NADU:
There are 7 Major Thermal power Stations in Tamil Nadu which are listed below with their capacity:
1. Neyveli Thermal Power Station-2 (1470MW)
2. Tuticorin Thermal Power Station (1050MW)
3. Neyveli Thermal Power Station-1 (1020MW)
4. Mettur Thermal Power Station (840MW)
5. North Chennai Thermal Power Station (630MW)
6. Ennore Thermal Power Station (450MW)
7. Neyveli Zero Unit (250MW)

IV. POWER GENERATION THROUGH WIND MILLS IN TAMIL NADU:
Tamil Nadu's sees heavy wind flows for about six months only. During the rainy season and summer season, the flow of wind is less moderate. The total installed capacity of windmill generation is 7470.86 MW, and all-time high generation is 4957 MW on 05th June 2017. Total capacity sought to be developed by the Tamil Nadu Generation and Distribution Corporation (TANGEDCO) is 2000Mw through solar in Tamilnadu. 50MW Solar Power Plant is constructed in 250 acres of land at two locations at Kullapuram & Viralipatti villages and Jeyamangalam village of Periyakulam Taluk in Theni and Dindigul District. The plant was commissioned on 23rd March 2018.
Kamuthi Solar Power Project is a solar power station which is Ramanathapuram district, in the state of Tamil Nadu, India. Tamil Nadu has a state-owned generation company named as (TANGEDCO).

Fig.1. shows the Photographical view of nuclear power generation station.
A large amount of electrical power is needed for Tamil Nadu. To meet the electrical power supply needs of the state, Tamil Nadu Electricity Board has a total installed capacity of 10,214 MW which includes shares from the State government, Central government, and private power producers. The state also has installations with renewable energy sources such as wind farms that supply up to 4,300 MW.

Fig.1. Nuclear Power Generation Station. Source: Thehindu.com
Every year there is an increase in energy demand in recent years, the state has a power deficit which is estimated to be approx. 11.9% as of Feb 2009. In order to meet the ever-increasing energy demand, TNEB has proposed a number of next-generation projects to be constructed over the next 5
years. The first thermal power plant was commissioned during 1971 at Ennore, Chennai with its first unit of 60 MW capacities (TNEB).

**IV.1. TNEB enterprise/company operates four large thermal power stations:**

- North Chennai Thermal Power Station: 1830 MW
- Mettur Thermal Power Station: 1440 MW
- Tuticorin Thermal Power Station: 1050 MW.
- Ennore Thermal Power Station capacity: 450 MW.

The total Thermal power plant capacity in Tamil Nadu is 4,770 MW.

**IV.2. TNEB enterprise/company operates two large Nuclear power stations:**

- Kudankulam Nuclear Power Plant: 2000 MW.
- Kalpakkam Atomic Power Station: 470 MW

The total nuclear power plant capacity in Tamil Nadu is 2,470 MW.

**V. Tamil Nadu Power Sector at a Glance**

Tamil Nadu Electricity Board was constituted in 1957 and it is responsible for power generation, transmission and distribution. According to Tamil Nadu Electricity Board, Tamil Nadu has installed a capacity of 13.2MW in addition to 8.4MW from renewable energy sources. The data is not up to date on that site, but it gives an idea. **Fig.2. shows the distribution Flow pattern of the Tamil Nadu power sector.** The thermal power plant contribution is maximum for electrical power generation in Tamil Nadu.

![Fig.2. Tamil Nadu Power Sector Distribution. Source: Greencleanguide.com](image)

**V.1. Tamil Nadu Hydro Power plant is divided into 4 circles:**

- Kunda Circle,
- Kadambarai Circle,
- Erode Circle,
- Tirunelveli Circle.

A total of 2,283.55 MW power has been generated in hydropower plant in Tamil Nadu.
VI. CONCERN OF POWER

In April 2019 the power demand in the state crossed 16,000MW for the first time. It touched 16,151Mw on Wednesday evening. The power demand was surpassing the previous high of 15,847MW on 13th March 2019 \(^{(5)}\). TANGEDCO Sources said the increasing demand was mainly from domestic uses, due to the increasing temperature and that they expected it to rise continuously in the coming days. In the Table-I shows the Tamil Nadu Electricity status.

<table>
<thead>
<tr>
<th>Tamil Nadu electricity status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total power demand in MW (2019)</td>
</tr>
<tr>
<td>--------------------------------</td>
</tr>
<tr>
<td>15,847</td>
</tr>
</tbody>
</table>

Table-1: Electricity Status in Tamil Nadu \(^{(6)}\)

VII. POWER SCENARIO IN TAMIL NADU

Tamil Nadu generating power by hydro, thermal, gas and wind through a mix of state-owned, central, and privately operated power plants. The windmill power plant is operated by a private parties, whereas the contribution of the state-owned wind power plants is only 0.2% of the total windmill. Tamil Nadu generating nearly 32% of India's total consumption through renewable energy (grid-connected) and about 42% of the state's energy that comes from renewable resources. Almost all of these efforts are privately driven and funded. Tamil Nadu is one of the early achievers of 100% village electrification and has the largest wind and solar power generation capacity across the country. The state has been maintaining an almost 24 hours of power supply to all consumers. Tamil Nadu is situated in the southern peninsula of the Indian subcontinent and is surrounded on the north by Andhra Pradesh and Karnataka, on the west by Kerala, on the east by the Bay of Bengal and on the south by the Indian Ocean. With a population of over seven crores and an area of 130,058 sq. km, it is the seventh-largest in terms of population and 11th largest state in India in terms of area.

VIII. TAMILNADU SUBSTATION LEVEL

The main purpose of transmission and distribution is the process in the delivery of electric power to consumers. Electric power transmission is the bulk transfer of electrical energy, from generating power plants to electrical substations located near demand centers at a high voltage, generally of 132 kV and above. The transmission sector of Tamil Nadu Transmission Corporation Ltd., (TANTRANSCO) is an electrical power transmission system operator owned by Govt. of Tamil Nadu. Transmission and distribution network is used for transmission through sub-station. A sub-station is a part of an electrical, transmission, and distribution system through a network.

The substations fall under one of the following categories:

- 400/230 kV sub-stations.
- 230/110 kV sub-stations.
- 110 kV sub-stations.
- 33 kV sub-stations.

For less than these kV transmissions as 22 kV and 11 kV are used for distribution.
Tamil Nadu Electricity Board has taken up the indigenous erection of 400 kV substations and lines. The establishment of 765 kV transmission lines are also under investigation. **Fig-3 shows the Layout of the Sub-station.**

![Sub-station Layout](image)

**Fig.3. Layout of Electrical Sub-Station**

**IX. RENEWABLE ENERGY GENERATION**

The state of Tamil Nadu is blessed with various forms of renewable energy sources viz., Wind, Solar Biomass, Biogas, Small Hydro, etc. The state has emerged as a major hub for the development of renewable energy in the last few years and presently approximately 40% of the total installed capacity in the state is from RE sources. The Govt. of Tamil Nadu set up the Tamil Nadu Energy Development Agency (TEDA) in 1985 to promote the use of new and renewable energy sources and promote energy conservation activities in the state. The state has a RE installed capacity of 9,687 MW (as of September 2016). The RE installed capacity is mostly contributed by wind (7,642 MW) followed by solar (1,155.4 MW). The state has planned off-grid renewable solutions to cater to the growth in demand in far-flung areas with poor accessibility. This includes 5,787 standalone solar solutions. Future plans for renewable capacity addition includes the addition of 5,265 MW of renewable energy through investments by the private sector.

**X. PLANNED CAPACITY IN RENEWABLE SOURCES**

Tamil Nadu and Karnataka are leading in generating renewable energy in India. Wind energy is favourable for Tamil Nadu during the month of April to September and Tamil Nadu's generation through windmill was 14,034 million units in 2019. A significant drop in windmill energy generation capacity from October to February in Tamil Nadu every year. Renewable resources are a part of Earth's natural environment and the largest components of its ecosphere. **The Renewable Sources at various capacities are tabulated with the following table-2.**
XI. UTILIZATION OF POWER IN TAMIL NADU

Tamil Nadu has become a leader in Wind Power in India. In the Muppandal wind farm the total capacity is 3500 MW, the largest wind power plant in India. During the fiscal year 2016-17, the electricity generation is 9.521 GWh, with about a 15% capacity utilization factor.

<table>
<thead>
<tr>
<th>Units consumption per day (Kwh)</th>
<th>Electricity cost per day (Rs)</th>
<th>Saving per month (Rs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15.43</td>
<td>108</td>
<td>0</td>
</tr>
<tr>
<td>14.34</td>
<td>100</td>
<td>223</td>
</tr>
<tr>
<td>13.42</td>
<td>93.94</td>
<td>416</td>
</tr>
<tr>
<td>12.6</td>
<td>88</td>
<td>582</td>
</tr>
<tr>
<td>11.89</td>
<td>83</td>
<td>737</td>
</tr>
</tbody>
</table>

Table-3: Power Utilization of Tamil Nadu. Source: Tamil Nadu-Ministry of Power

The utilization factor or use factor is the ratio of the time that a piece of equipment is in use to the total time that it could be in use. It is often averaged over time in the definition such that the ratio becomes the amount of energy used divided by the maximum possible to be used. Table-3 shows that the utilization of power is given below. Utilization factor = Amount of energy used / maximum possible to be used.

XII. POWER SHORTAGE IN TAMIL NADU

Power shortage or Power cut off is a serious issue that needs to be overcome immediately. The electricity requirements in Tamil Nadu are increasing at a rapid rate and the power supply-demand has been rising ahead of the supply which affects the progress of Tamil Nadu. Power shortage is more in the summer season because of the wind power generation and hydropower generation are almost nil during the summer. Also, High Aggregate Technical and Commercial Losses are more. The shortage of fuels may also be another one reason. Transmission and Distribution losses should be minimized. Tamil Nadu faces an annual electricity deficit of approximate 4,000 megawatts (MW) particularly, during summer. This happened as the Tamilnadu Electricity Board Ltd (TNEB) failed to anticipate demand and implement new power projects.

XII. CONCLUSION

Tamil Nadu is one of the states in India which is having a good number population of around 72 million people. The energy conservation technique has to be educated among the People to use power efficiently (Lean Management). Unnecessary usage of power should be discouraged. Tamil Nadu stands first in wind power production, though even more megawatts, the problem is during the summer season it is not producing any power can be produced by utilizing resources properly. By the vision of the Tamil Nadu 2023 document, the total investment in the energy sector is estimated at Rs. 4,50,000 crore. New power generation capacity dedicated for Tamil Nadu located within the state.
with bulk investment. In the long run, Tamil Nadu will have sufficient power generation capacity that is owned or secured under long term contracts. The electricity transmission and distribution have been successfully implemented in Tamil Nadu.

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