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Sustainable Energy Transformation Tamil Nadu (SET)

SET aims to facilitate higher clean energy deployment in the State by working with stakeholders in order to find sustainable and equitable solutions. SET is a collaborative initiative by Auroville Consulting (AVC), Citizen Consumer and civic Action Group (CAG), the World Resources Institute India (WRI).

Web: <https://settn.energy>

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Reaching 50% energy from renewables by 2030

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Purpose

This paper explores some possible implications of the recently announced 50% renewable energy 2030 target for Tamil Nadu and compares it to key parameters of the 2022 electricity tariff order.

Key messages

- (i) In FY 2021-22 22% of total energy in Tamil Nadu came from renewables (RE).
- (ii) While energy procured by TANGEDCO only had a share of 16% RE, energy procured under Open Access accounted for 51% of RE.
- (iii) As per TNERC tariff order (Order No.8 of 2021) the share of renewable energy procured by TANGEDCO is not expected to increase between FY 2021-22 and FY 2026-27.
- (iv) For the same time period an increase in coal energy by 31,311 MU or 63% compared to 2021-22 values is projected.
- (v) If the state were to meet its 50% renewable energy target by 2030 the renewable energy generation needs to increase by more than 230%.
- (vi) The 50% RE target implies the need to strategically reduce the coal power generation and sourcing. Coal power will need to be reduced by 4,511 MU or 5% compared to the 2021-22 values. And the projected increase in power demand will need to be sourced entirely from renewables.

- (vii) To meet the 2030 RE target approximately 32 GW of solar or 28 GW of wind capacity will need to be added. This means that an average of 4.80 – 5.50 GW of renewable energy capacity needs to be added every year from 2023 onwards.

Background

During the last COP events (COP 26 and COP 27) India stepped up its climate ambitions and announced a goal of reaching net-zero by the year 2070. More specifically its Nationally Determined Contributions (NDCs) includes to achieve about 50 percent cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030 (MoEFCC 2022).

In December 2022 Tamil Nadu launched its own Climate Change Mission. Its goals include the development of strategies to cut emissions by using green and renewable energy. This complements an earlier announcement by the State Government, that it aims to add an additional 20 GW of solar energy by the year 2030.

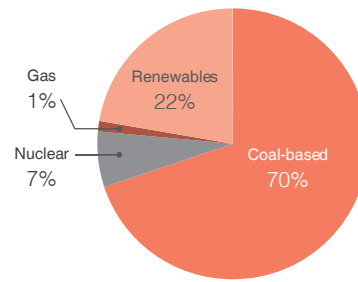
More recently, in March 2023, the Tamil Nadu Governments announced that it will target that 50% of all energy will be sourced from renewable energy sources. If the state were to meet this target it would firmly establish itself as a climate leader on the national and international stage. Further, Tamil Nadu aspires to be a leading export state and as there is increasing international supply chain pressures for industries to reduce their carbon emissions accelerating the transition towards a renewable energy can help its industries to stay competitive in a decarbonizing world. An accelerated energy transition will also promote Tamil Nadu as an attractive location for industries.

RE accounted for 22% of total generation

In FY 2021-22 the total energy generated was 1,17,553 million units (MU). Renewable energy, this is solar, wind, bioenergy, and hydro, accounted for a 22% of the total energy generation in FY 2021-22. Coal power with a share of 70% is the singles largest energy sources. This total energy generation can be subdivided into two parts, (i) energy procured by TANGEDCO and (ii) energy under Open Access. TANGEDCO accounted for 83% or 97,297 MU of energy in FY 2021-22. Whereas the remaining 17% of 20,266 MU are on account of Open Access.

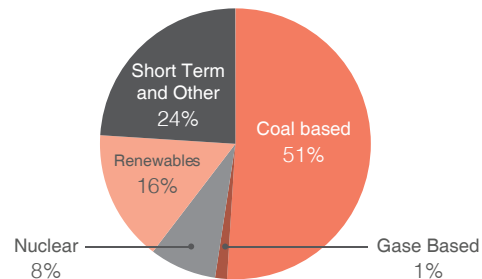
Interestingly TANGEDCO procured only 16% of its energy from renewables. Whereas 52% of all energy under Open Access is RE. 51% of all energy procured by TANGEDCO came from either TANGEDCO owned or Central owned coal power plants. The actual share of coal power may be higher as there is 24% of energy that was sourced under the category 'Short term and others' and this may primarily be coal power.

Figure 1 Tamil Nadu's Energy Share FY 2021-22



Source: TANGEDCO 2022

Figure 2 TANGEDCO Energy Share FY 2021-22

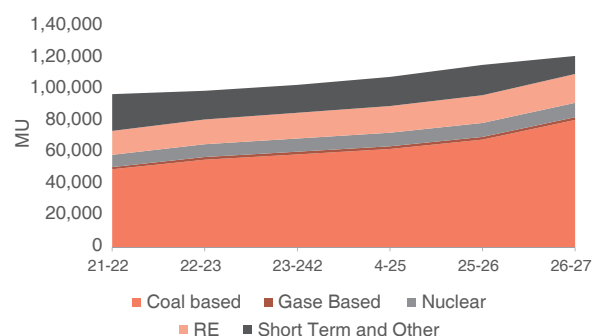


Source: TNERC 2022

No increase in RE as per recent tariff order

There are contradicting announcements about the state's long-term trajectory in regards increasing the share of renewables. While State Government's target of 50% RE by 2030, and the recent RPO announcement by the Ministry of Power of achieving a renewable energy share of 43% by 2029 are largely aligned. The 2022 electricity tariff order (TNERC 2022) on the other assumes that share of RE source by TANGEDCO between FY 2021-22 to FY 2027-28 stays between 15% and 16%, while the share of coal would increase from 51% to 67%. This represents an increase in coal by 31,311 MU or 63% by 2027-28 compared to 2021-22 values.

Figure 3 Evolution of energy mix as per TNERC 2022



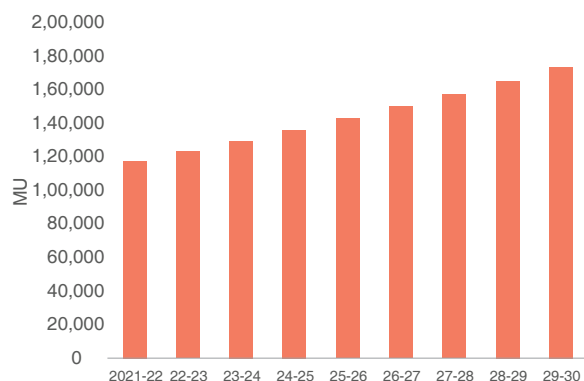
Source: TNERC 2022

RE generation needs to increase by more than 230%

The recent tariff order (TNERC 2022) contains a power generation forecast for TANGEDCO from 2021-22 FY

till FY 2027-28. The average compound growth rate in this forecast is 5% per annum. If we were to extrapolate the state's total power demand (Open Access and TANGEDCO) by an average annual increases of 5% then the power generation in FY 2029-30 will be 1,73,679 MU.

Figure 4 Generation forecast

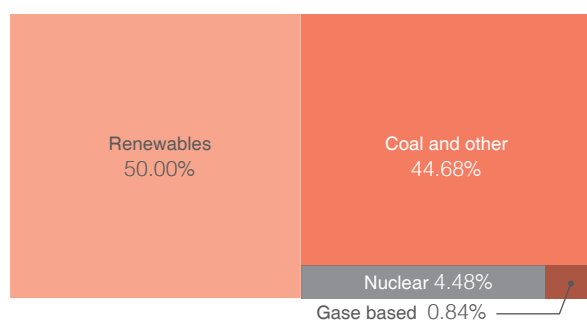


In FY 2021-22 26,202 MU of RE was generated in Tamil Nadu. To meet the 50% RE target by 2030 an estimated 86,839 MU on RE needs to be generated. This represents an increase by 231% or 60,637 MU.

50% RE by 2030 implies phasing down of coal

If the share of 50% renewables by 2030 represents 86,839 MU and assuming there will be no change in generation of nuclear energy and gas energy as , then coal energy will present a share of 45% or 77,597 MU in 2030.

Figure 5 Projected energy share by 2030



In 2021-22 coal power was at 82,109MU, to meet the 2030 renewable energy target of 50% share on total generation coal power well need to reduce by 4,511 MU or 5% compared to the 2021-22 values. However, the bulk of this reduction will need to come from TANGEDCO.

To put this into perspective in 2021-22 TANGEDCO operated 5 coal power plants, these five plants generated a 18,764 MU of power. The estimated coal power reduction of 4,511 MU required to meet the 50% RE target by 2030 represent 24% of the total coal power generated by TANGEDCO owned plans or the total energy generation by Tuticorin TPS in 2021-22 (refer to table 1 below).

Table 1 Power generation of selected TANGEDCO owned coal plants

Generator	MU
Tuticorin TPS	4,539
Mettur TPS I	4,388
Mettur TPS II	2,570
North Chennai TPS	3,071
NCTPS Stage II	4,196
Total	18,764

Source: TNERC 2022

Additionally, on needs to keep in mind that there are at least 4 new coal power plants by TANGEDCO expected to start power generation in the next few years. This includes NCTPC Stage III, Ennore Expansion, Udangudi Stage I and Ennore SEZ. Considering this it's quite likely that most of the existing coal power plants will have to retire or phase down if the 50% RE target were to be met.

The 50% RE target therefore implies the need to strategically reduce the coal power generation and sourcing. This may need a combination of retiring some of the older coal power plants operated by TANGEDCO and reducing of coal power purchased by central generation stations and other sources. The target also implies that the projected demand increase will need to be met entirely by renewable energy capacity addition.

28 to 32 GW of new RE to be added

To meet the 2030 RE target an additional 60,637 MU of RE will need to be generated by 2030. This represents approximately an addition of 28 GW of wind energy capacity or a 32 GW of solar energy capacity and means that in the next six years starting with FY 2023-24 approximately 4.80– 5.50 GW of renewable energy capacity needs to go on-grid. The average annual RE capacity addition in Tamil Nadu from 2018 to 2023 was 1.21 GW (refer to Table 2).

Table 2 Installed RE capacity (wind, solar, bi-energy hydro)

Year	RE (GW)	Change (GW)	Change (%)
2017	12.57	-	
2018	13.02	0.45	3.57%
2019	14.25	1.23	9.42%
2020	16.38	2.13	14.97%
2021	17.07	0.69	4.18%
2022	18.14	1.07	6.29%
2023	19.85	1.71	9.44%
Average		1.21	7.98%

Source: CEA, Installed Capacity Report

Recommendations

Meeting the 50% RE target will require a concerted effort by all major power sector institutions and players including the distribution licensee, the Electricity Regulatory Commission, the Energy Department, Independent Power producers and the consumers/prosumers. Some recommendations to facilitated this

accelerated energy transitions are outlined below. These include:

- (i) Develop an overarching energy policy
- (ii) Formulate a strategy to phase down coal power
- (iii) Assess the energy storage needs for RE integration
- (iv) Promote demand flexibility and energy efficiency
- (v) Protect Prosumer rights and prioritize distributed generation
- (vi) Develop an overarching energy policy**
The state would do well to develop an overarching energy policy that aligns policy targets with operations and sets a clear and concise long-term vision for the state's power sector and its decarbonization pathway.
- (vii) Formulate a strategy to phase down coal power**
The State currently has a cumulative coal power capacity of 14,187 MW in operations. In addition to the existing coal power fleet, Tamil Nadu has more than 5.04 GW of coal-based power plants under various stages of construction. It is therefore essential to carefully re-evaluate the addition of the 5.04 GW coal power plant capacity in order to avoid non-performing assets and plants running at low plant load factors.

The State Government will need to develop a legislation that details the shutdown of polluting plants and incentivises the higher utilization of less-polluting plants. Retirement and repurposing plans for coal power plants older than 20 years need to be made.
- (viii) Assess the energy storage needs for RE integration**
The integration of a higher share of renewables requires a more flexible grid. Energy store technologies are one of the solutions to address the variable nature of

renewables by providing various flexibility service. A comprehensive scenario planning will need to be undertaken to assess the energy storage capacity needs and the type of energy storage technologies that will help meeting the 50% renewable energy target

- (ix) Promote demand flexibility**
To address key grid management concerns such as peak load management or ramping-up and ramping down rates consumer will need to be provided with sufficient incentives and opportunities to participate in the electricity system and to shift or shed energy demand based on grid signals. Various demand flexibility strategies and offering will need to be either refined or developed this may include time varying tariffs, critical peak prices, industrial demand response programs or active demand response program for domestic consumers.
- (x) Promote prosumer rights and prioritize rooftop solar**
Consumers can also generate their own electricity through behind-the-meter energy systems such as rooftop solar, store it in batteries, and even sell any excess power back to the grid. This will require fair and transparent feed-in tariffs, the removal of network charges, choices for consumers on the metering mechanisms and simple and rapid interconnection processes. Existing energy subsidies and cross-subsidies can be utilized to help households acquiring rooftop solar systems.