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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>

Authors: Martin Scherfler
Reviewer: Umesh Ramamoorthy, Auroville Consulting
Designer: Thiagarajan Rajendiran, Auroville Consulting

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Briefing Note Community Solar: How to Meet Tamil Nadu's Solar Energy Target & Reduce the State's Subsidy Burden?

Date: May 2022

Author: Martin Scherfler

Email: martin@aurovilleconsulting.com

Purpose

This document presents opportunities for Tamil Nadu to meet its solar energy targets while reducing the State's subsidy and TAGNEDCO's cross subsidy burden.

Key messages

In the case of a swift tariff rationalization, that means the halting any subsidy and cross subsidy allocation, for all domestic consumers, the current slab 1 and slab 2 consumers will feel a much higher financial impact compared to the current slab 3 and slab 4 consumers.

Rooftop solar and community solar energy¹ programs provide attractive opportunities to mitigate the impact on domestic consumers, particularly so for slab 1 and slab 2 consumers. No mitigation strategy for current slab 3 and slab 4 consumers may be required in the case of tariff rationalization. Community solar programs are easier to scale and are therefore the more attractive solution.

¹A community solar project is a large, central solar power plant, whose electricity is shared by more than a single entity (household in this case). While the size of a residential solar installation is measured in kilowatts, community solar projects are measured in megawatts, meaning that a single community solar project can power hundreds or even thousands of homes.

If all the current slab 1 and slab 2 consumers in the State were assisted to participate in a community solar energy program in which they hold 1 kW of solar each, which will be accounted for under a virtual net metering mechanisms the following results can be expected:

Solar energy target contribution: ~59% (11.70 GW)
25-year reduction in subsidy: INR 65,858 Crore²
25-year gains to TN Government: INR 42,648 Crore (65%)
25-year gains to TANGEDCO: INR 3,60,052 Crore (107.44%)
Green jobs created: 79,121 FTE

Background

In January 2022 TANGEDCO announced that it aims to add an additional 20GW of solar energy capacity to the State’s generation fleet. It also emphasised that this shall be done through a focus on distributed solar energy generation.

As per CEA (2013) distributed solar energy generation is defined as solar systems interconnected at the electricity distribution network below 33 kV voltage levels. This includes a range of capacities on interconnection points small scale rooftop solar energy systems operating behind the meter, to front-of-the meter solar systems interconnected at the low voltage distribution networks to solar systems interconnected at high voltage distribution grid at up to 22 kVa.

- Advantages of Distributed renewable energy generation (DREG) include:
- Lower T&D losses: Having generation closer to the load reduces energy losses that happen in the transmission and distribution systems.
 - Reduction in average cost of supply (ACoS), benefiting both the consumers and the utility.
 - Deferred investment in grid infrastructure: distributed solar energy generation can reduce the load on the distribution transformer and substation, deferring (or avoiding) upgradation costs.
 - Improved grid resilience, if coupled with other flexible distributed energy resources including demand response and energy storage etc.
 - Improved reliability of power supply for consumers (Auroville Consulting ,2020d)

Additionally there is an opportunity to leverage distributed generation to tackle other policy objectives such as reducing the State’s burden of electricity subsidy while at the same time mitigating the burden of energy cost increase on low-income households.

Electricity tariffs for domestic consumers and several other consumer categories such as agriculture, huts, etc., are subsidized by the Government of Tamil Nadu. In addition to the electricity subsidy provided by the Government, TANGEDCO cross-subsidises the lower

consumer tariffs from revenue collected from higher tariff paying customers.

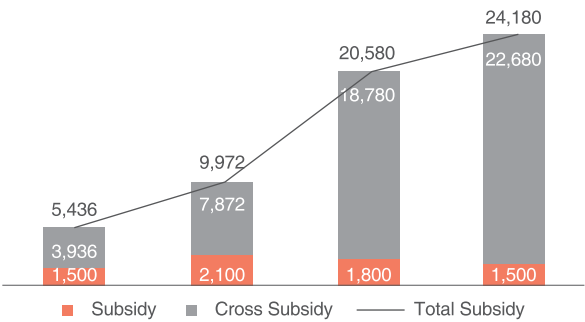
However, TANGEDCO is not able to recover its cost of supply. In 2015-16 TANGEDCO’s cumulative revenue gap was INR 30,884 Crore (TNERC 2017a). The trued-up revenue gap for the subsequent years is not available in the public domain, but the revenue gap is expected to have increased as no tariff revisions took place after the year 2017.

TANGEDCO’s outstanding debt increased from INR 65,879 Crore in 2017 to INR 1,01,173 Crore in 2019, an increase in 54% (Crisil 2020). As of May 2022 overdue payments to generators stood at INR 20,923 Crore, which equals 15 months of power purchase (Ministry of Power 2019).

In the FY 2019-20 INR 3,469 Crore of electricity subsidy for the domestic consumers was allocated by the State Government (TNERC 2021). The objective of State Government subsidies is to support low energy consuming residents. The current subsidy disbursement mechanisms however is favouring the higher consumption segment under domestic tariff slabs 3 and 4.

The per-service connection allocation of subsidy and cross-subsidy clearly favours domestic consumers with higher electricity consumption. On average a slab 4 consumers received close to 4 times more subsidy and cross-subsidy compared to an average slab 1 consumer.

Figure 1 Average annual subsidy and cross subsidy by slab



If one were to equate higher per household electricity consumption with higher household income level, then it can be concluded that higher income households receive more electricity subsidies than low-income households. Clearly, that cannot be the aim of the subsidy scheme.

Ministry of Power has repeatedly requested State Governments to phase out cross-subsidies and introduce a direct benefit transfer scheme in lieu of the current electricity subsidy scheme.

²Includes savings from phasing out subsidy for slab 3 and 4 consumers.

Considerations

Increasing both energy charges and fixed charges to the extend that the average billing rate (ABR) per kWh is equal to TANGEDCO’s average cost of supply (ACoS) is the simplest way to reduce both the subsidy and cross subsidy commitment by the Tamil Nadu Government and by TANGEDCO. However, such a transition is expected to encounter strong opposition. Therefore, a strategy that mitigates the impact of tariff increase will be required. Such a strategy shall focus primarily on low-income households (assumed to be equal to slab 1 and slab 2 consumers) and would in the best case also deliver on other key objectives of the State’s development agenda such as meeting its climate and renewable energy targets.

This document estimates the financial impact on the consumers, TANGEDCO and the State Government of rationalizing consumer energy tariffs by stopping all energy subsidy and cross subsidy allocation and by introducing dedicated solar energy programs for domestic consumers to mitigate the impact of such a tariff rationalization.

Results

Assuming a single tariff rate of INR 6.60 per kWh for all domestic consumers and an increase in fixed/demand charges in the tune that the ABR is close to the ACoS (~ INR 9.06 per kWh), then the expected 25-year increase in electricity cost is primarily affecting slab 1 and slab 2 consumers (refer to Table 1).

Table 1 25-year impact of tariff increase³

Con- sumer Slabs	TANGEDCO		TN Gov.		Consumer	
	INR	%	INR	%	INR	%
Slab 1	64,678	121%	36,662	100%	(1,00,112)	-440%
Slab 2	1,05,273	102%	49,285	100%	(1,43,347)	-140%
Slab 3	64,654	26%	57,799	100%	(95,901)	-18%
Slab 4	28,734	12%	28,900	100%	(59,428)	-7%

Table 2 Impact of 1 kW rooftop solar⁴

Con- sumer Slabs	TANGEDCO		TN Gov.		Consumer	
	INR	%	INR	%	INR	%
Slab 1	1,09,915	99%	18,250	50%	(1,534)	-7%
Slab 2	1,47,992	84%	30,874	63%	(36,744)	-43%
Slab 3	1,16,570	44%	57,799	100%	(56,781)	-13%
Slab 4	23,587	8%	57,799	100%	(33,860)	-4%

³**Tariff Assumptions:**
Energy charges: 6.60 INR/kWh
Fixed cost slab 1: 145 INR/b-monthly
Fixed cost slab 2: 290 INR/b-monthly
Fixed cost slab 3: 725 INR/b-monthly
Fixed cost slab 4: 1150 INR/b-monthly
Annual increase: 5% (CAG)

Table 3 Impact of 1 kW community solar⁵

Con- sumer Slabs	TANGEDCO		TN Gov.		Consumer	
	INR	%	INR	%	INR	%
Slab 1	1,09,915	99%	16,102	44%	(2,871)	-13%
Slab 2	1,47,992	84%	28,726	58%	(56,842)	-66%
Slab 3	1,16,570	44%	57,799	100%	(76,879)	-17%
Slab 4	23,587	8%	57,799	100%	(53,958)	-6%

Both approaches result in substantial benefits across all consumer slabs for TANGEDCO and the State Government. Both the rooftop solar program and the community solar program help mitigating the impact of a tariff increase and subsidy stop.

Scaling

To deploy a community solar energy program that allocates 1 kW solar PV capacity for to all slab 1 and slab 2 consumers in Tamil Nadu the following would be required. required:

Solar capacity: 11,706 MW
Gross capital cost: INR 39,215 Crore
Tamil Nadu Government share: INR 23,529 Crore
Consumer share: INR 15,686 Crore

Community solar energy program will have the following impact:
25-year reduction in subsidy: INR 65,858 Crore⁶
25-year gains to TN Government: INR 42,648 Crore (65%)
25-year gains to TANGEDCO: INR 3,60,052 Crore (107.44%)

Conclusions & Recommendations:

Introducing a community solar energy program or a rooftop solar energy program for low-income households (for slab1 and slab 2 consumers) has the

⁴**Rooftop Solar Assumptions:**
Cost of solar: 45,0000 INR/kW
Solar Metering: net metering with purchase or surplus solar at the end of the settlement period at a price of 3.61 INR/kWh
Network charges: 0.25 INR/kWh
MNRE capital subsidy: 40% of CAPEX
TN Gov. Subsidy: 40% of CAPEX exclusively for low-income households (assumed to be equal to Slab 1 and Slab 2 consumers)

⁵**Community Solar Assumptions:**
Cost of solar: 33,5000 INR/kW
Solar Metering: net metering with purchase or surplus solar at the end of the settlement period at a price of 3.61 INR/kWh
Network charges: 0.25 INR/kWh
MNRE capital subsidy: none
TN Gov. Subsidy: 60% of CAPEX exclusively for low-income households (assumed to be equal to Slab 1 and Slab 2 consumers)
This model would require the introduction of a virtual net metering mechanisms.
⁶Includes savings from phasing out subsidy for slab 3 and 4 consumers.

potential to mitigate impacts of a tariff rationalization on the consumers, while at the same time providing cost savings to TANGEDCO and the State Government.

While the solar rooftop model indicates slightly better financial benefits for the domestic consumers, such a model is more challenging to scaling. Additionally, the available MNRE subsidy for domestic rooftop solar is limited. Tamil Nadu currently has a subsidy allocation by MNRE for 5 MW for its domestic rooftop solar program which is only sufficient to solarize about 1% of all domestic service connections assuming an average of 1 kW solar PV capacity. A community solar energy program, on the other hand, is faster to replicate and to scale up. This model can be exclusively deployed for slab 1 and slab 2 consumers, and it can be done without depending on MNRE subsidy. The available

MNRE subsidy could then be primarily used for a rooftop solar program that targets slab 3 and slab 4 consumers.

Some recommendations:

- Interconnect community solar energy systems close to load centres at the distribution network level to leverage on existing infrastructure and reduce transmission and distribution losses.
- Implement standard solar capacity plants for example 10 MW) for fast deployment.
- Turn solar systems into community solar gardens by co-locating of solar energy systems and agriculture or animal grazing).
- Some savings to TANGEDCO and the Tamil Nadu Government may be re-invested into energy storage to manage high solar energy penetration.⁷

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⁷Assuming 25% of the gains are invested into energy storage, a 32 GWh storage capacity can be added. This represents ~ 50% of the daily solar energy generation