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Comparative Analysis of Central and State-Level Solar Energy Policies and Implementations

A Case Study of Tamil Nadu and Gujarat

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Executive Summary

This report presents a comprehensive analysis of central solar energy schemes in India, such as the National Solar Mission (NSM), PM-KUSUM, and various CPSU schemes, alongside state-specific solar energy policies. Focusing on Tamil Nadu and Gujarat, this study examines the quantitative and qualitative aspects of solar energy promotion, implementation, and efficiency. By contrasting the approaches and outcomes of these two diverse states, the report highlights the impact of state-level policies in complementing central initiatives, thereby providing insights into the success factors and challenges faced in the deployment of solar energy in India.

The findings aim to inform policymakers, stakeholders, and researchers about best practices and areas for improvement in solar energy governance. For instance, Tamil Nadu has updated its policy to allow net metering for systems up to 10kW, which benefits regular households. However, there is no net-metering provision for systems greater than 10kW, creating a significant barrier for high-tension (HT) consumers such as industrial complexes to switch to solar power due to the lack of grid connectivity and higher net feed-in tariffs.

In addition, Tamil Nadu imposes network charges, along with high open access and banking charges, which discourage consumers (primarily HT consumers) from transitioning to solar power, contradicting the vision of the central government.

Conversely, despite lower feed-in tariffs in Gujarat for domestic residential consumers compared to Tamil Nadu, the absence of network charges, provision of net-metering and grid connectivity for all, and lower costs/tariffs promote the adoption of solar panels. Furthermore, the implementation of solar energy under the PM Kusum scheme has been slow in Tamil Nadu due to the provision of free electricity for farmers, who do not perceive immediate economic incentives in adopting solar energy.

This is in contrast to Gujarat, which has specific policies for farmers such as the Suryashakti Kisan Yojana (SKY) aligned with PM KUSUM, offering higher feed-in tariffs for farmers to sell their surplus energy, and the Kisan Suryodhaya Yojana (KSY) providing solar energy to farmers for irrigation purposes from 9 am to 5 pm, benefiting farmers and boosting solar energy, thereby aligning with PM KUSUM.

Tamil Nadu faces a major issue with fixed charges for thermal (coal) power plants, which need to be paid even when they are not in operation. This discourages reducing thermal generation and leads to a preference for keeping these plants running, even when renewable energy could be used instead.

Renewable energy sources like solar and wind have variable outputs, which can fluctuate. Sometimes, renewable energy output needs to be reduced when it exceeds demand or when the grid can't handle the variability to maintain grid stability. Limited transmission network capacity can cause congestion, hindering the efficient transfer of electricity from renewable sources to where it is needed.

Traditional power plants, especially coal-fired ones, can't ramp up or down quickly in response to changes in renewable energy output, making it difficult to integrate large amounts of renewable energy into the grid without causing stability issues. Since fixed charges are payable for thermal plants regardless of their operation status, there is a financial incentive to keep them running, often leading to renewable energy being reduced when demand is low and the grid can't handle both renewable and conventional power simultaneously.

It is crucial to establish clear policies for solar energy in order to create a stable framework for investments and development in the renewable energy sector. Addressing TANGEDCO's financial issues and investing in grid infrastructure is also essential to facilitate better integration of renewable energy sources.

TANGEDCO's financial instability hinders investments in new infrastructure and the integration of renewable energy sources. This instability, along with the high fixed charges of thermal plants, results in the curtailment of renewable energy during periods of low demand. On the other hand, GUVNL has prioritized improving operational efficiency by reducing transmission and distribution (T&D) losses and enhancing revenue collection.

These efforts help minimize financial leakages and improve profitability. Additionally, Gujarat has implemented stringent financial controls and better debt management practices, including timely payment of dues and avoiding unnecessary borrowing, which contributes to a healthier financial position.

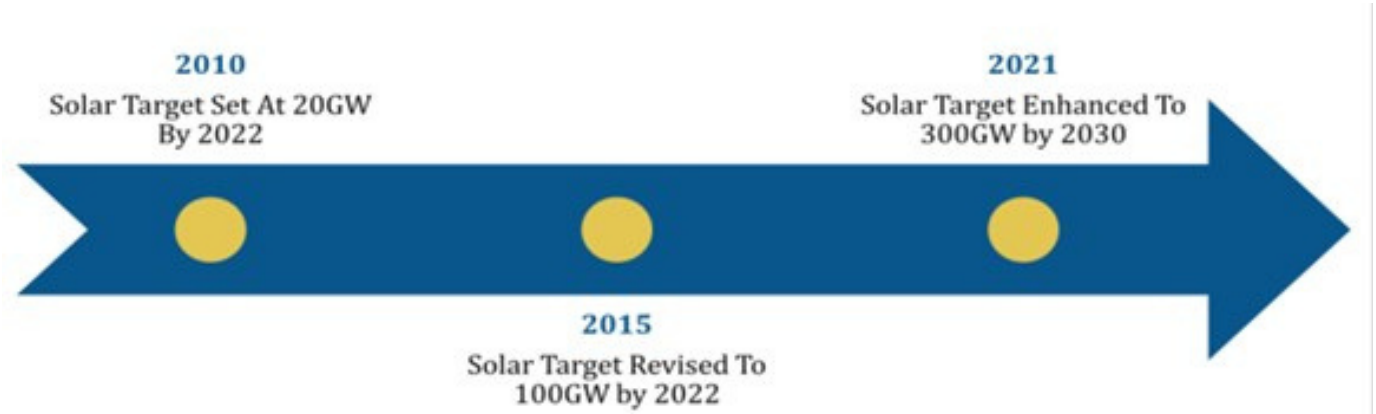
Given the high network and open charges in Tamil Nadu, the absence of net metering and grid connectivity for HT consumers, the lack of policy support, and the financial struggles of TANGEDCO, along with poor electricity infrastructure, present significant challenges in comparison to Gujarat for the successful implementation of solar energy schemes to meet India's 2030 energy target.

Therefore, Tamil Nadu must now prioritize policy development, and financial reforms for TANGEDCO to improve infrastructure and integration, as well as revising network charges and expanding net-metering.

1.Introduction

Solar energy has emerged as a pivotal component of India's renewable energy strategy, with the country setting ambitious targets (mentioned below) to meet its elaborate energy needs sustainably. As India strives to achieve its 2030 solar target of 300GW—a goal that has been revised multiple times due to various challenges — the role of both central and state-level policies becomes increasingly significant. The central government has introduced a range of solar energy schemes, such as the National Solar Mission (NSM), PM-KUSUM, and various Central Public Sector Undertaking (CPSU) schemes, aiming to accelerate solar energy adoption across the country. However, the success of these schemes largely depends on their implementation at the state level, where local policies, resources, and administrative capacities play a crucial role.

For example, the progress of the National Solar Mission and solar targets since its conception have been:-



Source: JMK Research

Fig 1: Timeline of India's solar target announcements

Despite substantial progress, India did not achieve the revised 100 GW solar target by 2022. By the end of 2021, India had installed around 55 GW of solar capacity, which was approximately 50% of the goal. The shortfall was largely due to challenges in the rooftop solar segment, like limits to net metering, financing issues, pandemic-induced supply chain disruption to policy restrictions, inconsistent policy framework, and so on. Hence fell significantly behind its 40 GW target, achieving only about 15 GW by the end of 2022.

As of August 2024, India's cumulative solar capacity is **89.43 GW**, out of which **69.19 GW** comes from ground mounted solar plant while **13.89 GW** is from grid connected solar rooftop. Hybrid projects which contain a solar component accumulates to 2.59 GW, while off-grid solar has about 3.76 GW capacity installed. Despite achieving significant progress, India's 2022 target wasn't met, and we can foresee significant challenges to meet the 2030 target, especially evident in the solar rooftop section where the target currently is 100GW.

This report addresses the critical question of how effectively central solar energy schemes are being implemented by individual states, and whether state-level policies align with, and complement the central vision. By focusing on Tamil Nadu and Gujarat—two states with distinct approaches and outcomes in solar energy promotion—this study offers a comparative analysis that sheds light on the factors contributing to the success or failure of solar energy initiatives.

For example, given the high network and open charges in Tamil Nadu, the absence of net metering and grid connectivity for HT consumers, the lack of policy support, and the financial struggles of TANGEDCO, along with poor electricity infrastructure, present significant challenges in comparison to Gujarat for the successful implementation of solar energy schemes to meet India's 2030 energy target. Therefore, Tamil Nadu must now prioritize policy development such that it aligns with the center's vision, financial reforms for TANGEDCO to improve infrastructure and integration, as well as revising network charges and expanding net metering.

The significance of this topic lies not only in its relevance to achieving national energy targets but also in its potential to provide actionable insights for policymakers, stakeholders, and researchers. Understanding the interplay between central initiatives and state-level execution is essential for optimizing solar energy governance in India. Furthermore, this comparative case study fills a gap in existing research, as no comprehensive analysis of state-wise solar energy policies and their alignment with central schemes has been undertaken to date. By contrasting the experiences of Tamil Nadu and Gujarat, this report aims to identify best practices, highlight challenges, and offer recommendations for enhancing the effectiveness of solar energy deployment across the country.

2.Methods

- The data for this project was obtained from MNRE, MoP, IEA, IREDA, SECI, TANGEDCO, TEDA, GUVNL, GEDA*, and other official documents.
- Secondary data collection from newspaper articles like The Hindu, The Economic Times, Mercom India, The Times of India, and the Business Standard.

**Abbreviations mentioned in the glossary*

3.Discussion

The following section will deep dive into the states Tamil Nadu and Gujarat with respect to their solar energy generation and consumption. The framework used to evaluate and compare the states is as follows:

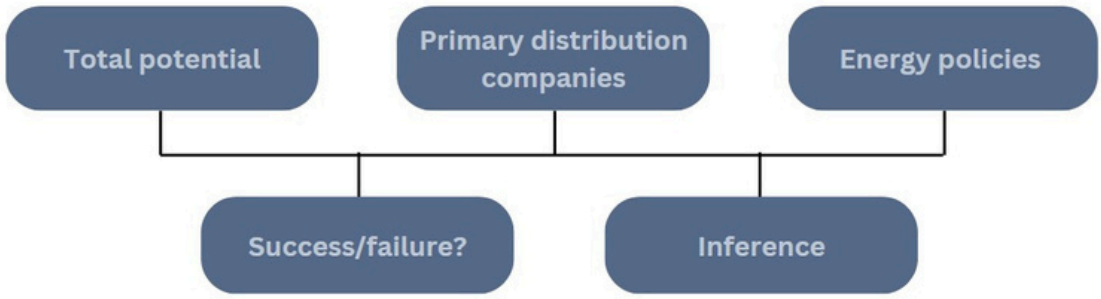


Fig 2: State-specific framework analysis

a.Tamil Nadu

Solar Potential:

1. Total solar potential of Tamil Nadu is 17.67 GWp.

2. Tamil Nadu ranks fourth in India with a total installed solar capacity of 8,145.53 MW, including both rooftop and central transmission network connectivity. (State transmission network (STU)= 7,995.53 (7,396.37+ Roof Top - 599.16); Central transmission network (CTU)=150).

3. The highest recorded peak for solar power generation was 5,398 MW on 05.03.2024, and the highest solar energy generation reached 40.50 million units on 23.04.2024.

4. The state harnessed 11,033 million units of solar energy from the installed Solar Power Plants of the State Transmission Utility during the year 2023-24.

5. Throughout 2023-2024, a total of 1,994.62 MW renewable energy capacity has been added to the grid:
   - 276.08 MW from wind energy (STU)
   - 248.40 MW from wind energy (CTU)
   - 1,260.76 MW from solar energy (STU)
   - 201.88 MW from rooftop solar
   - 7.5 MW from Co Generation.

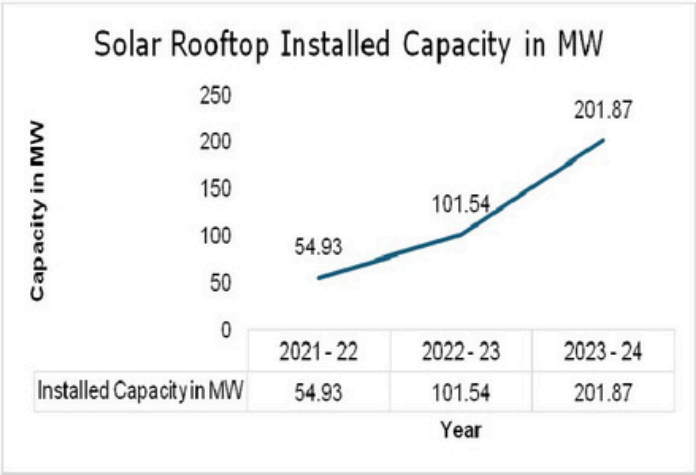


Fig 3: YoY solar rooftop capacity installed in Tamil Nadu

TEDA has also successfully implemented around 76.28 MW of medium and small solar projects, including 59.28 MW in domestic rooftop solar PV systems and 17 MW in demonstration wind projects to promote Renewable Energy in Tamil Nadu.

Distribution Agencies/ Companies:

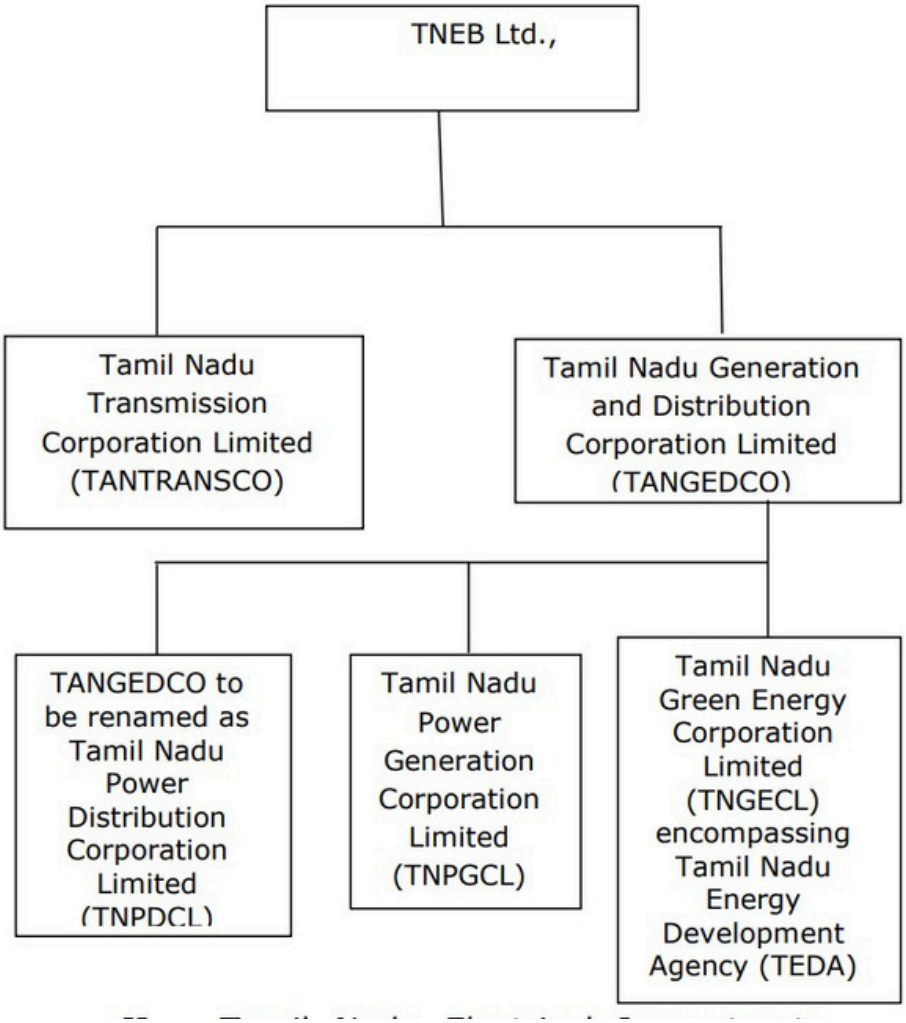


Fig 4: Flowchart of distribution companies in Tamil Nadu

The Government of Tamil Nadu on 24.01.2024, has accorded approval for the formation of a Green Energy Company in the name of Tamil Nadu Green Energy Corporation Limited (TNGECL) to take over the green energy activities (Hydro, Wind, Solar etc.,) of TANGEDCO and to take over functions of the Tamil Nadu Energy Development Agency 62 (TEDA).

The creation of green energy has been undertaken with the following objectives.

- To fast-track the energy transition from 22% of renewable energy mix to 50% of RE By 2030 so as to achieve the RPO trajectory.
- Promoting hydro generation, operation, and maintenance of existing hydro generating stations.
- Promoting hydro projects, and pumped storage projects.
- Promoting large-scale solar and wind projects.
- Promoting rooftop installations for the residential sector.
- Promoting other non-fossil fuel-based generation such as biomass etc.,
- New renewable energy hybrid policy to increase renewable energy penetration. Effective utilization of existing transmission and distribution infra by maximizing the technical limitation.
- To get green funds at a lower cost.

Policy Implementation

Grid-connected solar rooftop: The Ministry of New and Renewable Energy (MNRE) has sanctioned 10 MW to TANGEDCO under Phase II of the Grid-connected Rooftop Solar Programme. TANGEDCO has designated TEDA as the State Implementing Agency for Phase II of the Grid-connected Rooftop Solar Programme by MNRE to install Rooftop Solar PV systems for residential consumers. TEDA has successfully installed rooftop solar PV systems with a capacity of 9.84 MW, benefiting around 2,359 beneficiaries under the program. Despite the initial plan to reach 12 MW by July 2023, it failed to materialize. However, there are efforts to reach the sanctioned 10 MW capacity by 2024, before the scheme's expiration date in 2026. The program provided subsidies of up to 40% from MNRE. The validity of the program expired on 19.01.2024.

Solar park and ultra mega solar powered projects scheme: Tamil Nadu currently does not have any officially recognized solar parks listed under the National Solar Park scheme by the Ministry of New and Renewable Energy (MNRE). As a result, the official government website does not display any data for solar parks in Tamil Nadu, despite the existence of large-scale solar projects like Kamuthi. The Kamuthi solar park is privately owned and is not part of the MNRE's National Solar Park scheme.

PM-KUSUM: The Tamil Nadu Generation and Distribution Corporation (TANGEDCO) has introduced new guidelines to implement the PM-KUSUM (Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan) scheme in order to incentivize farmers to install solar energy-powered pump sets. According to the TANGEDCO guidelines issued on May 3 of this year, farmers will receive 0.50 paisa/unit as an "incentive" for the net energy supplied to the grid. As per the Tamil Nadu Electricity Regulatory Commission (TNERC) guidelines, this incentive will be a maximum of ₹3,000 per annum for a 7.5 HP pump and 11 KW solar panel. TANGEDCO will pay the bank ₹2.28/unit for the loan period for the gross energy realized. The application window for this scheme will be open for three months.

State nodal agency	Total nos sanctioned	Total nos installed	% central subsidy
AED	5200	3236	30

	State nodal agency	Total sanctioned	Total installed
Component A	TANGEDCO	424 MW	0 MW
Component B	AED	5200	3236
Component C	-	-	-

Table 1: Implementation of PM-KUSUM in Tamil Nadu

Ground Success or Hiccups

Net metering and net billing:

Net metering and net billing are two methods used to calculate compensation for private rooftop solar units that sell their excess power to the grid. In a net metering arrangement, the producer-consumer (prosumer) can subtract the energy they sell to the grid from the energy they buy, and the difference is billed at standard rates. Under net billing, the prosumer sells excess energy to the grid at a standard feed-in tariff, while purchased energy is charged at slab rates. The difference in savings between net metering and net billing can be significant due to the differences in feed-in tariff and slab rates.

Net metering is available for systems up to 10 kW, while net billing and net feed-in are options for consumers using systems larger than 10 kW but smaller than 112 kW. In Tamil Nadu, additional network charges apply for net billing and net metering. Setting up grid connectivity with solar can be a complex process. Customers who sell excess power to the grid typically receive an average of Rs 1.8 to Rs 2 per unit, which is significantly lower than the Rs 6-7 per unit cost of grid power. As a result, many consumers are opting to include battery storage with their rooftop units despite the higher initial setup costs.

Category	Eligibility	Metering Mechanism			Net Work Charges	Feed in Tariff		
		Net Metering	Net Feed-in	Gross Metering		0-10 kW	11-150 kW	151-999 kW
DomesticLT Category	Up to sanctionedload	✓	✓	×	**20% of Rs1.53 (** up to 10 kW); **75% of Rs 1.48(** above 10 kW)			
Other than domestic category in LT	Up to sanctionedload	×	✓	×	**Rs.1.53** per kWh on total generation	**Rs.3.61**	**Rs.3.37**	
Consumersof more than 150 kW	151-999 kW	×	✓	✓	**Re.0.96** per kWh for Net Feed-in. No charges for Gross Metering			**Rs.3.10**
Generator other than consumer	151-999 kW	×	×	✓	**Nil**			

Table 2: Electricity metering and tariffs in Tamil Nadu

The monitory value of the imported energy is debited at retail tariff; The monitory value of exported energy is credited at feed-in tariff.

Based on the CAG electricity consumption data, the below table compares the amount to be paid annually by a consumer who falls under (i) net metering and (ii) net feed-in mechanism

	Without Network charges (Rs)	With Network charges (Rs)
Net Metering Mechanism	18607	27827
Net feed-in Mechanism	32264	41484

Table 3: Comparative rates paid by consumer under net metering vs net-feed in (with and without network charges)

For more info, refer: here

No Grid Connectivity for Heavy Tension Consumers

Tamil Nadu stands out by not permitting high-tension consumers to use net metering, which would allow them to export surplus power to the grid. Without this option, a significant amount of the generated energy is likely to go to waste. High wheeling and additional charges (network/tariffs).

There are wheeling charges in Tamil Nadu, where charges are levied for using the distributor's network to transfer energy from the producer to the consumer. Solar energy can be consumed through wheeling using open access, or it can be rooftop solar, supplying energy directly to the industry.

New charges have been introduced and have consistently increased year after year. While the wheeling charges remained at 5% from the beginning to 2012, they were suddenly split into five components - Wheeling Charge, Transmission Charge, Transmission and Distribution Loss Charge, and Scheduling and System Operation Charge. The banking charge of 5%, historically maintained, was increased to 10% in 2012, then to 12% in 2016, and further to 14% in 2018. This holds true for wheeling solar energy as well. Unlike all other states maintaining substantially lower open access charges, Tamil Nadu alone has exorbitant and manifold charges.
Charges 2024: here

Free Power to Farmers

Solar power adoption has been slow in the agriculture sector under the PM-KUSUM because farmers receive free power and therefore do not see a strong incentive to switch to solar. There is a need to raise awareness about the advantages of solar power in order to promote its adoption.

Fixed Charges for Thermal Generation:

Thermal (coal) power plants incur fixed charges even when they are not operating. This creates a reluctance to reduce thermal generation because the charges must still be paid, leading to a preference to keep these plants running even when renewable energy could be used instead.

Inference

The analysis of the solar energy landscape in Tamil Nadu reveals both significant opportunities and challenges that need to be addressed to fully realize the state's renewable energy potential.

Opportunities and Benefits:

1. **Residential and Small-Scale Commercial Adoption:**
   - The Tamil Nadu Electricity Regulatory Commission (TNERC)'s recent draft guidelines enabling net metering for residential rooftop units up to 10 kW mark a positive step forward. This allows small-scale users to benefit from solar energy, reducing their reliance on the grid and cutting energy costs.
   - Concessions for low-tension commercial and industrial users further promote solar adoption, although the implementation of network charges remains a contentious issue.
2. **Agricultural Sector Potential:**

The agricultural sector in Tamil Nadu has significant potential for the adoption of solar energy, especially under schemes like the Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan (PM-KUSUM). Since electricity is free in Tamil Nadu, it is important to encourage farmers to shift to solar energy. Increasing awareness about the benefits of solar power can drive this adoption, helping to meet the energy needs of farmers sustainably.

Challenges and Barriers:

1. **High-Tension Consumer Restrictions:**
   - Tamil Nadu's policy of not allowing high-tension consumers to use net metering is a major hindrance. This restriction leads to wasted energy and deters industries with high power requirements from investing in rooftop solar units, impacting overall solar adoption in the state.
2. **Exorbitant Open Access Charges:**
   - Unlike other states with lower open access charges, Tamil Nadu imposes high and varied charges. This discourages investment in the renewable energy sector, causing the state to lag behind others like Gujarat in terms of capacity.
3. **Financial and Infrastructural Constraints:**
   - TANGEDCO's financial losses and the resultant inability to invest in new infrastructure or accommodate more renewable energy sources pose a significant challenge. The variability of renewable energy sources like solar and wind further complicates grid stability, requiring careful management and potentially leading to curtailment.
4. **Policy Gaps and Regulatory Issues:**
   - The absence of a comprehensive state policy on wind or solar energy leads to uncertainty and reduced investment in the sector. Additionally, unnecessary classification of rooftop solar promoters as prosumers and the imposition of heavy network charges, even without energy export, further burdens solar adopters.
5. **Traditional Power Plant Inflexibility:**
   - The inflexibility of traditional coal-fired power plants to adjust output quickly in response to renewable energy fluctuations complicates the integration of large amounts of renewable energy into the grid. Financial incentives to keep thermal plants running often result in renewable energy being backed down when demand is low.

Recommendations*:*

To foster a more conducive environment for solar energy growth in Tamil Nadu, the following measures are suggested:

1. **Revise High-Tension Consumer Policies:**
   - Allowing high-tension consumers to participate in net metering can prevent energy wastage and encourage industrial investments in solar energy.
2. **Reduce Open Access Charges:**
   - Aligning open access charges with those of other states can attract more investments in the renewable energy sector, boosting overall capacity.
3. **Strengthen Financial and Infrastructure Support:**
   - Addressing TANGEDCO's financial issues and investing in grid infrastructure can facilitate better integration of renewable energy sources.
4. **Develop Comprehensive Renewable Energy Policies:**
   - Formulating clear policies for wind and solar energy can provide a stable framework for investments and development in the renewable energy sector.
5. **Promote Flexibility in Power Generation:**
   - Encouraging the use of more flexible power generation technologies can help balance the variability of renewable energy, ensuring grid stability and reducing reliance on coal-fired plants.

By addressing these challenges and leveraging the opportunities, Tamil Nadu can enhance its renewable energy capacity and maintain a leading position in India's transition to sustainable energy.

b.Gujarat

Solar potential:

- The total potential is 35.77 GWp.
- Solar energy contributes around 10,133 MW to Gujarat's total renewable energy production of 19,414.8 MW.
- The state aims to increase its renewable energy capacity to 68,000 MW by 2030. Gujarat accounts for nearly 12% of India's total renewable energy capacity.
- The state has been power surplus since 2009.

Primary distribution companies:

In Gujarat, there are four power distribution companies responsible for supplying electricity to different regions. These companies are subsidiaries of the Gujarat Urja Vikas Nigam Limited (GUVNL), which oversees the overall development of the power sector in the state. Here are the four distribution companies:

- Dakshin Gujarat Vij Company Limited (DGVCL): Serving southern Gujarat.
- Madhya Gujarat Vij Company Limited (MGVCL): Responsible for central Gujarat.
- Paschim Gujarat Vij Company Limited (PGVCL): Covering western Gujarat.
- Uttar Gujarat Vij Company Limited (UGVCL): Serving northern Gujarat

There are other government companies that assist in or are involved, that are

GEDA (Gujarat Energy Development Agency): GEDA is responsible for promoting renewable energy sources and energy conservation in Gujarat. It focuses on solar energy, wind energy, and other sustainable practices.
GERC (Gujarat Electricity Regulatory Commission): GERC is the regulatory body that oversees the functioning of power distribution companies and ensures fair practices, tariff regulations, and consumer rights in the state.
GETCO (Gujarat Energy Transmission Corporation Limited): GETCO manages the transmission network in Gujarat. It plays a crucial role in transmitting electricity from power plants to substations and distribution companies.
GPCL (Gujarat Power Corporation Limited): GPCL is involved in power generation projects, including thermal, hydropower, and renewable energy. It contributes to the overall energy supply in the state.

Energy policies

Central schemes:

Grid-connected solar rooftop scheme: The state has implemented its own Surya Gujarat scheme which is a specific program for the state of Gujarat, India, that promotes the installation of grid-connected rooftop solar systems. It is essentially a state-level implementation of the broader Grid-Connected Rooftop Solar Programme (GCRTS) offered by the Ministry of New and Renewable Energy (MNRE) for all of India. The website has updated the subsidies and scheme to reflect the newly implemented Surya Ghar Muft Bhijli Yojana.

Residential consumers with grid-connected rooftop solar systems can avail the Central Financial Assistance directly from the newly launched ‘National Portal for Rooftop Solar’ portal. The subsidy details are as follows:

- From 1kW to 2kW capacity: ₹30,000/ kW
- For 3kW capacity: ₹30,000/ kW till 2kW and an additional ₹18,000.
- For systems over 3kW capacity: ₹78,000 (fixed)

Prior to 2024, there were state subsidies offered, but currently there is no update regarding state subsidies for the new scheme.

The "Surya Gujarat" scheme has significantly boosted the solar rooftop capacity in Gujarat. As of 2024, the scheme has led to the installation of approximately 2,078 MW (2.08 GW) of solar rooftop systems. This includes contributions from various residential, commercial, and industrial consumers, making Gujarat a leading state in solar rooftop adoption

The Surya Gujarat scheme provides state subsidies of 40% for solar rooftop systems up to 3 kW and 20% for systems beyond 3 kW up to 10 kW. This initiative is aimed at promoting the widespread adoption of solar energy by making it more financially accessible to residents. The solar rooftop system is installed within the premises of the electricity service connection, either on the roof or on the ground. The solar rooftop system is owned by the consumer.

Related DISCOMs (Distribution Companies) will purchase surplus electricity at a rate of Rs. 2.25 per unit. Electricity users or consumers are free to choose any approved agency for the installation of the solar system.

Aspect	Details
Launch Date	August 2019
Objective	To promote solar rooftop installations in residential sectors
Target	8 lakh residential consumers by end of FY 2021-22
Subsidy for Systems	40% for up to 3 kW, 20% for 3-10 kW
Financial Benefit	Consumers can earn Rs 2.25 per unit for surplus electricity
Application	Via SURYA-Gujarat portal
Installation & Maintenance	As per DisCom specs, with 5 years post-commissioning maintenance

Table 4: Surya Gujarat – solar policy in Gujarat (summary table)

Solar parks and ultra mega solar powered projects

Gujarat	Radhnesada Solar Park	700
	Dholera Solar Park	1000
	NTPC RE Park	4750
	GSECL RE Park	3325
	GIPCL RE Park Ph-I	600
	GIPCL RE Park Ph-II	1200
	GIPCL RE Park Ph-III	450

Table 5: Implementation of solar parks and ultra mega solar powered projects in Gujarat

PK Kusum

State nodal agency	Total nos sanctioned	Total nos installed	% central subsidy
GUVNL	12382	6399	30

	State nodal agency	Total sanctioned	Total installed
Component A	GEDA	500 MW	0 MW
Component B	GUVNL	12382	6399
Component C	-	625500 feeders	0

Table 6: Implementation of PM KUSUM in Gujarat

State subsidies and schemes:

In 2022, the Gujarat government introduced the Suryashakti Kisan Yojana, a program that enables farmers to install solar panels on their farms to increase their income. Through this initiative, farmers can sell excess energy back to the grid.

Under the program, farmers will receive a 60% subsidy on the project cost, with 30% provided as a loan at an interest rate of 4.5-6%. The remaining 5% of the project cost will be covered by the farmers.

Farmers will receive electricity at a rate of ₹7 per unit for the first 7 years, and ₹3.5 per unit for the subsequent years. The subsidy on the project cost will be divided between the State and Central Governments, and 35% of the project cost will be provided as a loan with an interest rate of 4.5-6%.

The program will span 25 years, divided into a 7-year period and an 18-year period. Approximately 12,400 farmers across 33 districts will benefit from this scheme.

State Energy Policy

Gujarat solar power policy:

- Operative period of the policy is for five years i.e. up to 31.12.2025.
- Benefits of the solar projects set up under the policy can be availed for the project life of 25 years.
- The project types covered under the policy are:
  a. Projects for residential consumers
  b. Captive projects set up by industrial and commercial consumers
  c. Projects set up for third party sale
  d. Projects for sale of power to DISCOMs.
- Any consumer can set up solar project as per his requirement without any capacity ceiling and existing ceiling of 50% sanctioned load/contracted demand for setting up solar project.
- Consumers can set up solar projects on their roof/premises or can give their roof/premises on lease to third party for generation and consumption of power in same premises.
- A group of consumers can set up solar projects for self-consumption as collective ownership project. The energy is to be consumed in the ratio of their ownership. However, this provision of policy has not been approved by GERC.
- The provision for security deposit to be submitted by developer to DISCOMs has been reduced from Rs.25 Lakh/MW to Rs.5 Lakh/MW.

Link: here

Other Solarization Projects

1.Solarization of Modhera

Modhera, a village in Gujarat, India, was declared the first 24x7 solar-powered village in India by the Prime Minister in October 2022. The project, called "Suryagram" (Sun Village), provides solar power to approximately 8,000 residents.

With the objective of solarizing the sun temple town of Modhera in District – Mehsana, Gujarat, and meeting the domestic and agricultural electricity needs of all the households in Modhera with solar energy, the Ministry of New & Renewable Energy (MNRE), Government of India launched a scheme on 19th March 2020.

The scheme aimed to set up renewable energy installations, including a 6 MW grid-connected ground-mounted solar PV power plant, a 15 MWh battery energy storage system, 1297 rooftop solar PV systems of 1KW each, 305 kW aggregate capacity of rooftop solar PV systems on government buildings, smart meters, solar EV charging stations, etc. in Modhera. This involved an investment of around Rs. 76.66 crore, with up to 50% Central Financial Assistance (CFA) from the Government of India through MNRE, and the remaining 50% coming from the Government of Gujarat.

The Gujarat Power Corporation Limited (GPCL), the implementing agency, awarded Letters of Intent (LoI)/Letters of Award (LoA) for the installation of the aforementioned components.

The project was completed and inaugurated by the Hon'ble Prime Minister on 9th October 2022.

Visit this link for more information on the Scheme Guidelines: here

RE Projects Under Implementation

Sr. No.	Name of the Project	Capacity in MW	Fuel
1	Govt. Waste Land Solar PV Power Plant at Various locations in Gujarat	637.5	Solar
2	Development of RE Park at Khavda in 30GW Ultra Mega RE Park	3325	Solar
3	Floating Solar Project at BLTPS reservoir	0.750	Solar
4	Solar PV with 57 MWH Battery Energy Storage System	35	Solar

Table 7: RE projects under implementation

Ground Success or Hiccups

Surya Gujarat Yojana

The Surya Gujarat Yojana has significantly boosted the adoption of rooftop solar energy in Gujarat since its launch in August 2019. Prime Minister Shri Narendra Modi championed **Clean Gujarat, Green Gujarat** resulting in explosive solar rooftop installations. Under the initiative, the state offers subsidies for solar panel installations ranging from 1 kW to 10 kW. This has led to widespread participation, with substantial investments from residents. For instance, in Banaskantha alone, 3,559 residents have received subsidies totaling nearly Rs 20 crores. The success of this program highlights Gujarat's commitment to becoming a leader in solar energy deployment.

Tariffs and Banking Charges

Gujarat has implemented a structured approach to tariffs and banking charges to encourage solar energy adoption:

- **Surplus Energy Purchase**: DISCOMs buy surplus energy **at Rs 2.25** per unit for the first five years, after which the rate is adjusted to 75% of the latest tariff discovered through competitive bidding.
- **Banking Charges**: Rs 1.50 per unit for demand-based HT and LT consumers, and Rs 1.10 per unit for MSMEs and other consumers. Residential consumers and government buildings are exempt from these charges.
- **Cross Subsidy and Additional Surcharges**: Not applicable for self-consumption but apply to third-party sales.

Transmission and Wheeling Charges: These are applied as per the standard rates for open access consumers

Net Metering

The net metering policy in Gujarat supports residential, commercial, and industrial consumers, enabling them to offset their electricity bills with the energy they generate. The policy allows for the purchase of surplus energy by DISCOMs, providing a financial incentive for consumers to install rooftop solar systems.

Wheeling Charges
Wheeling charges in Gujarat are aligned with the standard rates for open access consumers. This includes transmission and wheeling losses, ensuring that the infrastructure costs are adequately covered while promoting renewable energy integration. The state offers a 50% concession on wheeling charges for captive wind-solar hybrid power projects.

Solar Energy for Farmers
The Suryashakti Kisan Yojana (SKY) is a notable initiative in Gujarat, empowering farmers to generate electricity using solar panels and sell the excess power back to the grid. The program provides a 60% subsidy on the project cost, significantly reducing farmers' reliance on traditional power sources and enhancing energy security in the agricultural sector.

Inference

Lower Open Access Charges
Gujarat's approach to maintaining lower open access and network charges has been instrumental in making the state attractive for large consumers to adopt solar energy. By minimizing these charges, Gujarat reduces the financial burden on businesses and industries looking to invest in solar power, thereby fostering a more favorable environment for renewable energy growth.

Effective Policies and Programs
Programs like the Surya Gujarat Yojana have been pivotal in promoting residential rooftop solar installations. This program offers substantial subsidies and clear guidelines, making it easier for residents to adopt solar power. The success of this initiative is evident in the widespread adoption of rooftop solar systems across the state, significantly contributing to Gujarat's overall solar capacity.

Financial Stability of GUVNL
GUVNL (Gujarat Urja Vikas Nigam Limited) has achieved remarkable financial stability through effective management practices. The company's debt has reduced significantly, from Rs. 17,299 crore in 2019 to Rs. 4,769 crore in 2023. This reduction has been facilitated by regular repayments, prepayments, and healthy financial accruals. Financial stability enables GUVNL to invest more in renewable energy infrastructure and integrate solar power more efficiently into the grid.

Support for High-Tension Consumers
Gujarat's policies support high-tension (HT) consumers by allowing them to install rooftop solar systems with capacities ranging from 6 kW to 1000 kW. These installations are subject to system strengthening charges, which are calculated based on per kVA rates for new or additional high-tension loads. This provision for grid integration encourages larger industrial investments in solar energy, unlike Tamil Nadu, where HT consumers face more restrictions.

Operational Efficiency and Financial Prudence
GUVNL has focused on improving operational efficiency by reducing transmission and distribution (T&D) losses and enhancing revenue collection. These efforts minimize financial leakages and improve profitability. Additionally, Gujarat has implemented stringent financial controls and better debt management practices, including timely payment of dues and avoiding unnecessary borrowing, which contribute to a healthier financial position.

Renewable Energy Promotion
Gujarat has aggressively promoted renewable energy, particularly solar, to reduce the cost of power procurement. The state's policies, like the Surya Gujarat Yojana, have successfully reduced dependency on costly thermal power. This strategic shift not only supports environmental goals but also provides economic benefits by lowering energy costs.

Industry Support and Stable Cash Flow

Gujarat's support to industries and efficient handling of power purchase agreements (PPAs) ensure a stable and predictable cash flow. This financial stability aids in debt reduction and encourages further investment in the renewable energy sector.

Supportive Regulatory Environment

The Gujarat Electricity Regulatory Commission (GERC) has established a regulatory environment conducive to financial health. Policies set by GERC often support the utility's financial stability by ensuring reasonable tariffs and cost recovery mechanisms. This supportive regulatory framework further enhances Gujarat's attractiveness for solar energy investments.

c.Summary

Tabular format of the summary of analysis of Tamil Nadu and Gujarat:

	Tamil Nadu	**Gujarat**
Grid-connected solar rooftop (Surya ghar muft bhijli yojana)	201.88MW No additional subsidies offered	2078 MW No additional subsidies as of 2024
Solar parks and ultra mega solar powered projects (MNRE)	None that are MNRE sanctioned	7 parks of cumulative 12025 MW sanctioned
PM KUSUM	5200 sanctioned, 3236 components implemented with 30% state subsidy	12382 sanctioned, 6399 components implemented with 30% state subsidy
New solar power scheme (PM Janman)	None sanctioned	None sanctioned
State government policies	Tamil Nadu solar policy was supposed to be applicable from 2019 to 2023. Unsure if the policy is still active	Gujarat renewable enrgy policy-2023 Gujarat solar power policy (valid till 2025)

Table 9: Summary Table

4.Conclusion

The schemes that are being considered in the report for analysis and comparison purposes is covered in the appendix in the later part of this section.

The solar energy landscape in Tamil Nadu faces several key challenges that hinder its growth, particularly when compared to Gujarat. Firstly, the state imposes high network and open access charges on solar power, even for non-exported energy. These charges deter investment from high-tension consumers and small-scale industries, limiting the expansion of solar energy projects. Additionally, net metering is restricted to residential rooftop units up to 10 kW, preventing high-tension consumers from exporting surplus power to the grid. This results in energy wastage and reduces the feasibility of solar projects for industries.

Tamil Nadu's power utility, TANGEDCO, also struggles with financial instability, which hampers its ability to invest in new infrastructure and integrate renewable energy sources. High fixed charges from thermal plants further contribute to curtailment of renewable energy during periods of low demand. The lack of a clear state policy on solar and wind energy further exacerbates the situation, discouraging investment in the renewable energy sector. In the agricultural sector, despite significant potential, solar power adoption remains low due to free power provided to farmers and the high network charges under the PM-KUSUM scheme.

In contrast, Gujarat presents a more favorable environment for solar energy growth. The state maintains lower open access and network charges, making it more attractive for large consumers to adopt solar energy. Programs like the Surya Gujarat Yojana have successfully promoted residential rooftop solar installations by offering substantial subsidies and clear guidelines. Additionally, Gujarat’s power utility, GUVNL, has managed its finances effectively, reducing debt and enabling more investment in renewable energy infrastructure. This financial stability allows for smoother integration of solar power into the grid. Importantly, Gujarat provides grid connectivity provisions for high-tension prosumers, encouraging larger industrial investments in solar energy.

To improve solar energy adoption in Tamil Nadu, several recommendations can be made. Firstly, revising network charges to lower the costs for both residential and industrial consumers would encourage more installations and investments. Expanding net metering to include high-tension consumers would prevent energy wastage and enhance the feasibility of large-scale solar projects. Implementing financial reforms to stabilize TANGEDCO would also be crucial, enabling better investment in renewable energy infrastructure and integration. Furthermore, developing a comprehensive state policy on solar and wind energy would provide clear guidelines and incentives for investors and developers. In the agricultural sector, increasing awareness and providing additional incentives for farmers to adopt solar energy under the PM-KUSUM scheme, while gradually phasing out free power, could boost solar power adoption.

By addressing these challenges and drawing lessons from Gujarat’s successful strategies, Tamil Nadu can enhance its solar energy adoption and regain its leadership in renewable energy capacity. A balanced approach involving policy reforms, financial stability, and targeted incentives will be essential to achieving sustainable growth in the state’s solar energy sector.

This assessment should be conducted across all states to provide a comprehensive view of the nation's progress towards the 2030 solar energy targets.

Interviews with locals, stakeholders, and scheme applicants are recommended to gather valuable on-the-ground insights as the government websites are quite biased, and other websites are slow to update the ever-changing schemes.

a.Appendix

Name	Objective	Financial subsidies and investment	Implementation
PM Surya Ghar Bhijli yojana	The previous Grid-connected solar rooftop program got subsumed into the bigger PM surya Ghar Muft Bhijli yojana. · Aimed to to install solar panels in 1 crore houses of the country to provide relief to middle and poor-class families from expensive electricity bills · To achieve 40,000MW by 2026	The total financial outlay of 75021 crores. The previous Grid Connected solar rooftop is subsumed in this(along with its budget) as this scheme encompasses similar objectives and more. CFA- · Residential Sector (first 2 kWp of RTS capacity or part thereof) is eleigible for 60% of benchmark cost of 2 kWp · Residential Sector (with additional RTS capacity of 1 kWp or part thereof) is eligible for 40% of benchmark cost of additional kWp	Since this was announced May 2024, implementation status is not currently available Implementation of Grid Connected Solar Rooftop scheme is : here
CPSU Scheme phase II	·This scheme is for setting up 12,000 MW grid-connected Solar PV Power Projects by Central and State PSUs and Government Organizations	· Total VGF support: 8580 crores · The maximum allowable VGF has been set at Rs. 0.70 crore per MW. The VGF amount will be reviewed by MNRE, and it may be revised downward if necessary. · Any savings achieved through this process will be used to support additional capacity. · Total Investment anticipated: Rs. 48,000 crore for 12,000 MW capacity, @ Rs. 4 crore/MW. · Implementation Agency: SECI (till 2020) & IREDA (for later tranches)	Current implementation status- Link: here

Name	Objective	Financial subsidies and investment	Implementation
Scheme to develop solar parks and ultra mega solar powered projects	· The scheme was rolled out by MNRE on 12-12-2014. Under the scheme, it was proposed to set up at least 25 Solar Parks and Ultra Mega Solar Power Projects targeting 20,000 MW of solar power installed capacity within a span of 5 years starting from 2014-15. · The capacity of the Scheme was enhanced from 20,000 MW to 40,000 MW on 21-03-2017. These parks are proposed to be set up by 2025-26. · The capacity of the solar parks shall be 500 MW and above. However, smaller parks are also considered where contiguous land may be difficult to acquire.	· Under the scheme, the Ministry provides CFA of up to Rs. 25 lakh per Solar Park for the preparation of a DPR · Besides this, CFA of up to Rs. 20.00 lakh per MW or 30% of the project cost · The total Central Grants approved under the Scheme is Rs. 8100.00 crore. · SECI and IREDA are the implementation agency · CFA distribution link: here	As of 2023: · Within the approved parks, an aggregate capacity of 10,401 MW of solar projects has been commissioned, with 284 MW commissioned in the calendar year of 2023. · The government has approved 50 solar parks with a total capacity of 37,990 MW in 12 states. 11 parks with a combined capacity of 8,521 MW have been completed, and 7 parks with a total capacity of 3,985 MW have been partially completed. · Link: here
PM KUSUM	§ Component-A: Setting up of 10,000 MW of Decentralized Ground/ Stilt Mounted Grid Connected Solar § Component-B: Installation of 14 Lakh Stand-alone Solar Agriculture Pumps. § Component-C: Solarisation of 35 Lakh Grid Connected Agriculture Pumps including Feeder Level Solarization. All three components of the scheme aim to add a Solar capacity of about 34,800 MW by March 2026	The government of India will provide a 60% subsidy on the total cost of solar irrigation pumps installed by farmers. The initial deadline of 2022 was extended to 2026. CFA funding for the above scheme: · Component-A: Procurement Based Incentive (@ 40 paise/kWh or Rs. 6.60 lakhs/MW/year, whichever is less · Component-B & C: CFA of 30% of the benchmark cost. State Government subsidy 30%; Remaining 40% by the farmer In ceratin states like NE states and union territories- CFA of 50%, State Government subsidy 30%, Remaining 20% by the farmer	Implementation status: here

Name	Objective	Financial subsidies and investment	Implementation
New Solar Power Scheme	· Implementation of the New Solar Power Scheme for Particularly Vulnerable Tribal Groups (PVTG) Habitations/Villages. · Electrifying one lakh unelectrified households (HHs) in PVTG areas across 18 states and 1 union territory. · The project includes the provision of solar home lighting systems, solar mini systems, and solarization of multipurpose centers.	The funds for the implementation of this scheme will be met from DAPST allocation of the Ministry of New and Renewable Energy (MNRE) with an overall approved budget outlay of 515 crores with 500 crores for PVGT households and 15 crores for street lighting	Sanction and implementation status: here

b.Glossary

·TEDA :Tamil Nadu Energy Development Agency
·TANGEDCO :Tamil Nadu Generation and Distribution Corporation
·MNRE :Ministry of New and Renewable Energy
·MoP : Ministry of Power
·IEA : International Energy Agency
·IREDA : Indian Renewable Energy Development Agency
·SECI : Solar Energy Corporation of India
·GUVNL : Gujarat Urja Vikas Nigam Limited
·GEDA :Gujarat Energy Development Agency

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