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Tamil Nadu's Floating Solar Potential

Technology Can Save the State INR 16,000 Crore in Five Years

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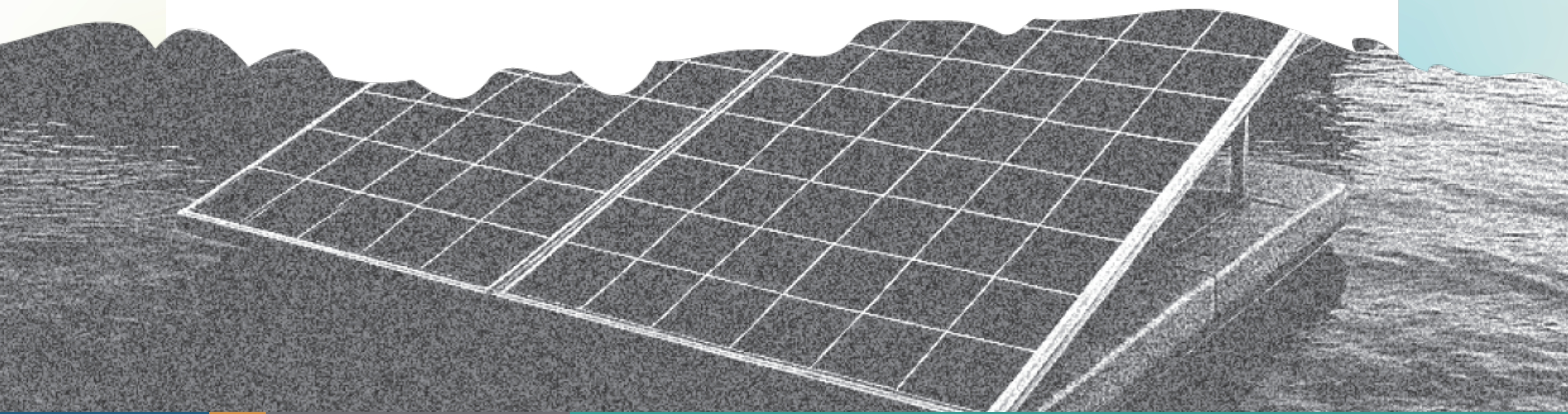


List of Abbreviations

ARR	Aggregate Revenue Requirement
BESS	Battery Energy Storage System
CAGR	Compound Annual Growth Rate
CERC	Central Electricity Regulatory Commission
CUF	Capacity Utilization Factor
CWC	Central Water Commission
DISCOM	Distribution Company
FPV	Floating Solar Photovoltaics
GLEV	Global Lake Evaporation Volume
GW	Gigawatt
INR	Indian Rupee
kWh	kilowatt-hour
LPV	Land Based Photovoltaics
NRLD	National Register of Large Dams
PAP	Project Affected Person
RE	Renewable Energy
SECI	Solar Energy Corporation of India Ltd
TANGEDCO	Tamil Nadu Generation and Distribution Corporation Limited
TN	Tamil Nadu
TNERC	Tamil Nadu Electricity Regulatory Commission
TNGECL	Tamil Nadu Green Energy Corporation Limited
TPP	Thermal Power Plant

1 Executive Summary

Tamil Nadu aims to be India's renewable energy leader by 2030, with the goal of increasing the contribution of green energy to the state's grid to 50% by 2030.[1] To achieve this ambitious target, the state government is planning a massive increase in green energy generation by 100 billion units. The newly established Tamil Nadu Green Energy Corporation Limited (TNGECL) will be the driving force behind this transformation.[2]

In 2022, Tamil Nadu became the first state in India to launch its own Climate Change Mission. Under the leadership of Chief Minister M.K. Stalin, the state aims to achieve carbon neutrality well ahead of the national target of 2070.

> ***"Our government views climate change as a major humanitarian crisis... Global warming has occurred due to high carbon emissions. Many scientists have said the world should reach carbon neutral by 2050. Last year, the Central Government declared that it would become carbon neutral by 2070. Let me assure that Tamil Nadu will achieve carbon neutrality before that. I am proud to lead from the front. I see this as my life's mission."***
>
> -Chief Minister M K Stalin, at the launch of the *Tamil Nadu Climate Change Mission*[3]

Achieving these goals will necessitate a significant increase in renewable energy generation in the state. In addition to ground-mounted photovoltaics and wind energy, Floating Solar Photovoltaics (FPV) will also play a significant role. This analysis attempts to quantify the potential availability across the state, and its likely financial cost in terms of delivered electricity, while suggesting mechanisms to unlock this potential that will benefit the state's finances.

2 Key Takeaways

#01

FPV energy potential: TN could generate 7,777 MU of electricity annually via 3.5 GW of floating solar at 57 major reservoirs across the state.

#02

Lower tariffs than thermal power: At an estimated average tariff of Rs. 3.16/kWh, electricity from FPV would cost less than half the average tariff of state-based coal thermal power plants (Rs. 7.12/kWh) and 30% lower than the average tariff of central-sector coal plants.

#03

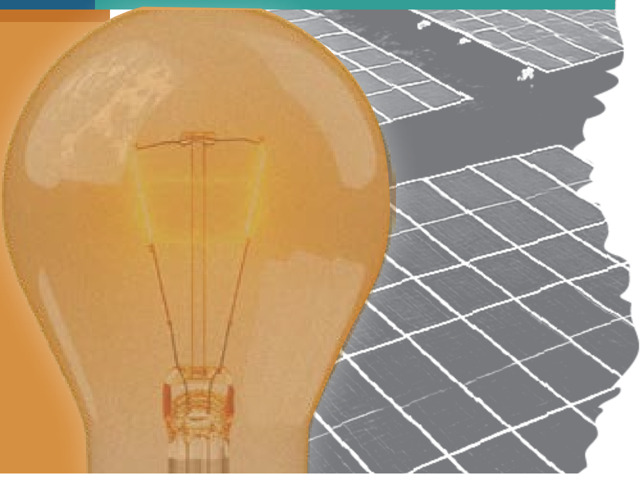
Savings from FPV could offset the equivalent of 50% of TANGEDCO's 2023-24 losses: Over a two-year transition period, this FPV capacity could replace 1.68 GW of coal power from the expensive North Chennai and Tuticorin power plants, both of which cost over Rs. 7/kWh. This could generate a savings of INR 3,211 crore annually, and over INR 16,000 crore over a five-year period. TANGEDCO's losses for 2023-24 stood at INR 6,920 crore.[4]

#04

Reduced evening peak load burden: If the 3.5 GW of FPV was tied to 2- hour storage, this will increase the FPV tariff to an estimated Rs. 3.73/kWh, but will allow TANGEDCO to meet part of its evening peak load from lower cost RE + storage.

#05

Price discovery: A reverse auction process under the joint auspices of the state of Tamil Nadu and SECI might be the best way to discover the lowest cost for such installations.



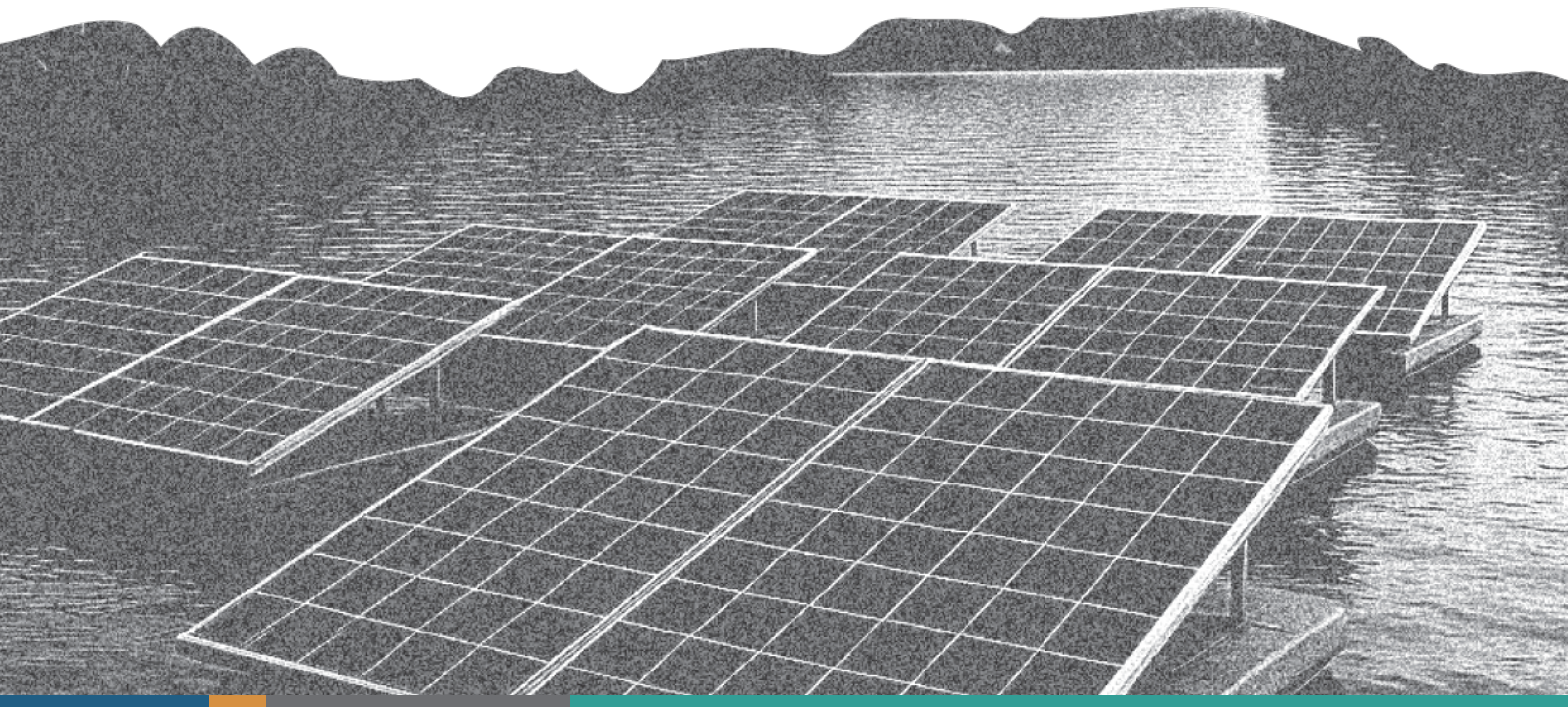
3 Background

Tamil Nadu (TN) is one of the most urbanised [5, 6] and industrialised [7] states in the country. It is the country's fourth highest electricity consuming state with an anticipated energy demand constituting 7.7% of the country's total demand in FY 2025.[8] The state was the first in the country to launch a dedicated Climate Change Mission in 2022 and to commit to achieving Net Zero ahead of India's target year of 2070. In its first-ever economic survey published for FY 2024-25, it has set itself a target to become a USD 1 trillion economy by 2030.[9] In the FY 2025-26 budget, the state has committed to generating an additional 100 Billion Units (BU) of renewable energy by 2030.

To achieve these twin ambitions (a Net Zero-USD 1 trillion economy), the state will need to capitalise on all types of renewable technologies — including wind systems, land and FPV-based systems, and pumped storage hydropower; all paired with Battery Energy Storage systems (BESS). FPV systems, the focus of this report, come with some distinct advantages over Land Based Photovoltaics (LPV) systems: they avoid the issues associated with land acquisition, they are more efficient, and reduce the evaporation loss from reservoirs where they are installed. They are also often significantly cheaper than conventional thermal power. In the case of TN, the FPV tariff is projected to cost less than half that of power supplied by older state-owned coal Thermal Power Plants (TPPs).

Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO), the agency under the Tamil Nadu Electricity Board which was responsible for generation and distribution of electricity across the state between 2010 and 2024, has been facing crippling, mounting losses since its inception. The agency has consistently struggled to address the crisis for a variety of reasons: the high cost of long-term Power Purchase Agreements (PPAs) with TPPs, the high and constantly rising cost of coal, as well as the under recovery of dues. It has resorted to three tariff hikes since 2022 to reduce its losses, passing on the burden of high coal tariffs to end users. The purchase of coal-based power has been such an extraordinary drain on TANGEDCO that the state government restructured it in order to separate the generation function from distribution, and created separate entities for fossil fuel power and renewable energy. The new entities that have been formed are the Tamil Nadu Power Distribution Corporation Limited, the Tamil Nadu Power Generation Corporation Limited (which will take over the fossil fuel assets), and the Tamil Nadu Green Energy Corporation Limited (TNGECL). This move is expected to help accelerate the influx of capital for new green energy projects.

To deliver cheaper, reliable electricity to its growing economy, TN must adopt the phased replacement of power from TPPs with renewable electricity, starting with the oldest plants with the highest tariffs. This will help reduce further losses while also helping the state move steadily towards its Net Zero goal.



4 Data and Methodology

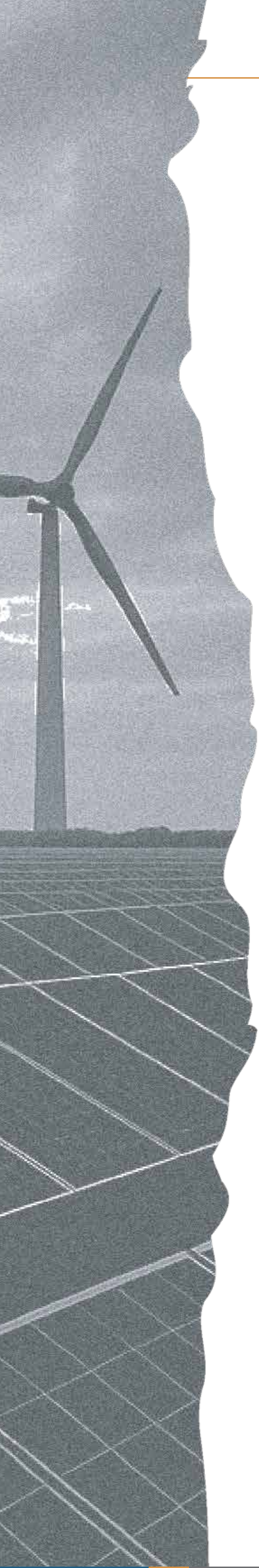
This report relies on the latest publicly available tariff, cost and scheduled dispatch data contained in the Aggregate Revenue Requirement (ARR) & Generation tariff order for FY 2022–23 to 2026-27 (September 2022) issued by the Tamil Nadu Electricity Regulatory Commission (TNERC).[10] Based on these figures, TANGEDCO's likely net savings per annum from replacing TPPs with solar based options (groundmounted solar, FPV and/or solar with BESS with an equivalent generation output), have been estimated. Since the latest FY 2022-23 to FY 2026-27 ARR order will be followed by a TNERC approved true-up involving actual demand and generation figures, there will be variance with actual tariff and dispatch figures. Therefore, total power purchase cost will vary. However, such variations are typically minor.

This analysis estimates FPV potential for 57 of the 116 reservoirs listed for TN by the Central Water Commission (CWC) in its National Register of Large Dams (NRLD).[11] These 57 were selected based on two criteria:

i. Reservoirs for which data on surface area at minimum annual water level was available as per the Global Lake Evaporation Volume (GLEV)) tool,[12] and

ii. Reservoirs that had not dried out even once in 2018 or in the decade preceding it.

Finally, FPV capacity was calculated based on the universally accepted yardstick of 4 acres/MW. The 25.11% Capacity Utilisation Factor (CUF) used for calculation of annual energy generation from FPV is based on the 22 MW Phase I of NTPC's 92 MW Kayamkulam FPV project, which in turn has been calculated based on global solar radiation at the project site by the project contractor and approved by Central Electricity Regulatory Commission (CERC).[13] The 35 MW Phase II of the same project has a CUF of 27.4%, but this analysis assumes the more conservative 25.11% CUF for all FPV systems.[14] Actual annual generation will vary from site to site. The number of



hours in a year (8766) used for calculation of annual energy generation with the given CUF has been taken based on CERC Renewable Energy Tariff Regulation.[15] The methodology used for the gradual expansion of FPV and elimination of expensive coal plants for elimination is built keeping in mind the increasing cost of power generation from these coal plants over the years, as specified in the tariff petition. This analysis suggests a phase-out schedule such that the most expensive coal plants with the highest differential above that of the replacement renewable energy are eliminated first, minimising costs and maximising savings for TANGEDCO.

The criteria for selecting TPPs for phaseout include the per unit cost of generation and the age of the plant (over 20 years). Only state plants qualify, as all old state-owned power plants have high costs of generation. This analysis uses a FPV energy tariff of Rs. 3.16/kWh based on the tariff from the NTPC Kayamkulam project.[16] The estimation of potential savings does not take into account likely declines in prices as the technology matures, and thus errs on the conservative side.

The socio-economic impacts of deploying FPVs have been assessed based on the policy and statutory framework within which a project developer is required to design and develop a FPV project in order to safeguard the livelihood and standard of living of the Project Affected People (PAP). We have reviewed Environmental and Social Impact Assessment (ESIA) reports, Resettlement Action Plans (RAP), and Detailed Project Reports (DPR) of some projects, including those associated with the Getalsud, Omkareshwar and Indravati FPV projects, to assess the measures included to protect the fishing communities from adverse social impact. Additionally, we have reviewed World Bank's guidance as part of their Environmental and Social Framework.[17,18] We have also relied on news articles to gauge how and to what degree these frameworks have been able to successfully safeguard the PAP from adverse effects of economic and physical displacement.

5 Findings

Tamil Nadu has the opportunity to leverage floating solar photovoltaic (FPV) systems to improve energy affordability, enhance energy security, and progress toward its climate goals. The report estimates that installing 3.5 GW of FPV on 57 major reservoirs could generate approximately 7,777 million units (MU) of electricity annually at a tariff of Rs. 3.16/kWh—less than half the cost of state coal-based power. This shift could save Tamil Nadu INR 16,000 crore over five years by replacing 1.68 GW of high-cost coal power. In addition to financial savings, FPV offers environmental benefits such as reduced water evaporation and less land use compared to traditional solar installations. However, there is also the need for careful planning to mitigate ecological impacts and ensure the protection of community livelihoods, particularly for fishing communities.

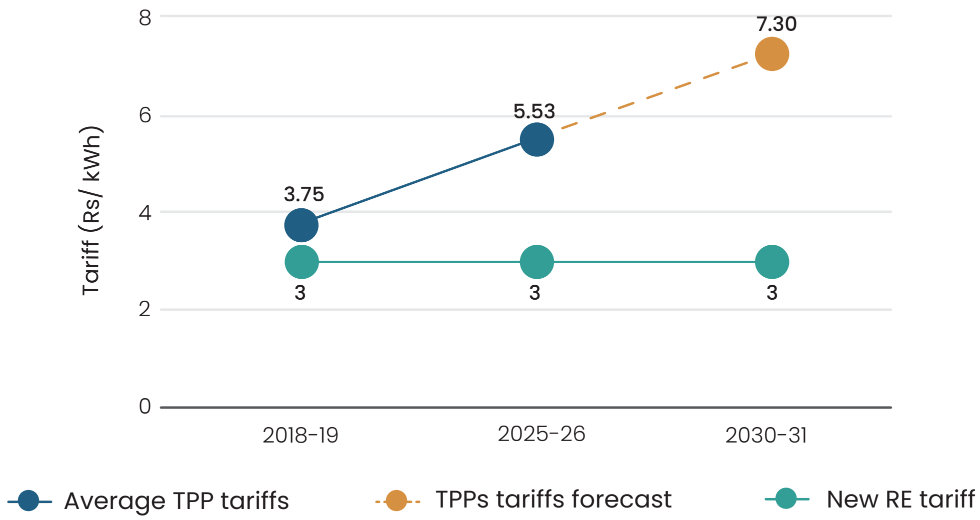
5.1 DISCOM Health Remains in the Red as Coal Costs Keep Rising

With coal costs rising continuously, the average per unit cost of energy purchased by TANGEDCO from central and state Thermal Power Plants (TPPs) has grown at a CAGR of 5.71%, from Rs. 3.75/kWh in 2018-19 to Rs. 5.53/kWh in 2025-26. At this growth rate, the projected per unit cost of coal-based energy would reach Rs. 7.30/kWh by 2030, as depicted in **Figure 1.** Similarly, the average per unit cost of energy purchased by TANGEDCO from just state-owned TPPs has grown at an even higher CAGR of 8.5% between 2018-19 and 2025-26, as shown in **Figure 2.**

Coal-based energy procurement has been a great drain on TANDGEDCO's finances. TANGEDCO's total debt stood at INR 1.80 lakh crore before bifurcation.[19] Annual losses have steadily declined in the past three years, narrowing down to INR 6,920 crore in FY 2023-24, but this has been achieved in large part through three punitive tariff hikes[20] – in September 2022[21], July 2023 and July 2024, with a hike of up to 6% planned for July 1 every year, up to

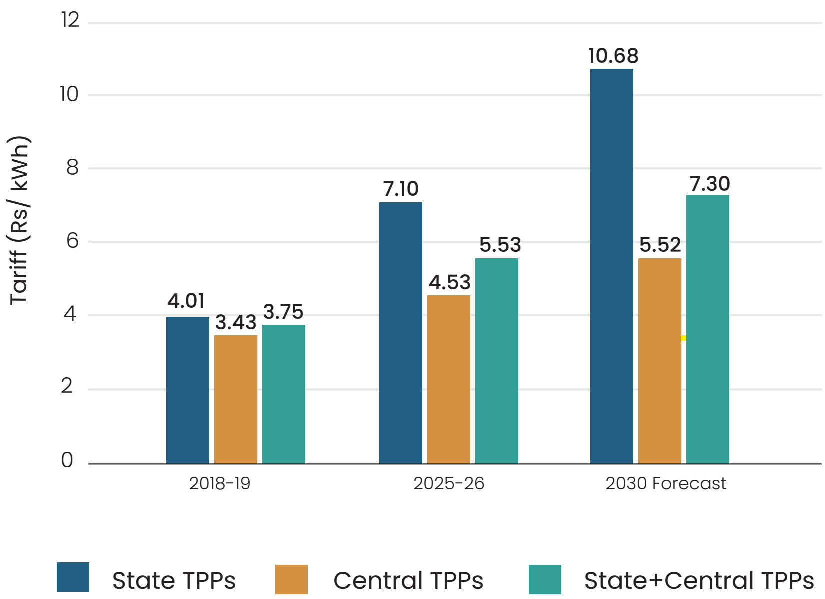
2026-27. In effect, the burden of persisting with legacy high-tariff PPAs is being borne by consumers. Even as the hikes are being absorbed by the state[22] to a certain degree, persisting with high-tariff PPAs for carbon emitting fossil fuel-based power is unjustifiable, particularly when viable renewable alternatives provide a way out of the crisis.

Figure 1: TN TPPs Tariff Trend



Source: TNERC Tariff Order & CRH Research

Figure 2: TN TPPs Ownership-wise Tariff Trend



Source: TNERC Tariff Order & CRH Research

5.2 RE's Twin Benefits: Reduced Power Costs, Increased Energy Security and Savings

Lowering the cost of power purchase and power generation will significantly improve the DISCOM's finances and eliminate the need to keep passing on the burden to customers. The optimal way to achieve this would be to gradually replace the share of more expensive coal power from the state's energy mix with cheaper RE. Such replacement would reduce the State's dependence on coal and boost its energy security by enhancing its energy self sufficiency.

RE tariffs, in contrast to coal-based energy tariffs, have either reduced or remained approximately the same between 2018-19 and 2024-25, hovering at about Rs. 3.00/kWh **(Figure 1)**. A rough comparison between the projected 2030 coal tariff and an RE tariff of Rs. 3.00/kWh indicates that the difference in average power purchase costs between the two would be INR 22,180 crore per annum. This in effect, is the amount of money TN would save on power purchases annually. This is based on the amount of power scheduled for procurement from central and state coal plants in 2024-25, which stood at 51,580 MU. If we compare projected 2030 coal tariffs only for state-owned plants with an RE tariff of Rs. 3.00/kWh, the savings would be INR 16,453 crore per annum, based on the latest scheduled energy procurement of 21,423 MU from state-owned coal power plants (2024-25). This calculation does not take into account issues of intermittency, storage costs or grid strengthening costs, but offers an indication of the potential savings available through cheaper electricity generation.

As per the latest multi-year tariff order dated 09 September 2022,[23] the scheduled energy dispatch from state and central-owned coal & lignite-based TPPs stood at 52% of the total scheduled energy dispatch in FY 2024-25. This energy is procured at an average per unit cost at Rs. 5.51/kWh, and individual plant tariffs reach up to Rs. 8.00/kWh, as depicted in **Figure 3**. If TANGEDCO is able to gradually replace its expensive coal power purchases with RE/RE+battery storage contracts, it can bring down the overall cost of power. As seen in **Figure 3,** the average RE (solar/wind) tariff, FPV tariff and solar+BESS tariffs are below most coal tariffs.

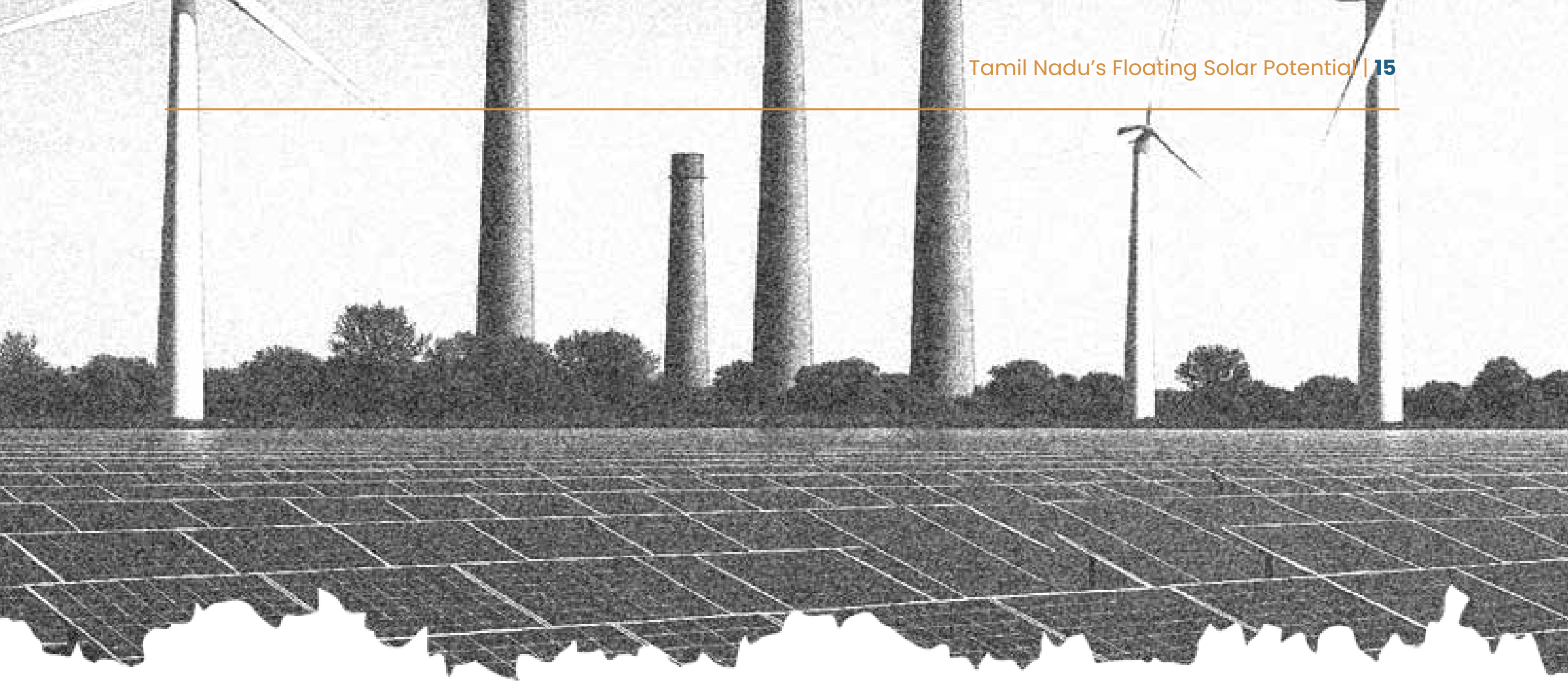
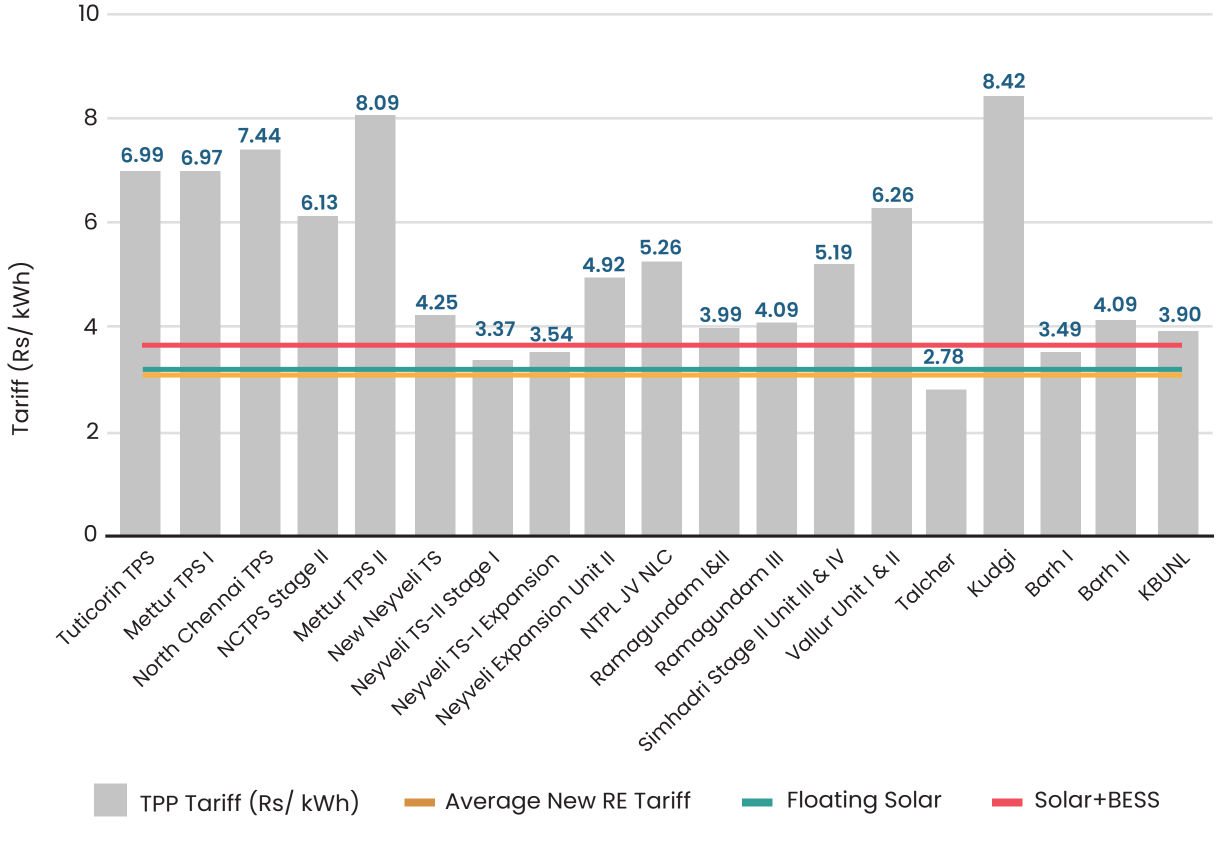


Figure 3: RE options to Lower Power Costs in Tamil Nadu



Source: TNERC Tariff Order & CRH Research

Table 1 below details TANGEDCO's existing coal plants and PPAs, and the hypothetical savings from replacing each with RE at an average tariff of Rs. 3.00/kWh. Scrapping expensive PPAs with private power producers might pose legal challenges but a start can be made with State and Central-sector projects. Several states have, in the past, surrendered their share of generation from Central-sector projects on account of low demand/high cost. Replacing power from these coal plants with RE would yield annual savings.

Table 1: Estimated Savings From Replacement Of Scheduled Coal Power With RE at Rs. 3/kWh

Plant Name	Energy (MU)	Plant/ Contracted Capacity (MW)*	Fixed Cost (Cr.)	Variable Cost (Rs./kWh)	Total Cost (Cr.)	Tariff (Rs./kWh)	Potential Annual Savings From Re Replacement (INR Cr.)
	A	B	C	D	E	F	G
State-owned Thermal Power Plants							
Tuticorin TPS	4,629	1050	1,396.74	3.97	3,234.45	6.99	1,845.75
Mettur TPS I	4,713	840	923.12	5.01	3,284.33	6.97	1,870.43
North Chennai TPS	3,282	630	1,259.71	3.6	2,441.23	7.44	1,456.63
NCTPS Stage II	5,866	1200	1,286.75	3.94	3,597.95	6.13	1,838.15
Mettur TPS II	2,933	600	910.64	4.99	2,374.21	8.09	1,494.31
Sub-total	**21,423**	**4320**			**14,932.18**	**6.97**	**8,505.28**
Central Thermal Power Plants							
New Neyveli TS	3,743	655	718.15	2.33	1,589.36	4.25	466.60
Neyveli TS-II Stage I	3,952	190	215.85	2.82	1,330.35	3.37	144.61
Neyveli TS-I Expansion	1,643	226	159.35	2.57	581.37	3.54	88.49
Neyveli Expansion Unit II	1,061	271	232.99	2.72	521.50	4.92	203.21
NTPL JV NLC	1,965	415	366.86	3.4	1,033.91	5.26	444.51
Ramagundam I&II	3,600	524	267.12	3.24	1,434.59	3.99	354.66
Ramagundam III	908	131	82.42	3.18	371.49	4.09	99.03
Simhadri Stage II Unit III	1,306	223	239.19	3.36	677.46	5.19	285.73
Vallur Unit I & II	5,617	1064	1,329.97	3.9	3,519.13	6.26	1,833.98
Talcher	3,746	490	270.61	2.06	1,040.90	2.78	-83.02
Kudgi	970	346	387.81	4.55	795.58	8.42	504.45
Barh I	533	80	30.00	3.07	180.56	3.49	20.64
Barh II	629	97	47.77	3.49	250.11	4.09	61.27
KBUNL	483	88	46.29	3.08	183.05	3.9	38.05
Sub-total	30,157	5,228			13,509.36	4.48	4,462.19
Total	51,580	9,548			28,441.54	5.51	12,967.47

* Based on TN's scheduled purchases from coal power stations in FY 2025, per TANGEDCO multi-year tariff order for the 2022–2027 period

Source: CRH Analysis

G- Saving from adopting RE at Rs. 3/kWh (converted to crore)

A- Energy dispatch (net energy generated) converted to kWh from Million Units (MU)

F- Is the existing tariff the power plant is generating electricity at (in Rs./kWh)

$$G = (F \times A) - (3 \times A)$$

5.3 TN's large FPV potential can augment other RE capacity

To achieve its goal of having over 50% of its electricity come from renewables by 2030, TN will need to tap into all its renewable potential. In FY 2023-24, about 27% of the energy generated in the state was from RE sources (wind 13.71%, solar 9.52%).[24] The current estimated wind and land-based solar potential for the state is 112.78 GW. [25] As of 28 February 2025, installed capacity of RE (excluding hydro) stood at 22.45 GW,[26] representing 53% of the total installed capacity from all sources in the state. Deployment of FPV to augment existing wind and solar capacity will increase overall in-state generation and bolster the state's energy security. FPV systems present some clear advantages over LPVs – they offer higher efficiency due to the natural cooling effect of water and, critically, do not require the acquisition of land which can be both socially contentious and a significant source of delay in a densely populated country like India. FPVs also have the advantage of positively impacting water-scarce regions by reducing natural evaporation and water loss by providing shade to the water beneath them.

The 57 large category dams chosen for analysis have a total surface area of 35,486 acres when their water levels are at their annual minimum. CRH analysis suggests that utilising just 40% of this minimum recorded water area would yield an installed capacity of 3.55 GW of FPV assuming a requirement of 4 acres/MW.

The current FPV tariff in the region is around Rs. 3.16/kWh, based on the Kayamkulam project in Kerala. With increased deployment and economies of scale, and given the continued cost declines in equipment, this tariff could decline further, but site specifics could also mean higher costs, especially for evacuation. Co-locating battery storage with FPV would add additional benefit in terms of being able to meet evening load.

At a conservative CUF of 25.11%, the estimated total energy generation output from 3.55 GW of FPV would be about 7,777 MU annually. This is sufficient to replace almost all the energy scheduled through TANGEDCO’s 1.68 GW of coal-based power plants of Tuticorin and North Chennai, accounting for roughly 7% of the state's total scheduled energy requirement of 1.1 lakh MU during FY 2024-25.

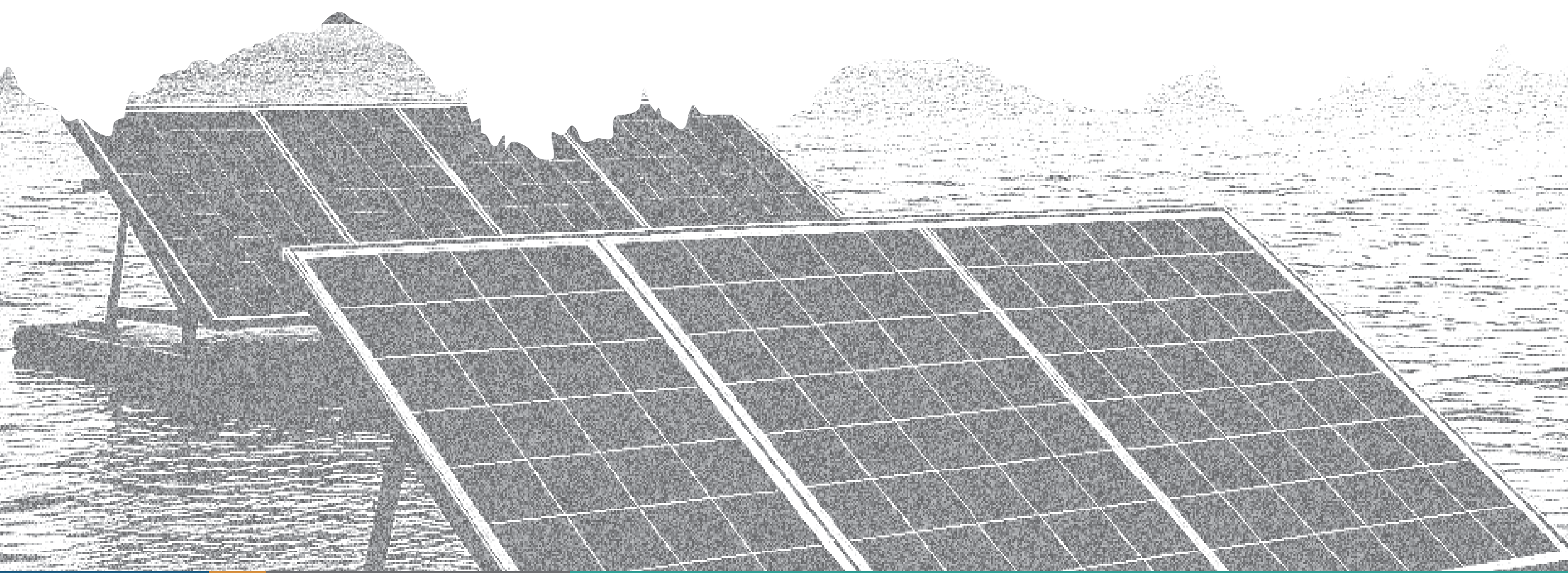
Table 2 details available surface area, potential capacity and power generated at 25% capacity utilisation factor. This table also illustrates the FPV capacity that can be developed on reservoirs with existing hydroelectric power projects, enabling access to the existing hydro project’s power evacuation infrastructure, reducing the cost of generation. Approximately 50% of the potential 3.55 GW FPV capacity in TN will have access to existing power evacuation infrastructure. On the other hand, the possibility of smaller-scale, distributed FPV on relatively smaller reservoirs and water bodies would enable local community power supply without the large investments needed for transmission/power evacuation.

Table 2: Tamil Nadu’s FPV Potential Capacity and Generation Potential

Reservoir Type	Reservoir Surface Area at Minimum Annual Water Level (Acres)	40% of Minimum Annual Reservoir Surface Area (Acres)	FPV Capacity (MW)	Gen. at 25% CUF (MU)
Non-hydro	17,506	7,002	1,751	3,836
Hydro	17,980	7,192	1,798	3,940
Total	35,486	14,194	3,549	7,777

Source: National Register of Large Dams (NRLD), CRH Analysis

*FPV capacity calculated assuming 4 acres/MW PV.



5.4 Phased Transition Pathway: Replacing the Oldest, Costliest TPPs with FPV

The phased decarbonisation of TN's electricity sector can be carried out by initially replacing the oldest TPPs with higher tariffs, replacing the scheduled electricity generated from renewable energy plants including wind, LPV and FPV. Given the massive decarbonisation task ahead, all three would need to be utilised eventually, but a short-term transition pathway that uses FPV as the bulk of the new PV to replace expensive coal power is presented in **Table 3.**

TN can tap into its significant FPV potential to initially replace 7,911 MU of electricity sourced from 1.68 GW of old coal capacity by 2025-26, and potentially save the DISCOM cumulatively INR 4,616 crore in just two years, while also hedging against future power cost inflation.

Table 3: FPV Phased Transition Pathway and Savings

Year	Current Scenario			Replacement Scenario			Annual Savings(Cr)	FPV Capacity(MW)
	Energy from coal TPPs (MU)	Avg Tariff (Rs./kWh)	Total Cost (Cr)	Energy from coal TPPs (MU)	Energy from FPV @₹3.16/ kWh (MU)	Total Cost (Cr)		
2024-25	7911	7.17	5675.7	4629	3282	4271.6	1404.1	1491
2025-26	7911	7.22	5711.4	0	7911	2499.9	3211.6	3594

Source: CRH Analysis

Over two years, 3.55 GW of FPV can replace 1.68 GW of coal power currently purchased from two state-owned power stations - the North Chennai TPS 1 and the Tuticorin TPS. In the first year, replacement of 630 MW of coal capacity with 1,491 MW of FPV will lead to an annual savings of INR 1,404 crore, which by the end of second year will lead to an annual savings of INR 3,211 crore by FY 2026 as the remaining 1,050 MW of TPPs are replaced.

Table 4 suggests a year-wise removal of coal plants along with their respective dispatch and tariffs over a two-year period.

Table 4: Year-wise Replacement Of Coal TPPs Based On Tariffs

Year 1	
Plant Replaced	North Chennai TPS I
Energy (MU)	3282
Cost (Cr)	2441.23
Tariff (Rs./kWh)	7.44
Contracted capacity (MW)	630
Year 2	
Plant Replaced	Tuticorin TPS
Energy (MU)	4629
Cost (Cr)	3264.043
Tariff (Rs./kWh)	7.05
Contracted capacity (MW)	1050

Source: CRH Analysis

5.5 Mitigation of Water Loss through Reduction in Evaporation Loss

In 2018, TN lost approximately 3,73,923 million litres of water to evaporation from across 55 major reservoirs, as per data from GLEV. This is equivalent to about 45% of Chennai's total annual water consumption projected for 2025.[27] In spite of having many large water bodies, the state faces particularly acute water shortages during summer, with reservoirs drying up partially or completely.[28] This is partially attributable to evaporation loss of stored water from the reservoirs due to the hot and dry daytime temperatures in summer. A study on water loss due to evaporation over more than 1.42 million lakes globally found that the volume of water loss due to evaporation in Indian[29] lakes and reservoirs have been going up by 5.9% per decade during 1985-2018.[30] According to the same report, evaporation loss from Chennai's Red Hills lake during April 2018 alone was 3,000 million litres.

FPV systems help reduce water evaporation by providing shade to the water beneath them, thereby increasing freshwater availability for multiple purposes, including drinking, irrigation, and industrial use while also helping groundwater recharge. Thus the systems have the potential to directly address two broader elements of the UN's sustainable development goals, energy and water.

Studies on water evaporation reduction as a result of FPV installations conducted in Egypt[31] and Brazil[32] (both with different climatic conditions and different coverage percentages) found that the lowest annual evaporation reduction was about 21.2% at 30% coverage in Brazil, and the highest reduction was 61.7% at 50% coverage in Egypt. This indicates that FPV can result in substantial reduction in evaporation losses when the coverage is significant. In the present study, the 40% coverage is at minimum recorded water levels and not at full reservoir capacity. As the water levels drop and reservoirs shrink during the drier months, the role of FPV in reducing evaporation-related water losses will become increasingly important. The impact of evaporation is not evenly distributed across seasons, and the highest impact is seen during drier months when water shortage is most severe.

5.6 Ecological and Social Impacts of FPV

Reservoirs and lakes support multiple resource uses, including water supply for domestic, agricultural, and industrial purposes, as well as fisheries and hydropower generation. Maximising FPV while taking into consideration these multiple resource uses and ecological value of water bodies will help lower the state's dependence on coal, while also increasing in-state generation and energy security.

While the ecological and social impacts of FPV systems are lower than for LPVs, they are not completely absent. Hence a process that takes into account legitimate community concerns, seeks to share benefits and ensures that existing benign use of water bodies for fishing, transport, etc., is not negatively impacted, would be important.

There are concerns about the impacts of FPV on the pond/reservoir ecosystems. This is an emerging field with no hard data yet available, but to err on the side of caution, it would be advisable to keep the total water surface covered by FPV down to 40% area at minimum recorded water levels as per GLEV database for existing multiple uses of the water body.

While this report mainly focuses on highlighting TN's FPV potential and financial benefits, it also acknowledges that where there are competing uses of reservoirs, community rights must be given due importance.

FPV projects that do not rely on accurate social impact assessments and principles of prior informed consent will alienate the local community, or worse, turn them into antagonists. Even when accurate assessments have been carried out, if the rehabilitation and resettlement plans are not followed through on, opposition to the project is probable. The loss of access to historical fishing areas or navigation routes, a key issue associated with FPV projects, can lead to both economic and physical displacement.

The opposition to the 600 MW FPV project on the Omkareshwar reservoir in Madhya Pradesh is instructive. As per the final social and environmental impact assessment report,[33] 312 fishing families from across six villages were affected as their traditional fishing areas were expropriated for the project. A Livelihood Restoration Plan was designed for these affected families. According to reports, despite a budget of over INR 5 crores being provisioned for it, the plan was not implemented.[34] The plan included a subsistence allowance for each PAP, a one-time additional financial assistance package for affected fishermen, and permanent jobs and skill development for subsets of PAP. Implementation of the rehabilitation plan would have helped the PAP rebuild their lives while also allowing the FPV plant to operate unfettered.

A proposed 1200 MW FPV project on the Jayakwadi reservoir in Maharashtra is also facing protests from fishing communities.[35] Accurately assessing and compensating for livelihood impacts, and winning community support, is essential to unlock the potential benefits that this technology can bring.

5.7 Co-location of FPV with Protected Areas

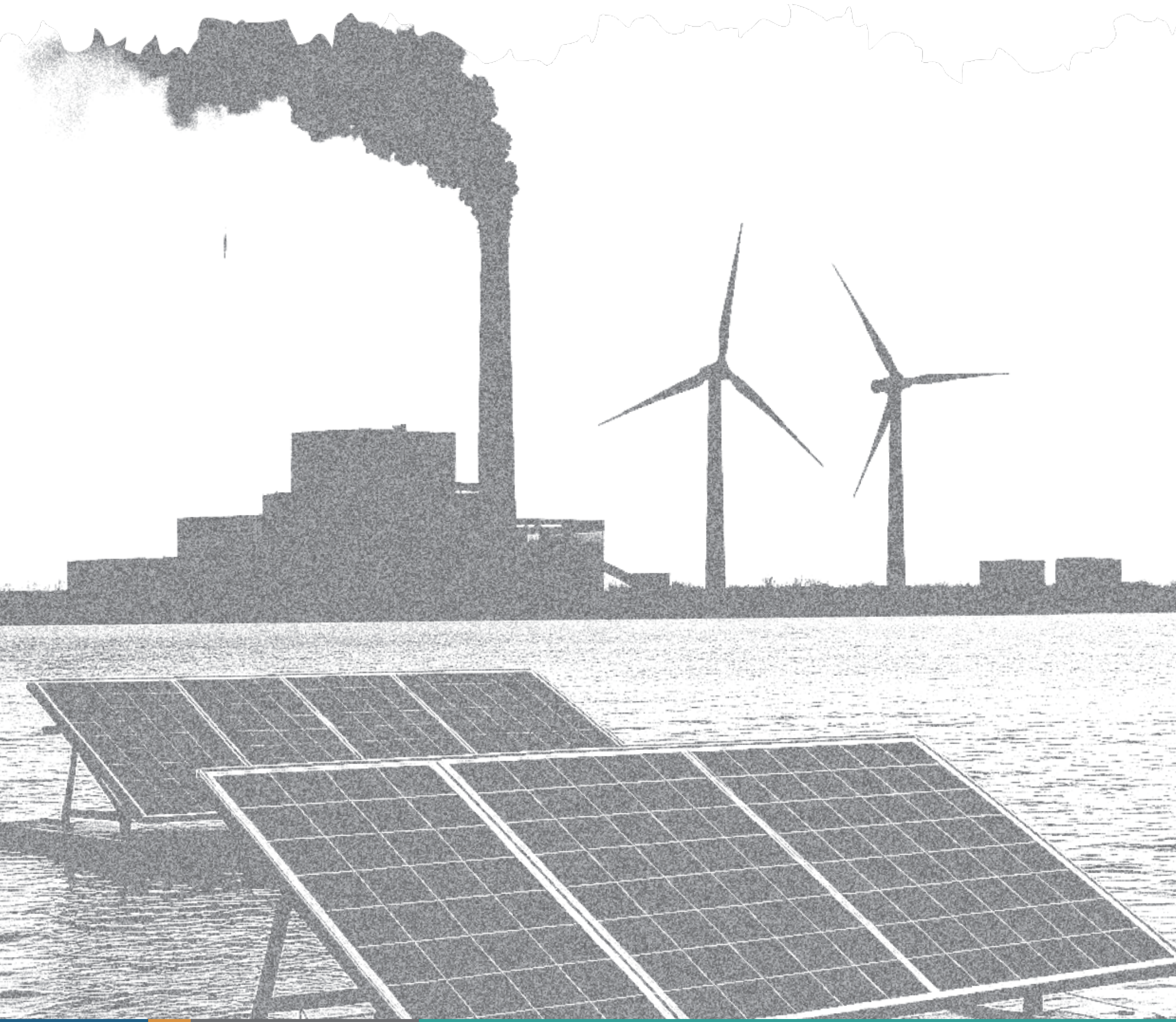
Of the total 3.5 GW of FPV potential in TN identified in this report, about 750 MW of the potential capacity, spread across six reservoirs, is within a protected area such as a wildlife sanctuary, a tiger reserve or a national park. Four of these reservoirs also have an existing hydroelectric project. Excluding these locations from any FPV projects would be advisable to avoid potential disturbance to critical habitats.

Details of the identified reservoirs with their respective capacity potential, purpose (hydro/non-hydro) and name of protected area they lie within, are given in **Table 5**.

Table 5: Reservoirs Co-Located With Protected Areas

Reservoir Name	FPV Capacity At 40% Of Min. Coverage (MW)	Purpose (Hydro/ Non-hydro)	Name Of Protected Area
Karaiyar	24.41401	Hydro	Kalakkad Mundanthurai Tiger Reserve (KMTR)
Amaravathi	31.40709	Hydro	Indira Gandhi Wildlife sanctuary
Manimuthar	110.9503	Non-hydro	Kalakkad Mundanthurai Tiger Reserve
Periyar	263.5622	Hydro	Periyar Tiger Reserve
Parambikulam	291.0897	Non-hydro	Parambikulan Tiger Reserve
Mukurthi	27.84873	Hydro	Mukurthi National Park

Source: CRH Analysis



6 Conclusion

In order to meet its targets of generating 50% of its electricity requirement from renewable sources by 2030 and of achieving Net Zero well ahead of 2070, while also reducing the debt burden to the state exchequer, TN will need to tap all available renewable energy sources and use them to replace TPPs in a phased manner.

FPV systems will need to augment wind and LPV systems solutions. They come with some distinct advantages - they are not burdened with the complexities around land acquisition and they help increase water conservation. The state has the opportunity to capitalise on its FPV potential, particularly in the near term, to quickly replace its oldest and most expensive fossil fuel-based power purchases.

This analysis suggests that, under conservative assumptions, TN can install 3.5 GW of floating solar on its reservoirs and lakes.This would be enough to generate 7,777 MU of electricity, at a lower tariff than either existing or new coal power, allowing the state to phase out some of its more expensive coal power purchases, delivering net savings and making meaningful progress towards Net Zero. By tapping into its FPV potential, the state can replace about 7,911 MU sourced from 1.68 GW of old coal capacity by 2025-26, and potentially save INR 4,616 CR in just two years.

By accurately assessing and compensating for livelihood impacts, FPV can garner community support which is essential to unlock the potential benefits that this technology can bring.

7 Endnotes

Note: In case the links do not work, please copy and paste the URL directly into your browser.

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8 Annexures

Annexure I

Details of 72 of the 116 reservoirs in TN from CWC's NRLD list, along with respective reservoir area, FPV potential capacity, expected energy generation and annual evaporation volume are given in **Table 6** below.

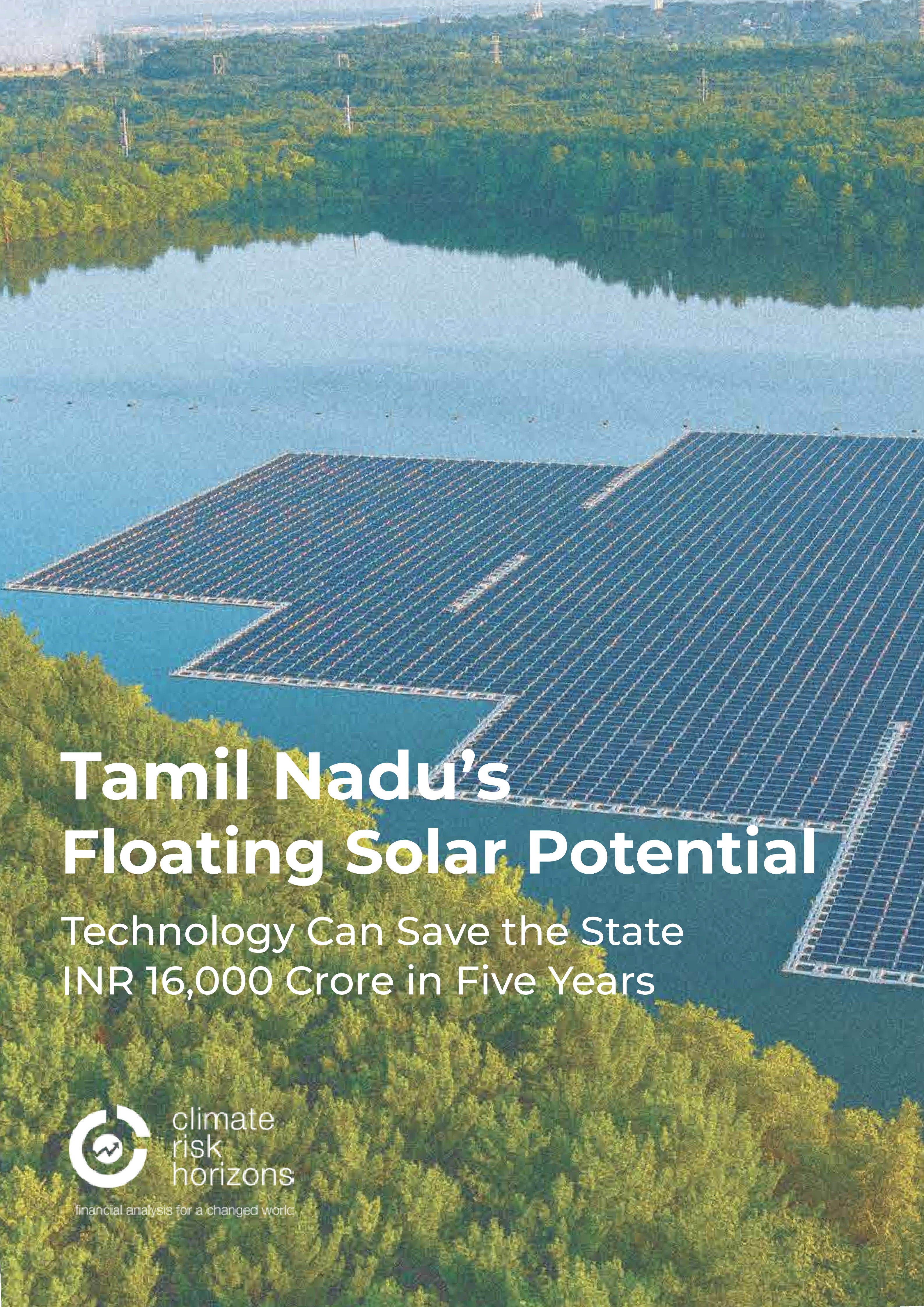
Table 6: Reservoir Area, FPV Potential Capacity, Expected Energy Generation and Annual Evaporation Volume of the Analysed Reservoir

Name of Dam	Nearest city	Reservoir Area (Acres)	40 % of Minimum recorded area (Acres)	FPV Potential (MW)	Gen. at 25.11% CUF (MU)	Annual evaporation volume (10^6 m^3)	Purpose+
Pechipparai	Nagerkoil	3743.65	434.9	108.7	238.27	14.7122	I
Willingdon	Thittagudi	3840.02	6.33	1.58	3.47	3.094	I
Glenmorgan	Uthagamandalam	41.02	19.37	4.84	10.61	0.379	H
Mettur	Salem	34273.52	3261.6	815.4	1786.95	144.83	I/H/S
Papanasam Div weir	Ambasamudaram	153.21	97.66	24.41	53.50	5.155	H/I
Poondi	Chennai	8310.15	102.99	25.75	56.43	3.104	S
Perunchani	Nagerkoil	23796.25	34.99	8.75	19.17	6.795	I
Bhavanisagar	Mettupalayam	17954.68	1887.88	471.97	1034.33	65.989	I
Amaravathi	Udumalpet	2240.01	125.63	31.41	68.83	7.362	I/H
Krishnagiri	Krishnagiri	3083.88	312.34	78.09	171.12	8.999	I
Manimuthar	Ambasamudaram	2322.30	443.8	110.95	243.15	10.303	I
Sathanur	Thiruvannamalai	4472.61	517.63	129.41	283.6	21.324	I/H/S
Vaigai	Andipatti	5979.95	409.8	102.45	224.52	14.532	I/S/H
Vidur	Dindivanam	1920.01	2.87	0.72	1.57	1.552	I
Avalanche	Uthagamandalam	1991.67	134.72	33.68	73.81	2.962	H
Emerald	Uthagamandalam	1991.67	220.12	55.03	120.6	4.449	H
Aliyar	Pollachi	1606.18	263.22	65.8	144.21	7.448	I
Gomukhinadhi	Kallakurichi	889.58	16.8	4.2	9.21	1.372	I
Upper Bhavani	Uthagamandalam	1124.33	183.15	45.79	100.35	4.223	H
Parson Valley	Uthagamandalam	412.67	40.03	10.01	21.93	0.926	H/S
Porthimund	Uthagamandalam	701.78	105.86	26.46	58	2.417	H
Manjalar	Periakulam	486.80	25.7	6.42	14.08	0.909	I
Pillur	Mettupalayam	642.47	76.4	19.1	41.86	1.665	H/S
Thirumurthi	Udumalpet	968.65	215.08	53.77	117.84	4.846	I
Uppar(Erode)	Dharapuram	1099.62	2.87	0.72	1.57	0.223	I
Chittar-I	Kuzhithurai	724.02	82.83	20.71	45.38	2.126	I

Name of Dam	Nearest city	Reservoir Area (Acres)	40 % of Minimum recorded area (Acres)	FPV Potential (MW)	Gen. at 25.11% CUF (MU)	Annual evaporation volume (10^6 m^3)	Pupose+
Chittar-II	Kuzhithurai	1025.49	157.36	39.34	86.21	4.314	I
Kuthiraiyar	Palani	181.13	5.14	1.28	2.82	0.69	I
Manimukthanadhi	Kallakurichi	1843.41	472.27	118.07	258.74	2.929	I
Kodayar-II	Nagercoil	10329.00	330.63	82.66	181.14	7.694	H
Sholayar	Valparai	1413.44	66.12	16.53	36.23	3.4	I/H
Gatana	Alwarkurichi	196.94	31.23	7.81	17.11	0.854	I
Parappalar	Palani	281.70				0.208 (dries out)	I
Ponnaniyar	Trichy	313.08	8.4	2.1	4.6	0.195	I
Ramanadhi	Keelakadayam	76.60	0.3	0.07	0.16	0.287	I
Pilavukkal Project Periyar	Srivilliputhur	188.05	6.3	1.58	3.47	0.222	I
Chinnar	Palacode	420.08				0.39 (dries out)	I
Karuppanadhi	Kadayanallur	96.37				0.008 (dries out)	I
Gunderipallam	Gopichettipalayam	145.79	4.05	1.01	2.22	0.486	I
Manalar	Chinnamanur	75.61	2.96	0.74	1.62	0.546	H
Palar Poranthalar	Palani	1280.01	7.12	1.78	3.90	4.639	I
Varadhamanadhi	Palani	96.37				0.292 (dries out)	I
Varattupallam	Bhavani	219.92	5.24	1.31	2.87	0 .639	I
Vattamalaikarai Odai	Dharapuram	509.04				0.019 (dries out)	I
Marudhanadhi	Vathalagundu	177.92				0.232 (dries out)	I
Lower Nirar	Valparai	128.49	2.57	0.64	1.41	0.164	I/H
Thumbalahalli	Palacode	479.38				0.2 (dries out)	I
Vaniar	Pappireddy patti	27.18	10.28	2.57	5.63	0.705	I
Nagavathi	Dharmapuri	291.58	7.02	1.75	3.84	0.419	I
Thoppaiyar	Dharmapuri	296.53				0.194 (dries out)	I
Perumpallam	Sathyamangalam	161.34				0.437 (dries out)	I
Noyyal Orathupalayam	Chennimalai	1050.20				0/017 (dries out)	I
Anaimadavu	Salem	261.93	4.35	1.09	2.38	0.319	I
Kariakovil	Salem	193.73				0.451 (dries out)	I
Kelavarapalli	Hosur	889.58	22.63	5.66	12.4	0.854	I/S
Periyar (Mullai Periyar)	Kurnily	142.33	1054.25	263.56	577.6		I
Parambikulam			1164.35	291.08	637.92		I/S/F
Peruvaripallam			74.03	18.50	40.56		i/h
Thunacavadu			66.6	16.65	36.49		I/H
Redhills			589.39	147.34	322.91		S
Chembarambekkam			674.20	168.55	369.37		S
Veeranam						(dries out)	I/S/F
Kannan kottai Thervoykandigai						(dries out)	I/S
Pykara			97.16	24.29	53.23		H
Mukurthi			111.39	27.84	61.03		H
Maravakandy			9.19	2.29	5.03		H
Kundahpallam			4.05	1.01	2.22		H
Sandynallah	Sivakasi	1368.47	119.49	29.87	65.47		H
Vembakottai						0.424 (dries out)	I
Upper Aliyar			21.84	5.46	11.96		H
Kadambarai			39.83	9.95	21.82		
Servalar						(dries out)	

Source: National Register of Large Dams (NRLD), CRH Analysis

+Purpose for which the reservoir exists - I- Irrigation, H- Hydropower, T- Tourism, S- Water Supply, N- Navigation, F- Fish Production, C- Flood Control, O- Other Benefits



Tamil Nadu's Floating Solar Potential

Technology Can Save the State INR 16,000 Crore in Five Years

climate risk horizons

financial analysis for a changed world