CSTEP

West Bengal Clean Energy Transition Roadmap 2030

West Bengal Clean Energy Transition Roadmap 2030

Hanumanth Raju G V

Mallik E V

Rishu Garg

Center for Study of Science, Technology and Policy (CSTEP)

August 2025

Edited and Designed by CSTEP

Disclaimer

Suggested citation: CSTEP. 2025. *West Bengal clean energy transition roadmap 2030*. (CSTEP-RR-2025-09).

August 2025

Editor: Garima Singh

Designer: Bhawna Welturkar

Bengaluru

No. 18, 10th Cross, Mayura Street
Papanna Layout, Nagashettyhalli
RMV Stage 2, Bengaluru 560094
Karnataka (India)

Noida

1st Floor, Tower-A
Smartworks Corporate Park
Sector 125, Noida 201303
Uttar Pradesh (India)

Tel.: +91 (80) 6690 2500
Email: cpe@cstep.in

Contents

Acknowledgements

We sincerely thank Shri Santanu Basu, IAS, Principal Secretary, Department of Power, Government of West Bengal, for his valuable guidance and support throughout this study. We also express our gratitude to Shri S Suresh Kumar, IAS, former Additional Chief Secretary, Department of Power, Government of West Bengal, for his keen interest in the subject and for entrusting CSTEP with this important work.

Our heartfelt thanks go to Shri Anjan Chakrabarti, WBCS (Exe.), Special Secretary, for his insightful inputs, and to Shri Pralay Majumdar, WBCS (Exe.), Additional Secretary, whose support in validating key assumptions, reviewing the analysis, and offering constructive feedback has been instrumental in enhancing the quality of this study. We also acknowledge the contributions of Mr Arnab Kumar Sinha (Associate Director, Deloitte), working with the Department of Power, Government of West Bengal, for the facilitation of data access and coordination in his role as the nodal officer.

Further, we appreciate the editorial and design support provided by the Communication and Policy Engagement team at CSTEP, which helped in shaping the final report. Finally, we are grateful to the leadership at CSTEP, especially Dr Jai Asundi, Executive Director, and Abhishek Nath, Sector Head, Energy and Power, for their continued encouragement and support.

Introduction

West Bengal is witnessing a steady rise in energy demand, a trend expected to continue due to the growing consumption in the residential, industrial, and commercial sectors. Currently, the state's power supply is predominantly dependent on thermal energy, which accounted for 80% of its total capacity mix in financial year (FY) 25. While renewable energy (RE) sources are beginning to play a larger role in shaping the power sector landscape of West Bengal, the state needs to recalibrate its energy strategy to realise India's national targets of achieving net-zero emissions and installing 500 gigawatts (GW) of RE capacity by 2030 (MoEFCC, 2022).

Objective

With rising energy demand and policy developments that have substantial implications for the state's power sector, West Bengal—heavily reliant on fossil fuels at present—is bringing in more RE for meeting the future energy demand.

The objective of this study was to develop a forward-looking roadmap that can assist West Bengal in integrating a higher share of RE effectively into its generation mix by FY 30. Accordingly, the recommendations focus on facilitating a smooth transition from fossil fuels to sustainable alternatives, while ensuring that the future power supply remains affordable, accessible, and reliable. They entail specific measures for the generation and distribution segments of the state's power sector, aiming to ensure its long-term energy security and enabling it to align with the nation's net-zero ambitions.

Methodology

As a first step towards assessing West Bengal's clean energy transition potential, a comprehensive review of the state's historical electricity consumption across consumer categories from FY 16 to FY 22 was conducted. For this, data sourced from the Department of Power, Government of West Bengal, was used to forecast the business-as-usual (BAU) demand up to FY 30, applying the compound annual growth rate (CAGR) method. This baseline demand was further refined by incorporating policy-based factors such as electric vehicle (EV) adoption, solar rooftop photovoltaic (RTPV) integration, and energy efficiency improvements in residential and commercial sectors. Agricultural demand was adjusted to reflect the expected impact of deploying energy-efficient (EE) irrigation pump (IP) sets and their solarisation.

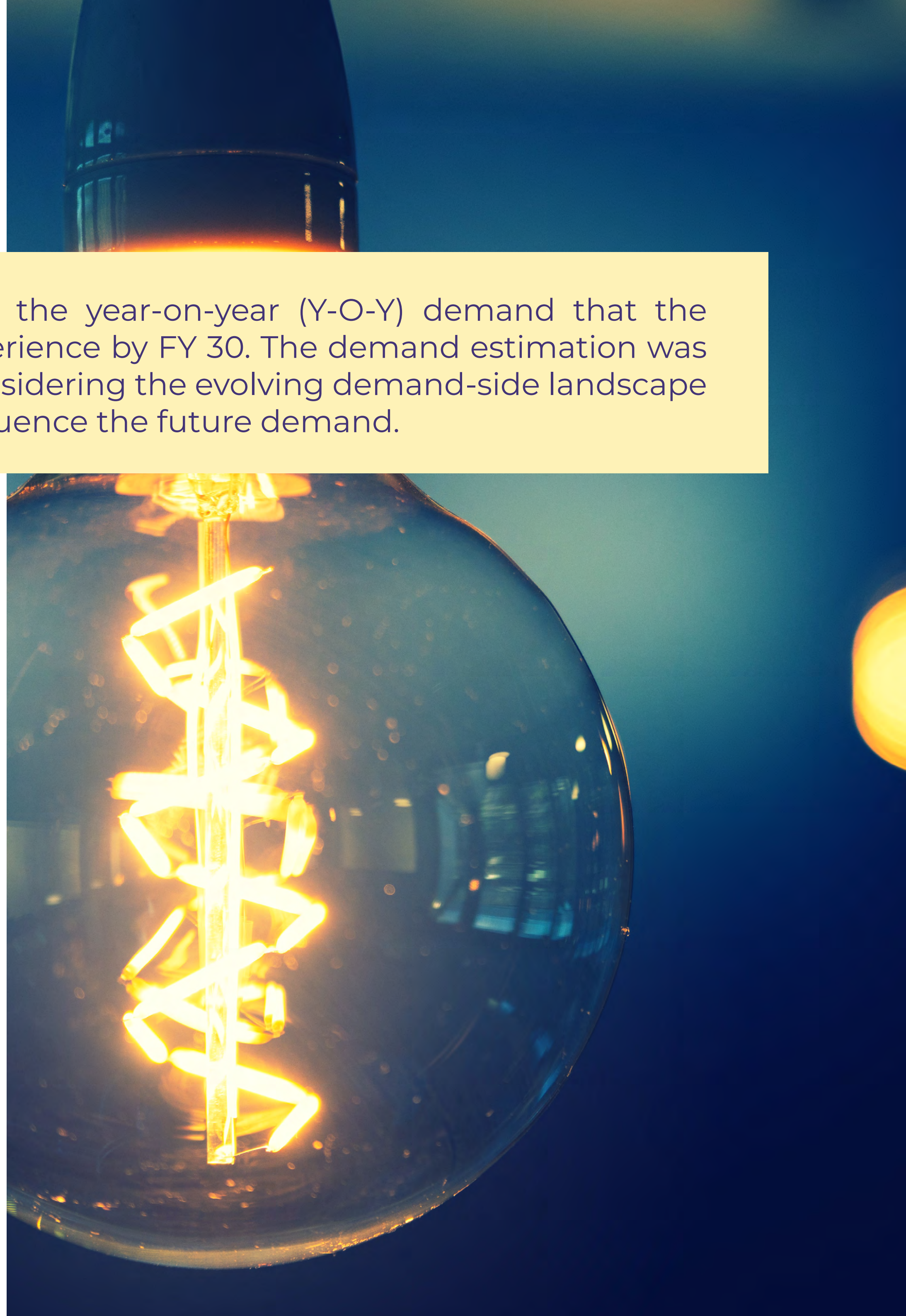
On the supply side, an in-depth analysis was conducted, wherein the existing generation assets and their retirement, along with the planned additions from both state and central generating stations (CGSs) were evaluated. Plant-level operational characteristics of all the 8,760 hours were considered. Based on the available dispatchable capacity, three scenarios were assessed to identify the additional generation and storage capacity required for meeting the projected demand reliably. These scenarios are:

1. RE + existing thermal plant load factor (PLF)
2. RE with nuclear capacity
3. RE with a restricted thermal PLF of 65%

Finally, the study analysed the financial implications of integrating a higher RE share for distribution companies (DISCOMs) by estimating the power purchase costs under each scenario. This included calculating the weighted average cost of energy sources and accounting for future solar tariff reductions (post FY 26) and market-based electricity procurement from exchanges and traders.

Demand Projections: FY 26 to FY 30

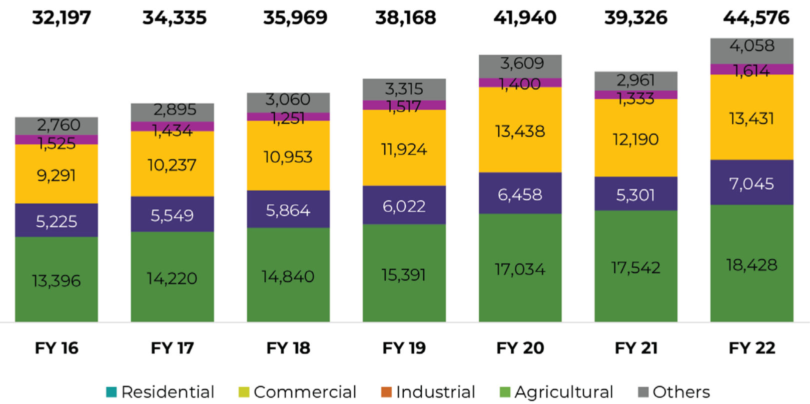
We forecasted the year-on-year (Y-O-Y) demand that the state may experience by FY 30. The demand estimation was carried out considering the evolving demand-side landscape that would influence the future demand.



BAU demand forecast

To estimate the demand for each consumer category within the state, we applied the CAGR method. The historical consumption data of West Bengal from FY 16 to FY 22 is presented in Figure 1. This consists of data from three DISCOMs, namely the West Bengal State Electricity Distribution Company Limited (WBSEDCL), Calcutta Electric Supply Corporation (CESC), and India Power Corporation Limited (IPCL); data from Damodar Valley Corporation (DVC) has not been included.

Figure 1: Historical consumer-category-wise energy sales (in million units [MUs])



Source: Department of Power, West Bengal

On analysing the historical trends, a CAGR of 5.6% was observed between FY 16 and FY 22.

In view of the surge in demand in recent years, especially post-COVID, we adjusted the traditional CAGR approach to better account for changes in demand patterns. This adjustment captures the COVID-driven variations, such as reduced growth rates for the industrial category of WBSEDCL and the residential, commercial, and industrial categories of CESC and the unexpected spike in the 'other' category of IPCL.

We then applied this modulated CAGR to forecast the demand for each consumer category by FY 30. Based on our discussion with the stakeholder, we anticipated the transmission and distribution (T&D) loss trajectory to be decreasing from 12.8% in FY 26 to 12.1% by FY 30.

Consequently, our study estimates that energy demand will rise from 64,930 MU in FY 26 to 84,280 MU by FY 30, reflecting a higher CAGR of 6.7%—an increase from the CAGR of 5.6% recorded between FY 16 and FY 22. The projected Y-o-Y energy requirement for the state is shown in Table 1.

Table 1: Projected state-level BAU electricity demand (in MU)

Particulars	FY26	FY27	FY28	FY29	FY30
BAU demand	57,566	61,475	65,695	70,252	75,175
Percentage of T&D losses	12.8	12.6	12.4	12.3	12.1
Total energy requirement	64,930	69,240	73,883	78,886	84,280

Impact of policy levers on the energy demand of West Bengal

We analysed the effect of four prominent policy developments on the state's energy demand. These are (i) RTPV adoption, (ii) EV penetration, (iii) solarisation of IP sets, and (iv) energy-efficiency measures (for commercial buildings, household appliances, and IP sets).

1. EV adoption

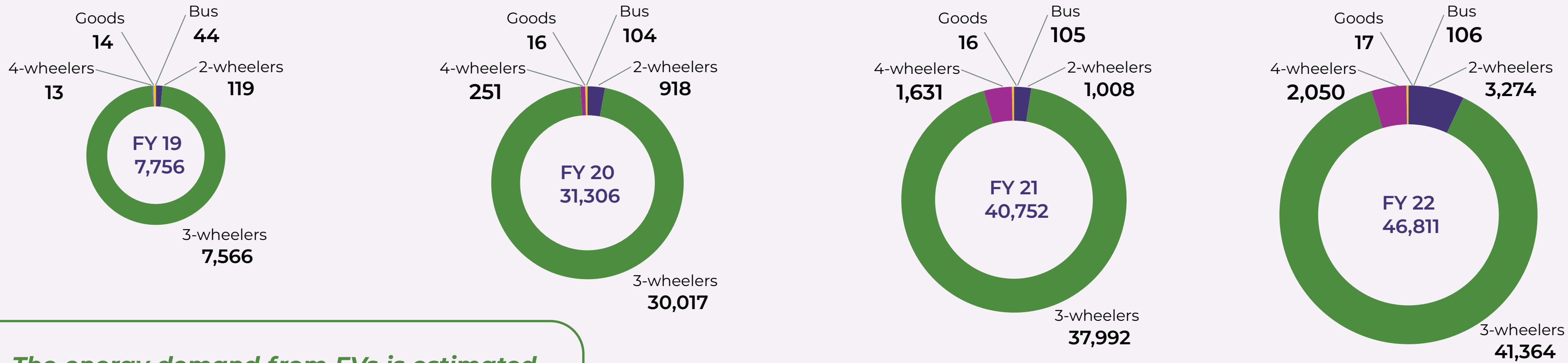
EV registrations in the state have risen significantly between FY 18 and FY 22, at a CAGR of 71%, indicating the accelerated shift towards electrification. Notably, total electric 3-wheelers made up 88% of all EVs in FY 22. The historical EV sales in the state are depicted in Figure 2.

Under its EV policy, West Bengal aims to reach 1 million EV sales by FY 26 (Government of West Bengal, 2021), aligning with the global 'EV30@30' initiative that targets reaching a 30% sales share for EVs by FY 30 (Clean Energy Ministerial, 2017). Table 2 shows the projected EV share across various vehicle categories, considering the state's EV policy targets and CAGR projections.

Table 2: Projected EV sales and corresponding energy demand

Particulars	FY 26	FY 27	FY 28	FY 29	FY 30
Projected total vehicle sales (in lakhs)	193	214	237	263	292
Projected EV sales (in lakhs)	10	16	22	30	38
Percentage share of EVs in all new vehicles	25%	26%	28%	29%	30%
Annual energy demand (in MU)	495	792	1,137	1,538	2,002
Share of EV demand to BAU demand (in %)	0.9%	1.3%	1.7%	2.2%	2.7%

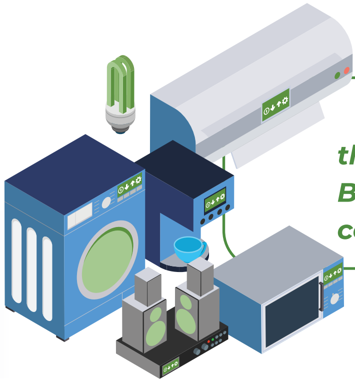
Figure 2: Historical EV sales in the state (in numbers)



Source: Vahan Dashboard (MORTH 2022)

The energy demand from EVs is estimated to constitute 2.7% of overall BAU energy demand by FY 30.

2. Energy efficiency in residential and commercial categories



Commercial buildings and household appliances constitute a large share of the electricity consumption in residential and commercial consumer categories. According to India Energy Security Scenarios 2047, appliance penetration trends show a shift toward energy efficiency from FY 25 to FY 30, with the use of low-efficiency appliances expected to decrease from 59% to 49% and that of high-efficiency appliances expected to increase from 19% to 25% (NITI Aayog and IIT Bombay, 2023). Further, LED lights adoption is projected to increase from 60% in FY 25 to 80% by FY 30. Additionally, buildings that are compliant with the Energy Conservation Building Code (ECBC) and use 30% less energy than conventional buildings are anticipated to grow from 21% to 28% over the same period in West Bengal. The Y-o-Y energy savings for residential and commercial categories are shown in Table 3.

Table 3: Impact of energy-efficiency measures in residential and commercial categories (in MU)

Year	BAU energy demand		Energy savings due to energy-efficiency measures		Resultant energy demand	
	D	C	D	C	D	C
FY 26	23,229	8,716	1,807	218	21,422	8,499
FY 27	24,629	9,209	2,160	258	22,469	8,952
FY 28	26,120	9,737	2,554	304	23,565	9,434
FY 29	27,707	10,302	2,994	357	24,713	9,945
FY 30	29,398	10,906	3,483	418	25,915	10,488

Owing to these energy-efficiency measures, the state would see a reduction of 12% and 4% in BAU energy consumption from the residential and commercial categories, respectively, in FY 30.

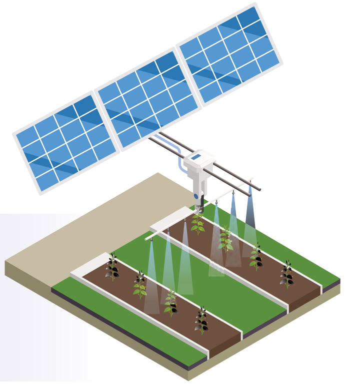
3. RTPV systems

According to the state-wise trajectory specified by the Ministry of New and Renewable Energy (MNRE), West Bengal had a target of installing 2,100 megawatts (MWs) of RTPV capacity by FY 22. However, the state's capacity reached only 54 MW by FY 22, with the current (in FY 25) value standing at 67.13 MY as of May 2025. Therefore, we have considered a conservative Y-O-Y growth rate of 0.05% for energy generation from RTPV till FY 30.

Table 4: Y-0-Y projected RTPV capacity and energy generation

Particulars	FY 26	FY 27	FY 28	FY 29	FY 30
Y-O-Y capacity addition (in MW)	26	30	33	37	41
Cumulative RTPV capacity (in MW)	134	164	197	234	275
RTPV energy generation (in MU)	201	246	296	351	413

According to the above estimates, the state may achieve 275 MW of RTPV capacity by FY 30, resulting in a net reduction of 413 MU (0.6%) in overall energy demand by FY 30, as shown in Table 4.



4. Solarisation and energy efficiency in agriculture sector

In the agriculture sector, conventional IP sets have grown at a CAGR of 6% between FY 16 (4,22,069 IP sets) and FY 22 (5,91,769 IP sets). By FY 30, solar IP sets are expected to account for 13.4% of all electric IP sets. Energy-efficient (EE) IP sets are anticipated to constitute 5% of all electric IP sets by FY 30.

We estimate that the specific energy consumption by IP sets will decrease from 2,644 units in FY 23 to 2,118 units by FY 30, assuming that EE IP sets operate at a 75% efficiency level (as compared to a 60% efficiency level for conventional sets), reflecting improvements in energy efficiency.

Table 5: Impact on agricultural category

Particulars	FY 26	FY 27	FY 28	FY 29	FY 30
A. Grid-solar IP sets (no.)	6,186	13,088	27,693	58,595	1,23,980
B. EE IP sets (no.)	2,499	5,583	11,999	25,106	50,856
C. Conventional IP sets (no.)	7,32,623	7,65,588	7,90,007	7,94,072	7,53,797
Total IP sets (A+B+C)	7,41,307	7,84,259	8,29,700	8,77,773	9,28,633
BAU demand (MU)	1,782	1,827	1,872	1,919	1,967
Energy savings due to solarisation and energy-efficiency measures (MU)	16	32	67	136	279
Resultant demand (MU)	1766	1794	1806	1783	1,688

Anticipating strong support from both state and central governments for solarising energy consumption and deploying EE pumps in the agriculture sector, we expect a 14% reduction in agricultural energy demand by FY 30, as shown in Table 5.

Demand forecast incorporating the impact of policy levers

The impact of the aforementioned policy levers was overlaid on the 'BAU demand forecast' to obtain the final Y-o-Y demand forecasts. The final demand is projected to be 81,354 MU by FY 30 (including T&D losses), growing at a CAGR of 6.5%. The energy requirement forecast for the state is shown in Table 6.

Table 6: Y-o-Y final energy demand forecast with T&D losses (in MU)

Particulars	FY 26	FY 27	FY 28	FY 29	FY 30
Final energy demand	55,819	59,572	63,612	67,952	72,583
T&D losses (%)	12.8%	12.6%	12.4%	12.3%	12.1%
Final energy requirement	62,957	67,090	71,531	76,289	81,354

By FY 30, the state's energy requirement under the BAU scenario is projected to be 84,280 MU. With the implementation of policy interventions, this demand could reduce to 81,354 MU—resulting in an energy savings of approximately 4%. This highlights the clear advantage of adopting policy levers to enhance energy efficiency and sustainability.

Peak demand forecast

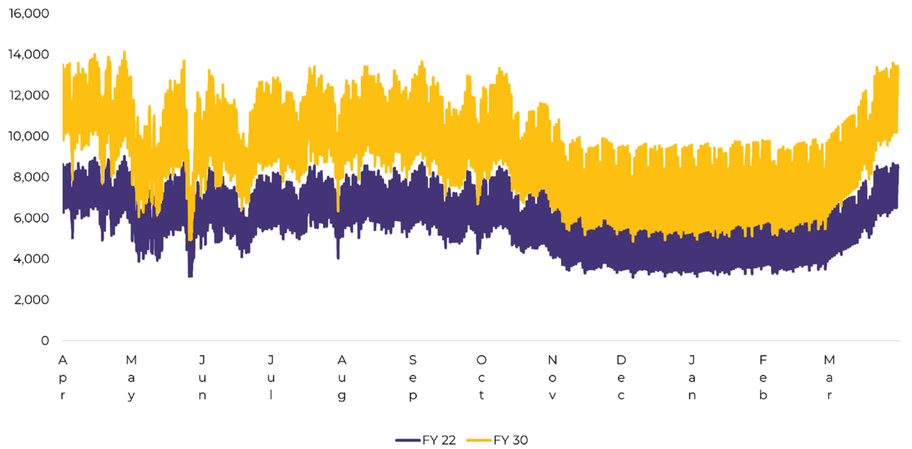
The FY 22 load curves were used as the reference for forecasting the hourly demand. Assuming the curve shape to remain the same, we extrapolated the curve for each year up to FY 30 (as depicted in Figure 3), adjusting only for variations in hourly load (based on the energy requirements for each year).

In FY 22, West Bengal observed a peak demand of 9,031 MW at 23:00 hours on 27 April 2021, while the off-peak demand was observed to be 3,103 MW at 5:00 hours on 6 December 2021. Our study projects that the peak demand would reach 14,138 MW by FY 30 (as shown in Table 7), with the off-peak demand increasing to 4,858 MW, growing at a CAGR of 6%.

Table 7: Y-o-Y peak demand (in MW)

Particulars	FY 26	FY 27	FY 28	FY 29	FY 30
Peak demand (in MW)	10,941	11,659	12,431	13,258	14,138

Figure 3: Comparison of FY 22 and FY 30 hourly load profiles



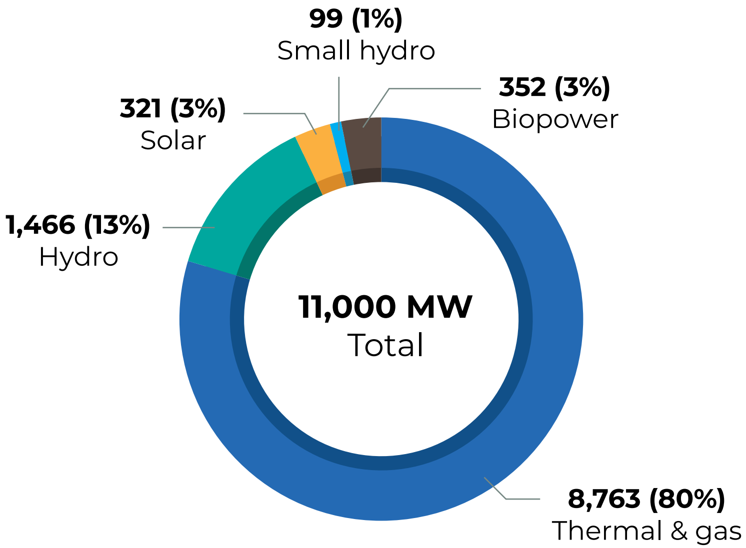
Supply Planning: FY 26 to FY 30

This section analyses the demand-supply gap to assess the adequacy of current generation capacity in meeting the state's projected demand. It then calculates the resource needs for meeting this demand—primarily through RE sources and storage—for all the three scenarios.

Existing installed capacity

The state's contracted capacity stood at 11 GW in FY 25. Its source-wise installed capacity mix is provided below.

Figure 4: Source-wise installed/tied-up capacity in FY 25



Source: (NITI Aayog and Vasudha Foundation, n.d.)

Supply-planning scenarios for identifying adequate resource requirement

We considered the following three scenarios for analysing the demand-supply gap to determine the optimal energy mix for West Bengal:

RE + existing thermal PLF: Considers RE addition, along with the state's future planned capacity addition and retirement.

RE with nuclear capacity: Considers RE addition, along with nuclear capacity and the state's future planned capacity addition and retirement.

RE with restricted thermal PLF: Considers the state-owned thermal plants to operate at a fixed PLF of 65% for the entire study period, along with RE addition, nuclear sources, and the state's future planned capacity addition and retirement.

The assumptions and considerations made for examining the above scenarios are provided in the Appendix.

Proposed capacity additions for all scenarios

The source-wise estimated new capacity additions for each scenario are provided in Table 8.

Table 8: Source-wise new capacity additions by FY 30

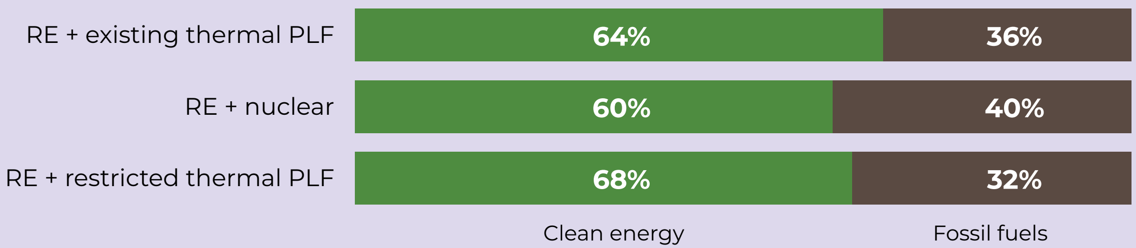
Source	RE + existing thermal PLF	RE + nuclear sources	RE + restricted thermal PLF
Solar	7,892	4,892	9,242
Wind	1,922	2,784	3,180
Solar–wind hybrid	1,550	800	1,550
Large hydro	584	684	784
Biomass	182	182	182
Waste-to-energy	136	136	136
Small hydro	198	198	198
RE (A)	**12,464**	**9,676**	**15,272**
Thermal (B)	0	0	0
Nuclear (C)	0	600	0
Total (A+B+C)	**12,464**	**10,276**	**15,272**
Energy storage (MW)	1,900	1,900	2,500

Cumulative installed capacity for all scenarios

The estimated installed capacity required in FY 30 for each scenario is shown in Table 9.

Table 9: Source-wise installed capacity required in FY 30

Installed capacity (MW)	RE + existing thermal PLF	RE + nuclear sources	RE + restricted thermal PLF
Solar	8,177	5,177	9,527
Wind	1,922	2,784	3,180
Solar–wind hybrid	1,550	800	1,550
Large hydro	1,986	2,086	2,186
Biomass	505	505	505
Waste-to-energy	136	136	136
Small hydro	286	286	286
RE (A)	**14,562**	**11,774**	**17,370**
Thermal (B)	8,270	8,270	8,270
Nuclear (C)	0	600	0
Total (A+B+C)	**22,832**	**20,644**	**25,640**
Energy storage (MW)	1,900	1,900	2,500



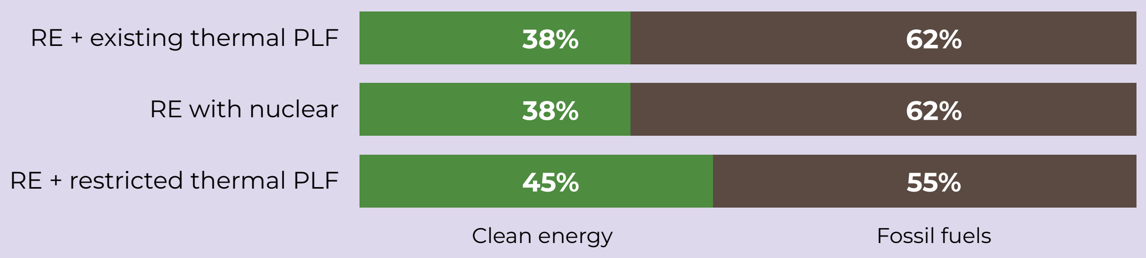
Percentage share of RE and fossil fuel sources in the total installed capacity by FY 30

Optimal energy mix for all scenarios

With the capacity additions proposed above, the state can expect a higher share of clean energy sources in its energy mix by FY 30, as shown in Table 10.

Table 10: Source-wise energy mix in FY 26 and FY 30

Source (MU)	RE + existing thermal PLF	RE with nuclear	RE + restricted thermal PLF
	FY 30	FY 30	FY 30
Solar	12,290	7,781	14,319
Wind	3,232	4,682	5,348
Large hydro	8,463	8,913	9,363
Biomass	2,054	2,054	2,054
Waste-to-energy	732	732	732
Small hydro	1,115	1,115	1,115
Solar–wind hybrid	3,354	1,731	3,354
Sub-total RE (A)	**31,240**	**27,009**	**36,285**
Thermal (B)	50,325	50,325	45,175
Nuclear (C)	0	4,423	0
Total (A+B+C)	**81,566**	**81,757**	**81,460**
Energy storage	678	614	885
Export	223	414	121



Percentage share of RE and fossil fuel sources in the total energy mix by FY 30

Storage analysis

We assessed the power surplus and deficit during all 8,760 hours in each of the financial years studied to identify the maximum deficit. Initially, we considered the existing 900-MW Purulia pumped storage project (PSP) and assumed that the planned 1,000-MW PSP would be operational by FY 27, resulting in a total storage capacity of 1,900 MW by FY 30 in the 'RE + existing thermal PLF' and 'RE with nuclear capacity' scenarios (WBSEDCL, 2025). For the 'RE with restricted thermal PLF' scenario, an additional 600 MW of storage capacity is considered in FY 29, resulting in 2,500 MW of total storage capacity by FY 30.

To manage peak demand, energy storage systems (ESSs) should be charged during periods of over-generation and discharged during periods of deficit. Any remaining surplus power (left after charging ESSs) can be exported or sold.

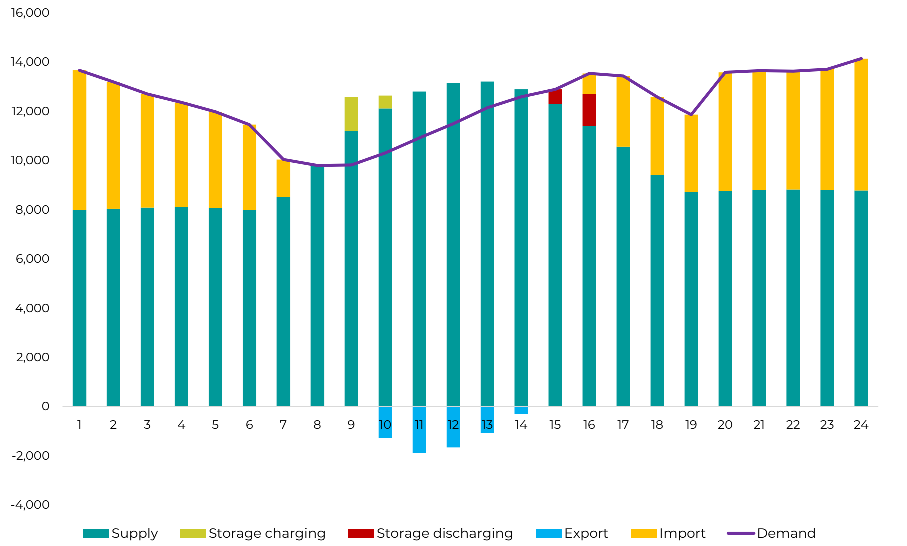
The time for ESS charging–discharging instances and of import–export instances for the peak-day operation across all scenarios is shown in Table 11.

Table 11: Summary of ESS operations for all scenarios

Scenario	ESS capacity (MW)	ESS charging	ESS discharging	Export/ sold	Import/ purchased
RE + existing thermal PLF	1,900	09:00 to 10:00	15:00 to 16:00	10:00 to 14:00	01:00 to 07:00 & 16:00 to 24:00
RE with nuclear	1,900	08:00 to 10:00	13:00 to 15:00	10:00 to 12:00	01:00 to 07:00 & 14:00 to 24:00
RE with restricted thermal PLF	2,500	08:00 to 10:00	13:00 to 15:00	10:00 to 12:00	01:00 to 07:00 & 15:00 to 24:00

Figure 5 presents an hourly analysis of supply, demand, and storage operations on the peak day of 27 April 2029 (FY 30). The demand curve shows higher demand during the night, peaking at 14,138 MW at midnight (24th hour), and lower demand of 9,746 MW during the day (8th hour). The supply curve follows a typical pattern, with surplus generation during RE availability periods and a deficit during RE non-availability periods. The demand gradually decreases during 01:00–08:00 hours and 17:00–19:00 hours, while it increases between 09:00 and 17:00 hours. The 1,900-MW storage systems charge during low-demand hours with surplus energy but start storing energy only after the 8th hour, charging between 09:00 and 10:00 hours. The surplus power (that remains after charging the ESS fully) is sold/exported between 10:00 and 14:00 hours. From 15:00 to 16:00 hours, the deficit is met by storage and energy imports, while from 17:00 to 24:00 hours, it is covered solely through energy market purchases.

Figure 5: Demand, supply, and storage curve for 'RE + existing thermal PLF' scenario



Similarly, Figure 6 and Figure 7 depict the hourly analysis of demand, supply, and storage operations of a 24-hour day for the 'RE with nuclear' and 'RE with restricted thermal PLF' scenarios, respectively.

Figure 6: Demand, supply, and storage curve for 'RE with nuclear' scenario

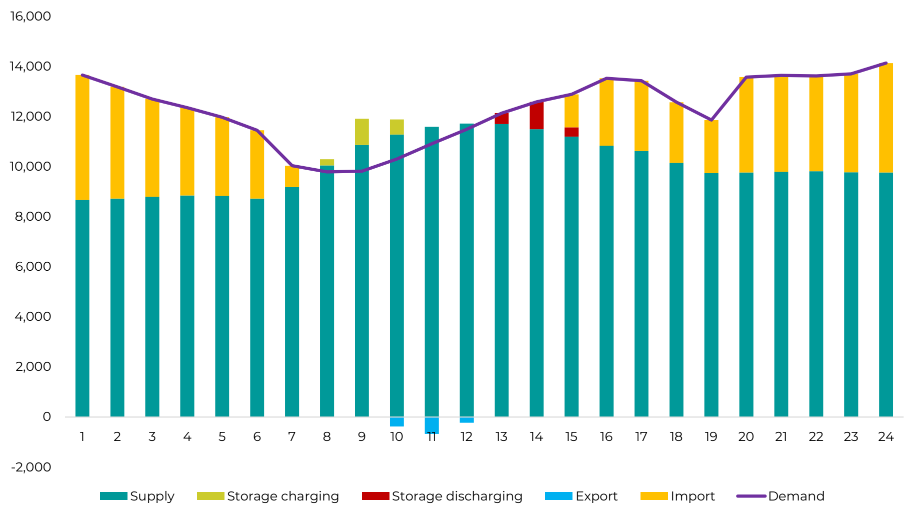
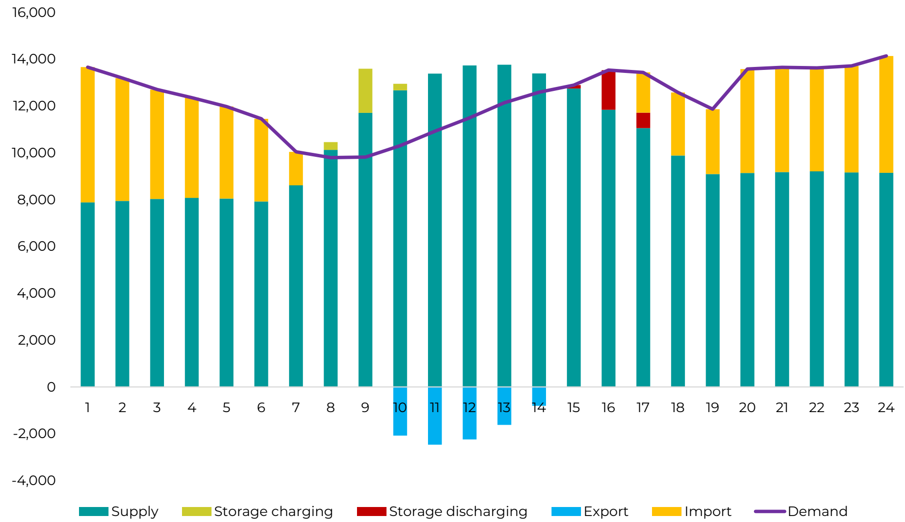


Figure 7: Demand, supply, and storage curve for 'RE with restricted thermal PLF' scenario

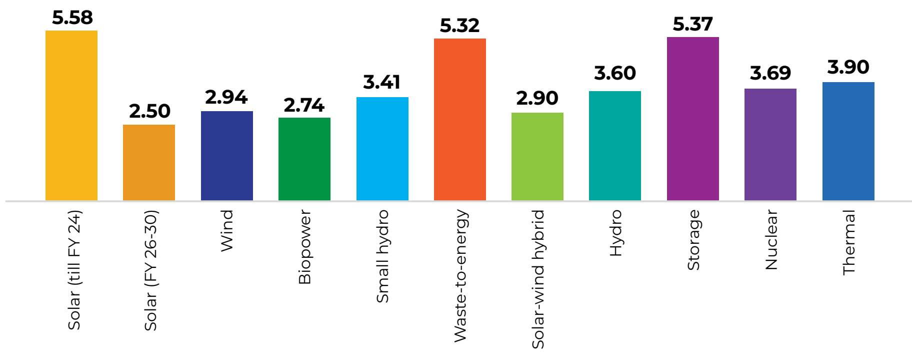


Impact of RE on the Power Purchase Cost for DISCOMs

Harnessing low-cost RE is key to building a sustainable, affordable, and secure power sector. In recent years, the cost of generating electricity from RE sources has been declining, which could affect the electricity procurement costs for DISCOMs and potentially lead to tariff adjustments.

To assess the nature and extent of such impact, our study analysed the unit cost of power purchases from various sources from FY 26 to FY 30. The tariff rate of each plant was considered in accordance with the power purchase agreements taken from India Climate and Energy Dashboard - NITI Aayog (as on 6 May 2025). Figure 8 shows the weighted average per unit cost of power during this period.

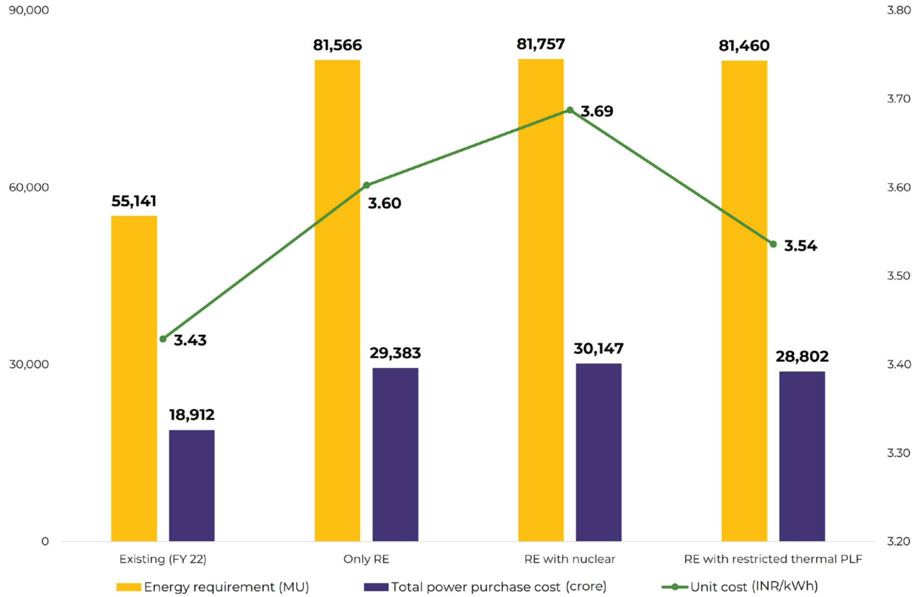
Figure 8: Source-wise weighted average power purchase cost (in INR/unit)



The analysis shows that the minimal increase in per unit cost in FY 30 is primarily due to the higher penetration of low-cost RE and a decline in expensive fossil-fuel-based energy across all scenarios. In the 'RE + existing thermal PLF' and 'RE with nuclear' scenarios, the low-cost benefit of increased RE penetration is slightly offset by a higher share of thermal and nuclear power. In contrast, in the 'RE with restricted thermal PLF' scenario, more of RE is accommodated, resulting in a lower per unit cost of INR 3.54, as compared to INR 3.60 and INR 3.69 in the 'RE + existing thermal PLF' and 'RE with nuclear' scenarios, respectively.

Therefore, it is advisable that the state increases RE integration and reduces reliance on thermal power by operating at the minimum PLF, which can be further supported by expanding nuclear capacity in the future. Figure 9 outlines the unit cost of power for DISCOMs under the three scenarios in FY 30. The source-wise power purchase costs by FY 30 are provided in the Appendix.

Figure 9: Total power purchase, cost, and unit cost in FY 30



Conclusions and Recommendations

West Bengal's power sector—the distribution and generation segments in particular—is undergoing a rapid change due to evolving consumer demand, increased industrial activity, and key policy developments that include growing EV penetration and RTPV adoption and energy efficiency initiatives across various sectors. These dynamics are reshaping the demand profile and operational needs of the sector, calling for strategic realignment.

The generation segment of West Bengal is under considerable pressure due to the state's rising energy demand and its heavy reliance on fossil fuels, particularly coal. To ensure long-term energy security and align with the country's net-zero ambitions, West Bengal must adopt resilient and sustainable strategies for both generation and distribution. According to our analysis, West Bengal's electricity requirement will reach 81,354 MU by FY 30. To meet this, the state will need to add 10,275–15,271 MW of clean energy capacity along with 1,900–2,500 MW of energy storage.

On the basis of the study findings, we put forth recommendations that can aid West Bengal to address the challenges associated with its growing energy demand and the higher RE integration underway in the state. For this, the critical focus areas for action within the distribution and generation segments have been identified and segment-specific measures have been recommended to form a roadmap that can enable a smooth clean energy transition for West Bengal.

Measures for distribution segment

Facilitating smoother adoption of EVs

Address charging infrastructure gaps

One of the key challenges hindering EV adoption is the lack of adequate public charging infrastructure. It is advisable for DISCOMs to collaborate with the Transport Department of West Bengal to identify and assess feasible locations for setting up EV charging stations. In parallel, feeder-level techno-feasibility studies of the distribution infrastructure should be conducted to ensure a reliable power supply to meet conventional loads as well as EV charging requirements.

Enhance demand-side management through smart metering

To efficiently manage the future electricity demand from conventional loads and EVs, it is recommended that DISCOMs prioritise the installation of smart meters, especially for consumers owning EVs. Smart metering enables precise tracking of load patterns and consumption behaviour, empowering DISCOMs to take data-driven decisions on peak-load shaving, load shifting, and infrastructure planning. This can help consumers to avoid the penalties on exceeding maximum contracted demand (particularly during evening peak hours) and facilitate timely upgradation of their sanctioned load.

Encourage RE integration coupled with storage

To promote green mobility, DISCOMs may consider deploying distributed RE systems coupled with battery energy storage systems (BESSs) at EV charging stations. This approach offers a cost-effective and sustainable solution, benefiting both DISCOMs and end consumers by reducing reliance on grid power during peak hours and enhancing energy resilience.

RTPV systems

West Bengal has achieved only around 67 MW of rooftop solar capacity by FY 25, against a national target of 2,100 (as given by MNRE), which it had to achieve by 2022. This major shortfall calls for urgent action across multiple fronts.

Localised outreach for scheme enrolment

Targeted awareness and community engagement programmes, especially leveraging the PM Surya Ghar Muft Bijli Yojana, should be launched. Communication should be tailored for urban and semi-urban households through ward-level campaigns and helplines that provide support in applying for the scheme.

Strategic deployment in high-growth urban areas and smart cities

Development of urban centres such as Kolkata, Durgapur, and Asansol, as well as smart cities such as Bolpur, Kalyani, and Siliguri, where residential and commercial development is accelerating, should be emphasised. West Bengal can create an empanelled vendor list and launch a dedicated website with comprehensive information for consumers and vendors, including rooftop potential estimators, rooftop space required, cost and savings calculators, and installation guidance.

Innovative financing through roof-leasing and community solar models

Innovative business models such as roof-leasing and community solar programmes should be promoted. Households unable to afford upfront costs can lease out roofs to private developers, who can, in return, install RTPV systems and share electricity benefits.

Energy efficiency in residential, agriculture, and commercial sectors

Improving energy efficiency in West Bengal's residential, agriculture, and commercial sectors can significantly reduce peak load and improve grid reliability. However, low penetration of efficient appliances and poor awareness remain major barriers.

Stricter enforcement of building efficiency codes

Compliance with ECBC should be mandated and enforced, especially for the upcoming residential and commercial buildings. Workshops and training sessions also need to be conducted to build the capacity of stakeholders, including architects, developers, and government officials.

Leverage digital tools for energy management

The state should promote digital platforms and mobile apps that provide real-time data on energy consumption. WhatsApp notifications and SMS alerts can be utilised to nudge consumers towards energy-saving behaviour, particularly at the household level. Partnering with gram panchayats and resident welfare associations to conduct energy audits should also be considered.

Strengthen sustainable agriculture practices through energy-efficient IP sets

Implement a comprehensive pump buyback scheme, offering financial incentives to farmers who replace old, inefficient diesel or electric pumps with BEE star-rated or solar pump sets. IP set replacement should be prioritised on the basis of their age, with older IP sets being replaced first.

Measures for generation segment

Increasing the share of RE in the state's supply mix

West Bengal holds an RE potential of 16 GW, of which solar and hydro resources constitute 78%. However, only a small fraction—1% solar and 8% hydro—has been harnessed so far. Projections indicate a need for 10,000–15,000 MW of RE capacity by FY 30. This study recommends certain actions to enable a faster and sustainable RE transition.

Techno-economic feasibility assessments

Detailed assessments of various RE technologies, particularly solar projects, should be conducted, factoring in resource availability, infrastructure readiness, land-use constraints, and economic viability. Further, integrated land-use planning tools should be developed to identify optimal sites for solar deployment, balancing the agricultural, ecological, and energy needs. This will enable evidence-based decision-making by policymakers.

Leverage inter-state RE procurement

The state can enter into power purchase agreements (PPAs) with RE-rich neighbouring states. This strategy can complement in-state RE development and help in meeting the renewable purchase obligations (RPOs).

Strengthening RE integration through energy storage systems

To ensure a smooth and reliable integration of 10–15 GW of RE capacity by FY 30, West Bengal must accelerate the deployment of ESSs. Leveraging its leadership in pumped storage (e.g., Purulia PSP) and tapping its 5,500 MW pumped-hydro potential presents a strategic opportunity to scale up storage from the current 900 MW to the required 1,900–2,500 MW. This will aid the DISCOMs in fulfilling their RPO and energy storage obligation (ESO) targets effectively. The following steps are recommended in this regard:

- Advance the commissioning of Turga PSP to FY 27 (from the planned FY 30), enabling faster capacity addition.
- Diversify storage technologies by integrating ~600 MW of BESS, capitalising on cost reductions and technological advancements.

Integrating nuclear power into the state's energy mix

West Bengal currently lacks nuclear power in its generation portfolio. To meet its rising electricity demand, the state cannot rely solely on RE, which is intermittent in nature. Moreover, the limited thermal capacity addition (660 MW) is inadequate for providing consistent base-load support. Nuclear energy, as a mature and clean source, offers a reliable solution for both base-load generation and decarbonisation. In this regard, the following measures are recommended:

- West Bengal should plan its nuclear capacity additions in a phased manner—adding 140 MW (in FY 27), 200 MW (in FY 28), 140 MW (in FY 29), and 120 MW (in FY 30), totaling 600 MW, in alignment with the projected demand growth.
- The state should formally consent to procure power from the upcoming central nuclear projects and explore long-term PPAs to replace costlier thermal CGS supply. With high PLFs, stable round-the-clock output, and a competitive average tariff (weighted average of INR 3.69/kWh at an all-India level in FY 24), nuclear power can serve as a reliable base-load option while lowering overall DISCOM procurement costs under clean energy mandates.

References

Clean Energy Ministerial. 2017. “EV30@30 Campaign.” https://www.cleanenergyministerial.org/initiatives-campaigns/ev3030-campaign/

Government of West Bengal. 2021. “West Bengal Electric Vehicle Policy 2021,” March 6, 2021. https://wbpower.gov.in/wp-content/uploads/Electric%20Vehicle%20Policy%202021%20(Kolkata%20Gazette%20Notification).pdf.

Ministry of New and Renewable Energy. 2025. “State-Wise (Location Based) Installed Capacity of Renewable Power.” https://cdnbbsr.s3waas.gov.in/s3716e1b8c6cd17b771da77391355749f3/uploads/2025/05/202505081659296923.pdf.

Ministry of Environment, Forest and Climate Change. 2022. “India’s Stand at COP-26.” GOI. PIB. March 2, 2022. https://pib.gov.in/PressReleasePage.aspx?PRID=1795071.

NITI Aayog and IIT Bombay. 2023. “IESS 2047 Calculator Tool.” GOI. India Energy Security Scenario. 2023. https://iess2047.gov.in/#?inputs=1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1.

NITI Aayog and Vasudha Foundation. n.d. “Installed Capacity of WB in FY 25.” GOI. India Climate & Energy Dashboard NITI Aayog. Accessed May 5, 2025. https://iced.niti.gov.in/state-report/west-bengal.

West Bengal State Electricity Distribution Company Limited.. 2025. “Turga PSP.” Government oof West Bengal. 2025. https://www.wbsedcl.in/irj/go/km/docs/internet/new_website/TPSP.html.

Appendix

Assumptions and considerations

- The contracted generation capacity and auxiliary consumption details for each plant in the state were considered in accordance with the data provided by the Department of Power, West Bengal.
- The PLFs for plants were taken from the FY 22 technical performance data provided by the Central Electricity Authority (CEA). Using the average PLF, the available generation capacity for each of the 8,760 hours was evaluated.
- For solar and wind plants, hourly generation profiles were modelled using their specific geographical locations and contracted/installed capacities, employing the Ninja RE and CSTEP's Solar Techno-Economic Model for Photovoltaic (CSTEM PV) tools.
- The state's capacity expansion plans till FY 30 were considered and the replacement of older thermal plants aged above 25 years (extended to 40–45 years) were considered as per the expiry dates of their PPAs. The details are given in Table A1.

Table A1: Source-wise state and CGS capacity addition and replacement plans till FY 30

S. No.	Source	Plant name	Capacity	State share (%)	State share (MW)	Year of commissioning
Capacity addition plans						
1	Solar	Kotaldih	10	100%	10	2023
2	Solar	Gangasagar	20	100%	20	2024
3	Solar	Goaltore	125	100%	125	2024
4	Hydro	TEESTA VI - Unit 1–4	500	25%	125	2024
5	Hydro	Lodhoma Small Hydel	10	100%	10	2025
6	Solar-wind hybrid	SECI	150	100%	150	2025
7	Thermal	Sagardighi Phase – III Extension Project of Unit- 5	660	100%	660	2026
8	Hydro	RAMMAM – III UNIT 1-3 Central	120	100%	120	2029
Capacity retirement plans						
1	Thermal	Bandel TPS Unit 2	60	100%	60	2025
2	Thermal	Bandel TPS Unit 5	215	100%	215	2027

Y-o-Y source-wise proposed capacity requirement (in MW)

Table A2: Y-o-Y new capacity addition plans for 'RE + existing thermal PLF' scenario

RE + existing thermal PLF

Source	FY 23	FY 24	FY 25	FY 26	FY 27	FY 28	FY 29	FY 30	Total
Solar	10	145	868	58	1,315	1,823	1,582	2,091	7,892
Wind	0	0	360	440	139	213	612	157	1,922
Solar–wind hybrid	0	0	150	0	300	500	50	550	1,550
Large hydro	0	125	150	120	29	26	135	0	584
Biomass	0	0	44	22	24	27	30	34	182
Waste-to-energy	0	0	33	16	18	20	23	26	136
Small hydro	0	0	46	32	25	28	32	35	198
Total	**10**	**270**	**1,650**	**688**	**1,851**	**2,638**	**2,464**	**2,892**	**12,463**

Table A3: Y-o-Y new capacity addition plans for 'RE with nuclear' scenario

RE with nuclear

Source	FY 23	FY 24	FY 25	FY 26	FY 27	FY 28	FY 29	FY 30	Total
Solar	10	145	618	58	565	823	1,082	1,591	4,892
Wind	0	0	760	440	247	321	465	550	2,784
Solar–wind hybrid	0	0	150	0	100	100	200	250	800
Large hydro	0	125	100	120	79	126	135	0	684
Biomass	0	0	44	22	24	27	30	34	182
Waste-to-energy	0	0	33	16	18	20	23	26	136
Small hydro	0	0	46	32	25	28	32	35	198
Nuclear	0	0	0	0	140	200	140	120	600
Total	**10**	**270**	**1,750**	**688**	**1,199**	**1,646**	**2,107**	**2,605**	**10,275**

Table A4: Y-o-Y new capacity addition plans for 'RE with restricted thermal PLF' scenario

RE with restricted thermal PLF

Source	FY 23	FY 24	FY 25	FY 26	FY 27	FY 28	FY 29	FY 30	Total
Solar	10	145	2,368	58	815	2,073	1,682	2,091	9,242
Wind	0	0	1,321	629	247	240	315	427	3,180
Solar–wind hybrid	0	0	500	0	100	250	350	350	1,550
Large hydro	0	125	300	120	79	26	135	0	784
Biomass	0	0	44	22	24	27	30	34	182
Waste-to-energy	0	0	33	16	18	20	23	26	136
Small hydro	0	0	46	32	25	28	32	35	198
Nuclear	0	0	0	0	0	0	0	0	0
Total	**10**	**270**	**4,611**	**877**	**1,309**	**2,665**	**2,567**	**2,962**	**15,271**

Y-o-Y probable cumulative installed capacity

Table A5: Y-o-Y probable installed capacity for 'RE + existing thermal PLF' scenario

RE + existing thermal PLF

Installed capacity (MW)	FY 23	FY 24	FY 25	FY 26	FY 27	FY 28	FY 29	FY 30
Solar	295	440	1,308	1,366	2,681	4,514	6,086	8,177
Wind	0	0	360	800	939	1,153	1,765	1,922
Large hydro	1,402	1,527	1,677	1,796	1,825	1,851	1,986	1,986
Biomass	324	324	368	389	414	441	471	505
Waste-to-energy	0	0	33	49	68	88	111	136
Small-hydro	88	88	134	166	191	220	251	286
Solar–wind hybrid	0	0	150	150	450	950	1,000	1,550
Sub-total RE (A)	2,109	2,379	4,029	4,717	6,568	9,216	11,670	14,562
Thermal (B)	**7,885**	**7,885**	**7,825**	**8,485**	**8,270**	**8,270**	**8,270**	**8,270**
Nuclear (C)	0	0	0	0	0	0	0	0
Total (A+B+C)	9,994	10,264	11,854	13,202	14,838	17,486	19,940	22,832
Energy storage	900	900	900	900	900	1,900	1,900	1,900

Table A6: Y-o-Y probable installed capacity for 'RE with nuclear' scenario

Scenario	Installed capacity (MW)	FY 23	FY 24	FY 25	FY 26	FY 27	FY 28	FY 29	FY 30
RE with nuclear	Solar	295	440	1,058	1,116	1,681	2,514	3,586	5,177
	Wind	0	0	760	1,200	1,447	1,769	2,234	2,784
	Large hydro	1,402	1,527	1,627	1,746	1,825	1,951	2,086	2,086
	Biomass	324	324	368	389	414	441	471	505
	Waste-to-energy	0	0	33	49	68	88	111	136
	Small hydro	88	88	134	166	191	220	251	286
	Solar–wind hybrid	0	0	150	150	250	350	550	800
	Sub-total RE (A)	2,109	2,379	4,129	4,817	5,876	7,332	9,289	11,774
	Thermal (B)	**7,885**	**7,885**	**7,825**	**8,485**	**8,270**	**8,270**	**8,270**	**8,270**
	Nuclear (C)	0	0	0	0	140	340	480	600
	Total (A+B+C)	9,994	10,264	11,954	13,302	14,286	15,942	18,039	20,644
	Energy storage	900	900	900	900	900	1,900	1,900	1,900

Table A7: Y-o-Y probable installed capacity for 'RE with restricted thermal PLF' scenario

Scenario	Installed capacity (MW)	FY 23	FY 24	FY 25	FY 26	FY 27	FY 28	FY 29	FY 30
RE with restricted thermal PLF	Solar	295	440	2,808	2,866	3,681	5,764	7,436	9,527
	Wind	0	0	1,321	1,950	2,197	2,438	2,753	3,180
	Large hydro	1,402	1,527	1,827	1,946	2,025	2,051	2,186	2,186
	Biomass	324	324	368	389	414	441	471	505
	Waste-to-energy	0	0	33	49	68	88	111	136
	Small hydro	88	88	134	166	191	220	251	286
	Solar–wind hybrid	0	0	500	500	600	850	1,200	1,550
	Sub-total RE (A)	2,109	2,379	6,990	7,867	9,176	11,851	14,408	17,370
	Thermal (B)	**7,885**	**7,885**	**7,825**	**8,485**	**8,270**	**8,270**	**8,270**	**8,270**
	Nuclear (C)	0	0	0	0	0	0	0	0
	Total (A+B+C)	9,994	10,264	14,815	16,352	17,446	20,121	22,678	25,640
	Energy storage	900	900	900	900	1,900	1,900	2,500	2,500

Y-o-Y energy mix

Table A8: Y-o-Y optimal energy mix for 'RE + existing thermal PLF' scenario

	Source (MU)	FY 23	FY 24	FY 25	FY 26	FY 27	FY 28	FY 29	FY 30
RE + existing thermal PLF	Solar	443	661	1,966	2,053	4,029	6,769	9,147	12,290
	Wind	0	0	605	1,345	1,580	1,939	2,968	3,232
	Large hydro	5,837	6,400	7,072	7,612	7,742	7,858	8,465	8,463
	Biomass	1,316	1,316	1,495	1,583	1,681	1,792	1,916	2,054
	Waste-to-energy	0	0	177	264	362	472	595	732
	Small hydro	344	344	521	647	745	855	978	1,115
	Solar–wind hybrid	0	0	325	325	974	2,056	2,164	3,354
	Sub-total RE (A)	**7,940**	**8,721**	**12,162**	**13,829**	**17,113**	**21,740**	**26,233**	**31,240**
	Thermal (B)	47,216	47,216	47,034	51,629	50,325	50,325	50,325	50,325
	Nuclear (C)	0	0	0	0	0	0	0	0
	Total (A+B+C)	**55,156**	**55,936**	**59,195**	**65,458**	**67,438**	**72,065**	**76,558**	**81,566**
	Energy storage	192	201	236	224	504	621	650	678
	Export	2,814	349	84	2,506	360	546	280	223

Table A9: Y-o-Y optimal energy mix for 'RE with nuclear' scenario

	Source (MU)	FY 23	FY 24	FY 25	FY 26	FY 27	FY 28	FY 29	FY 30
RE with nuclear	Solar	443	661	1,590	1,677	2,527	3,764	5,389	7,781
	Wind	0	0	1,278	2,018	2,434	2,975	3,757	4,682
	Large hydro	5,837	6,400	6,847	7,387	7,742	8,308	8,915	8,913
	Biomass	1,316	1,316	1,495	1,583	1,681	1,792	1,916	2,054
	Waste-to-energy	0	0	177	264	362	472	595	732
	Small hydro	344	344	521	647	745	855	978	1,115
	Solar–wind hybrid	0	0	325	325	541	757	1,190	1,731
	Sub-total RE (A)	**7,940**	**8,721**	**12,234**	**13,901**	**16,032**	**18,922**	**22,740**	**27,009**
	Thermal (B)	47,216	47,216	47,034	51,629	50,325	50,325	50,325	50,325
	Nuclear (C)	0	0	0	0	1,032	2,506	3,538	4,423
	Total (A+B+C)	**55,156**	**55,936**	**59,267**	**65,530**	**67,389**	**71,754**	**76,604**	**81,757**
	Energy storage	192	201	233	222	443	496	551	614
	Export	2,814	349	156	2,578	311	234	326	414

Table A10: Y-o-Y optimal energy mix for 'RE with restricted thermal PLF' scenario

Scenario	Source (MU)	FY 23	FY 24	FY 25	FY 26	FY 27	FY 28	FY 29	FY 30
RE with restricted thermal PLF	Solar	443	661	4,220	4,307	5,532	8,648	11,176	14,319
	Wind	0	0	2,222	3,280	3,696	4,100	4,630	5,348
	Large hydro	5,837	6,400	7,748	8,287	8,642	8,758	9,365	9,363
	Biomass	1,316	1,316	1,495	1,583	1,681	1,792	1,916	2,054
	Waste-to-energy	0	0	177	264	362	472	595	732
	Small hydro	344	344	521	647	745	855	978	1,115
	Solar–wind hybrid	0	0	1,082	1,082	1,298	1,839	2,597	3,354
	Sub-total RE (A)	**7,940**	**8,721**	**17,465**	**19,450**	**21,957**	**26,464**	**31,256**	**36,285**
	Thermal (B)	42,000	42,000	41,694	46,289	45,175	45,175	45,175	45,175
	Nuclear (C)	0	0	0	0	0	0	0	0
	Total (A+B+C)	**49,940**	**50,721**	**59,159**	**65,739**	**67,132**	**71,639**	**76,431**	**81,460**
	Energy storage	207	202	281	279	569	640	666	885
	Export	-2,401	-4,867	47	2,788	53	119	154	121

Table A11: Source-wise power purchase cost by FY30

Source	Description	RE + existing thermal PLF	RE + nuclear	RE + restricted thermal PLF
Solar	Energy (MU)	11,612	7,167	13,434
	Cost (INR crore)	2,903	1,792	3,359
Wind	Energy (MU)	3,232	4,682	5,348
	Cost (INR crore)	950	1,376	1,572
Small hydro	Energy (MU)	1,115	1,115	1,115
	Cost (INR crore)	380	380	380
Biopower	Energy (MU)	2,054	2,054	2,054
	Cost (INR crore)	563	563	563
Hydro	Energy (MU)	8,463	8,913	9,363
	Cost (INR crore)	3,047	3,209	3,371
Solar–wind hybrid	Energy (MU)	3,354	1,731	3,354
	Cost (INR crore)	973	502	973
Market (sales)	Energy (MU)	-223	-414	-121
	Cost (INR crore)	-186	-346	-101
Thermal	Energy (MU)	50,325	50,325	45,175
	Cost (INR crore)	19,627	19,627	17,618
Nuclear	Energy (MU)	0	4,423	0
	Cost (INR crore)	0	1,632	0
Storage	Energy (MU)	678	614	885
	Cost (INR crore)	364	330	475
Waste-to-energy	Energy (MU)	732	732	732
	Cost (INR crore)	390	390	390
Total	**Energy (MU)**	**81,566**	**81,757**	**81,460**
	Cost (INR crore)	**29,383**	**30,147**	**28,802**
Average power purchase cost	**INR/unit**	**3.60**	**3.69**	**3.54**

CSTEP

Center for Study of Science, Technology & Policy

Bengaluru

#18, 10th Cross, Mayura Street, Papanna Layout,
Nagashettyhalli (RMV II Stage),
Bengaluru – 560094, Karnataka, India

Noida

1st Floor, Tower-A, Smartworks
Corporate Park, Sector-125,
Noida-201303, Uttar Pradesh,
India

www.cstep.in
+91-8066902500
cpe@cstep.in
@cstep_India