सत्यमेव जयते

LONG-TERM NATIONAL RESOURCE ADEQUACY PLAN (2026-27 to 2035-36)

March 2026

Government of India
Ministry of Power
Central Electricity Authority

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Disclaimer

This Long-Term National Resource Adequacy Plan (LT-NRAP) Study has been prepared by the Central Electricity Authority (CEA) in pursuance of the Resource Adequacy Guidelines dated 28th June 2023. The analysis, results, and conclusions contained herein are based on the data and inputs provided by distribution licensees, generating companies, load dispatch centres, and other stakeholders. The accuracy and reliability of the outcomes are contingent upon the correctness, completeness, and timeliness of the information so furnished.

The LT-NRAP has been developed to assess the adequacy of electricity resources over a ten-year planning horizon at the national level and to facilitate coordinated planning, policy formulation, and investment decisions in the power sector. It is expressly stated that the responsibility for implementing the recommendations of this study, ensuring the adequacy of resources at the State and distribution licensee levels, and undertaking any related corrective measures, rests solely with the concerned stakeholders. CEA's role in this exercise is limited to the preparation and facilitation of the study in line with the provisions of the Resource Adequacy Guidelines.

CEA shall not, under any circumstances, be held liable for any loss, damage, or consequences arising directly or indirectly from the use of this report, or from any decisions or actions taken by stakeholders, policymakers, or third parties based on the findings and recommendations herein.

As this study is based on certain assumptions that may change over time, the results may vary due to the dynamic nature of the Indian power sector. Accordingly, the study will be reviewed and revised annually.

घनश्याम प्रसाद
अध्यक्ष तथा पदेन सचिव भारत सरकार
GHANSHYAM PRASAD
Chairperson & Ex-officio Secretary
To the Government Of India

सत्यमेव जयते

केन्द्रीय विद्युत प्राधिकरण
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FOREWORD

India's power sector stands at the cusp of a transformative decade, driven by rapid demand growth, accelerated integration of renewable energy, and the urgent need to reduce carbon emissions in line with our national and global commitments. Ensuring the adequacy of generation resources—while maintaining cost-effectiveness, operational resilience, and environmental sustainability—has never been more crucial.

In this context, the LT-NRAP provides a comprehensive, data-driven framework to guide the country's long-term electricity resource planning. It estimates state-wise coincident peak contributions, determines capacity credits for diverse generation sources, and evaluates planning reserve margins to ensure that the system can reliably meet the nation's future energy needs. The report also incorporates advanced modelling of demand growth, renewable variability, and system reliability, supported by indigenously developed tools like STELLAR, reflecting our growing institutional capabilities in power system planning.

It gives me great pleasure to present the Long-Term National Resource Adequacy Plan (LT-NRAP) for the period 2026-27 to 2035–36. This report marks an important milestone in our collective endeavour to ensure a reliable, secure, and sustainable power system for the nation. It reflects our shared commitment to forward-looking planning and resilient energy development in support of the country's growing needs.

I am confident that this report will serve as a valuable reference for policymakers, regulators, utilities, system operators, and other stakeholders as they plan their own long-term resource adequacy strategies (LT-DRAPs), and as we collectively strive to build a modern, resilient, and clean power system for India.

I commend the dedicated efforts of the officers of the Integrated Resource Planning Division under the guidance of Member (Planning), Central Electricity Authority, who have worked tirelessly in preparing this report, and I look forward to continued collaboration with all stakeholders to achieve our shared vision of reliable and sustainable electricity for all.

(Ghanshyam Prasad)

New Delhi
6 April 2026

ए. बालन
सदस्य (योजना) एवं पदेन अतिरिक्त सचिव,
भारत सरकार
A. Balan
Member (Planning) & Ex-officio Addl. Secretary
to the Government of India

सत्यमेव जयते

आज़ादी का अमृत महोत्सव

केन्द्रीय विद्युत प्राधिकरण
भारत सरकार
विद्युत मंत्रालय
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PREFACE

This report, titled "Long-Term National Resource Adequacy Plan", has been developed in accordance with the Resource Adequacy Guidelines notified by the Ministry of Power in June 2023 under Rule 16 of the Electricity (Amendment) Rules, 2022. It represents a comprehensive assessment of the generation capacity, demand growth, and system reliability requirements needed to ensure that the Indian power system can meet the nation's electricity energy needs reliably and sustainably over the coming decade.

The LT-NRAP lays down state-wise coincident peak contributions, capacity credits for different resource types, planning reserve margins (PRM), and generation expansion trajectories, etc. The analysis leverages advanced modelling techniques and tools—such as ORDENA and the indigenously developed STELLAR platform—integrating generation expansion, production cost analysis, and probabilistic reliability assessment. It also accounts for critical factors such as demand variability, renewable energy intermittency, and forced outages of thermal plants.

This report is intended to serve as a reference framework for states, distribution licensees, and other stakeholders in preparing their respective Long-Term Distribution Resource Adequacy Plans (LT-DRAPs), thereby enabling coordinated planning across the national power system.

I place on record my appreciation for the dedicated efforts of the officers of the IRP division under the able leadership of Sh. Ishan Sharan, Chief Engineer, IRP, in preparation of this report. Their commitment and technical rigour have been instrumental in bringing out this report. I am confident that the LT-NRAP will contribute meaningfully to the creation of a robust, reliable, and sustainable power system for India.

(A. Balan)

New Delhi
6th April, 2026

ईशान शरण
मुख्य अभियन्ता
Ishan Sharan
Chief Engineer

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Acknowledgement

Preparation of Long-Term National Resource Adequacy Plan (LT-NRAP) for the period 2026-27 to 2035-36 has been an extensive and collaborative effort, encompassing rigorous data collection, validation, modelling and carrying out studies. This report is the outcome of dedicated efforts and valuable contributions of officers and experts from various utilities whose commitment deserves sincere appreciation.

I express my heartfelt gratitude to Chairperson, CEA, and Member (Planning), CEA, for their valuable guidance, support, and encouragement throughout the course of this study.

I would like to place on record the commendable efforts of the officers of the Integrated Resource Planning (IRP) Division, in particular, Shri Ratnesh Kumar, Director, Shri Apoorva Anand, Deputy Director, Ms Jyotsana Kapoor, Deputy Director and Shri Girija Sankar Pati, Assistant Director, who have worked diligently in compiling and analysing a wide range of demand, generation, and reliability data, and developing advanced modelling frameworks for this study.

This report will serve as a valuable reference document for utilities, regulators, policymakers, and planners, and will contribute meaningfully to the development of a reliable, sustainable, and future-ready power system for the country.

(Ishan Sharan)

New Delhi
6th April, 2026

Table of Contents

Executive Summary i

Acronyms iii

Chapter 1 1

1.0 Introduction 1

1.1 Growth of the Indian Power Sector in the past Five Years (2020-21 to 2024–25) 1

1.1.1 Growth in electricity demand 1

1.1.2 Growth of Installed Power Generation Capacity 2

1.1.3 Renewable Energy Capacity Additions 3

1.2 Resource Adequacy Framework 3

1.3 Coincident Peak 5

1.4 Capacity Credit 7

Chapter 2 11

2.0 Planning Philosophy and Methodology Adopted for Resource Adequacy Studies 11

2.1 Generation Expansion Planning Studies 12

2.2 Production Cost Analysis 12

2.3 System Reliability Analysis 12

2.4 Generation Expansion Planning Tool 13

2.4.1 ORDENA 13

2.4.2 STELLAR 14

Chapter 3 17

3.0 Inputs-Assumptions for Long Term National Resource Adequacy Plan 17

3.1 Analysis of Electricity Demand Profile 17

3.2 Demand Complementarity and Correlation among States 20

3.3 Analysis of Generation Dispatch 27

3.4 Electricity Demand Projections 29

3.5 Installed Capacity and Generation Mix 31

3.5.1 Installed Capacity and Generation mix as on 31st March, 2025 31

3.5.2 Installed Capacity and Generation Mix as on 31st January, 2026 32

3.6 Under Construction and Planned Capacity 34

3.7 Reliability analysis of the generation expansion study results 35

3.7.1 Variation in Electricity Demand 36

3.7.2 Variation in Solar and Wind Generation 38

3.7.3 Forced Outage of Thermal Generators 39

3.8 Inter-State Transmission Modelling 40
Chapter 4 .... **41**
4.0 Introduction 41
4.1 Scenario I: Electricity Demand Projections as per mid-term review of 20th EPS 41
4.1.1 Likely capacity mix for the period of 2026-27 to 2035-36 41
4.1.2 Likely source-wise installed capacity and electricity generation in 2035-36 42
4.1.3 Likely growth of Energy Storage till 2035-36 43
4.1.4 Likely source-wise generation for the period of 2026-27 to 2035-36 44
4.1.5 Likely source-wise year-wise capacity addition for the period of 2026-27 to 2035-36 ... 46
4.1.6 Likely growth in non-fossil capacity till 2035-36 46
4.1.7 Likely source-wise hourly dispatch for a typical day in 2035-36 48
4.1.8 Emphasis on Energy Storage Capacity Addition 48
4.1.9 Reliability Analysis 50
4.2 Scenario II: Electricity demand projections as per recent trends 55
4.2.1 Likely capacity mix for the period of 2026-27 to 2035-36 55
4.3 Planning Reserve Margin (PRM) 56
4.3.1 Analysis of Year-wise Solar and Non-Solar PRM for Scenario I (electricity demand projections as per mid term review of 20th EPS) 56
4.3.2 Analysis of Year-wise Solar and Non-Solar PRM: Scenario II (electricity demand growth as per recent trends) 57
Chapter 5 .... **59**
5.0 Conclusions and Recommendations 59
5.1 Conclusions 59
5.2 Recommendations 60
Annexure-A: Projected Electrical Energy Requirement and Peak Electricity Demand as per the midterm review of 20th EPS **63**
Annexure-B: List of Under Construction and Candidate Projects **65**
Annexure-C: Assumptions and Inputs in the Study **75**
Annexure-D: State-wise Projected Coincident Peak **78**
Annexure-E: Capacity Credit of Solar and Wind (Solar and Non-Solar Hours) **82**

Executive Summary

The global transition towards green energy is gaining momentum as countries worldwide plan to reduce carbon emissions and mitigate climate change impacts. This transition encompasses a shift from fossil fuel-based energy sources to non-fossil fuel-based energy alternatives such as solar, wind, hydro, nuclear and geothermal, coupled with Energy Storage Systems.

The installed generation capacity in India as on 31st January, 2026, stands at 520.5 GW, of which 52% is from non-fossil generation sources. Moreover, during the current financial year 2025–26 (up to 31st January 2026), a record 52.5 GW of generation capacity (from all sources) has been added. Of this, about 43 GW has been from Renewable Energy sources. This is the highest ever capacity addition in a single year. Therefore, India has successfully demonstrated its transition towards clean energy by accelerating the pace of renewable capacity addition.

The Ministry of Power (MoP), Govt. of India, has notified the Electricity (Amendment) Rules, 2022. Rule 16 (1) of the said rules stipulates that "A guideline for assessment of resource adequacy during the generation planning stage (one year or beyond) as well as during the operational planning stage (up to one year) shall be issued by the Central Government in consultation with the Authority". Accordingly, the Resource Adequacy Guidelines were notified in June 2023 by the Ministry of Power in consultation with the Central Electricity Authority (CEA).

As per the Resource Adequacy (RA) Guidelines, the Central Electricity Authority is entrusted with preparing the LT-NRAP (Long-Term National Resource Adequacy Plan) for the period of 10 years. Further, the Distribution Utilities need to prepare the LT-DRAP (Long-Term Distribution Licensee Resource Adequacy Plan) to reliably meet the utility's peak electricity demand and annual electricity energy requirements. These plans have to be revised every year.

A long-term National Resource Adequacy Study has been carried out to determine the least-cost option for generation capacity expansion from 2026-27 to 2035-36 in order to reliably meet the projected electricity demand. The objective is to minimize the total system cost of generation, which includes the cost of future investments, the cost of operating the entire generation fleet, etc., while ensuring that all technical parameters associated with different power generation technologies are satisfied.

The electricity demand projections as per the mid-term review of the 20th Electric Power Survey (EPS) by CEA indicate that peak electricity demand is expected to increase at a CAGR of 5.58 % during 2024-25 to 2035-36, while the electricity energy requirement is projected to grow at a CAGR of 6.41 % during the same period. The projected peak electricity demand and electrical energy requirement in 2035-36 are 459 GW and 3365 BU, respectively.

As per the RA studies, the projected installed capacity by the end of 2035-36 is 1121 GW, comprising 315 GW Coal, 20 GW Gas, 22 GW Nuclear, 78 GW large Hydro, 509 GW Solar, 155 GW Wind, 16 GW Biomass and 6 GW Small Hydro. Additionally, the energy storage installed capacity of 174 GW/888 GWh (BESS of 80 GW/321 GWh and PSP of 94 GW/ 567 GWh) is envisaged by 2035-36. The non-fossil fuel-based installed capacity would be about 786 GW i.e 70% of the total installed capacity by 2035-36, as compared to about 52% in January 2026. Similarly, the fossil fuel-based installed capacity would be about 30% in 2035-36 as compared to 48% in January 2026.

The installed generation capacity projection in 2035-36 shows that the country is moving toward a strong transition to non-fossil energy. Renewable sources, especially solar PV, wind, and hydro, will dominate future capacity, supported by Energy Storage Systems. With this, the country will significantly increase its clean energy capacity and strengthen energy security.

Reliability studies are an important part of resource adequacy planning, as they help assess whether the power system can consistently meet electricity demand under different uncertain conditions. Variations in electricity demand, variations in renewable energy generation (solar, wind, hydro), and possible outages of thermal power plants have been considered in the study.

As part of the Resource Adequacy Planning framework, State-wise coincident peak requirement for the next two years (2026-27 and 2027-28) and generator-source-wise capacity credit have been estimated. Year-wise solar and non-solar PRM (Planning Reserve Margin) has also been estimated. This will help States and Utilities to plan the capacity procurement accordingly.

Additionally, in line with the increasing demand for clean firm power to meet growing electricity demand, the study also highlights the likely growth of nuclear-based generation capacity to reach 100 GW by 2047.

The structure of this report is outlined as follows: Chapter 1 elaborates on the growth of the power sector and Resource Adequacy guidelines, the concept of coincident peak, capacity credit, and demand complementarity of the States. Chapter 2 provides an overview of the philosophy and methodology adopted for the LT-NRAP studies. Chapter 3 provides a brief overview of the inputs/assumptions of the study. Chapter 4 analyses the long-term study results, while Chapter 5 focuses on the conclusion and recommended action. Annexures include the electricity demand projections, a list of generation projects, as well as techno-economic assumptions considered in the study, year-wise coincident peak of States/UTs for the next two years (2026-27 and 2027-28), capacity credit of solar and wind, etc.

Acronyms

BESS	Battery Energy Storage Systems
BU	Billion Units
C&I	Commercial & Industrial
CAGR	Compound Annual Growth Rate
CAPEX	Capital Expenditure
CEA	Central Electricity Authority
CRF	Capital Recovery Factor
CUF	Capacity Utilisation Factor
DoD	Depth of Discharge
DPR	Detailed Project Report
EENS	Expected Energy Not Served
EIA	Environmental Impact Assessment
ENS/NENS	Energy Not Supplied/Normalised Energy Not Supplied
EPS	Electric Power Survey
ESS	Energy Storage Systems
EV	Electric Vehicle
FDRE	Flexible and Dispatchable Renewable Energy
FY	Financial Year
GEC	Green Energy Corridor
ISTS	Inter-State Transmission System
JERC	Joint Electricity Regulatory Commission
LOLP	Loss of Load Probability
LT-DRAP	Long-term Distribution Licensee Resource Adequacy Plan
LT-NRAP	Long-term National Resource Adequacy Plan
MCS	Monte Carlo Simulation
MILP	Mixed Integer Linear Programming
MMT	Million Metric Tonne
MSW	Municipal Solid Waste
MTL	Minimum Technical Limit
MU	Million Units
MW/MWh	Megawatt/Megawatt-hour
NDC	Nationally Determined Contributions
NPCIL	Nuclear Power Corporation of India Limited
PLF	Plant Load Factor
PRM	Planning Reserve Margin
PSP	Pumped Storage Project
PV	Photovoltaic/solar
RA	Resource Adequacy
RAP	Resource Adequacy Plan
RAR	Resource Adequacy Requirement
RCO	Renewable Consumption Obligation

RE	Renewable Energy
RPO	Renewable Purchase Obligation
RTC	Round The Clock
S&I	Survey & Investigation
SERC	State Electricity Regulatory Commission
SMR	Small Modular Reactors
STELLAR	Strategic Expansion for Long-Term Load Adequacy and Resilience
VGF	Viability Gap Funding
VRE	Variable Renewable Energy
WACC	Weighted Average Cost of Capital
Y-o-Y	Year on Year

Chapter 1

1.0 Introduction

The world is currently experiencing significant technological shifts across multiple sectors. In the power sector, one of the most transformative shifts is the gradual replacement of thermal-based generation with renewable energy sources, complemented by Energy Storage Systems (ESS). This transition has been driven largely by the sustained decline in the cost of solar photovoltaic and the emergence of Energy Storage Systems such as Hydro Pumped Storage Plants (PSP) and Battery Energy Storage Systems (BESS).

In this evolving landscape of clean energy sources dominating the electricity production and ever evolving electricity demand patterns, the emergence of new loads like EV and green hydrogen production, strategic planning for a resilient generation capacity mix becomes critically important to ensure that the future power system is not just cost-effective and environmentally sustainable but also secure and reliable.

A suitable approach is needed that aims to balance the long-term sustainability of the power system with the need to reliably meet the electricity demand at optimal cost. This naturally translates into the need to ensure an adequate reserve margin, which could cater to varying levels of electricity demand and supply conditions in the grid. In the wake of high RE generation, it is important to understand the demand-supply situation in the grid precisely.

The Resource adequacy exercise under the purview of this report aims at the assessment of the generation capacity requirement in the grid for the horizon of the next ten years. This also aids in evaluating the long-term infrastructure needs to support these evolving energy dynamics. With increasing renewable energy capacity installation in RE-rich areas, the need for robust and adaptable grid systems to connect renewable energy-rich areas with consumption centres is growing.

Distribution utilities are tasked with providing a reliable, 24x7 power supply to consumers, ensuring that they have sufficient capacity to meet the electricity demand while also fulfilling their Renewable Consumption Obligation (RCO). This study is crucial in the assessment of the capacity needed to meet future electricity demand cost-effectively, ensuring that the right mix of generation resources is available across various timeframes. The objective is to optimize generation portfolios to balance reliability, cost, and sustainability, ensuring a stable and affordable supply of power while adhering to renewable energy targets.

1.1 Growth of the Indian Power Sector in the past Five Years (2020-21 to 2024–25)

Over the last five years, India's power sector has undergone a significant transformation characterized by rapid capacity expansion, accelerated renewable energy deployment, grid modernization, and major policy reforms. The sector has moved steadily towards cleaner energy while simultaneously ensuring reliability and energy security to meet the rising electricity demand driven by economic growth, urbanization, and electrification.

1.1.1 Growth in electricity demand

Peak electricity demand during 2020-21 was about 190 GW, which has increased to about 250 GW in 2024-25. During the period 2020-21 to 2024-25, peak electricity demand had increased at a CAGR of 7.06%. Similarly, the electrical energy requirement during 2020-21 was about 1276 BU, which has increased to about 1694 BU in 2024-25. During the period 2020-21 to 2024-

25, the electrical energy requirement has increased at a CAGR of 7.35%. There has not been any significant growth in peak electricity demand during 2025-26 (till January, 2026), with the peak electricity demand being about 245 GW. Peak electricity demand and electrical energy requirement (utilities) from 2020-21 to 2025-26 (till January 2026) are given below in Table 1.1:

Table 1.1 National Peak Electricity Demand and Electrical Energy Requirement (Utilities)

Year	Peak Electricity Demand (MW)	Y-o-Y Growth in Peak Demand (%)	Electrical Energy Requirement (MU)	Y-o-Y Growth in Electrical Energy Requirement (%)
2020-21	1,90,198		12,75,534	
2021-22	2,03,014	6.74	13,79,812	8.18
2022-23	2,15,888	6.34	15,13,497	9.69
2023-24	2,43,271	12.68	16,26,132	7.44
2024-25	2,49,856	2.71	16,93,959	4.17
2025-26 (till January, 2026)	2,45,444		14,27,436	

1.1.2 Growth of Installed Power Generation Capacity

India's installed power generation capacity has grown substantially since 2020. The total installed capacity increased from about 382 GW on 1st April 2021 to over 520 GW by 31st January 2026, reflecting a growth of nearly 36% over the period**.** A large share of this growth has come from renewable energy sources such as solar and wind. Growth of installed electricity generation capacity (utilities) is given below in Figure 1.1.

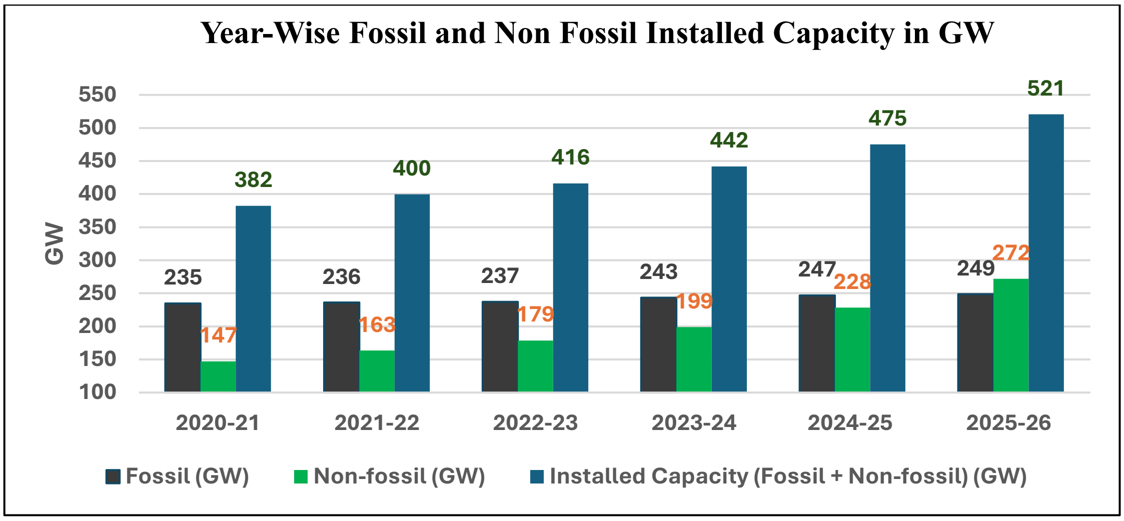


Figure 1.1:Year-wise growth of Fossil & non fossil fuel capacity (GW) for the last 5 Years

Currently, non-fossil fuel sources account for more than half of India's installed capacity, reflecting the structural shift of the power sector towards cleaner energy sources. Fossil fuel-based capacity has increased from 234.72 GW on 1st April, 2021, to 248.54 GW as on 31st January, 2026, showing a growth of 5.89% over the period. The non-fossil fuel-based installed capacity has increased from 147.35 GW on 1st April, 2021, to 271.96 GW as on 31st January, 2026, showing a growth of 84.56% over the period, in line with the Energy Transition goals.

Renewable energy has been the primary driver of capacity addition in the Indian power sector. India added record levels of renewable capacity between 2020-21 and 2024-25. Renewable energy capacity increased to over 260 GW by January 2026, including solar, wind, biomass and hydro. The major contributor to growth in RE capacity addition has been solar PV, which has expanded to about 140 GW by January 2026, making it the largest renewable energy source. Wind capacity has grown to about 55 GW and hydro capacity to 51 GW. The hydro capacity includes PSP capacity of 7.2 GW.

The share of Renewables in electricity generation has also increased significantly, reaching around 27% in 2025-26 (till January 2026), compared to 22% in 2020-21. India is now among the top countries globally in renewable energy deployment.

1.1.3 Renewable Energy Capacity Additions

In recent years, India has achieved record renewable capacity additions:

- 29.5 GW renewable capacity added in FY2024–25, one of the highest annual additions.
- Between April 2025 and January 2026, over 43 GW of renewable energy capacity has been added.

These additions demonstrate the increasing role of renewable energy in meeting the electricity demand.

1.2 Resource Adequacy Framework

Resource Adequacy is typically defined as a mechanism to ensure an adequate supply of generation resources to reliably meet the projected electricity demand at the least cost. A crucial aspect of resource adequacy planning is ensuring that sufficient generation capacities are available round the clock, capable of reliably serving electricity demand under various scenarios, while considering factors such as extreme weather events, plant availability, etc.

This approach aims to balance the long-term sustainability of the power system with the need to meet consumer demand at the most optimal cost. This naturally translates into the need to ensure an adequate reserve margin, which could cater to varying levels of demand and supply conditions in the grid. In the wake of high RE generation, it is important to understand the demand-supply situation in the grid precisely. The Resource Adequacy exercise will also help in the assessment of capacity requirements to be tied up or contracted on a long-term, medium-term, and short-term basis.

The Resource Adequacy exercise also involves evaluating the long-term infrastructure needs to support these evolving energy dynamics. Under Rule 16 of the Electricity (Amendment) Rules, 2022, Ministry of Power, Government of India, in consultation with Central Electricity Authority (CEA), has issued the guidelines for Resource Adequacy for the Indian electricity sector on 28th June 2023. The key Benefits of the Resource Adequacy Framework are shown in Figure 1.2.

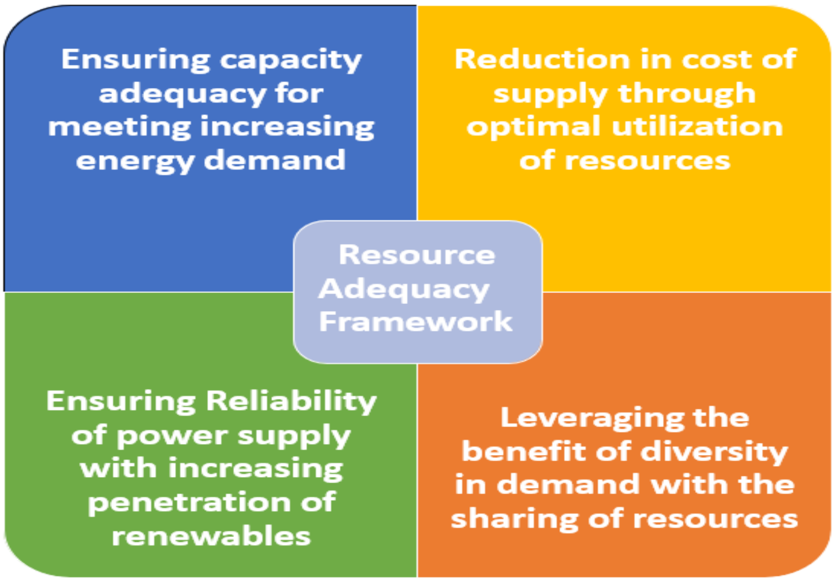


Figure 1.2: Benefits of the Resource Adequacy Framework

The relevant provisions of the Resource Adequacy Guidelines describing the role of the Central Electricity Authority are as follows:

3.1 The Central Electricity Authority shall publish the Long-term National Resource Adequacy Plan (LT-NRAP), which shall determine the optimal Planning Reserve Margin (PRM) requirement at the All-India level conforming to the reliable supply targets.

a) The report shall publish the national-level PRM as guidance for all the States/UTs to consider while undertaking their RA exercises.
b) The report shall also publish the Optimal Generation mix for the next 10 years required to ensure that the national-level system is RA-compliant while meeting the All-India demand at least cost. This shall guide capacity buildout investments in the country.
c) The report shall also publish the capacity credits for different resource types on a regional basis.
d) The report shall specify the State/UT's contribution towards the national peak.
e) The LT-NRAP shall be updated annually.

Distribution utilities are tasked with providing a reliable, 24x7 power supply to consumers, ensuring that they have sufficient capacity to meet the electricity demand while also fulfilling their Renewable Purchase Obligation (RPO) in line with Nationally Determined Contributions (NDC) targets. Resource adequacy studies are crucial in the assessment of the capacity needed to meet future electricity demand cost-effectively, ensuring the right mix of generation resources is available across all periods. The objective is to optimize generation portfolios to balance reliability, cost, and sustainability, ensuring a reliable power supply while adhering to renewable energy targets.

Some of the relevant provisions of the Resource Adequacy Guidelines describing the role of the Distribution Licensees are given below:

3.7 Each Distribution licensee shall undertake a Resource Adequacy Plan (RAP) for a 10-year horizon (Long-term Distribution Licensee Resource Adequacy Plan (LT-DRAP)) to meet their own peak and electrical energy requirements. The plan shall be vetted/validated by the Central Electricity Authority to leverage the benefits of national-level optimisation for distribution licensees. The LT-DRAP shall be undertaken as per the methodology outlined in Annexure-E of these guidelines.

3.7.1 The distribution licensees shall take inputs, if required, from the LT-NRAP, like PRM, capacity credits, etc., while formulating their LT-DRAP and submit their plans to CEA by the month of September for the period starting from the month of April in the subsequent year.

1.3 Coincident Peak

The term Coincident Peak refers to the share of different distribution utilities in the national peak demand. Based on the previous year's demand profile, it has been observed that the occurrence of peak demand varies across months and times of day. Therefore, it is pragmatic that instead of a single peak, the top 5% or 10% of demand hours of the national load should be considered for the determination of the coincident peak. It may be noted that the coincident peak demand may or may not coincide with the peak demand of respective utilities.

As per the Resource Adequacy Guidelines.

1.3.1 Based on the share in the national peak provided in LT-NRAP, each distribution licensee shall plan to contract the capacities equivalent to the

Total Firm Capacity to be contracted by State/Utilities =

Contribution during National Peak * (1 + National level PRM)

as prescribed in the resource adequacy guidelines. The distribution licensees shall demonstrate to the SERC/JERC a 100% tie-up for the first year and a minimum 90% tie-up for the second year to meet the requirements of their contribution towards meeting the national peak. Only resources with long, medium, and short-term contracts shall be considered to contribute to the RAR. Discoms have to show the SERC/JERC the plan to meet the estimated contribution towards the National Peak demand for the subsequent three years [Section 3.6 of Guidelines]

As per the guidelines [Section 3.6 of Guidelines], for meeting the contribution towards national peak demand, the share of long-term contracts is suggested to be in the range of 75-80% of the total supply side Resource Adequacy Requirement [RAR] or as specified by the respective SERC/JERC. The medium–term contracts are suggested to be in the range of 10% - 20% of the total supply side RAR, while the rest can be met through short-term contracts. Power procurement through the power exchanges, such as the Day-Ahead Market segment, shall not be considered to contribute to RAR. However, these ratios of long, medium and short-term contracts may be reviewed periodically based on further experience.

1.3.2 Distribution licensees, through the LT-DRAP, shall also demonstrate to the SERC/JERC their plan to meet their own peak demand and energy requirement with a mix of long-term, medium-term, and short-term contracts, including power exchanges [Section 3.8].

Central Electricity Authority has published a discussion paper titled "Methodology for Capacity Credit of Generation Resources & Coincident Peak Requirement of Utilities Under Resource Adequacy Framework" in February, 2025. The discussion paper has compared various methodologies for determining the capacity credit and coincident peak requirement. Based on the analysis, the discussion paper suggests that the solar vs. non-solar methodology (with the n^{th} percentile) may be a better approach for estimating coincident peaks, especially considering factors such as the focus on adding solar capacity and the shifting of electricity demand to solar hours.

The methodology followed for the calculation of coincident peak demand during solar and non-solar periods is as follows.

(i) Collect the block-wise demand for each State & UT for the year.

(ii) Segregate the demand between solar and non-solar Hours.

(iii) Determine the top 5% of all-India demand during solar and non-solar hours separately.

(iv) Calculate the maximum, different percentiles (90th, 80th), and the average demand value of individual States/UT during the top 5% demand hours.

(v) Check the summation of coincident demand for different measures (maximum, percentiles, average) of all the States/UT with the national peak demand (Solar and Non-Solar) for that year. The measure that is closest (and slightly higher) to the national peak demand should be considered for determining the coincident peak.

As per the suggested methodology, the coincident peak demand requirements of various States and Union Territories (UTs) for the year 2023-24 were published in the discussion paper. A similar methodology has been adopted to calculate the coincident peak requirements for the financial years 2026-27 and 2027-28. The detailed calculations are enclosed in **Annexure D**.

The peak electricity demand projections for the year 2026-27, as per mid term review of the 20th EPS is 289 GW. The projected peak electricity demand for the year 2025-26 was 270 GW. However, the actual peak electricity demand during the year 2025-26 has been about 245GW (till February'2026). Subsequently, **Annexure D** also outlines the calculations for the anticipated national peak demand of approximately 270 GW for the year 2026-27, taking into account the recent trend in demand growth.

The above coincident peak has been calculated based on the demand at the periphery of the State. State load dispatch centres with multiple distribution utilities are requested to calculate the share of distribution utilities in the national peak by calculation based on the methodology described above or any other methodology as suited to them. The above exercise will be carried out on an annual basis. Hence, any further change in demand pattern, weather events, agricultural load shifting, etc., will be captured in subsequent iterations.

It is pertinent to mention that towards the goal of meeting the projected national peak demand, it is important that the corresponding requirements from States towards the coincident peak, as described above is met. It is mandatory for States, as per RA guidelines, that sufficient long-term, medium-term, medium term and short-term tie-ups are ensured well in advance to ascertain adequacy towards meeting the projected national demand as per values given in **Annexure D** for the upcoming years 2026-27 and 2027-28.

It is seen that around 50% of the contribution towards the coincident peak (national) demand during solar hours is from six States, viz. Maharashtra, UP, Gujarat, Rajasthan, MP and Karnataka (the highest 12% being from Maharashtra, while the lowest 6.5% from Karnataka).

Similarly, it is seen that around 50% of the contribution towards coincident peak (national) demand during non-solar hours is from the States of Uttar Pradesh, Maharashtra, Gujarat, Tamil Nadu, Rajasthan and Madhya Pradesh (the highest 12% being from UP, while the lowest 5.5% from Maharashtra among these).

Therefore, it is noted that the States of Maharashtra, UP, Gujarat, Rajasthan, MP, Tamil Nadu, and Karnataka are the key contributors towards the projected national peak demand during solar and non-solar hours. These States need to ensure tie up of generation capacity, well in advance, towards fulfilling their coincident peak requirements.

However, it is pertinent to note that, as mandated by the RA guidelines, all the states are to ensure the timely tie-up of adequate generation capacity for meeting their respective designated requirement towards the All India peak demand (coincident peak), during both solar and non-solar hours.

Additionally, for the states with multiple distribution utilities, SLDCs are mandated to determine and enforce the share of each utility in the state's contribution towards the national peak (coincident peak). Accordingly, adequate tie-ups should be planned, but all the utilities should be tied up in a timely manner to fulfil this requirement.

1.4 Capacity Credit

Capacity credit refers to the dependable contribution of a power source or generation technology to meet peak electricity demand reliably. It is typically expressed as a percentage of the nameplate capacity that can be counted on during peak demand periods.

Based on the analysis in the discussion paper titled "**Methodology for Capacity Credit of Generation Resources & Coincident Peak Requirement of Utilities Under Resource Adequacy Framework**", the critical day's methodology is well-suited for estimating the capacity credit of variable renewable energy (VRE) sources, particularly for solar and non-solar hours. By focusing on days with adverse conditions for VRE, the Critical Day analysis provides a more realistic assessment of system performance and resilience. As more VRE is integrated into the system, the critical day's methodology becomes even more suitable compared to other methodologies. This approach provides a more resilient assessment of VRE as well as the actual performance during critical conditions. The capacity credit of conventional sources has been estimated as follows:

Table 1.2 Source-wise Capacity credit for Conventional Sources

Source	**Capacity Credit for Solar Hours**	**Capacity Credit for Non-Solar Hours**
Coal	0.8	0.8
Gas	0.3	0.5
Nuclear	0.7	0.7
Hydro	0.5	0.6
Biomass & MSW	0.2	0.2

Note: A lower value of the capacity credit of Gas based Generation during solar hours has been considered based on the historical trend of utilisation of gas-based generation. In case of availability of gas, a higher value may be considered.

It should be noted that the above figures represent an estimate at the aggregate level and may differ for individual generators. Distribution utilities are therefore advised to calculate the capacity credit for each generator based on its actual generation profile over the past, say, 3 years.

For VRE sources such as solar and wind, the critical days methodology was adopted. As per the methodology, the days in a month are classified into either High, Medium or Low demand and High, Medium or Low RE days. Based on the above, the critical days in the month are identified, and the capacity credit of VRE sources during the solar and non-solar hours has been estimated. As per the methodology suggested, the critical days identified for demand in the year 2024-25 are shown below.

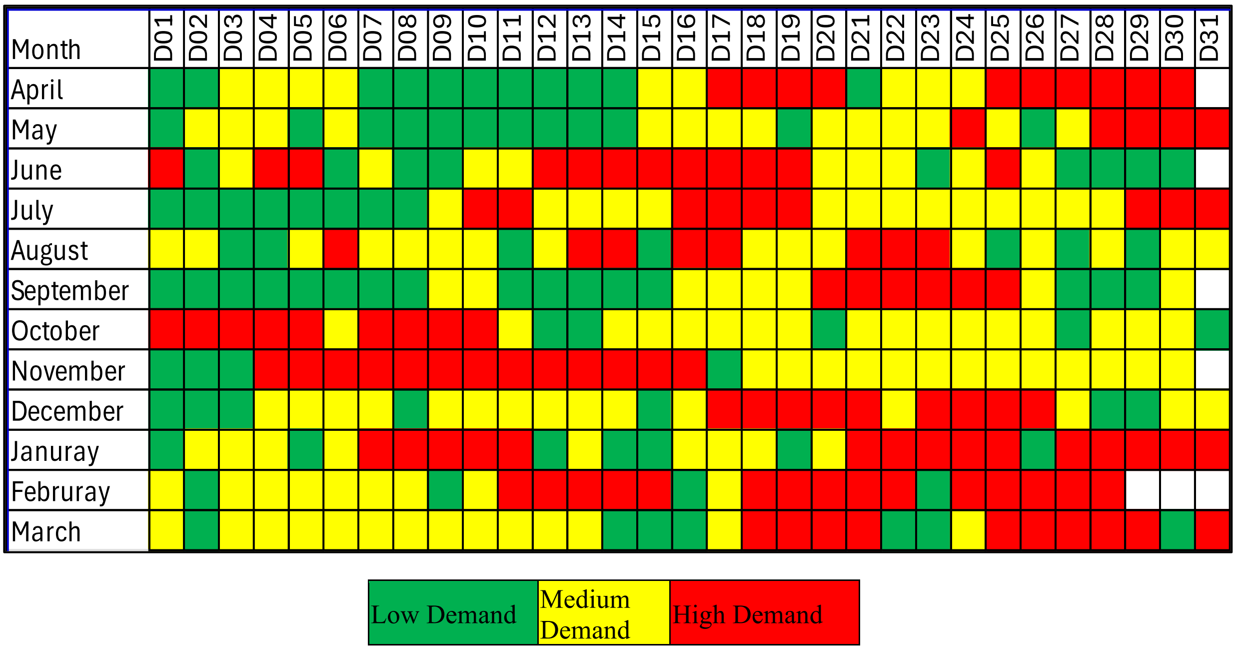


Figure 1.3: Demand Clustering Days in 2024-25

In the above figure, high-demand days are represented in red, medium-demand days in yellow, and low-demand days in green. These classifications have been determined using the K-means clustering algorithm. Similarly, the critical days based on the VRE (solar and wind) generation are shown below. The colour terminology is similar to the demand clustering.

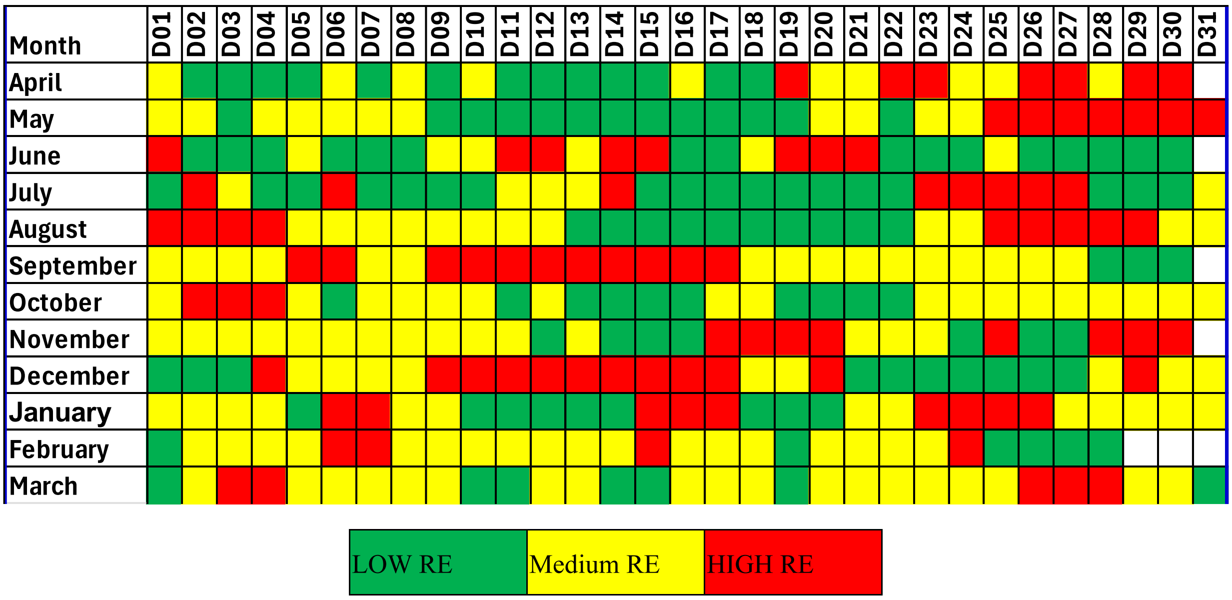


Figure 1.4: RE Clustering Days in 2024-25

Based on the above analysis, the critical days of the month—classified as High Demand–Low RE, High Demand–Medium RE, and Medium Demand–Low RE have been identified, and the capacity credit of solar and wind has been estimated accordingly. Figure 1.5 gives the pictorial representation of the above analysis.

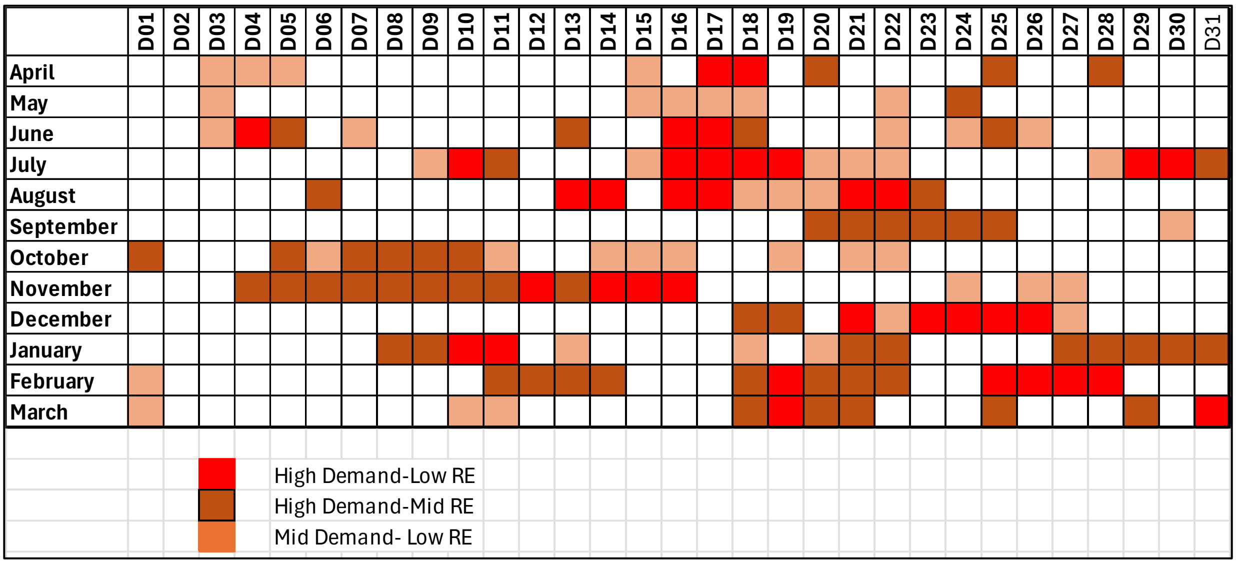


Figure 1.5: Month-wise critical days 2024-25

The State-wise capacity credit for VRE sources (solar and wind) has been estimated and enclosed in **Annexure E.**

To calculate the capacity credit of storage technologies such as PSP and BESS, continuous blocks during the top 10% of peak-demand non-solar periods were identified, and their frequency distribution was analysed. It was observed that the maximum occurrence of consecutive peak blocks is typically 6 hours, corresponding to 24 blocks of 15 minutes each.

The frequency distribution of consecutive peak blocks during the top 10% non-solar demand hours in 2024-25 and 2025-26 (up to January 2026) is shown below in Figures 1.6 and 1.7, respectively.

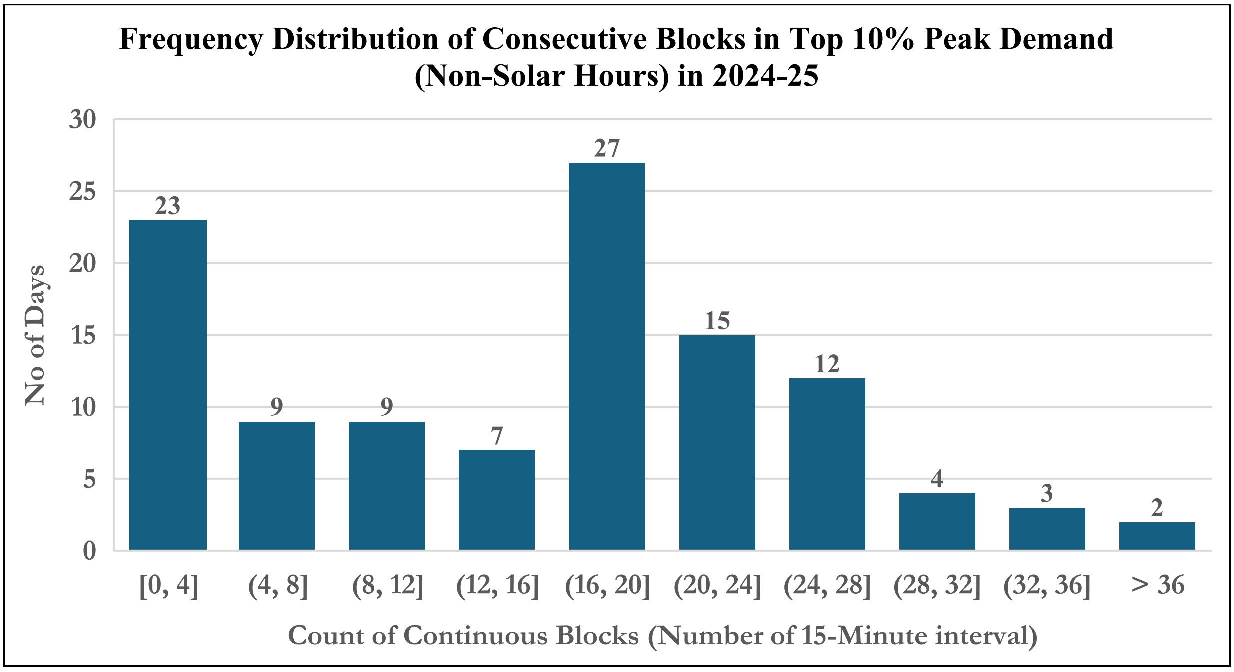


Figure 1.6: Frequency Distribution of Consecutive Blocks in Top 10% Peak Demand (Non-Solar Hours) in 2024-25

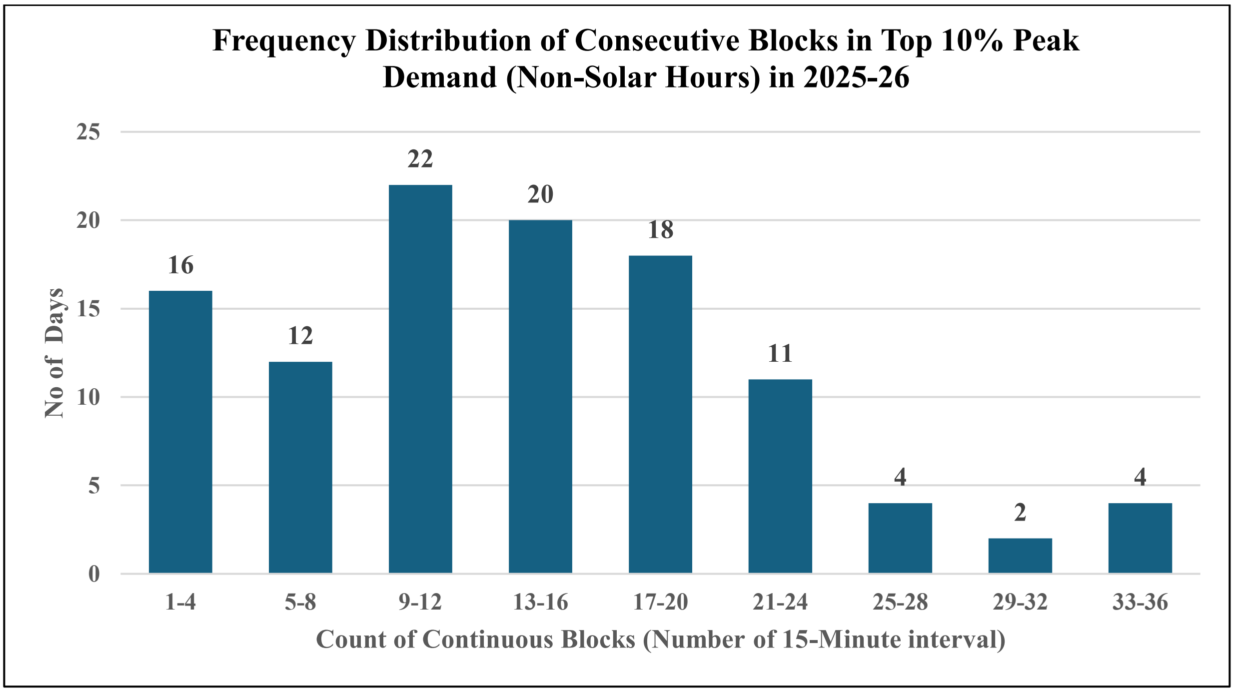


Figure 1.7: Frequency Distribution of Consecutive Blocks in Top 10% Peak Demand (Non-Solar Hours) in 2025-26

Therefore, storage systems with a duration of 6 hours or more can supply their full rated capacity during peak demand hours, making them highly effective in supporting system reliability. Storage systems with shorter durations can still contribute, but their impact will be proportionate to their available energy, highlighting the importance of appropriately sizing storage assets to ensure adequate peak support and maintain grid stability.

For storage assets, the capacity credit (CC) depends on the size of storage in terms of the number of hours of storage. In the case of BESS, for a 6-hour storage asset, as described above, the CC value is 1, while for lesser values of storage size (less than 6 hours), the CC value reduces proportionately. Thereby, the CC for 4-hour storage resource works out to be ~0.67.

For pumped storage plants, the maximum CC value is 0.95, considering planned maintenance and auxiliary consumption aspects. Therefore, the CC for a six-hour PSP is considered to be 0.95. However, similar to BESS, the CC value of a pumped storage plant with less storage size would reduce proportionately.

Chapter 2

2.0 Planning Philosophy and Methodology Adopted for Resource Adequacy Studies

The Resource adequacy studies employ a comprehensive, data-driven methodology to assess the adequacy of the power system in meeting national electricity demand while ensuring reliability, sustainability, and economic efficiency. The key steps in the methodology are as follows:

- **Electricity Demand Projection**: The study begins with a detailed demand projection using historical data, economic growth models, and demographic projections. This includes estimating State-wise peak electricity demand and annual electrical energy requirements for multiple timeframes, typically spanning twenty years, with a focus on aligning these projections considering the past trends as well as emerging loads like data centres, green hydrogen production, efficiency improvement, etc. Revised demand projections as per the mid-term review of the 20th Electric Power Survey (EPS) Report have been considered in the study.

- **Generation Capacity Assessment**: A thorough evaluation of generation capacity, including both conventional and renewable energy sources, has been performed. This assessment considers existing capacity, new capacity additions, potential retirements and upgrades to ensure that the generation mix is able to meet the projected electricity demand in different scenarios.

- **Optimisation and Sensitivity Analysis**: Optimisation techniques, such as MILP (Mixed Integer Linear Programming), linear programming and Monte Carlo simulations, are used to identify the most cost-effective and reliable energy mix. Sensitivity analysis is conducted to evaluate the system's resilience to variations in electricity demand, forced outage of thermal generators, variation in electricity generation from solar, wind, etc., helping to make more informed planning decisions.

- **Policy and Regulatory Alignment**: The study also incorporates national policies, such as renewable energy targets, electrification goals, etc., ensuring that the proposed plans align with long-term policy objectives.

- **Stakeholder Engagement**: Throughout the study, discussions have been carried out with stakeholders such as government agencies, utilities, industry associations, etc., to ensure that all perspectives are considered in the plan.

The fundamental steps involved in the Resource Adequacy study include the following:

- Conducting Generation Expansion Planning for a long-term horizon, generally spanning up to 10 years, to determine the optimal mix of future generation capacity.

- Evaluating System Performance through Production Cost Analysis, which assesses the economic and operational robustness of the power system under various conditions.

- Analyzing System Reliability using metrics such as Loss of Load Probability (LOLP) or Expected Energy Not Served (EENS), to ensure that the system can consistently meet electricity demand.

Each of these three steps is briefly explained below.

2.1 Generation Expansion Planning Studies

Generation Expansion Planning Studies are defined as the process to evaluate the most economically feasible generation capacity additions to meet the projected electricity demand. This takes into account factors such as the electricity demand projection, existing and planned capacity additions, evolving demand patterns, renewable energy profiles, cost trends of various investment options, operational characteristics of different generation technologies, phasing out of older capacity, etc.

2.2 Production Cost Analysis

Production cost analysis, also known as Economic Dispatch studies, is essential to carry out economic (least-cost) dispatch, adhering to unit commitment and other model inputs and constraints. This is typically carried out for a 1-year horizon with the time interval of Hourly (60 min)/sub-hourly (15 min) resolution.

Production cost models or the short-term studies help to validate results from long-term generation expansion models and complement the long-term results in overcoming their internal limitation in the time resolution.

A top-down approach of planning and assessments is quite logical, such that the process would move from high-scope planning (time horizon) to high-detail analysis. Production Cost Analysis gives information about the following:

- Generator-wise annual generation, fuel cost, start-up cost, etc.
- Start- Stop of thermal generators
- Renewable energy curtailment, if any
- Unserved Energy- demand blocks
- Reserve Requirement in the system
- Ramping Constraints of thermal generators

To begin with, long-term generation expansion planning defines and proposes a future capacity mix. Having established that mix in the respective years, that capacity mix is used to assess optimal dispatch, which in turn is used in hourly/sub-hourly analysis of the system to ascertain deficiency, if any, in system operation. Any issues about unmet demand, RE curtailment, etc., are addressed while fine-tuning the Long-term planning exercise in the subsequent iterations.

2.3 System Reliability Analysis

System Reliability Analysis involves the use of advanced probabilistic methods, such as Monte Carlo simulation and stochastic modelling, to capture the uncertainties that impact the power system. These methods help evaluate how the system behaves under various uncertain conditions, including:

a) Scheduled and unscheduled outages or maintenance of generating units,

b) Unforeseen fluctuations in renewable energy (RE) generation, such as wind and solar variability,

c) Unexpected changes in electricity demand,

d) Variations in hydroelectric generation, depending on hydrological conditions (e.g., normal, wet, or dry years),

By simulating hundreds of possible future scenarios that reflect these uncertainties, system reliability analysis allows for the estimation of key reliability indices, such as:

- Loss of Load Probability (LOLP) – the probability that projected electricity demand will exceed available generation capacity, and
- Expected Energy Not Served (EENS) – the amount of energy demand that cannot be met due to insufficient generation.

These indices can be calculated at the State, regional, or national level and provide valuable insights for planning and operational decisions.

Planning Reserve Margin (PRM) is a key metric in power system planning, representing the total available firm capacity above the expected peak demand to ensure reliability in the face of uncertainties. Estimating PRM is essential for maintaining system adequacy, especially as power systems integrate more variable resources like renewables.

Analyzing these probabilistic outcomes, system planners can determine the appropriate planning reserve margins to be maintained for the reliable supply of power.

2.4 Generation Expansion Planning Tool

Studies have been carried out using a combination of two models, namely ORDENA and STELLAR. Salient features of both these models are described below:

2.4.1 ORDENA

ORDENA is a mixed-integer linear optimisation model that minimises the net present value of investment and operating costs subject to several constraints. The major constraints include balancing electricity demand and supply, resource supply limits, planning and operating reserve limits, and policy targets. These constraints are met considering a broad portfolio of conventional generation, renewable generation, and energy storage systems.

ORDENA has a reliability module that uses Monte-Carlo simulation to determine the system's adequacy under various conditions, like variation in electricity demand, variation in RE generation, etc. The software is also capable of carrying out hourly/sub-hourly economic generation dispatch, considering all the technical constraints associated with various generation technologies.

The salient features of ORDENA include the chronological Modelling, Unit Commitment characteristics, DC transmission flow modelling, Monte Carlo simulation, fuel constraints, as well as renewable profile modelling, etc.

The schematic diagram of the software is given in **Exhibit 2.1.**

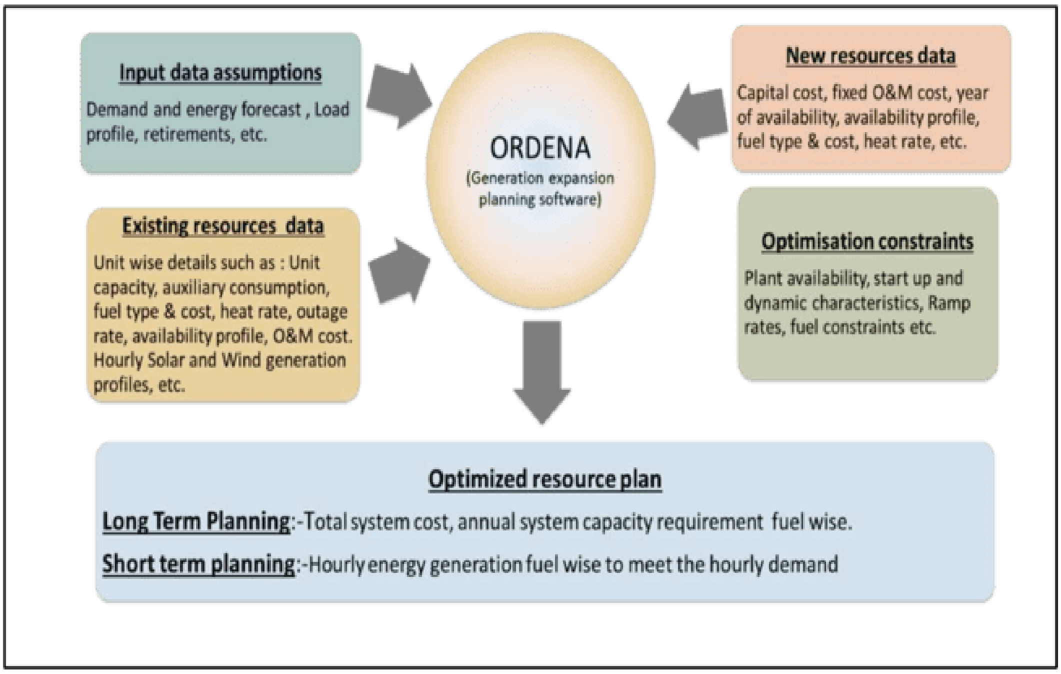


Exhibit 2.1 Schematic Diagram of ORDENA

2.4.2 STELLAR

The Central Electricity Authority (CEA) has successfully developed an indigenous generation expansion planning tool that integrates long-term capacity planning, economic dispatch, and reliability analysis into a unified framework. Named **"STELLAR" (**Strategic Expansion for Long-Term Load Adequacy and Resilience**)**, the tool represents a significant advancement in power system planning. STELLAR is a state-of-the-art optimization model framework designed to support long-term decision-making in the electricity sector, operational resilience, and cost-effective system evolution in line with India's energy transition goals.

The salient features of STELLAR include representative-day modelling, co-optimization of energy and ancillary services, demand-response modelling, etc. STELLAR also has a reliability module that uses Monte-Carlo simulation to determine the system's adequacy under various conditions, like variation in electricity demand, variation in RE generation, etc. The schematic diagram of the STELLAR tool is shown in Figure 2.2.

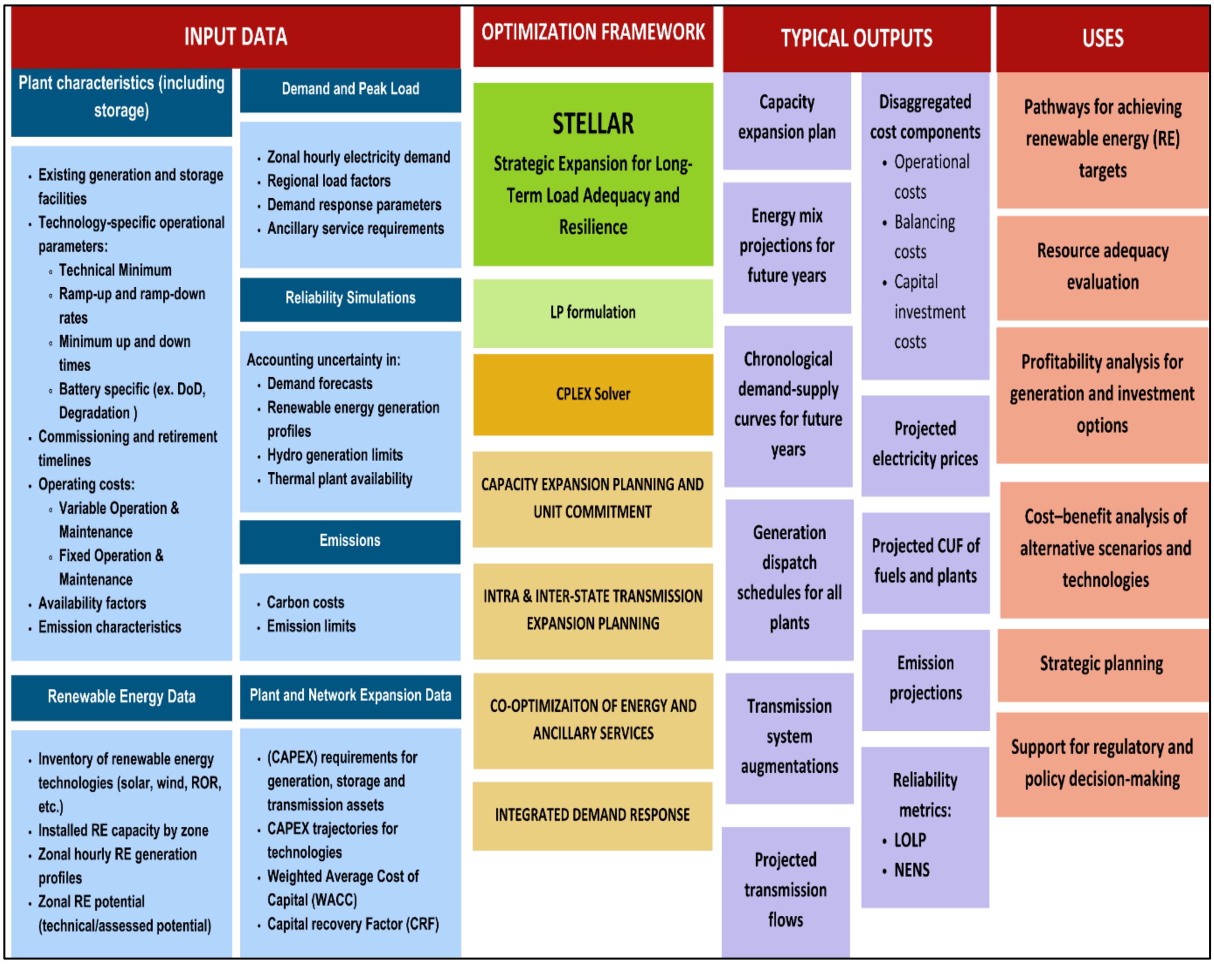


Exhibit 2.2 Schematic Diagram of STELLAR

Chapter 3

3.0 Inputs-Assumptions for Long Term National Resource Adequacy Plan

The Resource Adequacy study is a comprehensive assessment that integrates multiple interdependent inputs to ensure a reliable and cost-effective power system. It begins with long-term demand projections that account for economic growth, electrification trends, and seasonal variations, which are further refined into granular hourly demand profiles derived from historical consumption patterns to capture daily and intra-day fluctuations. Alongside demand, detailed renewable energy (RE) generation profiles—particularly for solar and wind—are incorporated to reflect their variability, intermittency, and correlation with demand. The study also considers the current fleet of generation assets as well as planned capacity additions and retirements, including thermal, hydro, nuclear, and storage resources, to evaluate future supply availability. These inputs are complemented by a range of techno-economic parameters such as plant availability, ramping capabilities, fuel costs, outage rates, transmission constraints, and reserve requirements, enabling simulation of system performance under diverse scenarios. Together, this integrated approach helps determine whether the system can reliably meet demand at all times, identify potential capacity gaps, and guide optimal planning decisions for generation expansion, storage deployment, and grid enhancements.

The various inputs considered for the national RA studies are elaborated below-

3.1 Analysis of Electricity Demand Profile

The daily solar and non-solar period peak demand for 2024-25 and 2025-26 (till 31.01.2026) is shown in Figures 3.1 & 3.2, respectively.

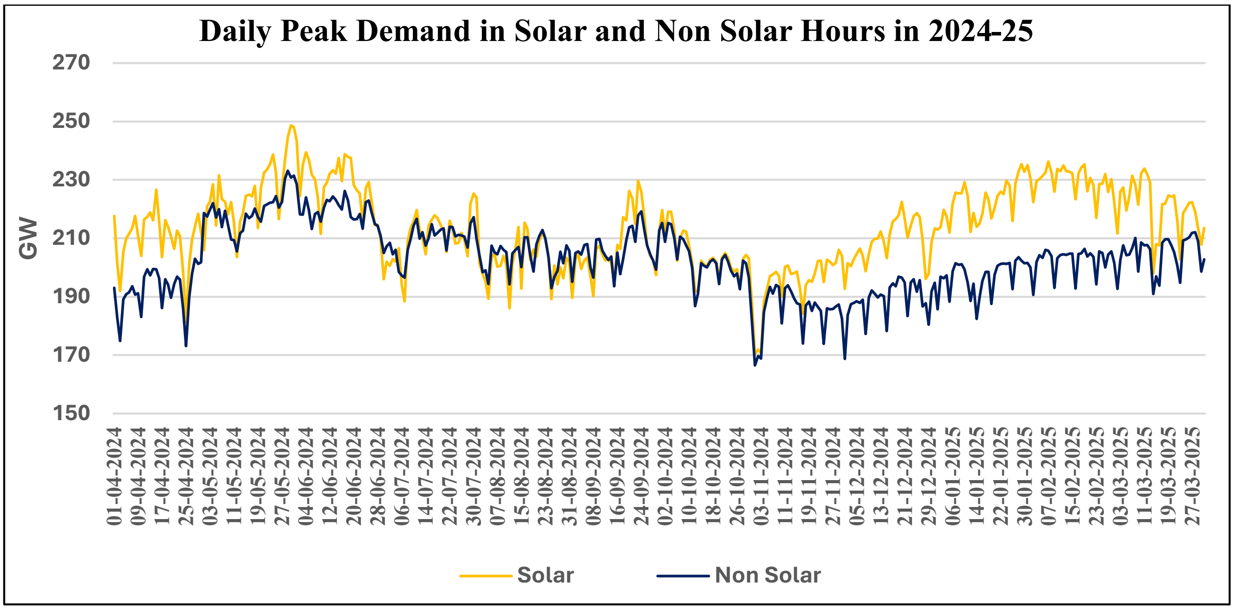


Figure 3.1 Daily Solar (6 to 18 hrs) and Non-Solar Hours Peak Demand in 2024-25

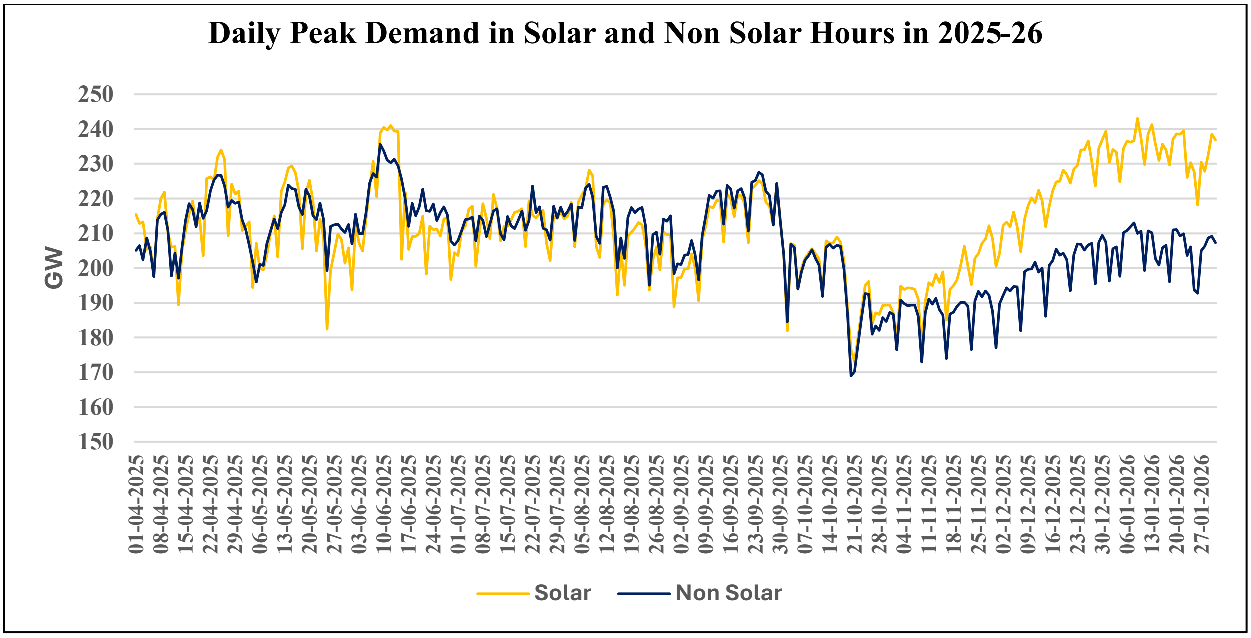


Figure 3.2 Daily Solar and Non-Solar hours Peak Demand in 2025-26 (till 31.01.2026)

As observed in both graphs, the electricity demand during solar hours is consistently higher than the non-solar hour demand on most days. However, the gap between the solar and non-solar peak demand is higher during the winter months (i.e., November-March). The peak electricity demand occurred in the month of May in 2024-25, while it occurred in the month of January in 2025-26.

The frequency distribution of solar and non-solar hourly electricity demand (hourly) in 2024-25 and 2025-26 is shown in Figure 3.3(a) and (b), respectively.

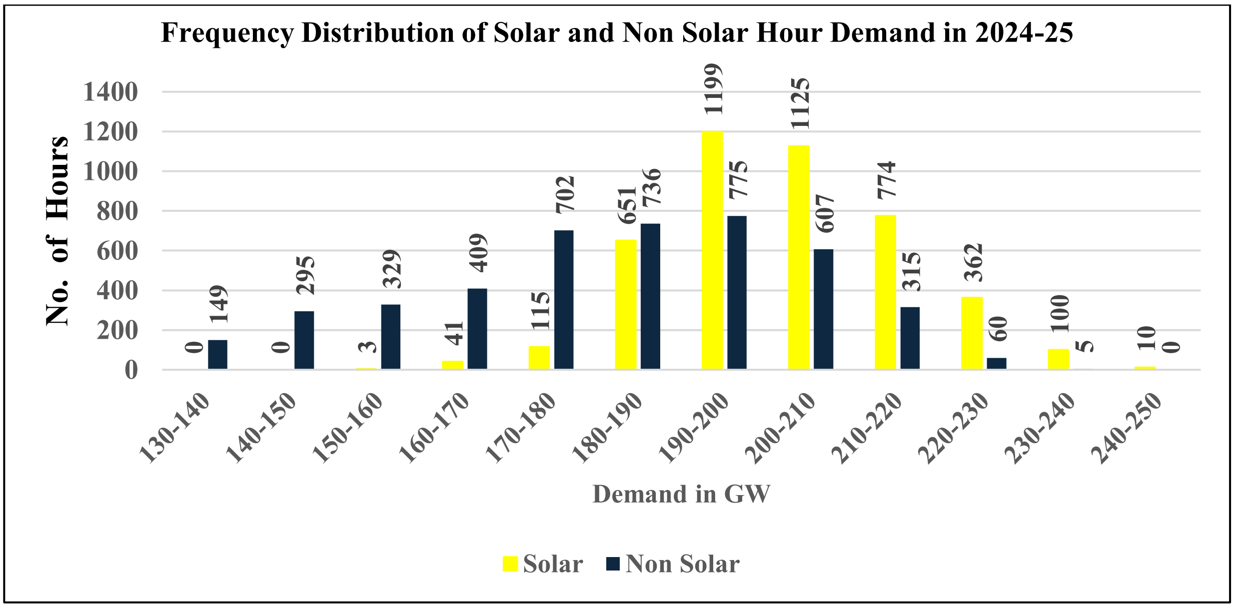


Figure 3.3 (a): Frequency Distribution of Solar and Non-Solar Hourly Demand in 2024-25

Figure 3.3(a) suggests a distinct shift between solar and non-solar demand hours during 2024-25. During non-solar hours, demand is more prominent in the lower demand ranges (130–230 GW), with maximum occurrences (around 775 hours) lying in the range of 190 - 200 GW. In contrast, during solar hours, demand is concentrated in higher demand ranges (160–240 GW), and the maximum occurrences (around 1200 hours) lie in the range of 190–200 GW.

Additionally, solar demand drops off sharply at very low and very high demand levels, while non-solar sources remain more consistently distributed across the range.

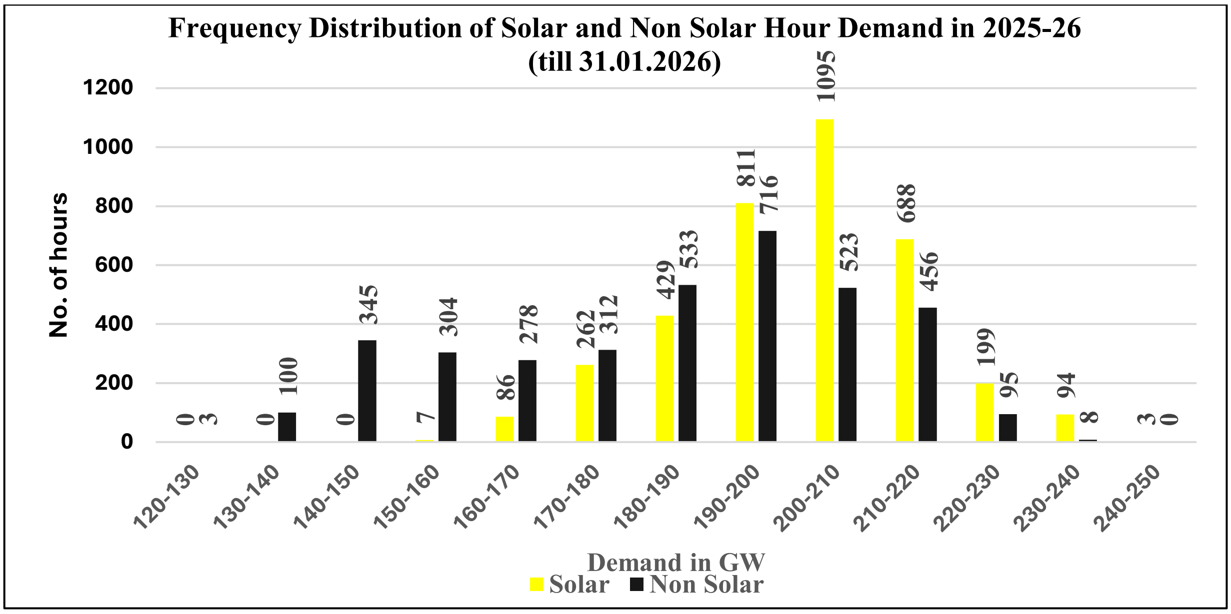


Figure 3.3(b): Frequency Distribution of Solar and Non-Solar Hourly Demand in 2025-26 (till 31.01.2026)

Figure 3.3(b) suggests that during 2025-26, during solar hours, demand is concentrated in the range of 160-240 GW for the maximum time, while the non-solar demand is more widespread, ranging from 140 GW to 230 GW, similar to the previous year. During Solar hours, demand lies in the range of 200-210 GW for the maximum number of hours (around 1000).

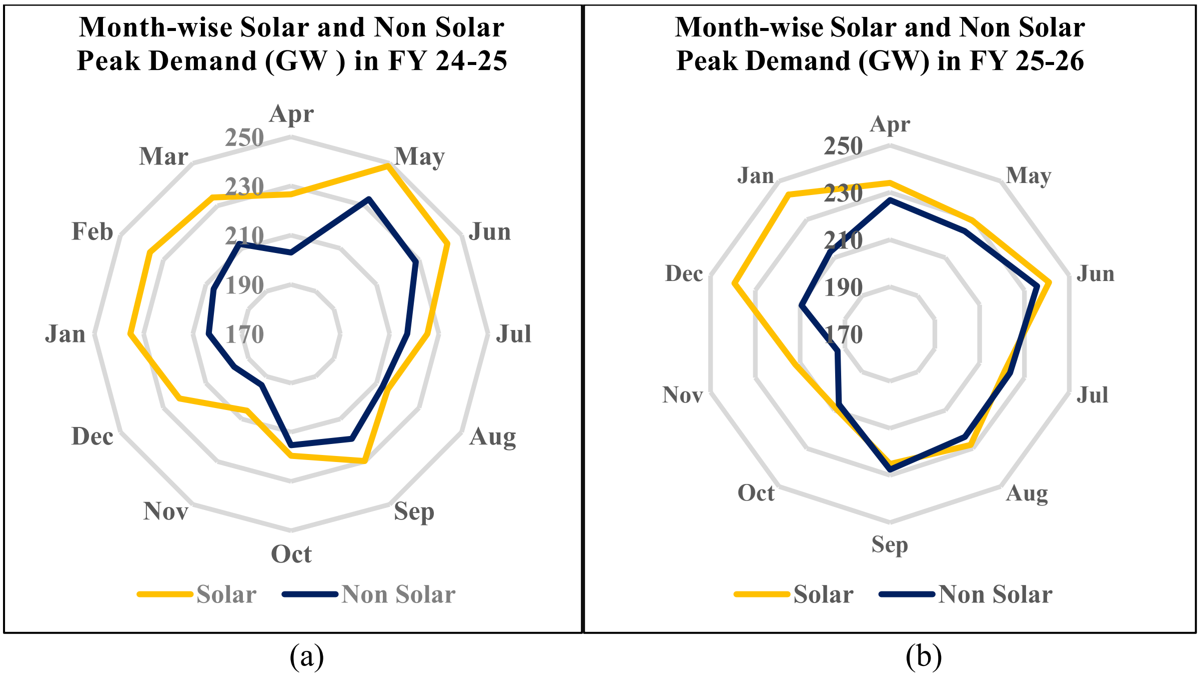


Figure 3.4(a)&(b): Month-wise Solar and Non-Solar Peak demand in 2024-25 & 2025-26 (up to Jan 2026)

The radar/spider chart presents the month-wise peak electricity demand in India (in GW) for FY 2024-25 [figure 3.4(a)] and for 2025–26 [figure 3.4(b)], comparing solar (daytime) and non-solar (evening/night) demand.

In 2024-25, the peak solar demand of 250 GW was observed in the month of May, with non-solar peak reaching 233 GW in that month. However, during August to October, there is minimal variation in solar and non-solar peaks – solar peaks in the range of 212-230 GW, while non-solar peaks in the range of 212-220 GW. In the winter months, viz. From December to February, this difference between solar and non-solar peak maximises, with solar peaks in the range of 220-236 GW while non-solar peaks in the range of 200-207 GW.

For 2025-26, it is seen that peak demand is generally highest during the summer months, especially from April to June, with demand reaching around 235–240 GW in June due to increased cooling requirements. During the monsoon period (July to September), demand slightly declines, and in September, both solar and non-solar peaks are nearly equal at about 225 GW. In the winter months (November to January), non-solar demand drops significantly to around 190–210 GW, while solar demand remains relatively higher, peaking near 240–245 GW in December and January. October acts as a transition month when both demands are almost equal. Overall, solar hour peak demand tends to be higher than non-solar hour demand for most of the year, with the largest gap observed in winter, indicating stronger daytime electricity usage compared to nighttime.

3.2 Demand Complementarity and Correlation among States

In the context of electricity consumption, demand complementarity refers to the compensating or balancing relationship between the electricity demand of different States where an increase in demand in one State coincides with a decrease or lower demand in another. This may be due to various factors, such as weather and crop patterns, leading to peak demand in some States during summer months and in others during winter months. Recognising and quantifying such relationships is crucial for grid operators and planners to optimise generation scheduling and enhance system efficiency.

On the other hand, demand correlation denotes the statistical degree of association between electricity demand patterns across sectors, regions, or time intervals. A positive correlation indicates that the demands in different States move in the same direction, such as electricity demand in hilly States in the winter months. A negative correlation arises when the demand in one State increases while it decreases in another. Analysing demand correlation both spatially (across regions) and temporally (across time) allows system planners to identify divergent demand patterns, assess load diversity, and design strategies that ensure reliable and balanced power system operation. Table 3.1 presents the month-wise peak electricity demand across various States during both solar and non-solar hours for 2024-25. The heat map denotes the colour where red represents high peak demand months, while yellow and green represent medium and low demand months, respectively. An analysis of this data reveals a notable complementarity in demand patterns among different States.

Table 3.1 Complimentary demand of States (month-wise peak demand) (Solar Hours) in 2024-25

(figures are in MW)

Peak Electricity Demand of State/UTs in 2024-25 (Solar Hours)

States/UTs	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Chandigarh	259	434	447	432	415	398	297	219	284	318	267	229
Delhi	5321	8253	8635	8170	6828	6726	6123	4201	5105	5629	4490	4342
Haryana	8738	12436	14539	14714	12780	12416	11140	7889	9392	9263	9665	8779
Himachal Pradesh	1883	1939	1963	2170	1921	1827	1883	2036	2250	2149	2098	2001
Jammu & Kashmir & Ladakh	2797	2735	2743	2667	2634	3075	2920	3060	3392	3378	3102	3057
Punjab	9945	14338	16072	15929	15488	15688	14381	8836	9512	10243	10150	10170
Rajasthan	14509	17846	17941	16644	13566	16524	16406	17587	18737	18753	19179	17844
Uttar Pradesh	24947	29036	29138	29573	28153	28298	26600	19918	20686	21994	20283	21344
Uttarakhand	2164	2410	2440	2538	2469	2358	2334	2418	2551	2697	2669	2281
Chhattisgarh	6659	5865	5430	5980	5658	5935	5992	4726	5265	5965	6220	6696
DNH & DD	1299	1356	1370	1354	1332	1499	1466	1358	1451	1371	1360	1382
Gujarat	24081	25039	26005	20040	22164	24331	22319	21683	25027	24157	24026	24742
Goa	642	616	683	675	622	603	678	677	663	643	748	743
Madhya Pradesh	12747	14169	13824	12387	11619	12669	13311	17628	18906	18497	18427	16579
Maharashtra	29736	29447	28750	25145	25164	25276	26571	27480	28419	29709	30348	30982
Andhra Pradesh	13454	13634	12524	11088	11800	12346	11532	11048	10538	12045	12644	13102
Karnataka	16977	16875	14339	14648	12524	15952	12842	14910	15274	17772	18321	18381
Kerala	5255	5320	4408	4137	4251	4363	4470	4475	4538	4535	4803	5081
Puducherry	515	528	517	492	489	508	479	460	454	424	449	476
Tamil Nadu	20871	20399	21183	18471	18158	19108	19077	16599	16257	19376	18787	22785
Telangana	13762	11106	11059	13485	15545	15488	13883	11100	14298	14890	17096	16933
Bihar	6798	7392	7442	7605	7331	7708	7062	6084	5393	5663	5321	6036
DVC	3632	3697	5162	3575	3417	4215	3481	3249	3391	3462	3270	3721
Jharkhand	1929	2082	5619	2066	1944	1974	1971	2045	1975	1959	1944	4081
Odisha	6804	6991	7025	6207	5711	6122	6340	6025	5290	5490	5812	6120
Sikkim	105	100	98	94	162	94	98	110	125	130	139	124
West Bengal	12290	11882	12336	11296	10534	11198	11023	9245	7574	8387	8794	11127
Arunachal Pradesh	173	165	178	163	170	184	167	164	185	193	194	182
Assam	2013	2401	2327	2498	2605	2644	2234	1904	1558	1587	1618	1958
Manipur	109	155	223	211	213	234	227	234	266	277	248	210
Meghalaya	244	274	419	327	336	313	381	399	343	300	285	259
Mizoram	127	130	120	125	161	159	134	141	151	164	157	153
Nagaland	161	182	182	188	180	174	171	171	182	164	174	164
Tripura	362	374	338	459	326	372	324	308	239	364	251	317
All India	222352	248563	243282	224630	214757	229697	217980	205982	222488	235321	236163	233618

Legend:

LOW	MEDIUM	HIGH

Table 3.2 Complimentary demand of States (month-wise peak demand) (non-solar hours) in 2024-25

(figures are in MW)

Peak Electricity Demand of States in 2024-25 (Non-Solar Hours)												
States/UTs	**Apr**	**May**	**June**	**July**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**
Chandigarh	249	414	412	406	383	380	292	201	243	252	241	207
Delhi	4921	7989	8309	7853	6512	6635	6039	3796	4011	4319	3483	4129
Haryana	9524	11474	12930	12763	12040	11656	10695	7620	7601	7694	7741	7538
Himachal Pradesh	1719	1763	1842	1805	1815	1722	1799	1783	1905	1872	1831	1814
Jammu & Kashmir & Ladakh	2976	2828	2808	2749	2631	2847	2916	2901	3345	3397	3005	3122
Punjab	9703	11864	15199	15380	15116	14417	11558	7151	7577	7583	7470	7787
Rajasthan	13044	16489	16504	14645	12831	15113	14717	15796	16004	16249	16349	15998
Uttar Pradesh	25327	29606	30555	30208	29007	29178	26502	18584	19638	21603	19449	21594
Uttarakhand	2170	2346	2480	2400	2426	2420	2209	2219	2335	2428	2474	2191
Chhatisgarh	6459	6098	5534	6009	5589	5914	5966	4779	4945	5716	6129	6578
DNH & DD	1255	1327	1325	1319	1286	1322	1370	1319	1321	1305	1320	1332
Gujarat	21552	22601	22198	18889	19024	20378	19299	16948	17951	17923	18866	23901
Goa	645	628	693	671	618	591	622	609	622	619	713	674
Madhya Pradesh	13008	13723	13373	12452	11516	12485	12840	15021	15022	15163	15221	14522
Maharashtra	28363	28245	27669	25000	24268	23925	25265	24417	25058	26632	27575	29409
Andhra Pradesh	11062	11469	10549	10060	10246	10116	9892	9202	8628	9598	10138	10794
Karnataka	13468	12941	11619	11018	10283	12199	10290	10890	11234	12844	14047	15090
Kerala	5632	5826	4405	4133	4159	4259	4392	4373	4350	4442	4988	5460
Puducherry	525	534	523	506	510	527	492	429	421	404	427	476
Tamil Nadu	19760	19589	17484	17467	16847	18360	16794	17909	14907	16050	16704	18549
Telangana	12995	10159	10294	12729	14634	14794	12861	10054	12530	13263	15249	16047
Bihar	7015	7546	7536	7861	7543	7847	7105	5993	4931	5531	4933	6169
DVC	3475	3572	3701	3522	3451	3500	3454	3206	3337	3426	3301	3337
Jharkhand	1911	2101	2101	2125	1942	1958	1861	2049	1919	1826	1841	1940
Orissa	6692	6805	7040	6326	5642	6800	6391	5179	4999	5374	5615	6253
Sikkim	93	90	94	80	81	82	91	94	110	121	126	101
West Bengal	12748	12721	12494	11762	10682	12036	11434	8639	6899	7557	7805	10765
Arunachal Pradesh	165	139	169	157	170	187	159	152	177	184	189	178
Assam	1974	2379	2373	2500	2539	2667	2215	1731	1473	1485	1570	1891
Manipur	109	142	195	185	172	182	197	201	238	256	243	197
Meghalaya	244	244	386	315	314	299	319	326	366	157	157	157
Mizoram	123	117	110	115	154	116	110	117	143	149	139	126
Nagaland	143	167	173	170	171	180	158	159	157	164	167	158
Tripura	361	378	341	437	326	353	321	279	219	247	229	317
All India	223000	232888	228456	216709	211121	215969	214091	182952	187329	199243	202351	210327

Legend:

LOW	MEDIUM	HIGH

Table 3.3 Demand Correlation matrix of all States based on the demand profile of 2024-25

State/Uts	Chandigarh	Delhi	Haryana	Himachal Pradesh	Jammu Kashmir & Ladakh	Punjab	Rajasthan	Uttar Pradesh	Uttarakhand	Chhatishgarh	DNH & DD	Gujarat	Goa	Madhya Pradesh	Maharshtra	Andhra Pradesh	Karnataka	Kerala	Puducherry	Tamil nadu	Telangana	Bihar	DVC	Jharkhand	Odisha	Sikkim	West Bengal	Arunanchal Pradesh	Assam	Manipur	Meghalaya	Mizoram	Nagaland	Tripura
Chandigarh	1.00	0.94	0.89	0.44	-0.07	0.84	0.25	0.78	0.58	-0.02	0.17	0.30	-0.02	-0.19	-0.19	0.09	-0.20	-0.16	0.51	0.31	-0.20	0.68	0.57	0.53	0.48	0.02	0.61	-0.05	0.68	0.12	0.48	0.16	0.50	0.49
Delhi	0.94	1.00	0.90	0.36	-0.19	0.81	0.29	0.84	0.48	0.04	0.15	0.39	-0.02	-0.19	-0.16	0.16	-0.20	-0.15	0.53	0.34	-0.21	0.71	0.58	0.54	0.57	-0.06	0.69	-0.14	0.66	0.02	0.50	0.06	0.42	0.52
Haryana	0.89	0.90	1.00	0.38	-0.18	0.90	0.27	0.80	0.50	0.02	0.19	0.25	-0.08	-0.23	-0.27	0.06	-0.26	-0.27	0.47	0.25	-0.17	0.67	0.54	0.49	0.46	-0.07	0.60	-0.17	0.64	0.01	0.46	0.02	0.44	0.46
Himachal Pradesh	0.44	0.36	0.38	1.00	0.46	0.37	0.66	0.14	0.54	0.07	0.26	0.43	0.14	0.41	0.24	0.24	0.31	-0.13	0.15	0.24	0.23	0.07	0.27	0.39	0.03	0.46	0.06	0.11	0.14	0.47	0.02	0.44	0.44	0.09
Jammu Kashmir & Ladakh	-0.07	-0.19	-0.18	0.46	1.00	-0.15	0.43	-0.29	0.30	0.02	0.13	0.21	0.32	0.52	0.43	0.15	0.44	0.20	-0.13	0.05	0.28	-0.34	-0.08	0.09	-0.27	0.51	-0.31	0.34	-0.22	0.57	-0.27	0.57	0.25	-0.17
Punjab	0.84	0.81	0.90	0.37	-0.15	1.00	0.19	0.67	0.41	-0.03	0.10	0.17	-0.13	-0.29	-0.36	0.06	-0.21	-0.37	0.39	0.22	-0.06	0.61	0.45	0.37	0.33	-0.07	0.51	-0.11	0.64	0.01	0.44	0.03	0.48	0.41
Rajasthan	0.25	0.29	0.27	0.66	0.43	0.19	1.00	0.09	0.32	0.13	0.20	0.65	0.11	0.70	0.44	0.42	0.46	-0.13	0.06	0.22	0.31	-0.05	0.15	0.35	0.07	0.42	0.00	0.03	-0.09	0.37	-0.14	0.32	0.26	-0.04
Uttar Pradesh	0.78	0.84	0.80	0.14	-0.29	0.67	0.09	1.00	0.43	0.11	0.06	0.22	-0.06	-0.26	-0.20	0.05	-0.34	-0.04	0.52	0.25	-0.39	0.84	0.61	0.60	0.62	-0.18	0.71	-0.10	0.65	-0.11	0.49	-0.10	0.25	0.58
Uttarakhand	0.58	0.48	0.50	0.54	0.30	0.41	0.32	0.43	1.00	0.05	0.28	0.19	0.11	0.20	0.01	-0.10	-0.13	-0.02	0.26	0.12	-0.09	0.39	0.43	0.49	0.17	0.28	0.15	0.20	0.39	0.47	0.08	0.40	0.48	0.28
Chhatishgarh	-0.02	0.04	0.02	0.07	0.02	-0.03	0.13	0.11	0.05	1.00	0.16	0.38	0.26	0.16	0.52	0.42	0.44	0.36	0.30	0.50	0.40	0.25	0.25	0.37	0.48	0.16	0.39	0.06	0.04	0.07	0.03	0.10	0.01	0.24
DNH & DD	0.17	0.15	0.19	0.26	0.13	0.10	0.20	0.06	0.28	0.16	1.00	0.35	0.32	0.12	0.26	0.07	0.11	0.15	0.25	0.27	0.06	0.01	0.17	0.12	0.10	0.20	0.11	0.02	0.14	0.10	-0.11	0.20	0.12	0.09
Gujarat	0.30	0.39	0.25	0.43	0.21	0.17	0.65	0.22	0.19	0.38	0.35	1.00	0.26	0.45	0.66	0.64	0.57	0.26	0.38	0.58	0.26	0.12	0.24	0.37	0.38	0.35	0.36	0.04	0.11	0.18	0.08	0.33	0.21	0.20
Goa	-0.02	-0.02	-0.08	0.14	0.32	-0.13	0.11	-0.06	0.11	0.26	0.32	0.26	1.00	0.14	0.44	0.29	0.32	0.50	0.28	0.36	0.18	-0.10	-0.06	0.05	0.12	0.29	0.07	0.21	0.08	0.15	-0.10	0.39	0.11	0.12
Madhya Pradesh	-0.19	-0.19	-0.23	0.41	0.52	-0.29	0.70	-0.26	0.20	0.16	0.12	0.45	0.14	1.00	0.63	0.32	0.55	0.09	-0.19	0.05	0.36	-0.34	-0.12	0.15	-0.20	0.47	-0.29	0.20	-0.37	0.37	-0.36	0.33	0.03	-0.24
Maharshtra	-0.19	-0.16	-0.27	0.24	0.43	-0.36	0.44	-0.20	0.01	0.52	0.26	0.66	0.44	0.63	1.00	0.61	0.78	0.55	0.16	0.50	0.45	-0.25	-0.01	0.19	0.14	0.46	0.03	0.20	-0.29	0.23	-0.12	0.36	-0.03	-0.03
Andhra Pradesh	0.09	0.16	0.06	0.24	0.15	0.06	0.42	0.05	-0.10	0.42	0.07	0.64	0.29	0.32	0.61	1.00	0.78	0.27	0.36	0.66	0.60	0.01	0.03	0.19	0.30	0.25	0.32	0.10	0.03	-0.01	0.07	0.14	0.04	0.11
Karnataka	-0.20	-0.20	-0.26	0.31	0.44	-0.21	0.46	-0.34	-0.13	0.44	0.11	0.57	0.32	0.55	0.78	0.78	1.00	0.35	0.10	0.56	0.72	-0.35	-0.16	0.03	-0.03	0.47	-0.02	0.21	-0.29	0.19	-0.15	0.30	-0.02	-0.12
Kerala	-0.16	-0.15	-0.27	-0.13	0.20	-0.37	-0.13	-0.04	-0.02	0.36	0.15	0.26	0.50	0.09	0.55	0.27	0.35	1.00	0.42	0.55	-0.04	0.00	0.05	0.10	0.29	0.23	0.22	0.26	0.04	0.12	0.12	0.38	0.01	0.24
Puducherry	0.51	0.53	0.47	0.15	-0.13	0.39	0.06	0.52	0.26	0.30	0.25	0.38	0.28	-0.19	0.16	0.36	0.10	0.42	1.00	0.74	-0.07	0.52	0.42	0.38	0.55	0.07	0.62	0.03	0.57	-0.02	0.45	0.21	0.29	0.56
Tamil nadu	0.31	0.34	0.25	0.24	0.05	0.22	0.22	0.25	0.12	0.50	0.27	0.58	0.36	0.05	0.50	0.66	0.56	0.55	0.74	1.00	0.27	0.26	0.30	0.31	0.47	0.29	0.54	0.11	0.34	0.07	0.33	0.33	0.25	0.40
Telangana	-0.20	-0.21	-0.17	0.23	0.28	-0.06	0.31	-0.39	-0.09	0.40	0.06	0.26	0.18	0.36	0.45	0.60	0.72	-0.04	-0.07	0.27	1.00	-0.31	-0.23	-0.10	-0.17	0.27	-0.13	0.16	-0.24	0.12	-0.29	0.10	0.00	-0.23
Bihar	0.68	0.71	0.67	0.07	-0.34	0.61	-0.05	0.84	0.39	0.25	0.01	0.12	-0.10	-0.34	-0.25	0.01	-0.35	0.00	0.52	0.26	-0.31	1.00	0.68	0.66	0.64	-0.18	0.76	-0.04	0.72	-0.04	0.49	-0.03	0.32	0.65
DVC	0.57	0.58	0.54	0.27	-0.08	0.45	0.15	0.61	0.43	0.25	0.17	0.24	-0.06	-0.12	-0.01	0.03	-0.16	0.05	0.42	0.30	-0.23	0.68	1.00	0.72	0.56	0.10	0.58	-0.05	0.47	0.16	0.43	0.09	0.29	0.49
Jharkhand	0.53	0.54	0.49	0.39	0.09	0.37	0.35	0.60	0.49	0.37	0.12	0.37	0.05	0.15	0.19	0.19	0.03	0.10	0.38	0.31	-0.10	0.66	0.72	1.00	0.56	0.18	0.57	0.05	0.40	0.26	0.29	0.22	0.32	0.48
Odisha	0.48	0.57	0.46	0.03	-0.27	0.33	0.07	0.62	0.17	0.48	0.10	0.38	0.12	-0.20	0.14	0.30	-0.03	0.29	0.55	0.47	-0.17	0.64	0.56	0.56	1.00	-0.07	0.77	-0.12	0.45	-0.08	0.45	0.02	0.15	0.56
Sikkim	0.02	-0.06	-0.07	0.46	0.51	-0.07	0.42	-0.18	0.28	0.16	0.20	0.35	0.29	0.47	0.46	0.25	0.47	0.23	0.07	0.29	0.27	-0.18	0.10	0.18	-0.07	1.00	-0.11	0.28	-0.07	0.48	-0.09	0.54	0.31	-0.02
West Bengal	0.61	0.69	0.60	0.06	-0.31	0.51	0.00	0.71	0.15	0.39	0.11	0.36	0.07	-0.29	0.03	0.32	-0.02	0.22	0.62	0.54	-0.13	0.76	0.58	0.57	0.77	-0.11	1.00	-0.07	0.66	-0.16	0.53	0.02	0.23	0.69
Arunanchal Pradesh	-0.05	-0.14	-0.17	0.11	0.34	-0.11	0.03	-0.10	0.20	0.06	0.02	0.04	0.21	0.20	0.20	0.10	0.21	0.26	0.03	0.11	0.16	-0.04	-0.05	0.05	-0.12	0.28	-0.07	1.00	0.12	0.34	-0.08	0.42	0.26	0.07
Assam	0.68	0.66	0.64	0.14	-0.22	0.64	-0.09	0.65	0.39	0.04	0.14	0.11	0.08	-0.37	-0.29	0.03	-0.29	0.04	0.57	0.34	-0.24	0.72	0.47	0.40	0.45	-0.07	0.66	0.12	1.00	0.04	0.47	0.21	0.54	0.72
Manipur	0.12	0.02	0.01	0.47	0.57	0.01	0.37	-0.11	0.47	0.07	0.10	0.18	0.15	0.37	0.23	-0.01	0.19	0.12	-0.02	0.07	0.12	-0.04	0.16	0.26	-0.08	0.48	-0.16	0.34	0.04	1.00	-0.04	0.64	0.48	0.06
Meghalaya	0.48	0.50	0.46	0.02	-0.27	0.44	-0.14	0.49	0.08	0.03	-0.11	0.08	-0.10	-0.36	-0.12	0.07	-0.15	0.12	0.45	0.33	-0.29	0.49	0.43	0.29	0.45	-0.09	0.53	-0.08	0.47	-0.04	1.00	0.06	0.31	0.44
Mizoram	0.16	0.06	0.02	0.44	0.57	0.03	0.32	-0.10	0.40	0.10	0.20	0.33	0.39	0.33	0.36	0.14	0.30	0.38	0.21	0.33	0.10	-0.03	0.09	0.22	0.02	0.54	0.02	0.42	0.21	0.64	0.06	1.00	0.61	0.26
Nagaland	0.50	0.42	0.44	0.44	0.25	0.48	0.26	0.25	0.48	0.01	0.12	0.21	0.11	0.03	-0.03	0.04	-0.02	0.01	0.29	0.25	0.00	0.32	0.29	0.32	0.15	0.31	0.23	0.26	0.54	0.48	0.31	0.61	1.00	0.38
Tripura	0.49	0.52	0.46	0.09	-0.17	0.41	-0.04	0.58	0.28	0.24	0.09	0.20	0.12	-0.24	-0.03	0.11	-0.12	0.24	0.56	0.40	-0.23	0.65	0.49	0.48	0.56	-0.02	0.69	0.07	0.72	0.06	0.44	0.26	0.38	1.00

Table 3.3 shows the demand correlation matrix of the States based on the demand profile of States for the year 2024–25. It may be observed that States with high positive correlation exhibit similar demand patterns, indicating limited potential for resource sharing or banking. Conversely, States with low or negative correlation demonstrate complementary demand profiles, which can be leveraged to enhance system reliability through coordinated resource planning or banking.

Such complementarities are particularly valuable in reducing peak demand stress and improving overall resource adequacy at the regional and national levels, and ensuring optimal utilization of generation resources.

Table 3.4 Complementary demand of States (month-wise peak demand) (Solar Hours) in 2025-26 (till 31.01.2026)

(figures are in MW)

Peak Electricity Demand of States in FY 2025-26 (Solar Hours)										
States/UTs	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Chandigarh	323	446	465	403	381	352	326	225	287	343
Delhi	5983	7711	8401	7515	6955	7055	5944	4393	5468	5939
Haryana	9720	12539	13637	14189	13015	12849	11385	8859	9573	10332
Himachal Pradesh	1911	2356	2613	1892	2292	1796	1991	2347	2240	2291
Jammu &Kashmir &Ladakh	2941	2885	2906	2740	2802	2799	2823	3382	3400	3399
Punjab	10907	14130	23469	17226	18585	14707	13208	9853	10442	10741
Rajasthan	15914	17433	18778	14262	17305	16023	13972	17575	19384	19415
Uttar Pradesh	23731	24613	28732	26521	25275	27943	25687	19269	22847	23350
Uttarakhand	2383	2559	2588	2321	2451	2553	2421	2437	2766	2846
Chhattisgarh	6884	5678	5594	5486	6475	6061	5322	4872	5579	5910
DNH &DD	1391	1404	1420	1432	1412	1395	1407	1390	1379	1398
Gujarat	26539	26941	26403	20977	25056	24910	22166	23624	24688	25884
Goa	715	715	775	632	622	671	681	629	631	641
Madhya Pradesh	14184	13803	12771	12832	12942	13241	13350	16027	19794	19826
Maharashtra	30944	28768	24740	25490	26727	25708	27637	34128	29203	31130
Andhra Pradesh	13139	12633	12297	18876	12906	12489	10817	10077	12003	13703
Karnataka	17389	16029	14085	19534	19789	18514	14432	16084	16997	17817
Kerala	4703	4722	4222	3999	4370	4470	4628	4636	5085	4786
Puducherry	518	528	509	522	486	483	477	467	432	431
Tamil Nadu	20116	19688	20209	22859	19240	19717	22533	22659	19260	18338
Telangana	14819	10572	11692	14834	16630	15868	12937	11143	14627	15882
Bihar	6892	7082	7466	7941	7835	8347	7142	5469	6351	6626
DVC	3479	3329	3245	4369	3260	3458	3304	3068	3260	3301
Jharkhand	2002	1965	2047	1848	2226	2134	2064	2137	2081	2169
Odisha	6698	6694	6854	6578	6980	6729	6340	5881	5589	5709
Sikkim	104	118	105	93	129	106	125	105	125	134
West Bengal	12576	12279	12753	12367	10836	11683	10358	9186	8330	8816
Arunachal Pradesh	178	196	194	220	213	216	200	176	188	196
Assam	2117	2288	2516	2635	2512	2764	2464	2040	1704	1697
Manipur	229	247	220	223	227	238	240	242	156	188
Meghalaya	339	352	337	332	384	361	317	319	290	291
Mizoram	142	145	149	174	177	171	146	161	166	167
Nagaland	175	182	189	201	190	157	153	168	100	100
Tripura	335	349	370	365	363	368	349	313	241	242
ALL INDIA	**234041**	**229395**	**240969**	**221179**	**228218**	**225143**	**208974**	**212185**	**239337**	**243073**

Table 3.5 Complementary demand of States (month-wise peak demand) (non-solar hours) in 2025-26 (till 31.01.2026)

(figures are in MW)

Peak Electricity Demand of States in 2025-26 (Non Solar Hours)										
States/UTs	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
Chandigarh	302	390	439	399	353	338	317	210	248	304
Delhi	5899	7505	8409	7505	6956	7016	5716	4070	4471	4836
Haryana	10094	11520	12713	13270	12442	12153	10715	7572	8214	8953
Himachal Pradesh	1823	1733	1838	1759	1649	1668	1526	1992	1987	2016
Jammu &Kashmir	2953	2925	3051	2786	2761	2809	2876	3216	3281	3307
Punjab	10883	12048	15265	15422	15201	12989	12508	7393	8174	9131
Rajasthan	14160	16606	29908	14617	16053	15527	13440	15406	17102	16592
Uttar Pradesh	26218	29814	31376	30783	30306	30179	26194	18929	23099	23799
Uttarakhand	2511	2577	2603	2539	2471	2566	2428	2317	2621	2647
Chhattisgarh	6774	5786	5627	5584	6573	6072	5237	4779	5204	5564
DNH & DD	1363	1384	1376	1408	1390	1382	1384	1352	1359	1379
Gujarat	22107	22067	22974	20063	22638	22542	20797	20516	20566	20342
Goa	717	718	715	602	610	693	681	632	628	634
Madhya Pradesh	13918	13533	12617	12794	12618	13133	11969	13423	15801	15559
Maharashtra	29570	28276	25293	32616	27544	25762	27667	26837	27724	28322
Andhra Pradesh	11158	10996	11049	11305	11280	11021	10011	9694	10171	10470
Karnataka	14274	13628	12404	12954	12506	12091	11282	12285	12461	13635
Kerala	5088	5180	4599	4215	4425	4499	4615	4609	4582	4780
Puducherry	547	557	539	560	511	505	478	471	422	420
Tamil Nadu	19503	18699	19321	19542	18466	18449	17373	17234	16644	17173
Telangana	14325	9340	11599	14500	16019	15531	12536	10403	13299	14078
Bihar	7368	7717	8291	8714	8336	8705	7667	5338	6316	6639
DVC	3424	3385	3293	3999	3316	3292	3097	3073	3298	3297
Jharkhand	2036	2014	2137	1968	2488	2115	2047	1916	2080	2149
Odisha	6634	6742	7112	7034	7591	6741	6041	5767	6670	5499
Sikkim	102	104	105	95	89	85	81	93	115	123
West Bengal	12398	12785	13163	12953	11493	11943	10169	8964	7705	8179
Arunachal Pradesh	179	194	201	221	212	222	195	175	185	194
Assam	2135	2350	2702	2797	2580	2813	2385	1910	1631	1645
Manipur	219	228	216	215	209	220	206	235	180	138
Meghalaya	334	349	343	338	415	359	309	182	322	161
Mizoram	135	132	132	167	172	157	128	155	155	159
Nagaland	159	170	186	194	189	167	133	163	100	100
Tripura	335	348	366	376	357	366	338	300	235	240
ALL INDIA	**226749**	**223904**	**235651**	**223607**	**224021**	**227548**	**206930**	**193336**	**209380**	**212971**

Table 3.6 Demand Correlation matrix of all States based on the demand profile of 2025-26

States	Chandigarh	Delhi	Haryana	HP	J&K & Ladakh	Punjab	Rajasthan	UP	Uttarakhand	Chhattisgarh	DD&DNH	Gujarat	Goa	Madhya Pradesh	Maharashtra	Andhra Pradesh	Karnataka	Kerala	Puducherry	Tamilnadu	Telangana	Bihar	DVC	Jharkhand	Odisha	Sikkim	West Bengal	Arunachal Pradesh	Assam	Manipur	Meghalaya	Mizoram	Nagaland	Tripura
Chandigarh	1.00	0.93	0.84	0.32	0.11	0.78	0.43	0.73	0.58	0.37	0.37	0.45	0.33	-0.02	0.10	0.39	-0.02	0.08	0.59	0.60	0.15	0.65	0.25	0.41	0.61	0.19	0.67	0.58	0.63	0.28	0.60	0.19	0.38	0.50
Delhi	0.93	1.00	0.88	0.18	-0.02	0.79	0.41	0.77	0.46	0.41	0.38	0.45	0.31	-0.06	0.04	0.41	-0.04	0.02	0.61	0.60	0.15	0.69	0.19	0.40	0.67	0.05	0.75	0.52	0.67	0.19	0.59	0.08	0.40	0.56
Haryana	0.84	0.88	1.00	0.13	-0.02	0.89	0.35	0.74	0.43	0.27	0.41	0.28	0.16	-0.12	-0.08	0.26	-0.13	-0.08	0.47	0.47	0.10	0.63	0.10	0.30	0.56	-0.01	0.59	0.51	0.62	0.19	0.55	0.01	0.40	0.47
HP	0.32	0.18	0.13	1.00	0.69	0.20	0.62	-0.07	0.50	-0.01	0.25	0.48	0.18	0.57	0.45	0.37	0.63	0.03	0.07	0.32	0.36	-0.11	0.22	0.36	-0.12	0.75	-0.08	0.22	-0.14	0.36	-0.02	0.48	-0.09	-0.13
J&K & Ladakh	0.11	-0.02	-0.02	0.69	1.00	0.05	0.51	-0.20	0.29	-0.11	0.04	0.37	0.23	0.51	0.44	0.24	0.55	0.23	-0.08	0.12	0.22	-0.29	0.05	0.23	-0.24	0.68	-0.20	0.17	-0.18	0.33	-0.17	0.57	-0.08	-0.16
Punjab	0.78	0.79	0.89	0.20	0.05	1.00	0.36	0.58	0.32	0.25	0.33	0.28	0.08	-0.13	-0.11	0.26	-0.06	-0.22	0.37	0.43	0.19	0.53	0.05	0.24	0.50	0.05	0.50	0.46	0.53	0.25	0.55	0.02	0.43	0.37
Rajasthan	0.43	0.41	0.35	0.62	0.51	0.36	1.00	0.20	0.42	0.22	0.15	0.68	0.12	0.71	0.39	0.37	0.43	-0.04	0.06	0.19	0.29	0.08	0.20	0.40	0.06	0.49	0.10	0.18	-0.04	0.20	0.06	0.25	-0.05	-0.03
UP	0.73	0.77	0.74	-0.07	-0.20	0.58	0.20	1.00	0.45	0.36	0.24	0.18	0.23	-0.14	-0.06	0.17	-0.35	0.10	0.56	0.38	-0.16	0.84	0.33	0.47	0.62	-0.20	0.71	0.45	0.66	0.06	0.51	-0.11	0.26	0.59
Uttarakhand	0.58	0.46	0.43	0.50	0.29	0.32	0.42	0.45	1.00	0.27	0.38	0.33	0.28	0.25	0.31	0.20	0.07	0.34	0.41	0.43	0.04	0.39	0.38	0.48	0.19	0.41	0.23	0.43	0.27	0.35	0.30	0.38	0.12	0.26
Chhattisgarh	0.37	0.41	0.27	-0.01	-0.11	0.25	0.22	0.36	0.27	1.00	0.15	0.42	0.31	0.19	0.47	0.44	0.13	0.21	0.43	0.41	0.36	0.44	0.41	0.46	0.51	0.10	0.52	0.15	0.24	0.00	0.29	0.01	0.17	0.35
DD&DNH	0.37	0.38	0.41	0.25	0.04	0.33	0.15	0.24	0.38	0.15	1.00	0.35	0.31	-0.01	0.21	0.19	0.11	0.12	0.40	0.48	0.09	0.18	0.12	0.09	0.20	0.24	0.27	0.27	0.29	0.14	0.21	0.14	0.13	0.17
Gujarat	0.45	0.45	0.28	0.48	0.37	0.28	0.68	0.18	0.33	0.42	0.35	1.00	0.42	0.54	0.61	0.55	0.48	0.18	0.34	0.46	0.34	0.11	0.22	0.36	0.22	0.49	0.34	0.19	0.12	0.15	0.17	0.30	0.04	0.15
Goa	0.33	0.31	0.16	0.18	0.23	0.08	0.12	0.23	0.28	0.31	0.31	0.42	1.00	0.04	0.54	0.35	0.28	0.68	0.57	0.57	0.00	0.13	0.20	0.28	0.32	0.31	0.47	0.17	0.22	0.05	0.20	0.35	-0.03	0.35
Madhya Pradesh	-0.02	-0.06	-0.12	0.57	0.51	-0.13	0.71	-0.14	0.25	0.19	-0.01	0.54	0.04	1.00	0.63	0.35	0.64	0.05	-0.16	-0.01	0.43	-0.20	0.20	0.33	-0.27	0.55	-0.22	-0.05	-0.38	0.08	-0.25	0.27	-0.28	-0.27
Maharashtra	0.10	0.04	-0.08	0.45	0.44	-0.11	0.39	-0.06	0.31	0.47	0.21	0.61	0.54	0.63	1.00	0.51	0.66	0.50	0.27	0.38	0.41	-0.09	0.32	0.38	-0.02	0.61	0.09	0.05	-0.15	0.12	-0.07	0.41	-0.18	0.01
Andhra Pradesh	0.39	0.41	0.26	0.37	0.24	0.26	0.37	0.17	0.20	0.44	0.19	0.55	0.35	0.35	0.51	1.00	0.65	0.08	0.37	0.59	0.68	0.18	0.14	0.35	0.32	0.33	0.34	0.14	0.14	0.04	0.14	0.14	0.03	0.14
Karnataka	-0.02	-0.04	-0.13	0.63	0.55	-0.06	0.43	-0.35	0.07	0.13	0.11	0.48	0.28	0.64	0.66	0.65	1.00	0.09	-0.02	0.33	0.66	-0.36	0.02	0.18	-0.18	0.65	-0.12	-0.08	-0.32	0.10	-0.20	0.35	-0.19	-0.24
Kerala	0.08	0.02	-0.08	0.03	0.23	-0.22	-0.04	0.10	0.34	0.21	0.12	0.18	0.68	0.05	0.50	0.08	0.09	1.00	0.41	0.35	-0.21	0.05	0.20	0.24	0.09	0.28	0.20	0.20	0.15	0.07	0.12	0.48	-0.04	0.28
Puducherry	0.59	0.61	0.47	0.07	-0.08	0.37	0.06	0.56	0.41	0.43	0.40	0.34	0.57	-0.16	0.27	0.37	-0.02	0.41	1.00	0.80	-0.03	0.54	0.31	0.34	0.57	0.09	0.65	0.33	0.55	0.13	0.50	0.15	0.23	0.56
Tamilnadu	0.60	0.60	0.47	0.32	0.12	0.43	0.19	0.38	0.43	0.41	0.48	0.46	0.57	-0.01	0.38	0.59	0.33	0.35	0.80	1.00	0.26	0.39	0.21	0.33	0.48	0.36	0.55	0.37	0.46	0.21	0.46	0.32	0.25	0.43
Telangana	0.15	0.15	0.10	0.36	0.22	0.19	0.29	-0.16	0.04	0.36	0.09	0.34	0.00	0.43	0.41	0.68	0.66	-0.21	-0.03	0.26	1.00	-0.05	0.03	0.18	0.08	0.40	0.02	0.04	-0.11	0.10	-0.03	0.11	0.11	-0.12
Bihar	0.65	0.69	0.63	-0.11	-0.29	0.53	0.08	0.84	0.39	0.44	0.18	0.11	0.13	-0.20	-0.09	0.18	-0.36	0.05	0.54	0.39	-0.05	1.00	0.36	0.57	0.68	-0.18	0.74	0.49	0.74	0.08	0.51	-0.06	0.41	0.67
DVC	0.25	0.19	0.10	0.22	0.05	0.05	0.20	0.33	0.38	0.41	0.12	0.22	0.20	0.20	0.32	0.14	0.02	0.20	0.31	0.21	0.03	0.36	1.00	0.55	0.27	0.19	0.30	0.19	0.12	0.15	0.17	0.10	0.00	0.21
Jharkhand	0.41	0.40	0.30	0.36	0.23	0.24	0.40	0.47	0.48	0.46	0.09	0.36	0.28	0.33	0.38	0.35	0.18	0.24	0.34	0.33	0.18	0.57	0.55	1.00	0.41	0.33	0.46	0.39	0.34	0.24	0.20	0.29	0.18	0.46
Odisha	0.61	0.67	0.56	-0.12	-0.24	0.50	0.06	0.62	0.19	0.51	0.20	0.22	0.32	-0.27	-0.02	0.32	-0.18	0.09	0.57	0.48	0.08	0.68	0.27	0.41	1.00	-0.15	0.78	0.42	0.63	0.08	0.50	0.00	0.42	0.62
Sikkim	0.19	0.05	-0.01	0.75	0.68	0.05	0.49	-0.20	0.41	0.10	0.24	0.49	0.31	0.55	0.61	0.33	0.65	0.28	0.09	0.36	0.40	-0.18	0.19	0.33	-0.15	1.00	-0.11	0.26	-0.11	0.38	0.00	0.64	0.01	-0.09
West Bengal	0.67	0.75	0.59	-0.08	-0.20	0.50	0.10	0.71	0.23	0.52	0.27	0.34	0.47	-0.22	0.09	0.34	-0.12	0.20	0.65	0.55	0.02	0.74	0.30	0.46	0.78	-0.11	1.00	0.38	0.71	0.04	0.46	0.03	0.36	0.73
Arunachal Pradesh	0.58	0.52	0.51	0.22	0.17	0.46	0.18	0.45	0.43	0.15	0.27	0.19	0.17	-0.05	0.05	0.14	-0.08	0.20	0.33	0.37	0.04	0.49	0.19	0.39	0.42	0.26	0.38	1.00	0.62	0.37	0.43	0.43	0.45	0.48
Assam	0.63	0.67	0.62	-0.14	-0.18	0.53	-0.04	0.66	0.27	0.24	0.29	0.12	0.22	-0.38	-0.15	0.14	-0.32	0.15	0.55	0.46	-0.11	0.74	0.12	0.34	0.63	-0.11	0.71	0.62	1.00	0.20	0.54	0.16	0.59	0.79
Manipur	0.28	0.19	0.19	0.36	0.33	0.25	0.20	0.06	0.35	0.00	0.14	0.15	0.05	0.08	0.12	0.04	0.10	0.07	0.13	0.21	0.10	0.08	0.15	0.24	0.08	0.38	0.04	0.37	0.20	1.00	0.27	0.43	0.34	0.15
Meghalaya	0.60	0.59	0.55	-0.02	-0.17	0.55	0.06	0.51	0.30	0.29	0.21	0.17	0.20	-0.25	-0.07	0.14	-0.20	0.12	0.50	0.46	-0.03	0.51	0.17	0.20	0.50	0.00	0.46	0.43	0.54	0.27	1.00	0.11	0.47	0.46
Mizoram	0.19	0.08	0.01	0.48	0.57	0.02	0.25	-0.11	0.38	0.01	0.14	0.30	0.35	0.27	0.41	0.14	0.35	0.48	0.15	0.32	0.11	-0.06	0.10	0.29	0.00	0.64	0.03	0.43	0.16	0.43	0.11	1.00	0.19	0.19
Nagaland	0.38	0.40	0.40	-0.09	-0.08	0.43	-0.05	0.26	0.12	0.17	0.13	0.04	-0.03	-0.28	-0.18	0.03	-0.19	-0.04	0.23	0.25	0.11	0.41	0.00	0.18	0.42	0.01	0.36	0.45	0.59	0.34	0.47	0.19	1.00	0.46
Tripura	0.50	0.56	0.47	-0.13	-0.16	0.37	-0.03	0.59	0.26	0.35	0.17	0.15	0.35	-0.27	0.01	0.14	-0.24	0.28	0.56	0.43	-0.12	0.67	0.21	0.46	0.62	-0.09	0.73	0.48	0.79	0.15	0.46	0.19	0.46	1.00

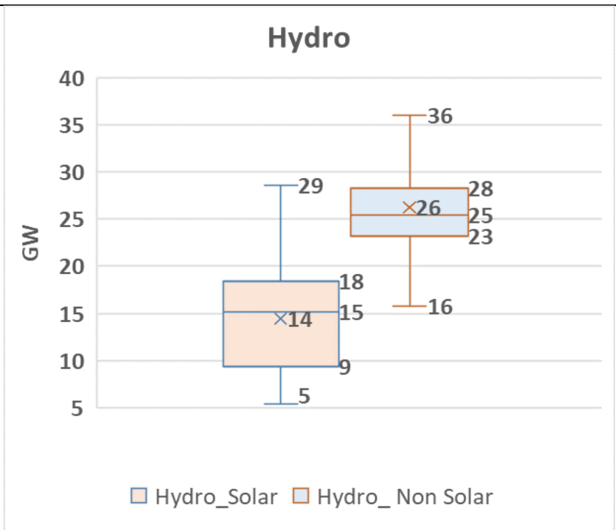
The above graph shows the demand correlation matrix of the States based on the demand profile of States for the year 2025-26 (as on 31 January,2026). It may be observed that states with high positive correlation exhibit similar demand patterns, indicating limited potential for resource sharing or banking. Conversely, States with low or negative correlation demonstrate complementary demand profiles, which can be leveraged to enhance system reliability through coordinated resource planning or banking. Such complementarities are particularly valuable in reducing peak demand stress and improving overall resource adequacy at the regional and national levels.

For instance, for the State of Madhya Pradesh, the States of Punjab and Uttar Pradesh, among others, have higher negative coorelation values of -0.13 and -0.14. This suggests an avenue of sharing of resources of the latter during their leaner demand periods towards meeting the peak demand of Madhya Pradesh.

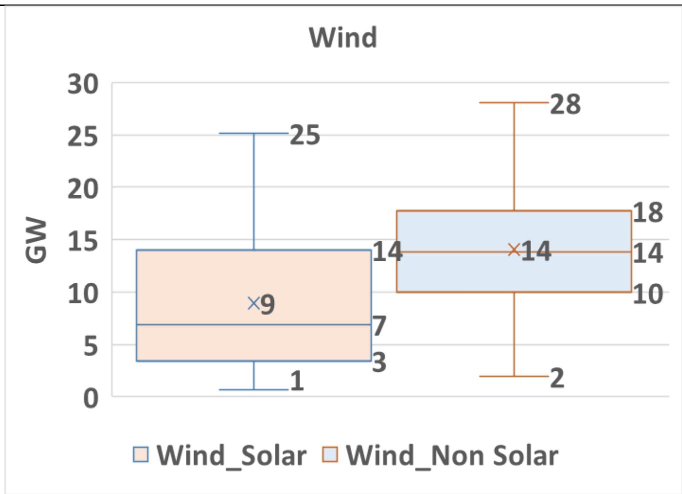
Similarly, the correlation values are negative for the States of Karnataka and Bihar, indicating a higher potential for resource sharing or banking among the two States.

3.3 Analysis of Generation Dispatch

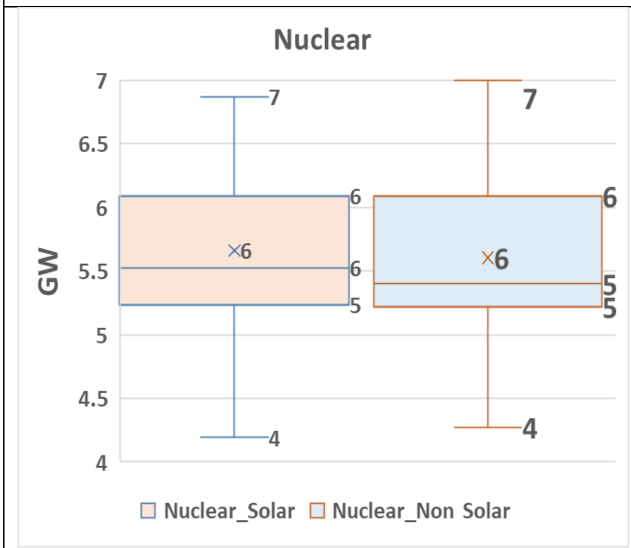
The contribution of various sources for meeting future demand during peak hours has been estimated based on the actual hourly generation of 2024-25.



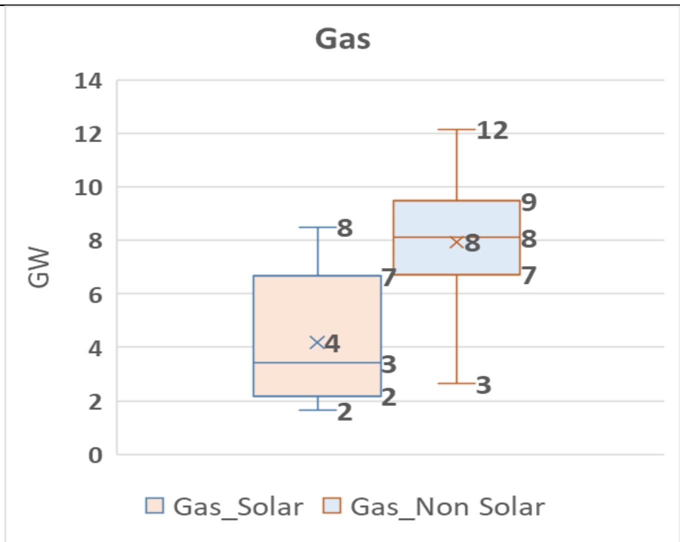
(a)



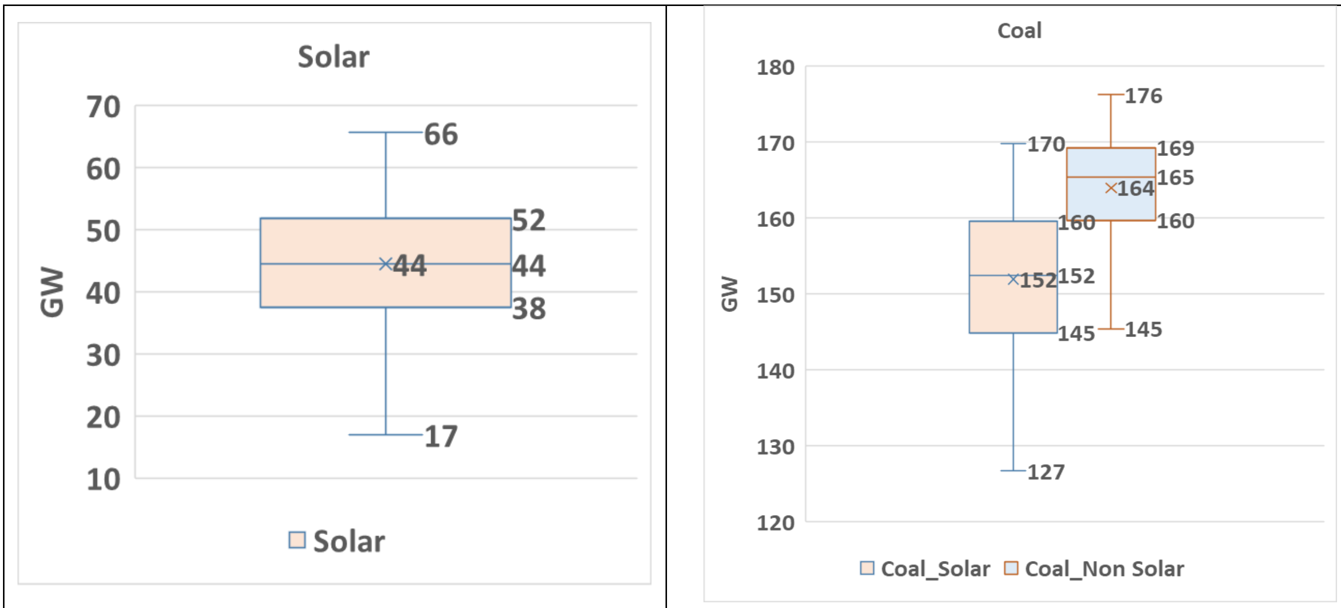
(b)



(c)

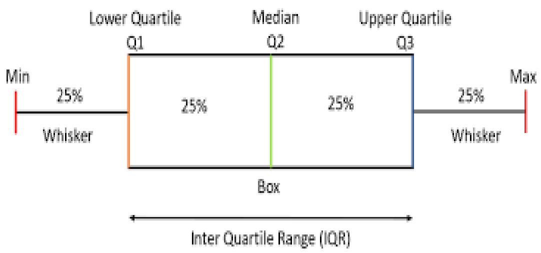


(d)



(e) (f)

Figure 3.5 (a) to (f): Source-wise Generation Box Plot During Top 10% Solar/Non-solar Hours in 2024-25



A **box plot** (or box-and-whisker plot) is a graph used in Statistics to visually summarize how a set of data is distributed. It displays five important values: the **minimum**, **first quartile (Q1)**, **median (Q2)**, **third quartile (Q3)**, and **maximum**. The middle 50% of the data is shown as a **box** that stretches from Q1 to Q3, with a **line inside the box** marking the median (the centre of the data). From each side of the box, **whiskers** extend to the smallest and largest values, showing the overall spread of the dataset, while any unusually high or low values may appear as separate points called **outliers**.

Figure 3.6: Box Plot description

The box plots given in Figure 3.5 (a to e) depict generation from various sources during the top 10% of demand blocks during solar/non-solar hours in 2024–25. Solar output shows a high median of approximately 44 GW, ranging from 17 GW to 66 GW, highlighting significant variability with solar availability. Wind generation varies between 1 GW and 25 GW, with a median of 7 GW, while hydro ranges from 5 GW to 29 GW, and gas output remains low, around the median of 3 GW, showing limited dispatch during these hours, whereas nuclear generation is stable at roughly 6–7 GW.

The figure also highlights that the hydro generation varies between 16 GW and 36 GW during the top 10% of demand blocks during non-solar hours. Similarly, the wind generation varies between 2 GW and 28 GW, showing high variability of wind generation across peak demand blocks.

In addition, Figure 3.5 (f) illustrates the dispatch from coal during the top 10% demand hours for both solar and non-solar hours, allowing a comparison of coal generation patterns under different solar availability conditions. The figure highlights that the coal generation during peak periods varies between 127 GW and 170 GW during the top 10% of demand blocks during solar hours, while during non-solar hours, it ranges from 145 GW to 176 GW to accommodate variable solar generation. It may be noted that the variation in the coal-based generation during the top 10 % peak demand blocks during solar vs. non-solar hours is minimal (~13 GW for the median value of coal generation). It should be noted that this figure represents an estimate at the aggregate level and may differ for individual generators.

To calculate the contribution of energy storage technologies such as PSP and BESS towards meeting the peak demand, continuous blocks during the top 10% of peak-demand non-solar periods were identified, and their frequency distribution was analysed.

Based on the figure no 1.6 & 1.7, it has been observed that the maximum occurrence of consecutive peak blocks is typically for six hours, corresponding to 24 blocks of 15 minutes each. Therefore, energy storage systems with a duration of 6 hours or more can supply their full rated capacity during peak demand hours, making them highly effective in supporting system reliability. Energy storage systems with shorter durations can still contribute, but their impact will be proportionate to their available energy, highlighting the importance of appropriately sizing energy storage assets to ensure adequate peak support and maintain grid stability.

3.4 Electricity Demand Projections

Accurate and robust assessment of electricity demand is a foundational element of any long-term expansion planning study. It provides the critical baseline upon which future generation capacity, transmission infrastructure, and policy interventions are designed. Demand assessment helps in projecting peak electricity demand and annual electrical energy requirements across different time horizons and geographies, considering economic growth, demographic shifts, sectoral trends, climate impacts, distributed energy resources, etc. These insights enable planners to identify potential demand-supply gaps, assess the adequacy of existing infrastructure, and formulate investment strategies accordingly.

The trends of peak electricity demand in the last five years are given in Table 3.7:

Table 3.7 Year-wise Peak Electricity Demand on an all-India basis

Year	Actual Peak Electricity Demand on an all-India basis (GW)	Growth (%)
2020-21	190.20	
2021-22	203.01	6.74
2022-23	215.89	6.34
2023-24	243.27	12.68
2024-25	249.86	2.71
2025-26 (till January, 2026)	245.44	-1.78

As per the mid term review of 20th EPS, the projected peak electricity demand on an all-India basis in 2024-25 and 2025-26 was 253 GW and 270 GW respectively. However, the actual peak electricity demand during 2024-25 and 2025-26 (till February 2026) has been 250 GW and 245.44 GW, respectively.

The midterm review of the 20th EPS demand projections by CEA indicates that peak electricity demand on an all-India basis is expected to increase at a CAGR of 5.58% during FY 24-25 to FY

35-36. In comparison, the annual electricity energy requirement is expected to grow at a CAGR of 6.41 % during the same period. The demand projections incorporate the demand estimates of the emerging sectors like electric vehicles and Green Hydrogen. Electricity demand projections as per midterm review of the 20th EPS is given in Fig. 3.7.

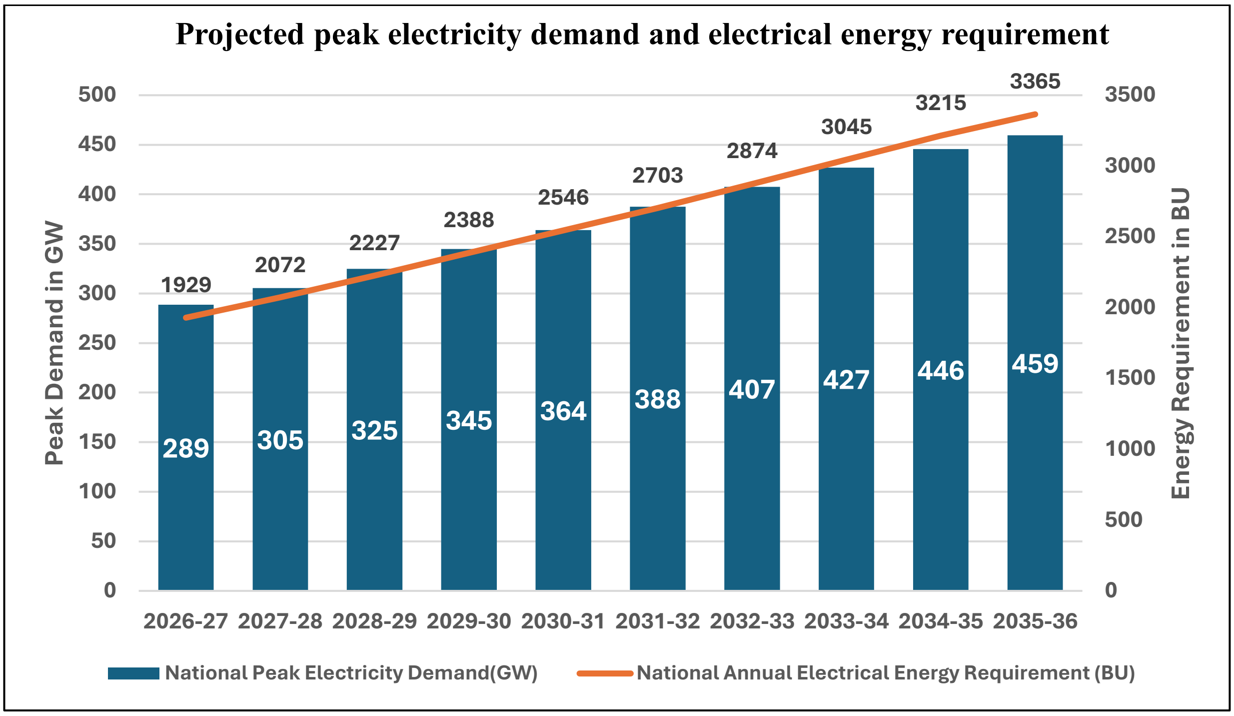


Figure 3.7 Projected peak electricity demand and electrical energy requirement

State-wise projections of peak electricity demand and annual electricity energy requirement are essential components of comprehensive power system planning. Given the regional diversity in consumption patterns, economic growth, industrial activity, climate conditions, and policy priorities, a granular approach enables more accurate and effective planning of generation, transmission, and distribution infrastructure. Peak electricity demand projections are particularly critical for assessing capacity adequacy, planning for system reliability, and ensuring that States can meet demand during critical hours without resorting to load shedding or costly short-term power purchases. The State-wise peak electricity demand and annual electrical energy requirement is enclosed as **Annexure A.**

3.5 Installed Capacity and Generation Mix

3.5.1 Installed Capacity and Generation mix as on 31st March, 2025

The installed electricity generation capacity (Utilities) of the country stood at 475.2 GW as on 31st March 2025, with an additional BESS capacity of 204 MW/505MWh. The source-wise installed capacity is shown in Figure 3.8. Coal continues to be the dominant source, accounting for 47% of the total capacity. The cumulative installed capacity from renewable energy (RE) sources has reached 220 GW, which includes 47 GW from large hydro, 5.1 GW from small hydro, 105 GW from solar, 50 GW from wind, and 11.5 GW from biomass.

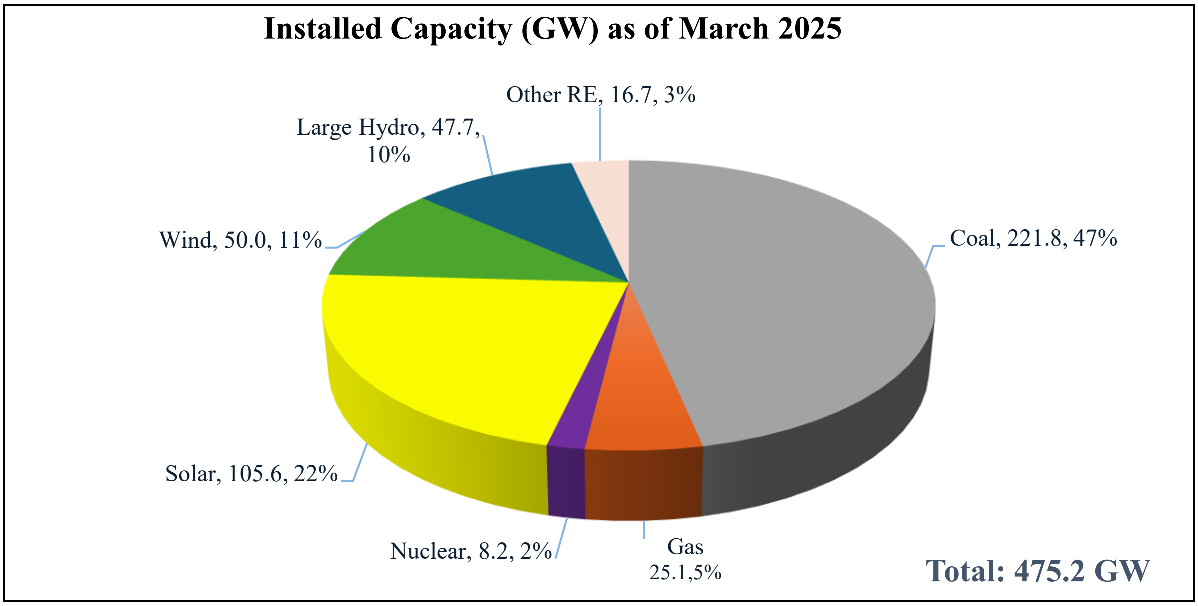


Figure 3.8 Source-wise Installed Capacity as of March 2025

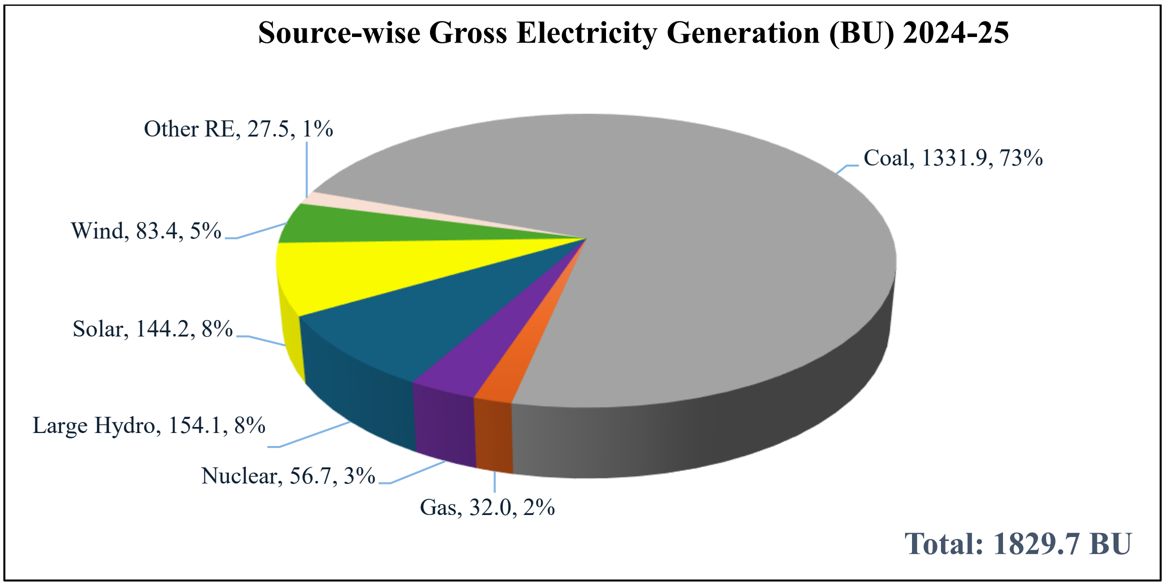


Figure 3.9 Source-wise Electricity Generation in 2024-25

The source-wise generation mix for the year 2024-25 is shown in Figure 3.9. Coal accounts for around 73% of the total electricity generation, while the shares of hydro, solar, wind, other RE and nuclear is 8%, 8%, 5%,1% and 3% respectively.

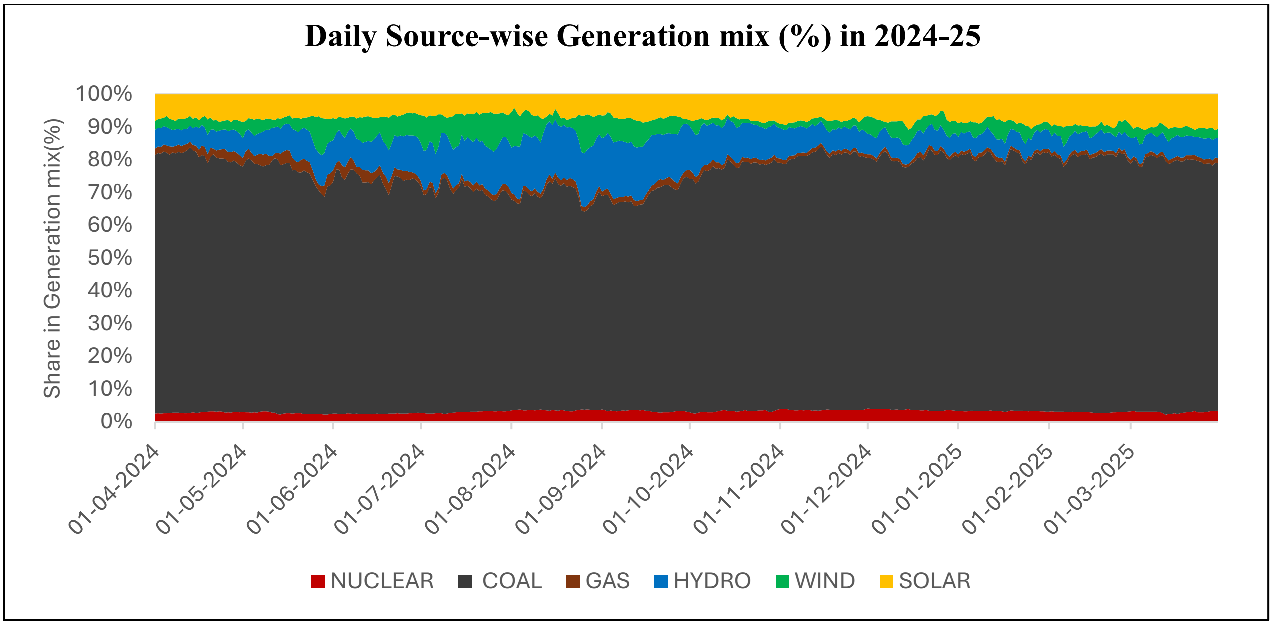


Figure 3.10 Source-wise Generation (%) in 2024-25

The daily generation mix (%) by source for 2024-25 is depicted in Figure 3.10. Coal consistently accounts for over 70% of the total generation on the majority of days. However, during the monsoon period (July–August), there is a marked increase in the contribution from wind and hydro sources, attributed to seasonal variability in resource availability.

3.5.2 Installed Capacity and Generation Mix as on 31st January, 2026

The source-wise installed generation capacity (Utilities) in the country as on 31st January, 2026, is shown in Table 3.8 and Figure 3.11 below:-

Table 3.8: Installed Generation Capacity of the country as on 31st January, 2026

Source	Installed Capacity (GW)
Coal (including Lignite)	227.8
Gas	20.12
Diesel	0.59
Nuclear	8.78
Solar	140.60
Wind	54.65
Other RE	16.8
Large Hydro	51.16
TOTAL	**520.50**
BESS (≥ 1 MWh)	275.85 MW/791.8 MWh

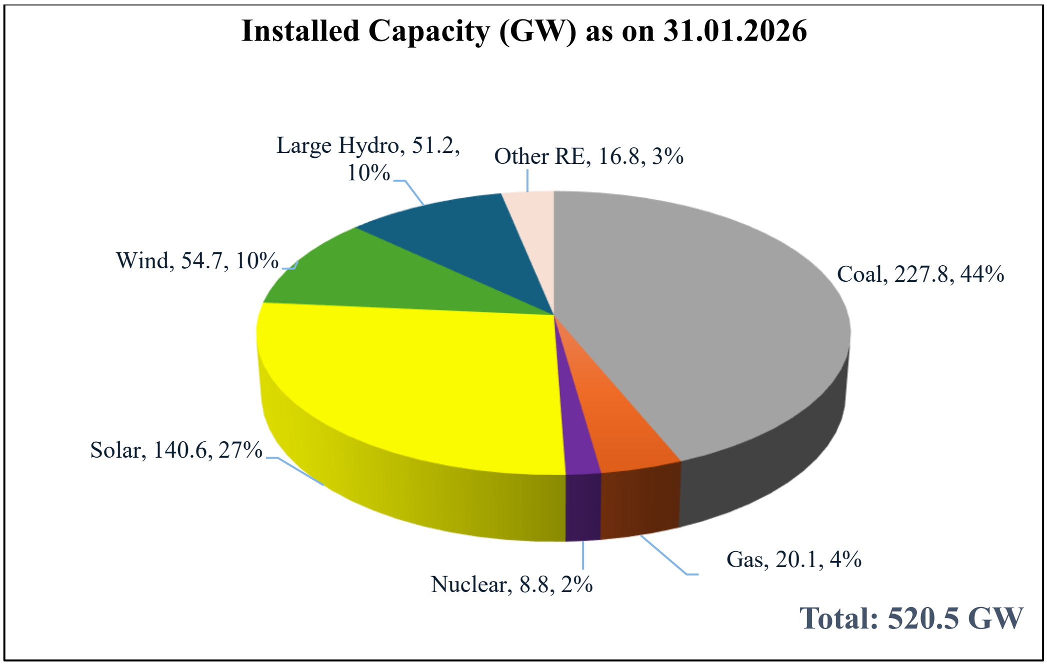


Figure 3.11 Source-wise Installed capacity as on 31st January, 2026

During the current financial year 2025–26 (up to 31st January 2026), a record 52,537 MW of generation capacity (from all sources) has been added. Of this, 43,027 MW has been from Renewable Energy sources (34,955 MW of Solar Power, 4,613 MW of Wind Power, 3,370 MW of large hydro, 58 MW of small hydro, 31 MW of bio power). This is the highest ever capacity addition in a single year. The same has been shown in Table 3.9.

Table 3.9: Capacity addition in the country during 2025-26 (till 31st January 2026)

Type	Capacity added during 2025-26 (till January, 2026) (MW)
Solar	34,955
Wind	4,613
Large Hydro	3,370
Small Hydro	58
Other RE	31
Nuclear	700
Coal	8,810
Total	**52,537**

The source-wise gross electricity generation for the current year 2025-26 (till 31st January, 2026) is given in Figure 3.12.

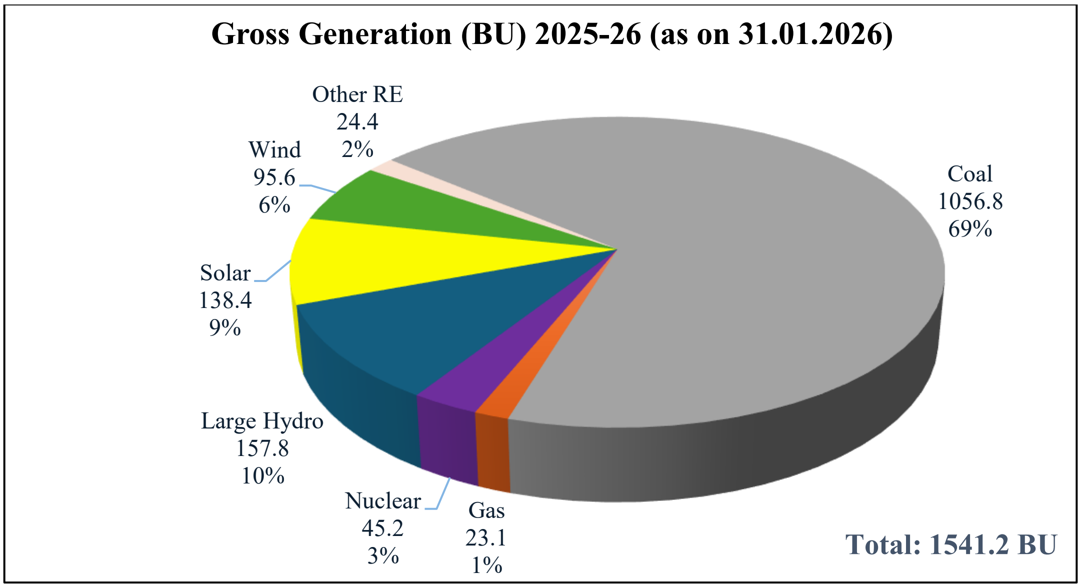


Figure 3.12 Source-wise gross generation for 2025-26 (till 31st January 2026)

The source-wise generation mix for the year 2025-26 (up to 31st January, 2026) is shown in Figure 3.12. Coal accounts for around 69% of the total electricity generation, while the share of hydro, solar, wind, other RE and nuclear is 10%, 9%, 6%, 2% and 3% respectively.

3.6 Under Construction and Planned Capacity

In generation expansion planning, under-construction capacity refers to the power generation projects that are under construction, and planned capacity refers to the power generation projects that are already in the pipeline. This includes projects that are in advanced stages of permitting, and projects that have secured financing but are yet to be taken up for construction, projects that have been ordered but are yet to be taken up for construction, etc.

In the planning process, in addition to the under-construction capacity, the planned capacities are considered as must-add resources within the planning horizon and are treated as firm inputs in the model. Incorporating planned capacity ensures that the expansion plan reflects a realistic baseline scenario, accounting for infrastructure that will inevitably come online regardless of further optimisation. It helps in accurately identifying additional capacity requirements, avoids overestimation of investment needs, and provides a clear distinction between committed and prospective assets. Furthermore, the spatial and temporal characteristics of planned capacity (e.g., location, commissioning timeline, fuel type, and technology) significantly influence decisions related to network reinforcement, grid integration of renewables, and policy compliance.

Technology-wise details of under construction capacity considered in the studies are given below-

a) Thermal Power Projects

Thermal capacity (coal and lignite-based) of 40,865 MW is currently under construction. The contracts of 22,400 MW thermal capacity (coal and lignite-based) have been awarded and are due for construction. Further, 16,420 MW of coal and lignite-based candidate capacity has been identified, which is at various stages of planning in the country.

b) Hydro Electric Projects (Large Hydro)

Hydroelectric projects totalling 12,723.5 MW are currently under construction. Further, 19,386 MW of hydroelectric projects are under various stages of planning (projects concurred by CEA or under S&I).

c) Nuclear

6,600 MW of Nuclear Capacity is presently under construction and is targeted to be completed by 2031-32. Additionally, 7,000 MW of Nuclear Capacity is under various stages of planning and approval.

d) Renewables (excluding Large Hydro)

Around 1,54,830 MW Renewable Capacity (64,670 MW Solar, 6,490 MW Wind, 83,230 MW Hybrid power and 440 MW of Small hydro) is presently under construction. Additionally, 47,920 MW of Renewable Capacity (35,440 MW Solar, 2,400 MW Wind and 10,080 MW Hybrid Power) is under tendering. In addition, about 1,34,000 MW Capacity is planned to be added under the Green Energy Corridor (Phase III) Scheme. Several other RE generation projects are being planned by the States.

e) Energy Storage Systems

Pumped Storage Projects (PSPs) totalling 13,120 MW/78,720 MWh are currently under construction. Further, a total of 9,580/57,480 MWh capacity of Pumped Storage Projects (PSPs) is concurred and yet to be taken up for construction. Pumped Storage Projects totalling about 75,000 MW are under Survey and Investigation.

Battery Energy Storage System (BESS) capacity of 10,658.94 MW/ 28,739.32 MWh are currently under construction, and 22,347.15 MW/ 69,836.70 MWh BESS capacity is under tendering stage.

The generator-wise details of the under-construction and planned generation projects as on 31st January, 2026, along with likely commissioning dates, are enclosed in **Annexure B**. In addition, the detailed techno-economic parameters considered in the studies are given in **Annexure C.**

3.7 Reliability analysis of the generation expansion study results

Reliability analysis in power systems is a critical process used to ensure that electricity is delivered to consumers consistently and without unexpected interruptions. Power system reliability is typically categorised into three areas: generation reliability, which ensures enough generating capacity to meet demand; transmission reliability, which deals with the ability to deliver power from generators to load centres despite line or equipment outages; and distribution reliability, which focuses on delivering electricity to end-users with minimal service interruptions. Various statistical indices are employed to quantify and assess reliability.

For system-level evaluation, indices like Loss of Load Probability (LOLP) and Normalised Energy Not Supplied (NENS) help to estimate the likelihood and impact of supply shortfalls. The reliability analysis process begins with modelling the power system, collecting data on forced outages of thermal generators, demand profiles, RE generation profiles, etc. and then applying analytical or simulation techniques such as Monte Carlo simulation.

The reliability analysis indices considered in the study are explained as follows:

- **Loss of Load Probability (LOLP)**

Definition:
LOLP measures the expected number of days or hours per year (or other time period) during which the system may not have enough generation capacity to meet the electricity demand.

Unit: Days/year or Hours/year

LOLP is used to assess probabilistic shortfalls in capacity. A typical reliability target in many power systems is 0.1 days/year, meaning a shortfall is expected once every 10 years on average. It's essential to note that LOLP does not indicate the amount of energy lost, only the total duration in a year during which a shortfall may occur.

- **Normalised Energy Not Served (NENS)**

Definition:
NENS quantifies the **amount of electrical energy (in % of total Annual Energy Requirement)** that is expected **not to be delivered** due to insufficient resources.

Unit:%
NENS complements LOLP by putting a **volume** to the potential shortfalls. For example, two systems can both have LOLP = 0.1 days/year, but one might fail to supply much more energy during its outage hours than the other. NENS captures this difference and is often used to evaluate the **severity of shortages**.

- **Planning Reserve Margin (PRM)**

Definition:
PRM is the **percentage of additional firm capacity** available above the expected peak electricity demand.

Formula:

PRM = [(Total available Firm Capacity- Peak Electricity Demand)/ Peak Electricity Demand]×100%

PRM is a metric used to ensure that there is enough cushion to handle unexpected events, such as generator outages or higher-than-expected electricity demand, etc. Typically, PRM might range from 10% to 15%, depending on the demand profile and capacity mix.

3.7.1 Variation in Electricity Demand

Visualizing the year-on-year (YoY) differences in normalized electricity demand profiles offers critical insights into how consumer demand behaviour evolves over time, independent of overall load growth. By normalizing hourly or daily demand values to a range between 0 and 1, where 1 represents the annual peak demand, analysts can isolate and compare the structural patterns of demand across different years. This method enables a more meaningful comparison by focusing on the shape and timing of the demand curve rather than the absolute magnitude. Such analysis is particularly effective in capturing changes in demand patterns, including shifts in peak demand timing, load flattening during solar hours, and the effects of climate variables like temperature, humidity, and seasonal monsoon. It also reveals the growing influence of distributed energy resources such as rooftop solar, which can affect the electricity demand incident on the grid during solar hours and reshape demand profiles.

To capture these dynamics, a detailed analysis of normalized demand patterns was conducted for the three most recent years: 2023–24, 2024-25 and 2025–26. The findings provide a data-driven basis for understanding evolving demand behaviour and serve as a valuable input to resource adequacy and reliability studies. By anticipating how demand patterns may continue to shift in future years, planners and utilities can make more informed decisions regarding capacity additions, flexibility requirements, and the integration of clean energy technologies.

The block-wise variation in normalized electricity demand between the years 2024–25 and 2023–24 (with 2023-24 considered as the base year) is illustrated below. This comparison highlights the changes in demand patterns on a time-block basis across the year, allowing for the identification of shifts in peak demand timing, load curve flattening, and other structural changes in consumer behaviour.

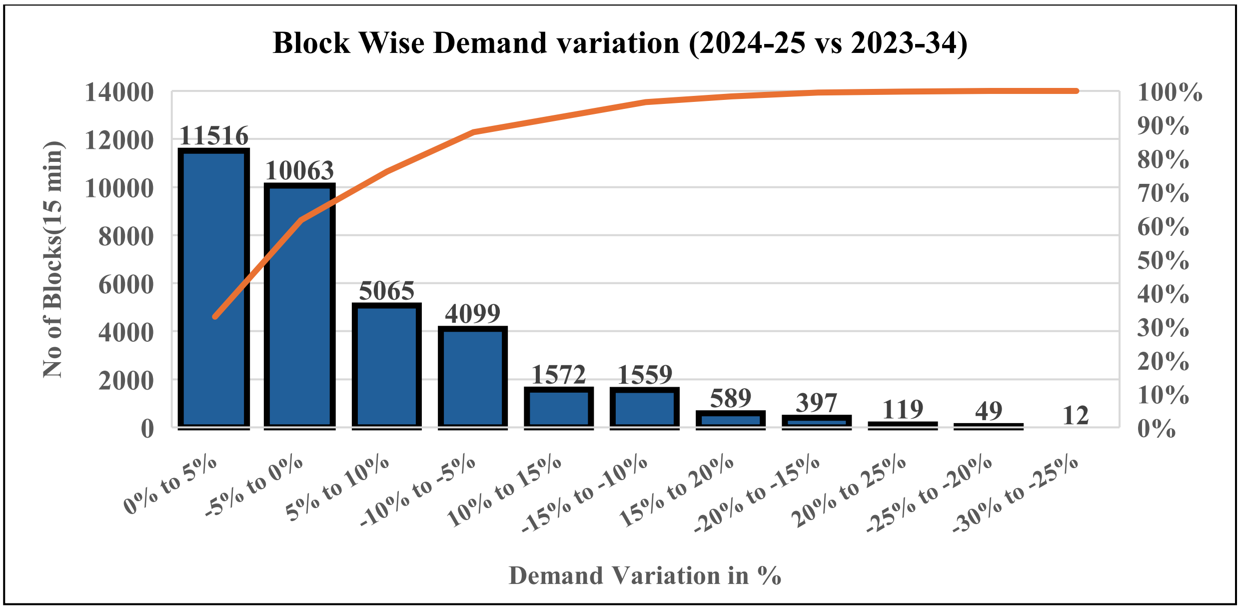


Figure 3.13: Demand Variation frequency distribution 2024-25 vs 2023-24

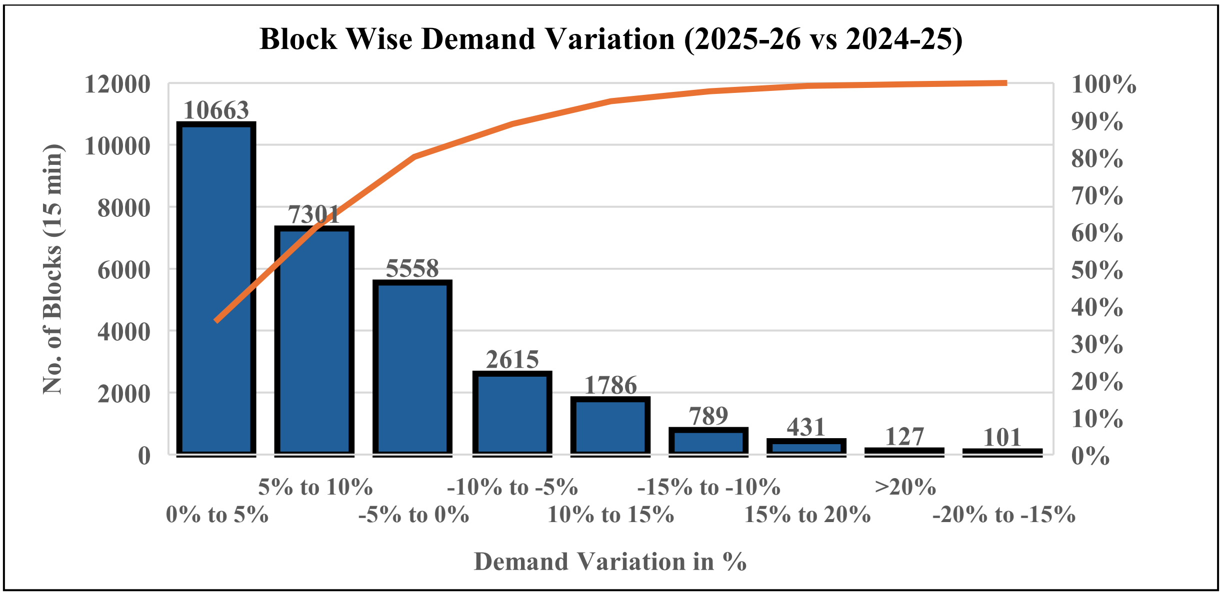


Figure 3.14: Demand Variation frequency distribution 2025-26 (till January 26) vs 2024-25

Analysis of Block-wise Demand Variation

Figure 3.13 indicates that the block-wise demand during 2023–24 and 2024–25 remains within a ±10% range for approximately 90% of the time blocks across the year. This reflects a high degree of stability and consistency in the overall demand pattern on a year-on-year basis, with most fluctuations falling within a predictable and manageable range. A similar trend can be seen in Figure 3.14, wherein the demand variation for the years 2024-25 and 2025-26 (till January) has been shown.

The remaining 10% of blocks exhibit higher deviations, which are likely attributable to short-term factors such as festivals or unusual weather conditions. These variations appear irregular and show no consistent temporal or structural pattern, suggesting they are stochastic in nature and arise from transient anomalies, such as extreme weather events or localised behavioural shifts. Given their random occurrence and limited duration, these outlier variations are not expected to have any material impact on long-term planning and can be reasonably excluded from capacity forecasting and reliability assessments.

In addition to national-level trends, the analysis of State-wise demand variation reveals significant regional disparities in year-on-year normalised demand profiles. These differences are influenced by a variety of State-specific factors, including economic activity, industrial growth, climate conditions, population dynamics, and the penetration of distributed energy resources like rooftop solar. Some states exhibit more pronounced shifts in peak demand timing, while others show greater volatility in daily or seasonal load profiles. Importantly, when examined at the State level, demand variation becomes more pronounced. States demonstrate unique load behaviour shaped by local economic trends, climate conditions, electrification rates, and the penetration of distributed energy resources such as rooftop solar.

3.7.2 Variation in Solar and Wind Generation

To assess the variability and emerging trends in the power system, a comprehensive analysis of the generation profiles for the fiscal years 2023–24 and 2024–25, focusing on solar and wind resources, has been carried out.

A key focus was the contribution of solar generation, which typically peaks during mid-day. Year-on-year, a rise in total solar generation has been observed. The increased share of solar led to deeper midday dips in net demand (electricity demand-demand met through solar generation), particularly in States with high solar penetration. This trend highlights the need for flexible generation to support grid stability during periods of high solar generation.

Wind generation showed notable seasonal variation, with higher generation during the monsoon months (June to September). The capacity factor for wind generation increased slightly compared to the previous year, but its output remained highly variable, affecting evening and nighttime demand profiles. The geographic contribution of wind generation was also analysed, revealing that States with substantial wind capacity (e.g., Tamil Nadu, Gujarat) showed the most significant fluctuations.

The month-wise all-India solar and wind generation variation is shown below.

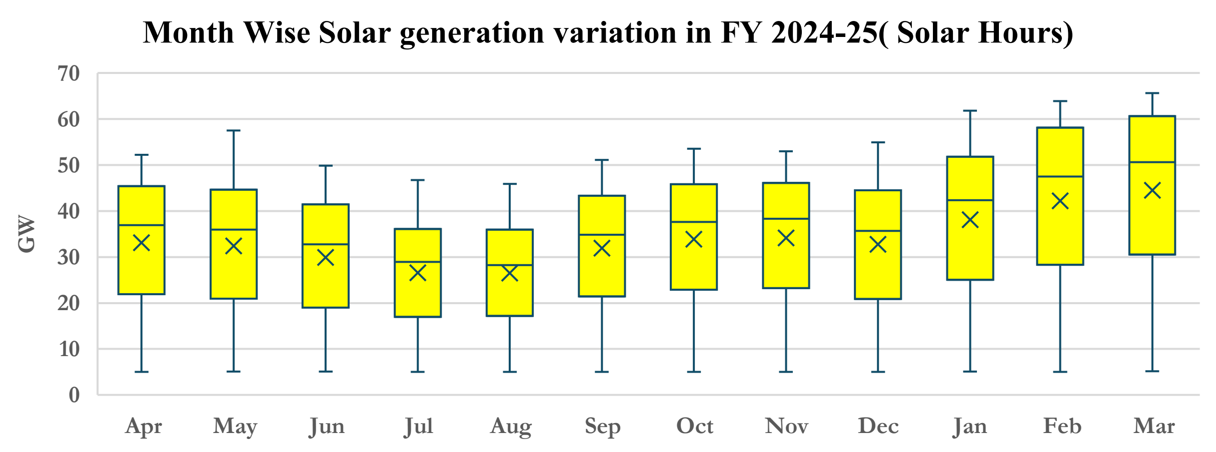


Figure 3.15: Month-wise Solar Generation Variation

From the Figure above, it may be inferred that Solar generation shows a clear seasonal variation. It is lower during the monsoon months due to cloud cover and reduced solar radiation. The monthly average solar generation ranges from 28 GW in July-Aug to 48-51 GW in Feb-Mar. The variability of solar generation during a month is maximum in March (lowest 5 GW to highest 65 GW). However, this variability during a month is least during the monsoon month, from 5 GW to 47 GW.

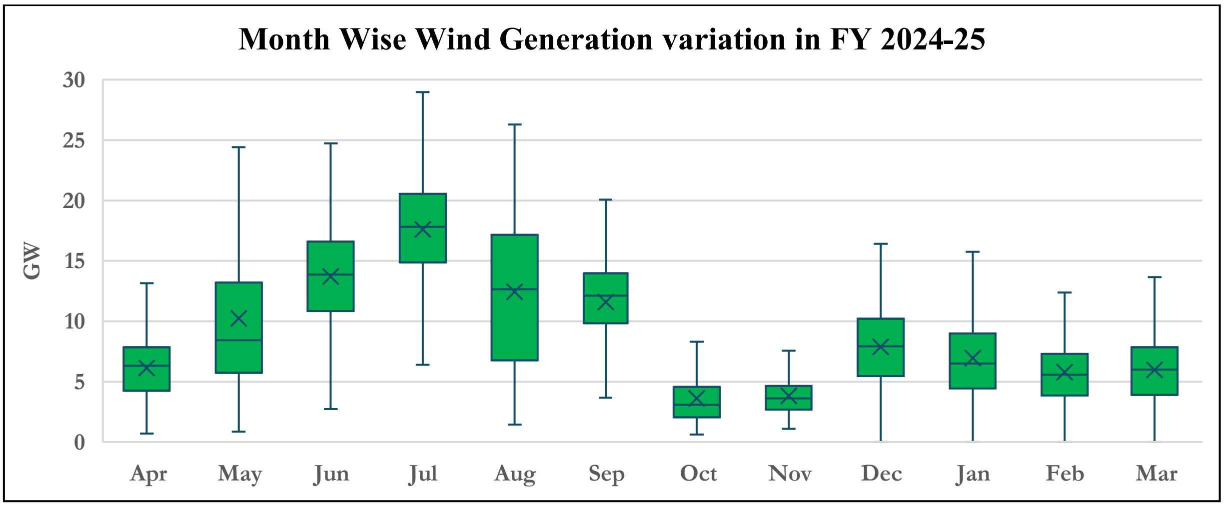


Figure 3.16: Month-wise Wind Generation Variation

The wind generation shows strong seasonal dependence on the monsoon, with peak output in June–August and very low output in October–November. From the Figure above, it may be inferred that the monthly average wind generation ranged from ~3 GW in Oct-Nov to 18 GW in July. The variability of wind generation during a month was maximum in August, lowest 2.5 GW to highest 27 GW. However, this variability during a month was least during low wind months, October and November (lowest 2 GW to highest 8 GW).

3.7.3 Forced Outage of Thermal Generators

Thermal generators, which form a significant part of the power generation mix, can experience forced outages due to unforeseen operational issues, equipment failures, or maintenance requirements. Forced outages refer to unscheduled shutdowns of power plants that occur unexpectedly, often due to technical malfunctions or mechanical failures in critical equipment like turbines, boilers, or generators.

Thermal generator forced outages are an important factor in resource adequacy analysis because they directly affect the available generation capacity and the ability to meet peak demand, particularly in regions where thermal plants make up a large portion of the energy mix. Tracking forced outages, along with planned maintenance schedules, helps ensure that resource adequacy assessments remain realistic and reflective of actual grid conditions.

Analysing forced outage rates and their impact on grid reliability is crucial for effective resource adequacy planning. Forced outages can be unpredictable, but understanding their frequency and duration helps in developing strategies to mitigate their effects.

3.8 Inter-State Transmission Modelling

For resource adequacy planning studies, each state has been modelled as a representative node. These nodes have been connected by ISTS lines representing the existing interstate transmission network. The State-wise demand profile and RE generation profile have been considered corresponding to the individual State node.

Chapter 4

4.0 Introduction

The Resource adequacy studies have been carried out to assess the installed capacity required to meet the projected electricity demand of the country for the period 2026-27 to 2035-36. These studies aim to provide a comprehensive and data-driven evaluation of the electricity demand and supply requirements, ensuring that the power system can meet the nation's electricity needs in a reliable, sustainable, and cost-effective manner over the next decade.

The studies have been carried out for two scenarios based on electricity demand projections for the study period. The first scenario considers electricity demand projections as per the mid term review of the 20th EPS report, while in the second scenario, the recent trend of electricity demand growth has been considered.

4.1 Scenario I: Electricity Demand Projections as per mid-term review of 20th EPS

This section elaborates on the various outcomes of the Resource Adequacy studies for the period of 2026-27 to 2035-36, including aspects like projected year-wise capacity mix, generation mix, growth of Fossil and non-fossil resources in view of meeting the projected demand for the country, considering demand projections are as per mid term review of the 20th EPS.

Section 4.2 also presents the reliability modelling carried out as part of the preparation of this plan, wherein all the key assumptions considered for the studies, as well as the results of the studies, have been provided for the study period.

4.1.1 Likely capacity mix for the period of 2026-27 to 2035-36

Based on generation planning studies, the year-wise, source-wise projected capacity requirement is shown in Table 4.1 and Figure 4.1.

Table 4.1 Year-wise Source-wise projected Installed Capacity requirement (Electricity Demand projection as per mid-term review of 20th EPS)

(All figures are in GW)

Year	Coal (including Lignite)	Gas	Nuclear	Large Hydro	PV	Wind	Other RE	Total	BESS	PSP
2026-27	237	20	10	48	176	63	17	571	6	5
2027-28	239	20	12	54	214	73	17	629	12	7
2028-29	245	20	12	55	254	83	18	687	17	13
2029-30	260	20	13	58	285	93	18	747	24	23
2030-31	276	20	14	59	320	103	19	811	28	32
2031-32	291	20	16	61	356	113	20	877	37	44
2032-33	299	20	19	64	395	123	20	940	46	54
2033-34	303	20	22	66	434	133	21	999	57	64
2034-35	307	20	22	75	474	144	21	1063	68	79
2035-36	315	20	22	78	509	155	22	1121	80	94

Note- Existing PSP capacity of 3.7 GW (closed cycle), which are not operating in PSP mode at present, have been modelled as conventional large hydro plants for studies; hence, have not been considered in projected PSP capacity for the study period. Considering these projects, the projected PSP capacity in 2035-36 will increase to around 98 GW.

Other RE includes Biomass, Waste to Energy and Small Hydro.

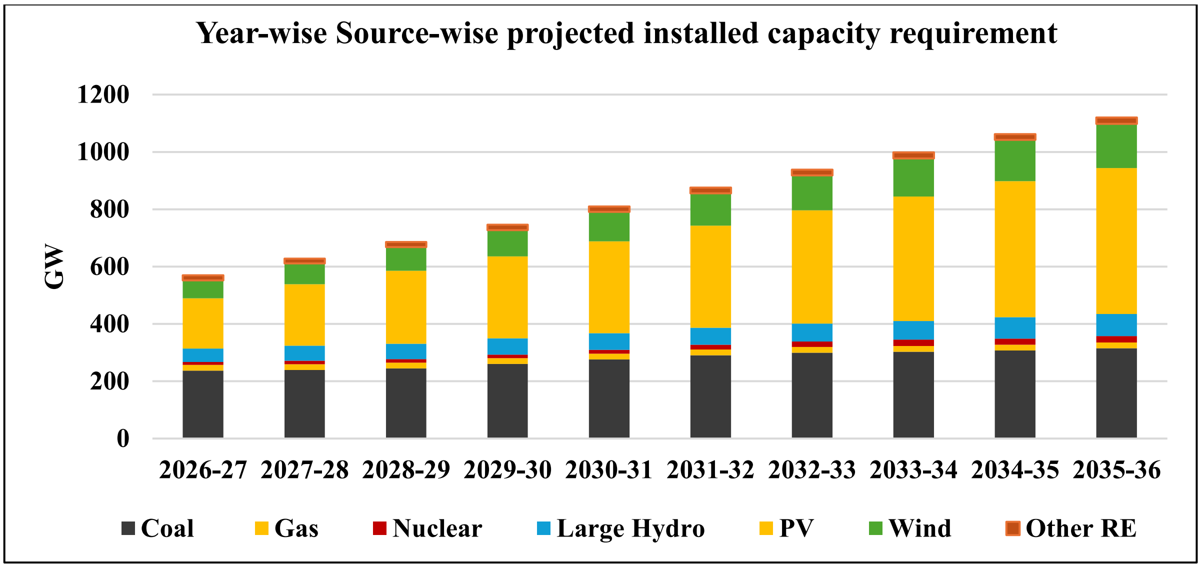


Figure 4.1 Year-Wise Source-Wise Projected Installed Capacity Requirement (in GW)

4.1.2 Likely source-wise installed capacity and electricity generation in 2035-36

Figure 4.1 presents a detailed projection of India's year-wise installed capacity requirements by source from FY 2026-27 to FY 2035-36, highlighting a significant expansion in total installed capacity from approximately 520 GW as on 31.01.2026 to over 1,000 GW during the period. While coal and lignite continue to serve as the dominant sources of capacity, their relative share shows a gradual decline, indicating a strategic shift in the country's energy mix. The most substantial growth is observed in solar photovoltaic (PV) capacity, which expands rapidly across the decade, underscoring India's commitment to large-scale solar deployment in line with its clean energy goals. As per the studies, the solar PV capacity is expected to become more than 500 GW and wind capacity is expected to become more than 150 GW by 2035-36.

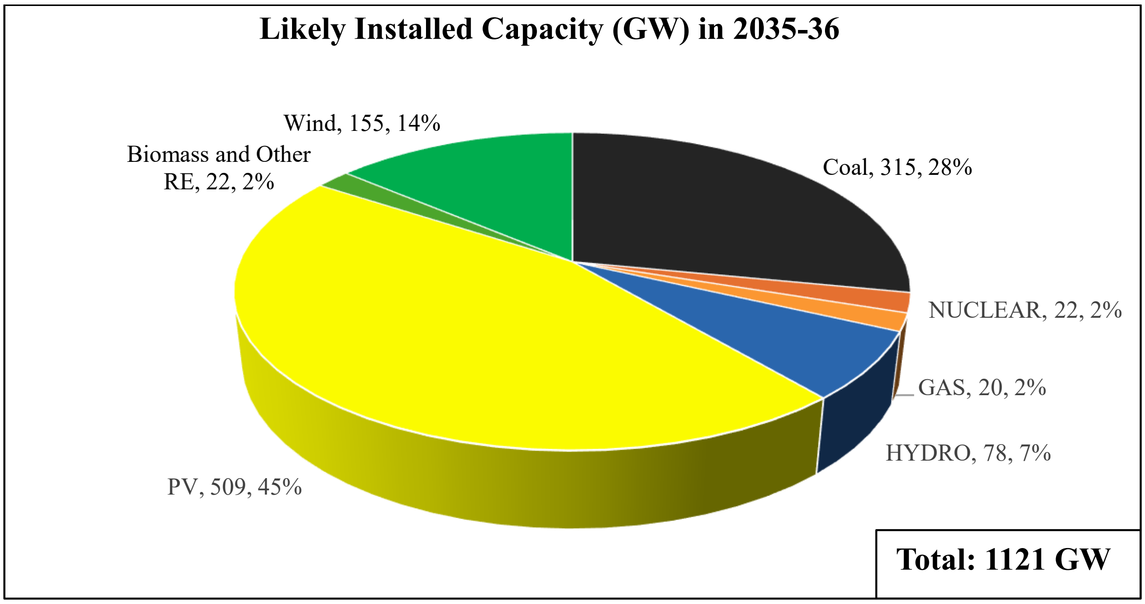


Figure 4.2 Likely Installed Capacity Requirement (GW) in 2035-36

Figure 4.2 shows the projected installed electricity generation capacity for 2035–36, totalling 1,121 GW. Solar PV is expected to dominate the energy mix with 509 GW (45%), making it the largest contributor. Coal remains the second-largest source at 315 GW (28%), while wind power contributes 155 GW (14%). Hydropower accounts for 78 GW (7%), and smaller shares come from nuclear (22 GW, 2%), gas (20 GW, 2%), and biomass and other renewables (22 GW, 2%). Overall, the projection highlights a strong shift toward renewable energy, particularly solar and wind, while coal continues to maintain a notable but reduced share of the total capacity.

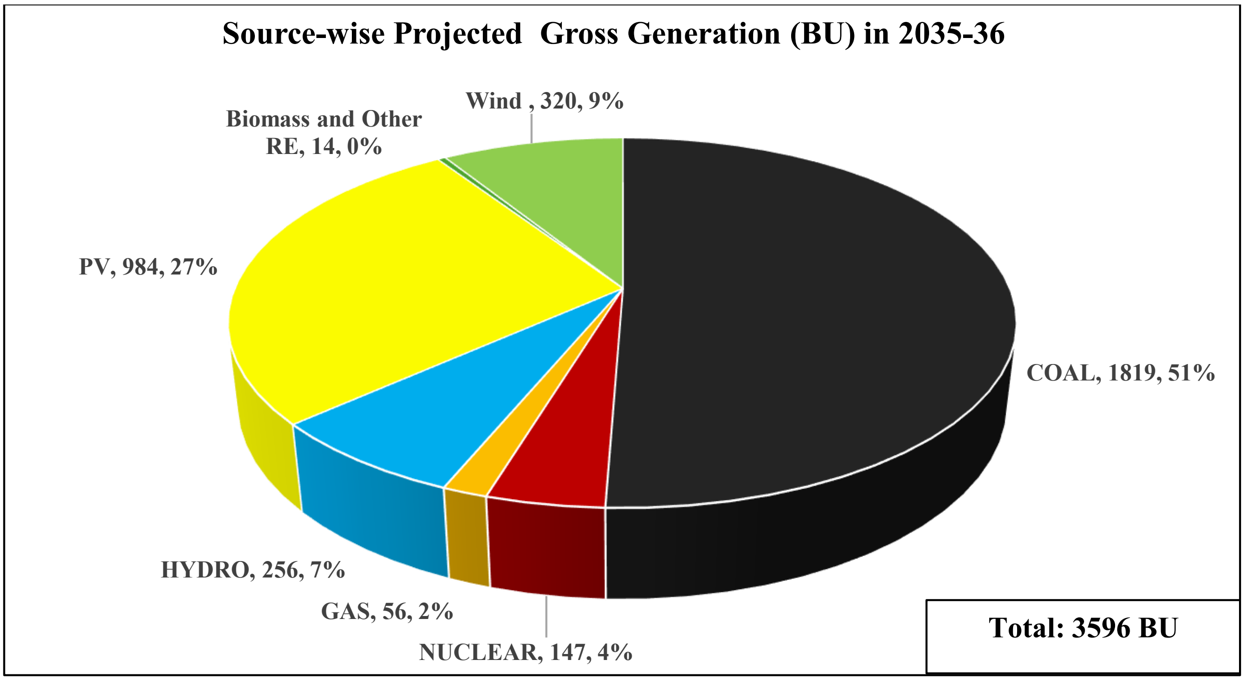


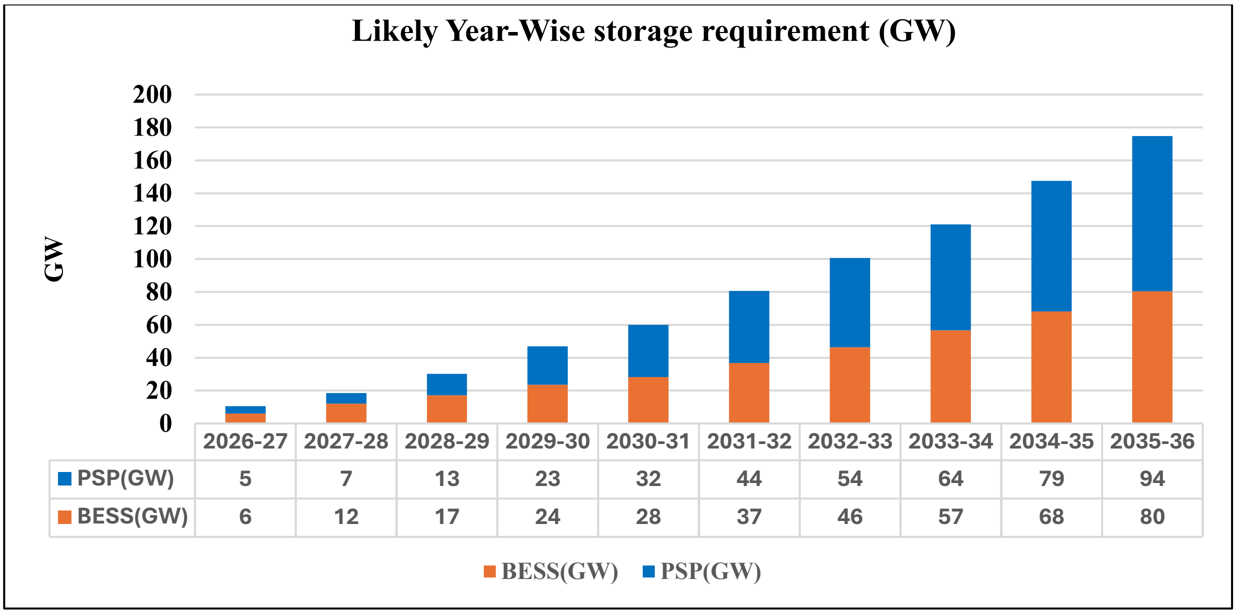
Figure 4.3 Source-wise Projected Gross Generation (BU) in 2035-36

Figure 4.3 depicts that the projected gross electricity generation for 2035–36 is 3596 BU. Coal is expected to remain the dominant source, generating 1819 BU (51%). Solar PV follows with 984 BU (27%), showing a strong contribution from renewable energy. Wind power is projected to generate 320 BU (9%), while hydropower contributes 256 BU (7%). Smaller shares come from nuclear energy at 147 BU (4%), gas-based generation at 56 BU (2%), and biomass and other renewables at 14 BU (less than 1%). Overall, although renewable energy sources contribute significantly to electricity generation, coal is still projected to supply about half of the total electricity requirement in 2035–36.

Other renewable sources, including hydropower, also exhibit consistent growth, contributing to the diversification of the generation portfolio. A particularly noteworthy trend is the accelerated development of Energy Storage Systems [Battery Energy Storage Systems (BESS) and Pumped Storage Plants (PSP)], which indicates a growing focus on grid flexibility and reliability as variable renewable penetration increases. Additionally, the steady rise in Energy Storage Capacity and renewable energy (RE) sources supports the broader transition towards a more resilient and sustainable energy system. Overall, the projected trajectory reflects India's evolving strategy to balance reliability, affordability, and sustainability in its power sector planning.

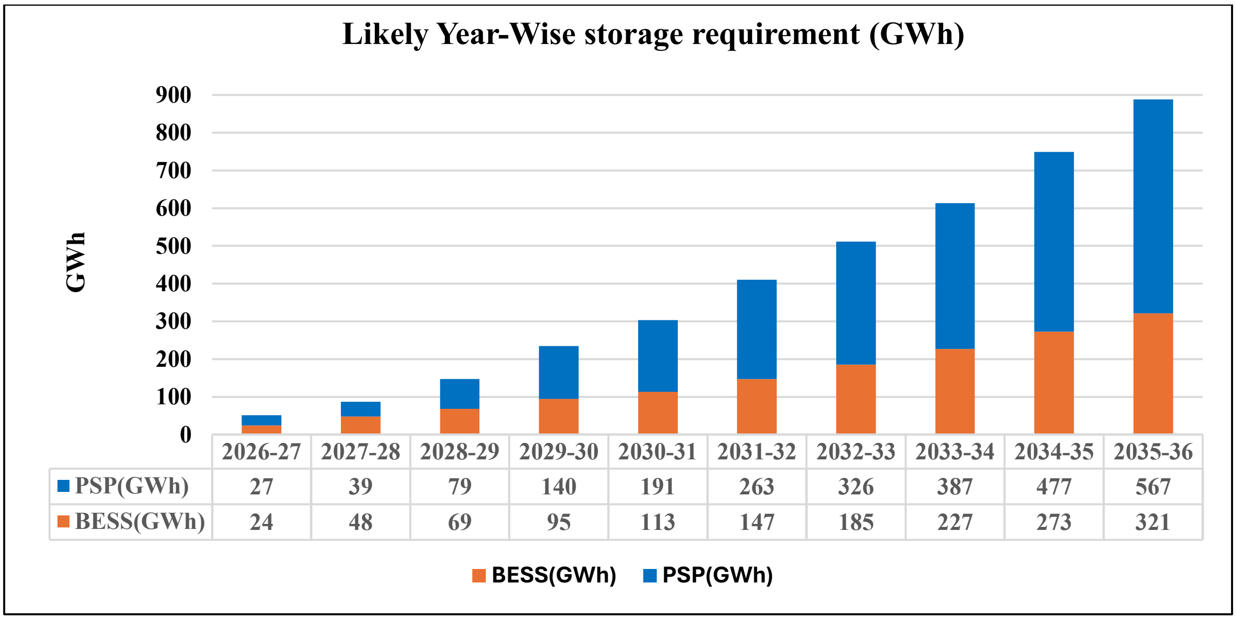
4.1.3 Likely growth of Energy Storage till 2035-36

The year-wise energy storage requirement in GW and GWh is shown in Figure 4.4 and Figure. 4.5 respectively.



	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36
PSP(GW)	5	7	13	23	32	44	54	64	79	94
BESS(GW)	6	12	17	24	28	37	46	57	68	80

Figure 4.4 Year-Wise Source-Wise Energy Storage Capacity Requirement in GW



	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36
PSP(GWh)	27	39	79	140	191	263	326	387	477	567
BESS(GWh)	24	48	69	95	113	147	185	227	273	321

Figure 4.5 Year-Wise Source-Wise Energy Storage Capacity Requirement in GWh

4.1.4 Likely source-wise generation for the period of 2026-27 to 2035-36

Figure 4.6 represents projections of net electricity generation from different energy sources in India from FY 2026-27 to FY 2035-36, measured in billion units (BU). The net electricity generation increases substantially over the period, rising from around 1,725 BU in 2024-25 to about 3,450 BU by 2035-36, nearly doubling in a decade. Throughout the timeframe, coal and lignite maintain a dominant position in the generation mix, contributing the largest share of electricity. Despite a relative decline in percentage terms, coal remains the primary backbone of electricity generation.

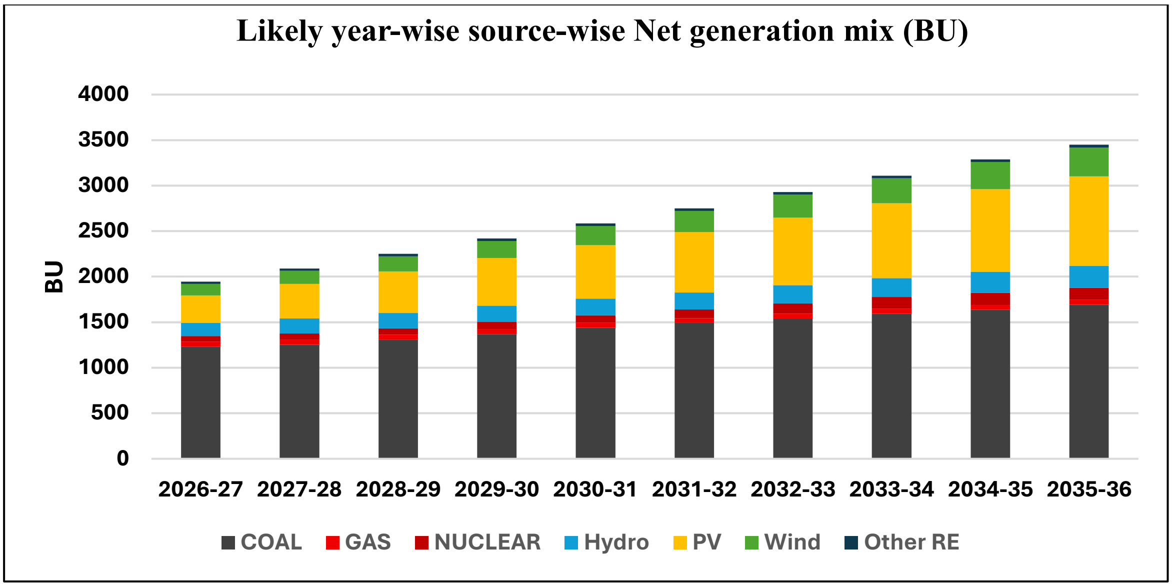


Figure 4.6 Year-Wise Source-Wise Generation Mix

Solar PV emerges as the fastest-growing contributor to the generation mix, reflecting aggressive capacity additions and improved performance factors. Other renewables, particularly wind and hydropower, also show a steady increase in generation output, reinforcing the renewable energy growth trajectory. A notable trend is the rising contribution from Pumped Storage Projects (PSP) and Battery Energy Storage Systems (BESS). This suggests a strong policy and operational emphasis on integrating energy storage technologies to facilitate increased RE integration, along with mitigating the impact of the intermittency of renewables for ensuring grid reliability.

Thermal sources continue to operate at a higher Plant Load Factor, while renewable generation scales up with expanded deployment and better integration measures. This transition reflects India's evolving strategy to balance energy security, sustainability, and system flexibility in its long-term power sector planning.

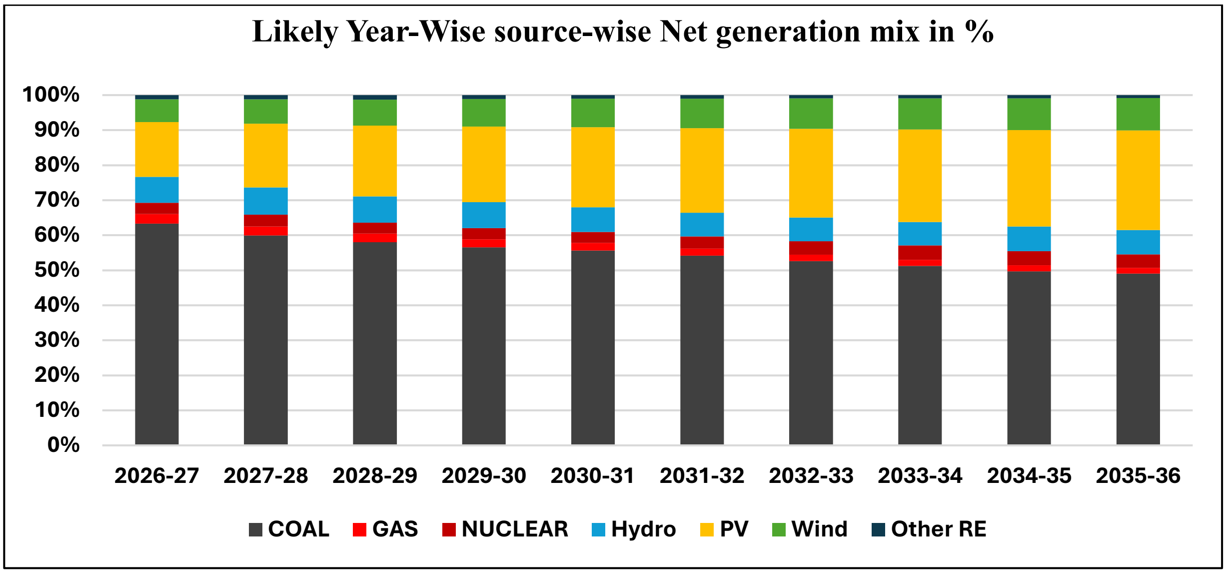


Figure 4.7 Source-wise Generation Mix in %

Figure 4.7 represents the projected percentage contribution of various energy sources to India's total electricity generation from 2026-27 to 2035-36. It highlights a clear transition in the country's generation mix towards a more diversified and renewable-driven portfolio, even as coal and lignite continue to dominate. While coal's share in electricity generation declines steadily from nearly 64% in 2026-27 to about 49% by 2035-36, it remains the largest single source of power, reflecting its critical role in providing baseload energy during the transition period.

Solar PV shows the most prominent increase in share, reflecting its rapid capacity addition and improving generation efficiencies. This growth is accompanied by a moderate yet consistent rise in wind and hydropower contributions. The share of nuclear increases while the share of gas decreases during this period.

4.1.5 Likely source-wise year-wise capacity addition for the period of 2026-27 to 2035-36

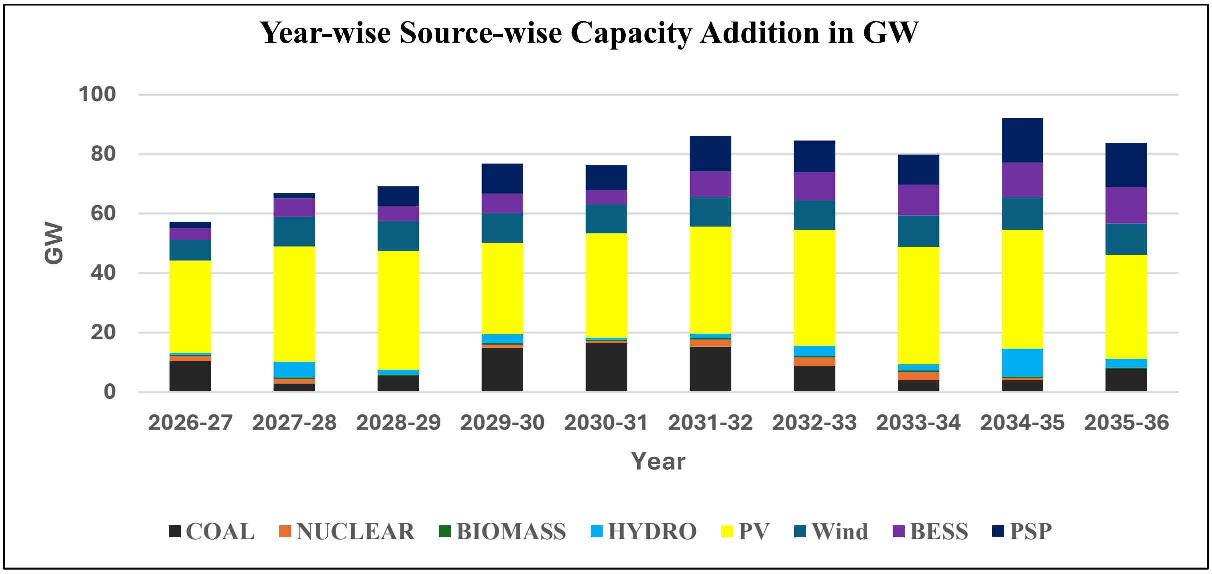


Figure 4.8 Likely Year-wise Capacity Addition

Figure 4.8 presents a detailed overview of annual capacity additions required from FY 2026-27 to FY 2035-36. The data underscores a decisive shift towards renewable energy, with solar PV emerging as the dominant contributor. PV additions remain consistently between 30-40 GW per annum (excluding Solar Roof Top installation), indicating its pivotal role in meeting future electricity demand and decarbonization targets.

Overall, the projected capacity expansion strategy reflects a balanced approach, scaling up non-fossil capacity while maintaining energy security and grid stability. The increasing share of renewables and energy storage is aligned with India's energy transition goals and commitment to achieving net-zero emissions by 2070.

4.1.6 Likely growth in non-fossil capacity till 2035-36

Figure 4.9 illustrates the projected fossil fuel-based and non-fossil fuel-based installed generation capacity from 2026-27 to 2035-36. Non-fossil fuel-based capacity rises sharply from 272 GW in 2025-26 (as on 31st January 2026) to 786 GW in 2035-36, while fossil capacity grows only modestly from 248 GW (as on 31st January 2026) to 335 GW during the same period. Projections suggest that by 2035-36, non-fossil sources will constitute approximately 70% of the total installed capacity, underscoring the strong policy impetus and sustained momentum towards clean energy transition.

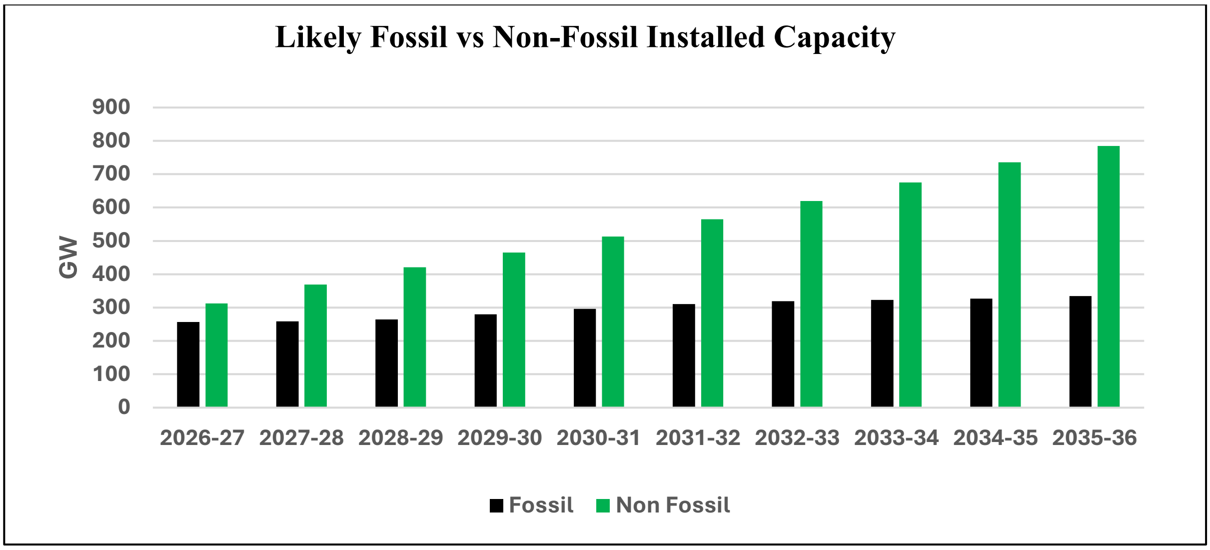


Figure 4.9 Fossil vs Non-Fossil Installed Capacity

Figure 4.10 illustrates the projected share of fossil and non-fossil fuel sources in India's electricity generation mix from 2026-27 to 2035-36. Over this period, the share of fossil fuel-based generation steadily declines, while the share of non-fossil sources, which includes renewables like solar, wind, hydro, and nuclear, increases consistently. The share of fossil fuel-based generation steadily declines from about 66% in 2026-27 to approximately 51% by 2035-36. Conversely, the share of non-fossil fuel-based generation increases from about 34% in 2026-27 to 49% in 2035-36. This suggests that India is not only expanding its clean energy infrastructure but also effectively integrating it into the energy mix. Furthermore, the declining reliance on fossil fuels directly contributes to the broader objective of reducing the carbon intensity of the economy, which is a key milestone on the path to achieving net-zero emissions by 2070.

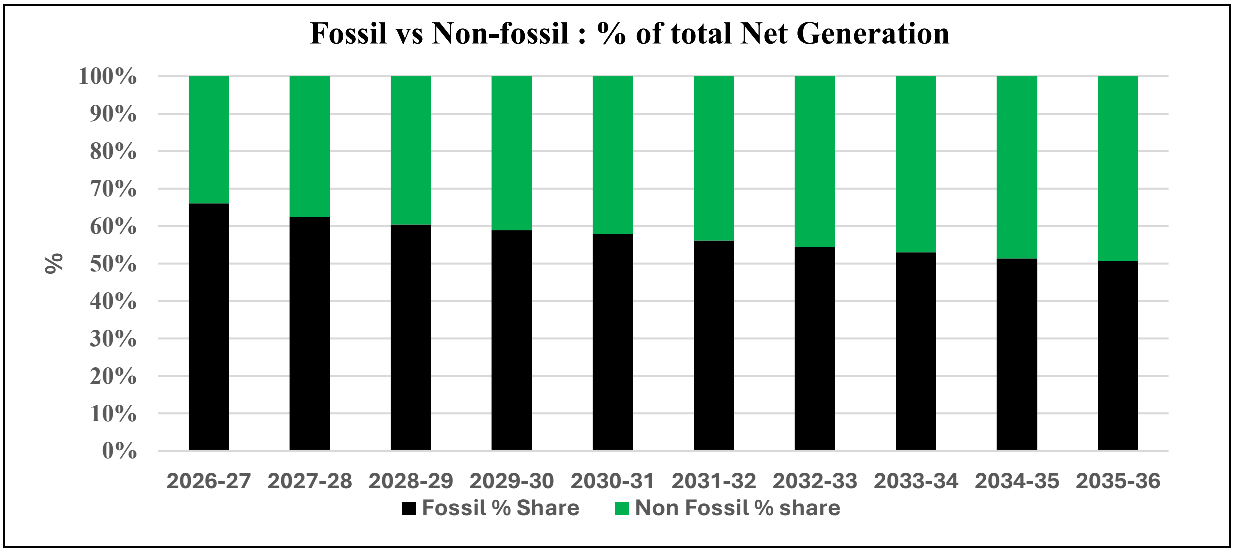


Figure 4.10 Net Generation from Fossil vs Non-Fossil Sources

The projected Plant Load Factor (PLF) of coal-based power plants is expected to remain in the range of 62% - 65% during 2026-27 to 2035-36. The relatively steady PLF throughout the period suggests that coal will continue to play a crucial role in India's energy mix, even as the country rapidly expands its non-fossil capacity. The consistent utilisation of coal plants reflects the efficient operation of existing and upcoming coal-based plants, which are expected to provide dependable base-load power and support grid stability amid the growing integration of variable renewable sources like solar and wind.

4.1.7 Likely source-wise hourly dispatch for a typical day in 2035-36

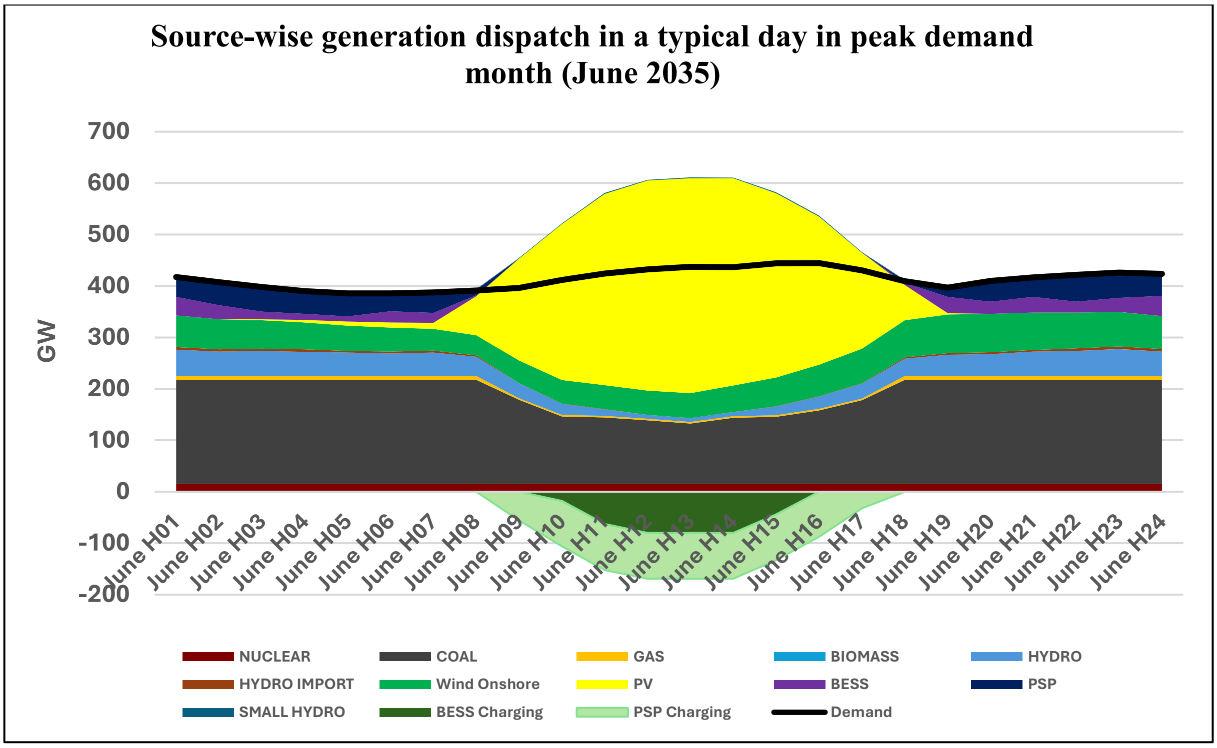


Figure 4.11 Source-wise Dispatch in 2035-36

Figure 4.11 illustrates how different energy sources contribute to meeting electricity demand throughout a 24-hour period in June 2035. During the early morning and late night hours, base load demand is primarily met by conventional sources such as coal, gas, nuclear, and wind power and energy storage systems such as PSP and BESS. During the day, solar PV (represented by the large yellow band) begins to dominate, which necessiates coal based plants to operate at Minimum Technical Limit (MTL). BESS and Pumped Storage Projects (PSP) charge during periods of high solar generation and discharge during the evening peak demand period and early morning hours when solar generation is less. Wind energy contributes consistently throughout the day, while hydro and small hydro provide moderate and stable support. The dispatch pattern highlights a high reliance on solar during daylight hours and the crucial balancing role played by energy storage systems and the flexible generation requirements of coal in future years.

4.1.8 Emphasis on Energy Storage Capacity Addition

Thrust has been on Capacity addition from RE generation Sources. On the basis of Generation planning studies, it is projected that the non-fossil fuel-based installed capacity is likely to increase to 786 GW by 2035-36. It has been observed that storage (about 4-6 hrs) would be required for integrating a higher quantum of RE beyond 2030. In this regard, PSPs provide a comprehensive solution for meeting future storage capacity requirements at reasonable cost, along with ensuring grid reliability by providing frequency regulation, inertia and voltage support, acting as a safety net for rapid changes in RE generation.

As per the studies, the likely requirement of energy storage is about 174 GW/ 888 GWh by 2035-36 for energy shifting and facilitating increased RE integration by mitigating challenges associated with RE generation, like variability and intermittency.

The storage requirement can be met either through Hydro PSP or BESS or a combination of both. BESS is suitable for short-duration storage, and PSPs are suitable for long-duration storage. Long-duration energy storage will also be crucial for the supply of RE RTC power to Commercial & Industrial (C&I) Consumers. PSP as an energy storage system can serve the purpose of providing long-duration storage associated with RE, RTC or FDRE power. Storage co-located with RE generation sources would optimise the requirement of the transmission system and would improve the utilisation of the transmission system.

Advantages of PSP

Pumped Storage Projects (PSPs) represent a critical component of India's evolving power system as the share of Variable Renewable Energy Sources (VRE), such as solar and wind, continues to increase. As an established and reliable technology, PSPs provide long-duration energy storage—typically six hours or more, thereby enabling effective management of peak demand and addressing variability in renewable generation. Being largely developed as off-river systems, PSPs have relatively limited environmental impact and rely predominantly on indigenous technologies and domestically manufactured equipment, aligning well with the vision of Atmanirbhar Bharat. Their technological maturity also enhances investor confidence, facilitating long-term financing and making them a viable large-scale storage solution compared to alternatives that rely heavily on imported components.

In addition to strengthening grid flexibility, PSPs play a vital role in maintaining system stability by providing physical inertia through rotating machines—an increasingly important attribute as conventional thermal generation gradually declines. PSPs also support the efficient integration of renewable energy by storing surplus generation during periods of high RE generation, supplying power during peak/high demand hours and reducing renewable energy curtailment. Furthermore, the development of PSPs stimulates regional economic growth through infrastructure development, increased demand for domestic industries such as steel and cement, and local employment generation, making them an important investment for both power system reliability and socio-economic development.

Central Electricity Authority (CEA) unveiled a roadmap in January 2026, aiming for 100 GW of Pumped Storage Projects (PSP) by 2035-36 to support India's renewable energy goals. This plan involves speeding up clearances, promoting off-stream (closed-loop) projects, providing budgetary support, and incentivizing private sector participation.

Measures to expedite the deployment of grid-scale storage solutions

The Government of India has already taken several measures to expedite the development and deployment of grid-scale storage solutions in the country. Some of the measures are given below:

a. Notified Guidelines for Procurement and Utilization of BESS as part of Generation, Transmission and Distribution assets, along with Ancillary Services.

b. Issued the National Framework to promote Energy Storage Systems in the country.

c. Issued Guidelines to promote PSP.

d. Granted 100% waiver of Inter-State Transmission System (ISTS) charges for PSP for which construction work is awarded on or before June 30, 2028.

e. Granted 100% ISTS charges waiver for co-located BESS projects, commissioned on or before 30th June 2028, with certain conditions.

f. The Government has approved a Viability Gap Funding (VGF) Scheme for the development of about 43,000 MWh of BESS.

g. 'Advisory on co-locating Energy Storage Systems with Solar Power Projects to enhance grid stability and cost efficiency' has been issued.

h. Streamlining of Environmental Clearances: Off-stream or closed-loop PSPs have been placed under simplified environmental clearance categories, with certain projects exempted from detailed EIA requirements to reduce approval timelines.

i. CEA has published Guidelines for Formulation of DPRs of PSPs to fast-track the process of formulation of DPRs.

Heavy Import Dependency for BESS

- India imports approximately **75-80% of its lithium-ion cells**, which constitute roughly 80% of total system costs.
- One of the Asian countries dominates over **75-80% of global battery manufacturing**, exposing India to geopolitical risks, trade frictions, and price volatility.

Critical minerals like lithium, cobalt, nickel, and graphite, essential for clean energy technologies and advanced manufacturing, are almost entirely imported due to a lack of domestic reserves and refining infrastructure. Global supply chains for these minerals are highly vulnerable to geopolitical risks, trade restrictions, and concentration of production in a few countries.

Recent cost trends witnessed in the latest tenders for BESS have been quite encouraging for the development of grid-scale storage solutions. However, the actual cost of such solutions would depend on operational characteristics of such technologies, like depth of discharge, round-trip efficiency, annual degradation, number of cycles of operation, land and other infrastructure, along with free charging power being provided to the BESS developers, etc.

4.1.9 Reliability Analysis

Power system reliability and robustness are critical for ensuring an uninterrupted supply under uncertain conditions. In view of the increasing share of renewable energy (RE) and the inherent variability of electricity demand and generation, advanced probabilistic methods are necessary to evaluate system adequacy. To this end, a Monte Carlo simulation has been carried out for the year 2035-36. Monte Carlo Simulation (MCS) is a probabilistic modelling technique that uses repeated random sampling to evaluate the impact of uncertainty in complex systems. Unlike deterministic approaches, which assume fixed values for demand, generation, or outages, MCS captures the full range of possible scenarios and their probabilities, providing a more realistic picture of system performance.

Monte Carlo Simulation Methodology

Monte Carlo simulation involves running a large number of random sample runs, each representing possible system states under different conditions of demand, generation, and outages. Key steps of the methodology include:

(i) Generating random scenarios of demand and renewable generation based on historical data and forecast distributions.

(ii) Simulating forced outages of thermal generators using probability distributions derived from historical outage rates.

(iii) Evaluating the adequacy of available capacity to meet demand under each scenario.

(iv) Aggregating results to determine reliability indices such as Loss of Load Probability (LOLP) and Normalised Energy Not Served (NENS).

For the preparation of the National Electricity Plan (Generation), brought out in May 2023, Loss of Load Probability (LOLP) and Normalised Energy Not Served (NENS) values of 0.2% and 0.05%, respectively, had been considered. The same values have been considered in the present study.

A Monte Carlo simulation study has been conducted to evaluate the reliability metrics for the period 2035-36. Analysis has been done for the results given in Table 4.1. The simulation involves a large number of samples to capture uncertainties in demand, solar and wind generation, and the forced outage rates of thermal generators. The variation considered in Demand, forced outages, solar and Wind Generation are based on the historical block-wise variations observed in the last two years. The following variations have been considered in the reliability-sensitive parameters:

Table 4.2: Variations considered for Monte Carlo Simulation

Parameter	**Standard Deviation (σ)**	**Range of Variation (3σ)**
Forced Outage of thermal generators (Coal and Gas)	3.33%	±10%
Block-wise Demand	3.33%	±10%
Block-wise Solar Generation	3.33%	±10%
Block-wise Wind Generation	10%	±30%
Block-wise Hydro Generation	3.33%	±10%

For instance, if the block-wise demand is 400 GW, then the simulated samples depict demand variation within a range of 360 GW to 440 GW.

The model has been iterated for a total of 100 sample runs, with a tolerance limit of 0.05% and a 99.9% confidence interval. The simulation estimated the sample-wise Normalised Energy Not Served (NENS) and Loss of Load Probability (LOLP), which are within the prescribed limits. These results indicate that while the overall probability of supply shortfalls is low, there remain critical risk periods that must be addressed through adequate reserve planning, flexible generation, or energy storage integration.

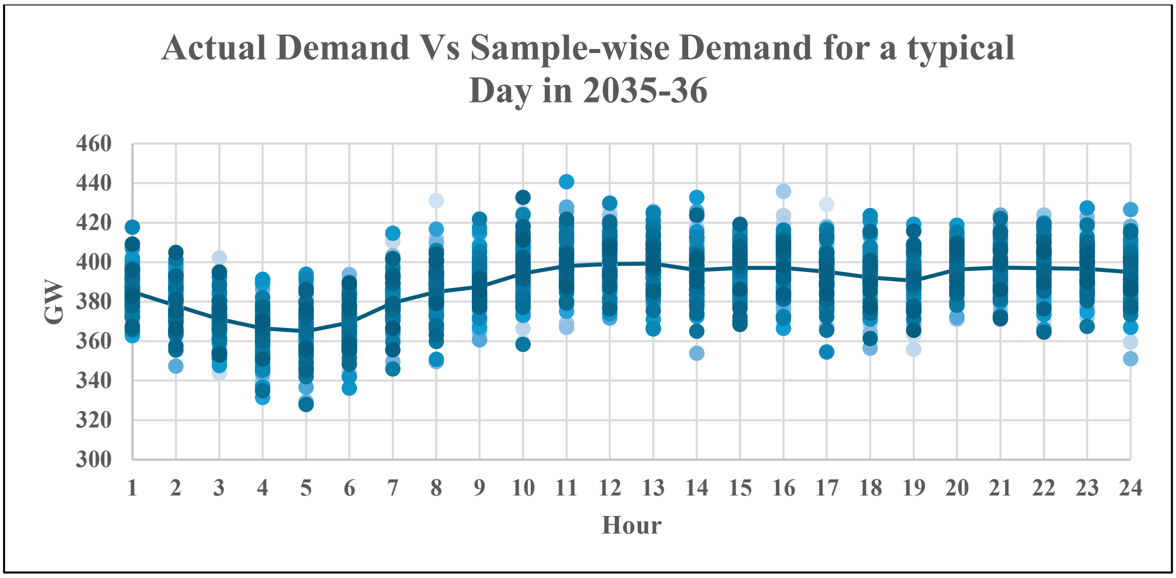


Figure 4.12 Actual Demand Vs Sample-wise Demand for a typical Day in 2035-36

The above graph shows the actual demand on a typical day of 2035-36 by a solid line, whereas the electricity demand variation is depicted by means of a scatter plot.

It may be noted that the system adequacy analysis has been carried out based on a set of assumptions relating to future demand and supply conditions. These include projections of peak electricity demand and annual electrical energy requirement, planned renewable energy (RE) capacity additions, resource availability factors, and variability in renewable generation profiles, as well as availability of thermal generators. Any deviation in these assumptions-whether in demand growth trajectory, pace of RE deployment, or operational availability of generating resources will invariably impact the adequacy results and reliability indices presented in this study. Hence, it is imperative that these assumptions are reviewed and updated on an annual basis to capture evolving system realities and provide a more realistic and robust assessment of resource adequacy**.**

Analysis of Results of Monte Carlo Simulation

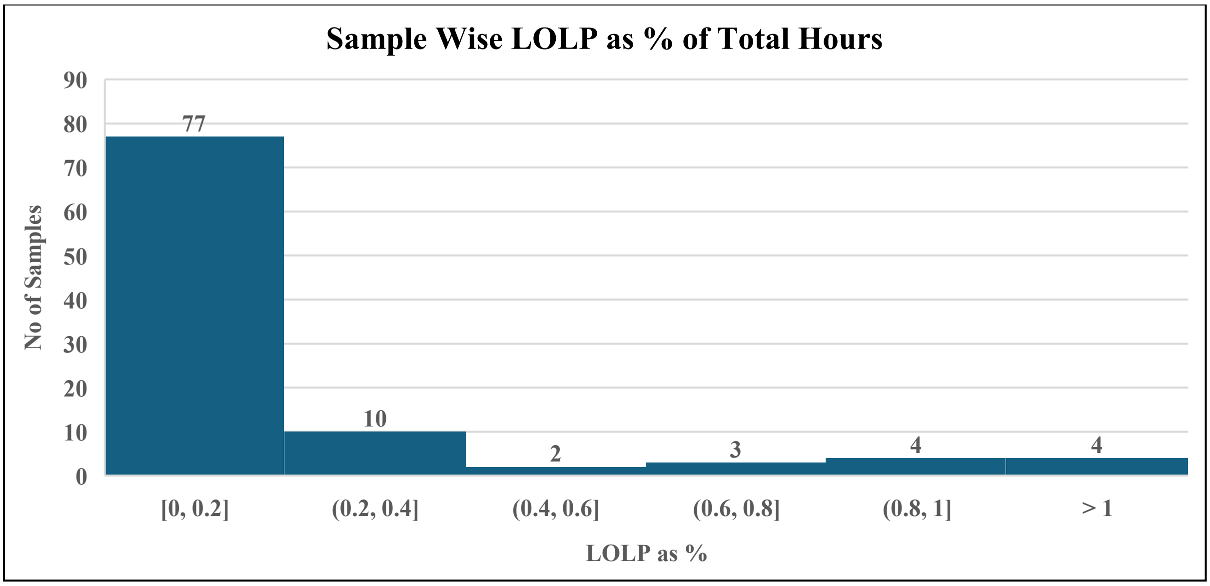


Figure 4.13 Frequency Distribution of LOLP across Samples

As observed in Figure 4.13, a large majority of the observations (77 samples) fall within the 0–0.2% LOLP range, indicating that under most simulated conditions, the power system operates with very high reliability and a negligible probability of supply shortfall, which is under the prescribed LoLP value of 0.2%.

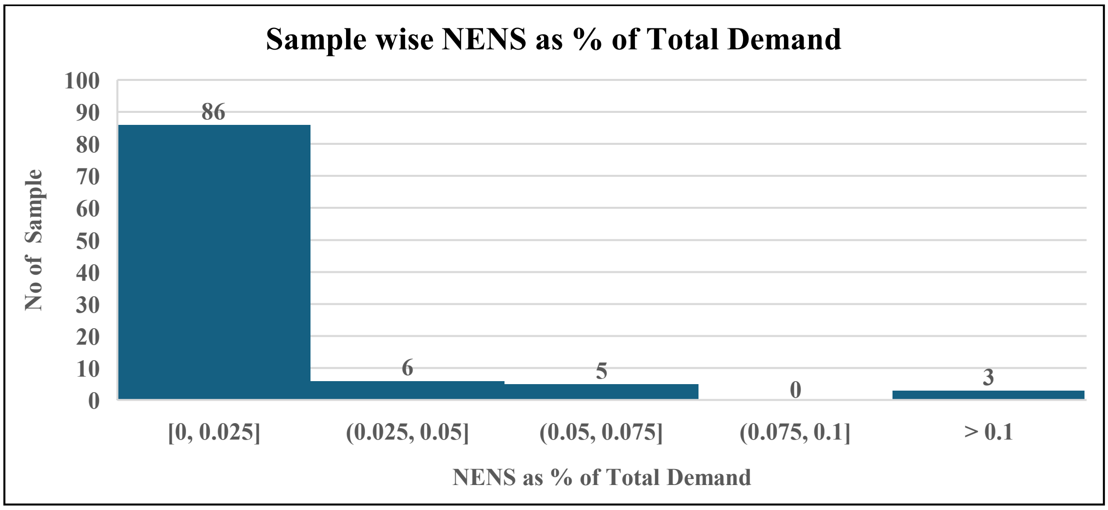


Figure 4.14 Frequency Distribution of NENS across Samples

Figure 4.14 shows the frequency distribution of Normalized Energy Not Served (NENS) across the sampled scenarios. The distribution indicates that most samples experience extremely low levels of unserved energy. A large majority of the observations (92 samples) fall within the 0–0.05% NENS range, indicating that in most cases the system can meet demand with negligible energy shortfall.

Figure 4.15 shows the sample-wise quantum of Unserved energy(MU) observed in the system as a result of the reliability studies. For the majority of the sample runs, the value of Unserved Energy is limited to less than 2000 MU.

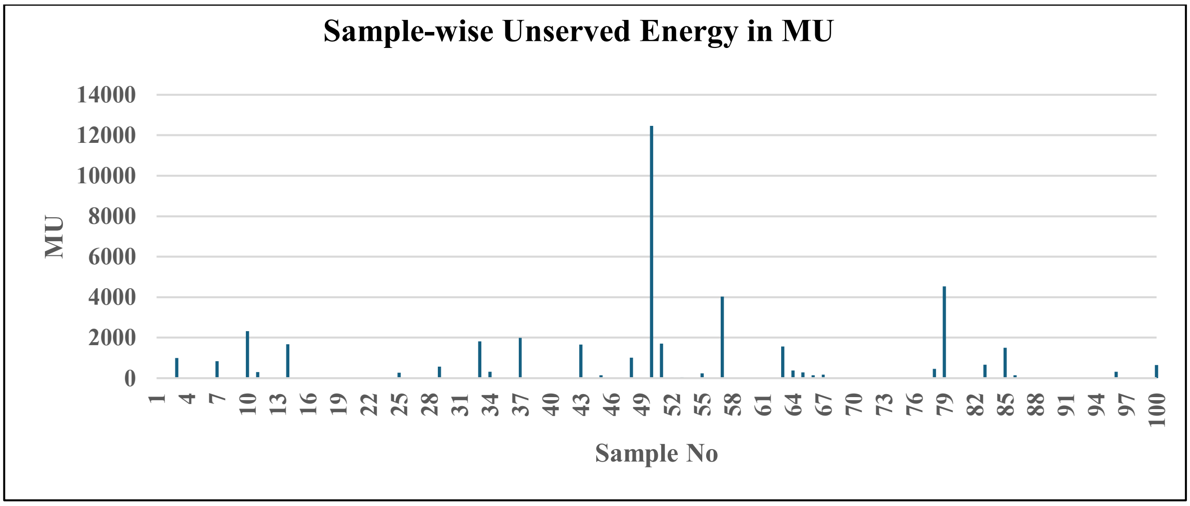


Figure 4.15 Sample-wise Unserved Energy in MU

The summarised results of reliability studies are given in Table 4.3:

Table 4.3 Results of Reliability Analysis

Parameter	2035-36
LoLP - Average(%)	0.18
NENS - (%) - Average	0.01
Max ENS over iterations - MU	12457
Min ENS over iterations - MU	0.00
Max NENS over iterations - %	0.37
Min NENS over iterations - %	0.00
Max LoLP over iterations (% of total hours)	3.52
Min LoLP over iterations(% of total hours)	0.00

The average LoLP for the given capacity mix in 2035-36, as found in reliability studies, is about 0.18%, which is within the prescribed limit of 0.2%. Similarly, the average NENS is 0.01 %, which is also within the prescribed limit of 0.05% as per the RA framework.

4.2 Scenario II: Electricity demand projections as per recent trends

As per the mid term review of 20th EPS, the projected peak electricity demand on an all-India basis in 2024-25 and 2025-26 was 253 GW and 270 GW, respectively. However, the actual peak electricity demand during 2024-25 and 2025-26 (till February 2026) has been 250 GW and 245.44 GW, respectively.

An additional scenario is envisaged for carrying out resource adequacy studies, wherein the recent trend of lower electricity demand growth has been considered. As a part of this scenario, the peak electricity demand and the annual electricity energy requirement projections as projected by the mid-term review of the 20th EPS study (as considered in section 4.1 above) have been shifted by one year for the entire study horizon. This takes into account the lower demand values observed during the year 2025-26 when compared to projections, and the effect of the same on the future electricity demand projections has thus been factored in. Consequently, the peak electricity demand and electrical energy requirement for the period starting from 2026-27 to 2035-36 as part of this scenario have been given in Figure 4.16.

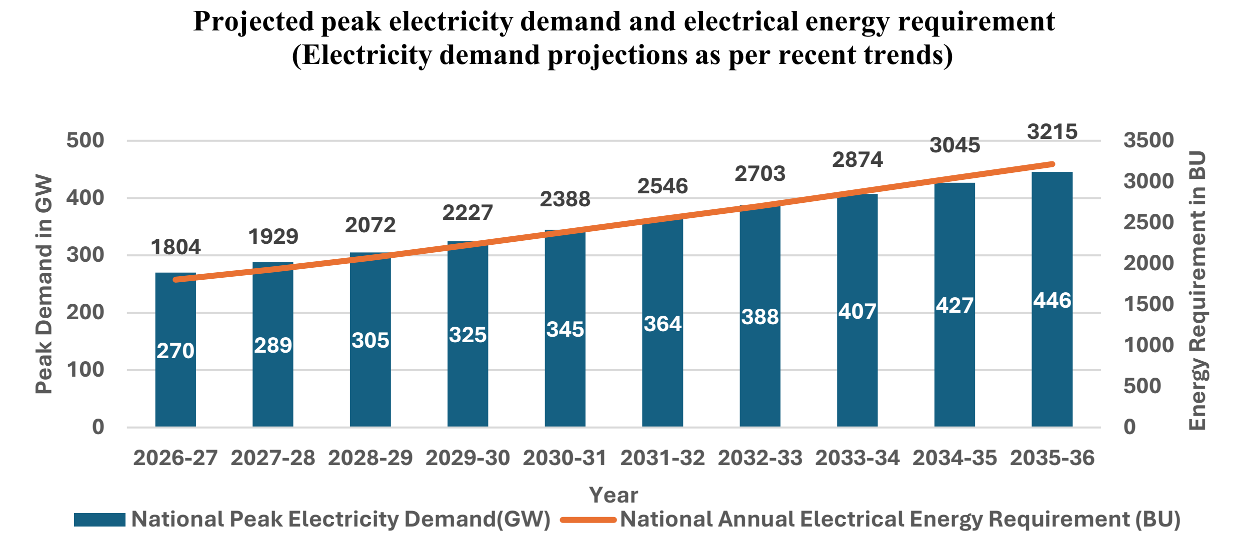


Figure 4.16 Projected peak electricity demand and Electrical Energy requirement

4.2.1 Likely capacity mix for the period of 2026-27 to 2035-36

The year-wise, source-wise projected capacity requirement in this scenario is given in Table 4.4.

Table 4.4 Year-wise Source-wise projected Installed Capacity requirement (Electricity demand projections as per recent trends)

(figures are in GW)

Year	Coal (including Lignite)	Gas	Nuclear	Large Hydro	PV	Wind	Other RE	Total	BESS	PSP
2026-27	237	20	10	48	171	63	17	566	6	5
2027-28	239	20	12	54	201	73	17	616	12	7
2028-29	245	20	12	55	231	83	18	664	12	12
2029-30	260	20	13	58	248	93	18	710	12	15
2030-31	276	20	14	59	269	103	19	760	12	16
2031-32	291	20	16	61	300	113	20	821	15	19

2032-33	299	20	19	64	334	123	20	879	25	29
2033-34	303	20	22	66	369	133	21	934	35	39
2034-35	307	20	22	67	407	144	21	988	47	54
2035-36	314	20	22	76	444	156	22	1054	59	69

It may be noted that in this scenario, the projected peak electricity demand in 2035-36 reduces from 459 GW to 446 GW, while the electrical energy requirement reduces from 3365 BU to 3215 BU. Correspondingly, the total installed capacity requirement in 2035-36 is about 1054 GW compared to 1121 GW in the scenario where demand had been considered as per mid term review of 20th EPS (section 4.1). The requirement of storage in this scenario is lower at about 128 GW compared to 174 GW in the scenario where demand had been considered as per mid term review of 20th EPS (section 4.1).

4.3 Planning Reserve Margin (PRM)

The Planning Reserve Margin (PRM) is a crucial metric in power system planning that ensures the reliability and stability of the electricity grid in terms of contingencies. It represents the extra generation capacity maintained above the expected peak electricity demand to act as a buffer. This additional capacity is essential for handling unforeseen situations such as sudden surges in demand, unplanned power plant outages, or reduced generation from variable renewable sources like solar and wind.

Mathematically, PRM can be expressed as:

PRM (%)=[(Total available firm capacity-peak electricity demand)/Peak electricity demand]×100

It may be noted that in modern power systems, especially those with high renewable energy penetration, the Planning Reserve Margin (PRM) is often categorised into Solar and Non-Solar PRMs to better reflect resource availability throughout the day. Solar PRM refers to the reserve margin maintained during solar hours (typically from 7 AM to 6 PM) when solar generation is abundant. In contrast, non-solar PRM covers the early morning and evening hours, especially the evening peak demand period when solar output drops and the grid relies more on conventional or storage systems. Maintaining adequate non-solar PRM is critical for system reliability, as demand often increases during these hours while the availability of renewables is lower.

4.3.1 Analysis of Year-wise Solar and Non-Solar PRM for Scenario I (electricity demand projections as per mid term review of 20th EPS)

Figure 4.17 illustrates the solar and non-solar hours PRM from 2026-27 to 2035-36 in Scenario I, in which demand projections have been considered as per the mid term review of the 20th EPS report.

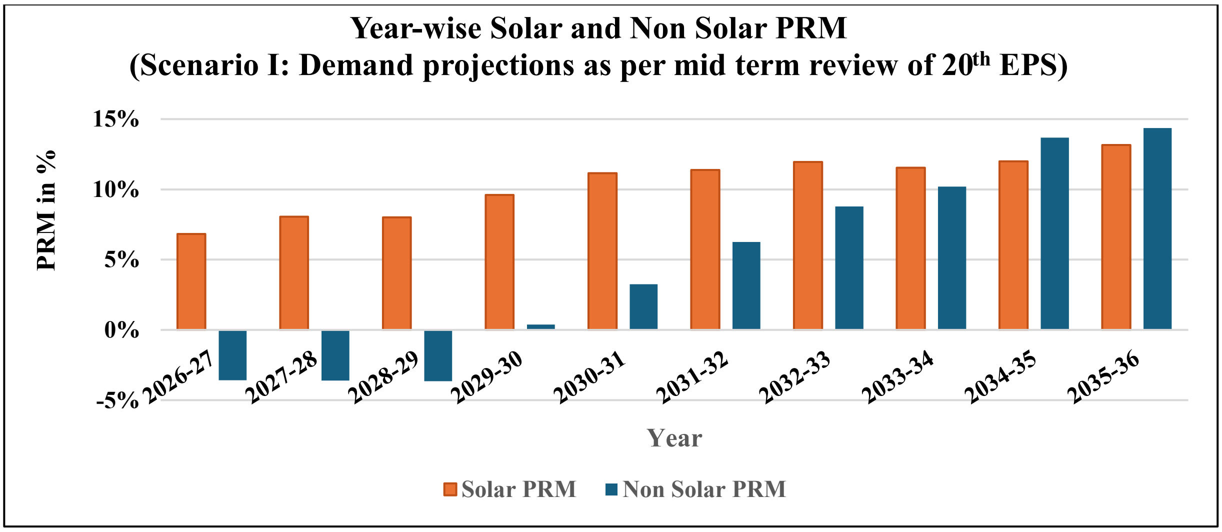


Figure 4.17 Year-wise Solar and Non-Solar PRM in %

- In the initial years (2026-27 to 2029-30), PRM values for solar hours remain relatively low, generally under 10%, with the non- solar hour PRM for 2026-27 to 2028-29 having negative values.

  The negative values of PRM indicate that with the available and upcoming capacity as envisaged, a shortfall is likely in meeting the projected electricity demand in non-solar hours. The following steps are suggested to avoid a shortfall in meeting the electricity demand in non-solar hours:

  - Deferral of Planned maintenance of existing thermal plants during the likely peak demand periods, especially the summer months.
  - Ensuring expeditious completion of plants that are currently under maintenance/overhaul.
  - Ensuring expeditious commissioning of plants envisaged to yield benefits towards meeting demand during the next three years.
  - Ensuring timely commissioning of Energy Storage Systems (PSP and BESS) for providing support during non-solar peak demand hours.

- From 2030–31 onwards, both solar and non-solar PRM begin to rise, reflecting the planned addition of new capacities and improved system adequacy.

- Solar hour PRM reaches a steady level of 13% by 2035–36, while non-solar hour PRM increases more sharply after 2031-32, reaching around 14% by 2035-36.

4.3.2 Analysis of Year-wise Solar and Non-Solar PRM: Scenario II (electricity demand growth as per recent trends)

Figure 4.18 illustrates the solar and non-solar hours PRM from 2026-27 to 2035-36 in the scenario where demand projections have been considered as per recent trends as outlined in Section 4.2.

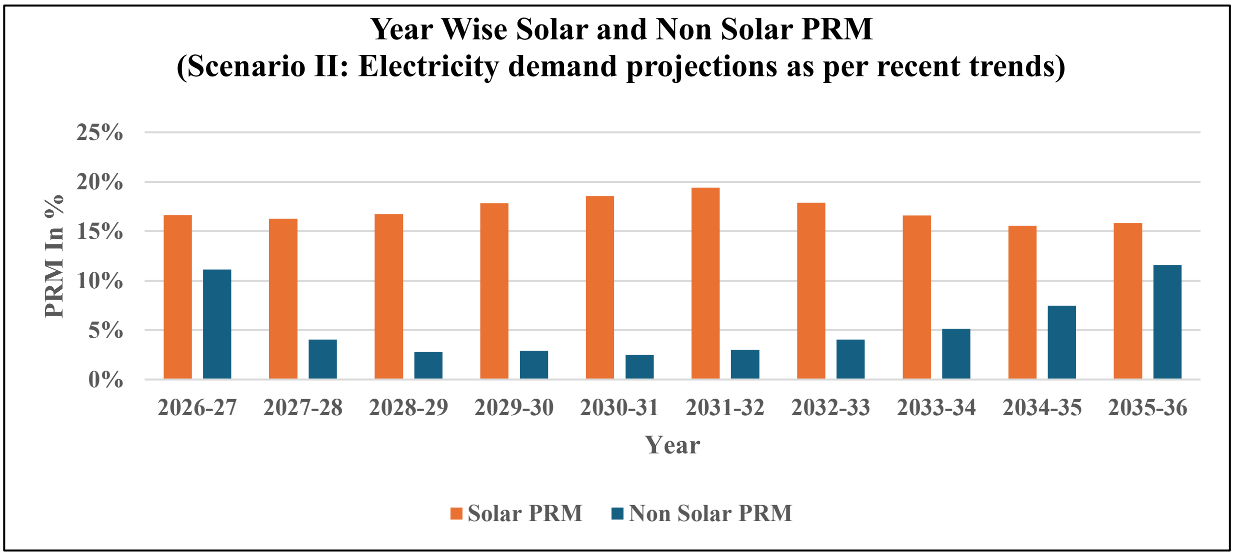


Figure 4.18 Year-wise Solar and Non-Solar PRM in %

As observed in the above figure, in the second scenario (wherein lower electricity demand is envisaged for the study period in line with recent trends), the values of solar and non-solar PRM for the initial years (till 2029-30) improve as compared to the previous scenario. Additionally, the PRM during non-solar hours is no longer negative (as was seen in Fig. 4.17 in the first scenario, with electricity demand projections as per mid term review of 20th EPS) in this case indicating sufficient reserves in the system during non-solar hours to cater to contingency in the forseen demand and supply.

In this case, solar hour PRM is above 15% throughout the study period. During non-solar hours, PRM increases more sharply after 2031-32, reaching ~ 8% by 2035-36. This is primarily due to faster pace of capacity addition of Energy Storage Systems during this period. It is important to note that for having sufficient PRM in the system during non-solar hours, Energy Storage Systems are likely to play an increasingly important role. Therefore, timely deployment of storage assets, both PSP and BESS, are necessary for ensuring adequate PRM during non-solar hours.

As per the RA guidelines [Annexure A of the guidelines], system studies can be undertaken by the States/Utilities to determine the PRM through any scientific method, provided the reliability criteria (LOLP and NENS) are more stringent or as guided by CEA from time to time. The LOLP and NENS values adopted by CEA are 0.2% and 0.05%, respectively, as covered in section 4.3 of this report.

Chapter 5

5.0 Conclusions and Recommendations

This report provides a comprehensive, data-driven roadmap designed to ensure that India's power system is well-equipped to meet the growing electricity demand in a manner that is reliable, sustainable, and cost-effective. The report aligns with the country's clean energy goals by incorporating a balanced mix of fossil and non-fossil fuel-based generation capacity additions along with energy storage solutions.

The resource adequacy study for the period of the next 10 years has been carried out to ensure that adequate capacity is available to meet the country's increasing electricity demand as economic growth and electrification expand. Additionally, the studies focus on reducing the overall cost of electricity supply by promoting the optimal utilisation of available generation resources. Another key benefit is the leveraging of demand diversity across regions through the sharing of resources, which enhances system efficiency and resilience. Importantly, with the rising penetration of renewable energy sources, the reliability of power supply has to be maintained despite the inherent variability and intermittency associated with renewables.

5.1 Conclusions

The installed generation capacity required in 2035-36 has been assessed as 1,121 GW. The detailed study underlying this report highlights the need to expand capacity across multiple energy sources to reliably meet the future electricity demand. Specifically, it estimates the following capacity requirement in 2035-36:

i. Approximately 315 GW of coal-based generation capacity, which will continue to serve as the backbone of the power system for baseload supply. Expansion of gas-based capacity has not been considered due to the limited availability of domestic gas. The existing gas-based capacity of 20 GW would provide flexibility and peaking support. The plan also estimates 22 GW of nuclear power, contributing to low-carbon, reliable baseload generation.

ii. On the renewable front, the report envisages significant capacity expansions to accelerate the clean energy transition. This includes 78 GW of hydroelectric power, which offers both renewable energy and grid balancing capabilities, 509 GW of solar photovoltaic (PV) capacity, and 155 GW of wind power. These renewable sources will substantially reduce the carbon footprint of the power sector while meeting growing electricity demand.

iii. The plan also recognises the need for energy storage systems to shift the energy generated in high RE generation periods for use during low/no RE generation and high demand periods. Specifically, 94 GW of Pumped Storage Plants (PSP) and 80 GW of Battery Energy Storage Systems (BESS) are projected to be added. These energy storage solutions will enhance grid flexibility, ensure smooth integration of renewables, and maintain system reliability. However, it is pertinent to note that the actual trajectory of reduction in the BESS costs, along with actual values of key properties like Depth of Discharge, round-trip losses, degradation trajectories, storage duration, etc., will determine the cost-effectiveness and hence deployment of BESS vis-à-vis PSP systems.

iv. The broad is the visibility of capacity addition till 2035-36 is given below:
- Coal-based capacity of about 41 GW is under construction, about 22.4 GW coal-based capacity is to be shortly taken up for construction, and about 16 GW coal-based capacity is under various stages of planning. Some more capacity is being planned by the States.
- 12.7 GW hydro projects are under construction, and about 17 GW of hydro projects are under different stages of planning.
- 6.6 GW of nuclear projects are under construction, and 7 GW of nuclear projects are under various stages of planning and approval.
- 155 GW of RE Capacity (solar, wind, hybrid, etc.) is under construction, and 48 GW of RE capacity are under tendering. 134 GW RE Capacity is planned to be added under the Green Energy Corridor (Phase III) Scheme. Additional RE Capacity is being planned and to be implemented by the States.
- More than 100 GW of hydro pumped storage projects have been identified, out of which about 7.2 GW is commissioned, 13 GW is under construction, and about 9.5 GW capacity is under an advanced stage of planning and will shortly be taken up for construction. Remaining projects are under Survey & Investigation or at DPR Stage.
- 10.7 GW of BESS capacity is under construction, and about 22 GW is under tendering.

In summary, this report offers a forward-looking, strategic framework that balances capacity additions across fossil and renewable sources, supported by advanced energy storage technologies, to ensure that India's power system can meet future electricity demand with reliability, sustainability, and economic efficiency.

As part of the Resource Adequacy Planning framework, State-wise coincident peak requirement for the next two years (2026-27 and 2027-28) and generator-source-wise capacity credit have been estimated. This will help States and Utilities to plan their capacity procurement accordingly. The peak electricity demand projections for the year 2026-27, as per mid term review of the 20th EPS is 289 GW. The State-wise coincident peak requirements for the financial years 2026-27 and 2027-28 are enclosed in **Annexure D**. The projected peak electricity demand for the year 2025-26 was 270 GW. However, the actual peak electricity demand during the year 2025-26 has been about 245 GW (till February'2026). Subsequently, **Annexure D** also outlines the calculations for the anticipated national peak demand of approximately 270 GW for the year 2026-27, taking into account the recent trend in demand growth.

Further, the State-wise capacity credit for VRE sources (solar and wind) has been estimated and enclosed in **Annexure E.**

A key outcome of the study is the recognition of optimal Planning Reserve Margin (PRM) as a critical reliability metric, with the projected requirement reaching about 13-14% in 2035-36. Incorporating these targets into national and regional planning processes will help ensure that the power system remains resilient under high renewable penetration.

5.2 Recommendations

- **Planned Expansion of Non-Fossil Capacity**

The projections indicate that a substantial increase in non-fossil capacity would be essential to meet the future electricity demand for achieving energy transition goals. Solar PV is likely to increase from about 141 GW in 2025–26 (as on 31.01.26) to around 509 GW by 2035–36, while wind is likely to expand from about 55 GW to 155 GW in 2035-36 and large hydro from 51 GW to nearly 78 GW in the same period. Nuclear installed capacity increases from 8.78 GW to about 22 GW in 2035-36. The overall non-fossil installed capacity would reach approximately 786 GW by 2035-36.

- **Progressive Development of Energy Storage**

With an exponential increase in RE Capacity in the grid, the role of Energy storage systems is likely to become increasingly crucial. Installed capacity of Pumped Storage Projects (PSP) is likely to increase to about 94 GW by 2035-36, while installed capacity of Battery Energy Storage Systems (BESS) is projected to be approximately 80 GW by 2035-36. The installed capacity of BESS at present is about 0.27 GW, and the installed capacity of PSP at present is about 7.2 GW. Out of the commissioned PSPs, 2.58 GW capacity is off-stream (closed loop).

Central Electricity Authority (CEA) unveiled a roadmap in January 2026, aiming for 100 GW of Pumped Storage Projects (PSP) by 2035-36 to support India's renewable energy goals. This plan involves speeding up clearances, promoting off-stream (closed-loop) projects, providing budgetary support, and incentivizing private sector participation.

- **Maintaining Adequate Planning Reserve Margins (PRM)**

PRM is likely to be around 13-14% in 2035-36 in Scenario I. Ensuring adequate planning reserve margins, in conjunction with capacity additions, would help ensure that system adequacy remains aligned with evolving operational requirements.

- **Enhancing Grid Flexibility and Infrastructure**

The integration of large-scale renewable and energy storage capacities would require parallel strengthening of the transmission network. Timely expansion of inter-State and intra-State corridors, along with adoption of smart grid technologies, demand-side response mechanisms, and advanced forecasting systems, would help maintain grid stability under dynamic operating conditions.

- **Ensuring Reliability through Resource Diversity**

With the share of fossil-based generation expected to decline from around 75% in 2025–26 (as on 31st January, 2026) to about 50% by 2035-36, the overall resource mix may increasingly rely on diversified resources such as solar, wind, hydro, nuclear, gas-based generation, coal and energy storage systems to maintain grid reliability. Such diversification could enhance the energy security and resiliency of the power system during the transition period.

- **Critical Role of Coal-based capacity:**

Coal generation is still expected to be the dominant source of energy generation among all the resources. In India's efforts to integrate rapidly growing solar and wind power, coal-fired plants are being reimagined as flexible backbone generators. The minimum operating limit of coal-based plants has been considered as 55% in the studies. Moving forward, incentivising mechanisms to further lower the minimum operating limit and regulatory reforms will be critical to ensure coal's flexibility role to support grid reliability without undermining plant longevity.

- **Focus on Nuclear Capacity Development:**

The Government of India has, under the Union Budget for 2025-26, launched a Nuclear Energy Mission setting a target of 100 GW of nuclear power installed capacity by 2047, a substantial increase from the current 8.8 GW. The government has committed substantial reforms, including amendments to the Atomic Energy Act and the Civil Liability for Nuclear Damage Act, to enable greater private and foreign participation, along with budgetary allocation for research and development of Small Modular Reactors (SMRs), with a goal of operationalising at least five indigenously developed SMRs by 2033 under the Nuclear Energy Mission. Development of Nuclear capacity can secure a stable, clean-energy baseload generation, reduce dependence on fossil fuels, address climate commitments, and support India's long-term energy and infrastructure security. NPCIL is in the process of identifying suitable sites for setting up nuclear power plants corresponding to 100 GW of Nuclear capacity by 2047, and the same will be considered in future studies.

- **Timely tie-up of adequate generation capacity by Discoms/States**

Discoms/States should ensure timely tie-up of adequate generation capacity to reliably meet their contribution towards the national peak demand as well as their own peak electricity demand and electrical energy requirement. Timely tie-up of generation capacity needs to be achieved through a balanced portfolio of long-term power purchase agreements, medium-term contracts, and short-term contracts. Also, timely tie-up of Energy Storage Capacity (PSP and BESS) by the States for providing support during non-solar peak demand hours should be ensured by the States.

- **Contributions to National Peak Demand by States and the Need for Advanced Capacity Planning**

It is pertinent to note that, as mandated by the RA guidelines, all the states are to ensure timely tie-up of adequate generation capacity for meeting their respective designated requirement towards All India peak demand (coincident peak), during both solar and non solar hours.
Moreover, it is seen that more than 50% of the coincident peak requirement is from a few States, viz. Maharashtra, UP, Gujarat, Rajasthan, MP, Tamil Nadu and Karnataka. As these States are the key contributors towards the projected national peak demand during solar or non-solar hours, it is especially important for these states to ensure tie-up of generation capacity, well in advance, towards fulfilling their coincident peak requirements.

For the states with multiple distribution utilities, SLDCs are mandated to determine and enforce the share of each utility in the state's contribution towards the national peak (coincident peak). Accordingly, adequate tie-ups should be planned, but all the utilities should be tied up in a timely manner to fulfil this requirement.

Annexure-A: Projected Electrical Energy Requirement and Peak Electricity Demand as per the midterm review of 20th EPS

Based on the midterm review of the 20th EPS, the year-wise, State-wise energy requirements—including solar rooftop projections—have been incorporated into the study and are given below.

Projected Electrical Energy Requirement (utilities)

(All figures are in MU)

State Name	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36
Andhra Pradesh	104852	120023	136824	155671	175509	196379	219064	243019	266684	293798
Arunachal Pradesh	1178	1242	1309	1378	1436	1492	1560	1630	1701	1753
Assam	14978	15972	17056	18162	19220	20294	21461	22673	23932	25003
Bihar	51479	55014	58638	62215	65523	68646	72031	75331	78519	81318
Chhattisgarh	50124	53692	57317	60805	64016	66987	69966	72729	75240	77611
Delhi	39694	41518	43612	45671	47523	49354	51387	53507	55718	57309
DVC	31391	33079	34791	36522	38267	40018	41769	43513	45243	46680
Goa	5922	6227	6548	6860	7128	7376	7689	7967	8239	8463
Gujarat	172616	189293	208193	229153	250562	272829	296563	321645	346740	365811
Haryana	76158	80574	85151	89547	93616	97469	101259	104747	107998	111042
Himachal Pradesh	15417	16347	17297	18203	19048	19830	20657	21444	22185	22814
Jammu & Kashmir	23372	24559	25780	26966	28096	29176	30346	31501	32633	33576
Jharkhand	18217	19576	20958	22251	23373	24314	25503	26583	27572	28449
Karnataka	110602	119165	128891	139108	149200	159353	171090	182548	194099	205142
Kerala	35279	37008	38954	40892	42541	44151	45968	47836	49762	51157
Madhya Pradesh	117150	123541	130076	136293	141943	147105	153305	158681	163766	168255
Maharashtra	235505	246577	258523	270101	281078	291726	304198	316096	328140	337885
Manipur	1235	1318	1407	1497	1576	1653	1741	1830	1920	1996
Meghalaya	2666	2833	3011	3194	3355	3510	3726	3920	4120	4285
Mizoram	803	847	893	936	970	996	1038	1078	1119	1148
Nagaland	1121	1195	1276	1355	1419	1476	1550	1625	1700	1759
Chandigarh	1900	1972	2059	2145	2203	2258	2326	2395	2467	2520
Odisha	55389	68432	83642	101131	119439	138641	159225	181254	203191	219446
Punjab	79213	82827	86715	90574	94257	97924	101739	105530	109366	112475
Rajasthan	131476	140331	149533	158537	167073	175289	183819	191995	199857	206934
Sikkim	627	658	690	715	733	734	761	787	811	826
Puducherry	4071	4294	4531	4764	4967	5159	5371	5581	5788	5960
Tamil Nadu	148219	159922	173291	187630	201806	216304	231863	248150	264712	280398
Telangana	108125	116497	125099	133444	141376	148870	156694	163925	170661	177219
Tripura	2029	2131	2243	2352	2454	2551	2670	2784	2899	2988
Uttar Pradesh	174613	183871	193478	202804	211149	218991	227440	235559	243387	249997
Uttarakhand	19113	20426	21799	23140	24427	25671	26935	28165	29351	30428
West Bengal	80131	85096	90402	95660	100785	105765	110956	116139	121220	125645
DNH&DD	13923	15270	16619	17941	19198	20362	21521	22569	23482	24499
All India	1929087	2071852	2227157	2388193	2545864	2703271	2873835	3045406	3214921	3365312

Projected Peak Electricity Demand (utilities)

(All Figures are in the MW)

State Name	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36
Andhra Pradesh	17272	19559	22061	24837	27712	32025	35346	38800	42136	44540
Arunachal Pradesh	217	226	236	245	253	259	268	277	286	295
Assam	2914	3068	3235	3403	3557	3710	3877	4048	4224	4412
Bihar	10016	10569	11125	11658	12129	12554	13017	13454	13860	14354
Chhattisgarh	7750	8218	8686	9124	9512	9857	10197	10499	10759	11098
Delhi	9251	9343	9671	9982	10240	10486	10767	11059	11362	11687
DVC	4097	4281	4465	4648	4829	5061	5283	5503	5722	5904
Goa	914	951	1000	1048	1089	1127	1175	1217	1258	1293
Gujarat	29865	31904	34706	37786	40873	45801	49242	52831	56345	57220
Haryana	16100	16800	17514	18173	18749	19267	19759	20181	20548	21127
Himachal Pradesh	2729	2861	2993	3114	3222	3318	3418	3511	3593	3695
Jammu & Kashmir	3813	3964	4117	4262	4395	4517	4651	4780	4903	5045
Jharkhand	2786	2964	3142	3304	3437	3541	3679	3799	3903	4027
Karnataka	20236	21543	23028	24565	26045	28875	30637	32308	33958	34240
Kerala	6022	6247	6503	6752	6949	7136	7351	7571	7794	8013
Madhya Pradesh	21653	22560	23472	24306	25020	27085	27889	28526	29097	28345
Maharashtra	36096	37416	38841	40184	41413	43249	44663	45967	47267	47927
Manipur	312	328	345	361	374	386	401	415	429	446
Meghalaya	484	509	534	560	582	602	632	657	683	711
Mizoram	191	198	206	213	217	220	226	231	236	243
Nagaland	213	224	236	248	256	264	274	284	293	304
Chandigarh	488	498	511	524	530	534	542	550	558	570
Odisha	8672	10463	12662	15159	17728	20380	23181	26138	29027	31349
Punjab	17668	18207	18791	19351	19860	20350	20858	21348	21834	22455
Rajasthan	22256	23494	24762	25971	27078	28110	29171	30154	31068	32168
Sikkim	155	160	165	168	170	168	171	174	177	181
Puducherry	617	644	673	701	723	744	768	790	812	836
Tamil Nadu	22438	23971	25722	27581	29381	31194	33124	35121	37120	39319
Telangana	19953	21240	22539	23761	24882	25902	26955	27884	28708	29812
Tripura	484	501	519	536	551	564	582	598	615	633
Uttar Pradesh	34379	35141	36519	37810	38890	39852	40900	41866	42758	43919
Uttarakhand	3347	3537	3732	3917	4090	4251	4413	4565	4707	4880
West Bengal	13838	14316	15043	15746	16412	17040	17689	18324	18929	19620
DNH&DD	1786	1943	2097	2264	2422	2569	2715	2847	2963	3091
All India	**288602**	**305339**	**324845**	**344797**	**363889**	**387681**	**407464**	**426941**	**445729**	**459421**

Annexure-B: List of Under Construction and Candidate Projects

List of under construction Thermal Projects

Sl. No.	Project Name / Implementing Agency	Sector	State	Unit No.	Capacity (MW)	Anticipated Commissioning
F Y. 2025-26						
1	Yadadri TPS (TSGENCO)	State	Telangana	U-3	800	Mar-26
2	Sagardighi TPP St-III (WBPDCL)	State	West Bengal	U-5	660	Mar-26
3	Udangudi STPP St-I (TNGENCO)	State	Tamil Nadu	U-1	660	Mar-26
				Sub-Total	**2120**	
F Y. 2026-27						
4	Ghatampur TPP (NUPPL)	Central	Uttar Pradesh	U-3	660	Jun-26
5	Patratu STPP (PVUNL)	Central	Jharkhand	U-2	800	Jun-26
6	Malibrahamani TPP(JPL)	Private	Odisha	U-2	525	Apr-26
7	Yadadri TPS (TSGENCO)	State	Telangana	U-5	800	Jun-26
8	Udangudi STPP St-I (TNGENCO)	State	Tamil Nadu	U-2	660	Jun-26
9	Buxar TPP (SJVN)	Central	Bihar	U-2	660	Jun-26
10	Korba TPP. Ph-II (Lanco Amarkantak TPP), M/s Adani Power Ltd	Private	Chhattisgarh	U-3	660	Jun-26
11	Singhitarai TPP(M/s Vedanata)	Private	Chhattisgarh	U-2	600	Nov-26
12	Mahan STPP, St-II (Mahan Energen)	Private	M. P.	U-3	800	Jan-26
13	Patratu STPP (PVUNL)	Central	Jharkhand	U-3	800	Feb-27
14	Ennore SCTPP (TANGEDCO)	State	Tamil Nadu	U-1	660	Feb-27
15	Ennore SCTPP (TANGEDCO)	State	Tamil Nadu	U-2	660	Mar-27
16	Korba TPP. Ph-II (Lanco Amarkantak TPP), M/s Adani Power	Private	Chhattisgarh	U-3	660	Mar-27
				Sub-Total	**8945**	
F Y. 2027-28						
17	Mahan STPP, St-II (Mahan Energen)	Private	M. P.	U-4	800	Jun-27
18	Talcher TPP St-III (NTPC)	Central	Odisha	U-1	660	Sep-27
19	Raipur Ext TPP, Ph-II /Adani Power	Private	Chhattisgarh	U-3	800	Jan-28
20	Raigarh USCTPP, St-II/ Adani Power	Private	Chhattisgarh	U-2	800	Jan-28
21	Talcher TPP St-III (NTPC)	Central	Odisha	U-2	660	Mar-28
22	Lara STPP St-II (NTPC)	Central	Chhattisgarh	U-3	800	Mar-28
				Sub-Total	**4520**	
F Y. 2028-29						

Sl. No.	Project Name / Implementing Agency	Sector	State	Unit No.	Capacity (MW)	Anticipated Commissioning
23	Lara STPP St-II (NTPC)	Central	Chhattisgarh	U-4	800	Sep-28
24	Raipur Ext TPP, Ph-II /Adani Power	Private	Chhattisgarh	U-4	800	Jul-28
25	Raigarh USCTPP, St-II/ Adani Power	Private	Chhattisgarh	U-3	800	Jul-28
26	Koderma TPS, St-II/ DVC	Central	Jharkhand	U-1	800	Aug-28
27	Koderma TPS, St-II/ DVC	Central	Jharkhand	U-2	800	Dec-28
28	Raghunathpur TPS, Ph-II/DVC	Central	W. B.	U-3	660	Dec-28
29	Singareni TPP, Ph-II/SCCL	State	Telangana	U-3	800	Feb-29
				Sub-Total	**5460**	
			F Y. 2029-30			
30	Raghunathpur TPS, Ph-II/DVC	Central	W. B.	U-4	660	Apr-29
31	Singrauli STPP, St-III (NTPC)	Central	UP	U-8	800	May-29
32	Koradi TPS, St-V (MSPGCL)	State	Maharashtra	U-11	660	May-29
33	Nabinagar STPP, St-II (NTPC)	Central	Bihar	U-4	800	Jul-29
34	Korba(W) SCTPP (CSPGCL)	State	Chhattisgarh	U-1	660	Jul-29
35	Mahan STPP, St-III (Mahan Energen)	Private	M. P.	U-5	800	Aug-29
36	DCR TPP Ext., /HPGCL	State	Haryana	U-1	800	Sep-29
37	Sipat STPP, St-III (NTPC)	Central	Chhattisgarh	U-6	800	Sep-29
38	Ukai TPP/GSECL	State	Gujarat	U-7	800	Sep-29
39	Gadarwara STPP, Ph-II(NTPC)	Central	M. P.	U-3	800	Sep-29
40	Koradi TPS, St-V (MSPGCL)	State	Maharashtra	U-12	660	Nov-29
41	Nabinagar STPP, St-II (NTPC)	Central	Bihar	U-5	800	Jan-30
42	Korba(W) SCTPP (CSPGCL)	State	Chhattisgarh	U-2	660	Jan-30
43	Singrauli STPP, St-III (NTPC)	Central	UP	U-9	800	Feb-30
44	Mahan STPP, St-III (Mahan Energen)	Private	M. P.	U-6	800	Feb-30
45	TALABIRA TPP (NLC)	Central	Odisha	U-1	800	Feb-30
46	Gadarwara STPP, Ph-II(NTPC)	Central	M. P.	U-4	800	Mar-30
47	Amarkantak TPS (MPPGCL)	State	M. P.	U-3	660	Mar-30
48	Satpura TPS,(MPPGCL)	State	M. P.	U-12	660	Mar-30
				Sub-Total	**14220**	
			F Y. 2030-31			
49	Nabinagar STPP, St-II (NTPC)	Central	Bihar	U-6	800	Jul-30
50	Talabira TPP (NLC)	Central	Odisha	U-2	800	Aug-30
51	Darlipalli STPP, St-II (NTPC)	Central	Odisha	U-2	800	Jan-31

Sl. No.	Project Name / Implementing Agency	Sector	State	Unit No.	Capacity (MW)	Anticipated Commissioning
52	Talabira TPP (NLC)	Central	Odisha	U-3	800	Feb-31
53	Akaltara TPP(JSW Energy)	Private	Chhattisgarh	U-4,5&6	1800	Mar-31
				Sub-Total	**5000**	
			F Y. 2031-32			
54	Binjkote TPP (Sharda Energy & Mineral)	Private	Chhattisgarh	U-3&4	600	Mar-32
				Sub-Total	**600**	
				Grand Total	**40865**	

Thermal Projects Awarded -to be taken up for Construction (As on 31.01.2026)						
Sl.No	**Name of Project**	**Sector**	**Developer**	**State**	**Unit Size**	**Total capacity (MW)**
1	Kawai	Private	Adani	Rajasthan	4x800	3200
2	Mirjapur TPS	Private	Adani	Uttar Pradesh	2x800	1600
3	Telangana Stage II	Central	NTPC	Telangana	3x800	2400
4	Salboni STPP Ph-I	Private	JSW	West Bengal	2x800	1600
5	Pirpanthi TPS	Private	Adani Power	Bihar	3x800	2400
6	Torent Power	Private	Torent Power	Madhya Pradesh	2x800	1600
7	Anuppur TPS Ph II	Private	M B Power	Madhya Pradesh	1x800	800
8	Adani Power Ltd. Anuppur TPP	Private	Adani Power	Madhya Pradesh	2x800	1600
9	Meja-II	Central	NTPC-UP-JV	Uttar Pradesh	3x800	2400
10	Assam TPP	Private	Adani Power	Assam	4x800	3200
11	Salboni STPP Ph-II	Private	JSW	West Bengal	2x800	1600
					Total	**22,400**

Thermal Projects under various stages of Bidding (as on 31.01.2026)						
S.No	**Name of Project**	**Sector**	**Developer**	**State**	**Unit Size**	**Total capacity (MW)**
1	Durgapur TPS Ph-III	Central	DVC	West Bengal	1x800	800
2	Lara TPP Ph-III	Central	NTPC	Chhattisgarh	2x800	1600
3	IB Valley Extn St-III, (U#5 & 6)	State	OPGC	Odisha	2x660	1320
4	Chandrapura Extn TPS	Central	DVC	Jharkhand	2x800	1600
	Total					**5,320**

List of under-construction Hydro Plants & PSP

Hydro

Sl. No.	Name of the Project (Executing Agency)	State / UT	District	Unit Size	Cap. Under Execution (MW)	River/Basin	Anticipated commissioning
	Central Sector						
	NHPC						
1	Subansiri Lower (NHPC)	Arunachal Pradesh/Assam	Lower Subansiri, Ar. Pradesh / Dhemaji, Assam	6x250	1500.00	Subansiri/ Brahmaputra	2026-27 # (Aug'26)
2	Dibang Multipurpose Project (NHPC)	Arunachal Pradesh	Lower Dibang Valley	12x240	2880.00	Dibang/Brah maputra	2031-32 (Feb'32)
3	Teesta St. VI NHPC	Sikkim	South Sikkim	4x125	500.00	Teesta/Brah maputra	2027-28 (Dec'27)
4	Rangit-IV (NHPC)	Sikkim	West Sikkim	3x40	120.00	Rangit/ Teesta/ Brahmaputra	2026-27 (Apr'26)
5	Ratle (RHEPPL / NHPC)	UT of Jammu & Kashmir	Kishtwar	4x205 + 1x30	850.00	Chenab/Indus	2028-29 (Nov'28)
	CVPPL						
6	Pakal Dul (CVPPL)	UT of Jammu & Kashmir	Kishtwar	4x250	1000.00	Marusadar/ Chenab / Indus	2026-27 (Dec'26)
7	Kiru (CVPPL)	UT of Jammu & Kashmir	Kishtwar	4x156	624.00	Chenab/ Indus	2026-27 (Dec'26)
8	Kwar (CVPPPL)	UT of Jammu & Kashmir	Kishtwar	4x135	540.00	Chenab/Indus	2027-28 (Mar'28)
	SJVN						
9	Luhri-I (SJVN)	Himachal Pradesh	Kullu/Shi mla	2x80+2 x25	210.00	Satluj/Indus	2029-30 (Feb'30)
10	Dhaulasidh (SJVN)	Himachal Pradesh	Hamirpur/ Kangra	2x33	66.00	Beas/Indus	2026-27 (Mar'27)
11	Sunni Dam (SJVN)	Himachal Pradesh	Shimla/Ma ndi	4x73+1 x73+1x 17	382.00	Satluj/Indus	2029-30 (Dec'29)
	THDC						
12	Vishnugad Pipalkoti (THDC)	Uttarakhand	Chamoli	4x111	444.00	Alaknanada/ Ganga	2027-28 (Sept'27)
	NTPC						
13	Tapovan Vishnugad (NTPC)	Uttarakhand	Chamoli	4x130	520.00	Dhauliganga /Alaknanada & /Ganga	2028-29 (Mar'29)

Sl. No.	Name of the Project (Executing Agency)	State / UT	District	Unit Size	Cap. Under Execution (MW)	River/Basin	Anticipated commissioning
14	Rammam-III (NTPC)	West Bengal	Darjeeling	3x40	120.00	Rammam/ Rangit/Teesta Brahmaputra	2028-29 (Mar'29)
	NEEPCO						
15	HEO	Arunachal Pradesh	West Siang	3x80	240.00	Yarjep River	2029-30 (Sept'29)
16	Tato-I	Arunachal Pradesh	Shi-Yomi	3x62	186.00	Siyom River	2029-30 (Sept'29)
Sub-Total: Central Sector					**10182.00**		
	State Sector						
	APGENCO						
17	Polavaram (APGENCO/ Irrigation Dept., A.P.)	Andhra Pradesh	East & West Godavari	12x80	960.00	Godavari/EFR	2027-28 (Jan'28)
18	Lower Sileru Extension (APGENCO)	Andhra Pradesh	Alluri Sitharamaraju	2x115	230.00	Sileru/Godavari	2026-27 (Apr'26)
	HPPCL						
19	Shongtong Karcham (HPPCL)	Himachal Pradesh	Kinnaur	3x150	450.00	Satluj/ Indus	2028-29 (Sep'28)
20	Chanju-III (HPPCL)	Himachal Pradesh	Chamba	3x16	48.00	Chanju Nallah	2027-28 (Dec'27)
	KSEB						
21	Mankulam (KSEB)	Kerala	Idukki	2x20	40.00	Melachery	2027-28 (Nov'27)
	APGCL						
22	Lower Kopli (APGCL)	Assam	Dima Hasao & Karbi Anglong	2x55+2x2.5+1x5	120.00	Kopili/Brahmaputra	2025-27## (Apr'26)
	JKSPDC						
23	Parnai (JKSPDC)	UT of Jammu & Kashmir	Poonch	3x12.5	37.50	Jhelum/ Indus	2027-28 (Dec'27)
	PSPCL		Poonch				
24	Shahpurkandi (PSPCL/ Irrigation Deptt., Pb.)	Punjab	Pathankot	3x33+3x33+1x8	206.00	Ravi/ Indus	2027-28 (May'27)
	UJVNL						
25	Lakhwar Multipurpose Project (UJVNL)	Uttarakhand	Dehradun & Tehri Garhwal	3x100	300.00	Yamuna	2031-32 (Dec'31)
Sub-Total: State Sector					**2391.50**		

Sl. No.	Name of the Project (Executing Agency)	State / UT	District	Unit Size	Cap. Under Execution (MW)	River/Basin	Anticipated commissioning
	Private Sector						
	JSW						
26	Tidong-I (JSW)	Himachal Pradesh	Kinnaur	3x50	150.00	Tidong/Satluj/Indus	2026-27 (Jul'26)
Sub-Total: Private Sector					**150.00**		
	Total:				**12723.50**		
# Unit-2 (250MW)& Unit-3 (250MW) have been commissioned during Dec'25 to Jan'26, and the remaining 2 units (500 MW) likely during 2025-26, 4 units (1000 MW) likely during 2026-27.							
##2 units (110 MW) likely during 2025-26, 3 units (10 MW) likely during 2026-27.							
Note: Presently, 26 no. of hydro electric project (above 25 MW) totalling 12723.50 MW are under construction.							

PSP

Sl. No.	Name of the Project (Executing Agency)	State / UT	District	I.C. (No. x MW)	Cap. Under Execution(MW)	River/Basin	Anticipated commissioning
	Central Sector						
	THDC						
1	Tehri PSS (THDC)	Uttarakhand	Tehri Garhwal	1x250	250.00	Bhilangna/ Bhagirathi/ Ganga	2025-26 (Mar'26)*
Sub-Total: Central Sector					**250.00**		
	State Sector						
	APGENCO						
2	Upper Sileru PSP (APGENCO)	Andhra Pradesh	Alluri Sitharamaraju	9x150	1350.00	Sileru/Godavari	2028-29 (Feb'29)
	KPCL						
3	Sharavathy Pumped Storage Project	Karntaka	Upper dam (Shimoga) & Lower dam (Uttara Kannada)	8x250	2000.00	Sharavathy /WFR	2032-33 (May'32)
	TANGEDCO						
4	Kundah Pumped Storage Phase I, II, II&III)	Tamil Nadu	Nilgiris	4x125	500.00	Kundah/Bhavani/ Cauvery/EFR (Off Stream)	2026-27 (Sept'26)
Sub-Total: State Sector					**3850.00**		

Sl. No.	Name of the Project (Executing Agency)	State / UT	District	I.C. (No. x MW)	Cap. Under Execution (MW)	River/ Basin	Anticipated commissioning
	Private Sector						
5	MP30 Gandhi Sagar Pumped Storage Project (Greenko MP01 IREP Private Limited)	Madhya Pradesh	Neemuch	7x240 + 2x120	1920.00	Off stream	2026-27 (Dec'26)
6	Chitravathi PSP(M/s Adani Renewable Energy Forty-Two Limited)	Andhra Pradesh	Satya Sai	2x250	500.00	Chitravathi River (Off Stream)	2026-27 (Dec'26)
7	Bhivpuri PSP(M/s Tata Power Company Limited)	Maharashtra	Raigad	4x200 + 2x100	1000.00	Off stream	2028-29 (Feb'29)
8	Saundatti PSP (M/s Greenko KA01 IREP Private Limited)	Karnataka	Belagavi	320x4+160 x2	1600.00	Off stream	2027-28 (Dec' 2027)
9	Bhavali PSP (M/s JSW Energy PSP Two Limited)	Maharashtra	Nashik & Thane	5x250+2x125	1500.00	Dharna, Ulhas (Off Stream)	2028-29 (Dec' 2028)
10	Gandikota PSP (M/s Adani Renewable Energy Fifty-One Limited)	Andhra Pradesh	Kadapa	4x250	1000.00	Penna River (Off Stream)	2028-29 (Mar' 2029)
11	Tarali PSP (M/s Adani Renewable Energy One Limited -AREIL)	Maharashtra	Satara	300x4 +150x2	1500.00	Tarali River (Off Stream)	2029-30 (Jun' 2029)
Sub-Total: Private Sector					**9020.00**		
Total:					**13120.00**		
Note: Presently 11 no. of Pumped Storage projects (above 25 MW) totalling 13120 MW are under implementation.							
***Out of total four units three units of Tehri PSP(750 MW) have been commissioned during June-December,2025**							

LIST OF CANDIDATE HYDRO PLANTS (till 2035-36)

Sl. No.	Name of the project	Type	Sector	State	Capacity (MW)	Likely Commissioning year
1	Uri-I stage-II	RoR	Central	J&K	240	2029-30
2	Dulhasti Stage-II	RoR	Central	J&K	260	2029-30
3	Attunli	ROR	Central	Arunachal Pradesh	680	2030-31
4	Tato-II	ROR	Central	Arunachal Pradesh	700	2031-32
5	Kirthai-II	RoR	Central	J&K	820	2031-32
6	Kalai-II	ROR	Central	Arunachal Pradesh	1200	2031-32
7	Naying	ROR	Central	Arunachal Pradesh	1000	2032-33
8	Teesta Stage-IV	ROR	Central	Sikkim	520	2032-33
9	Etalin	ROR	Central	Arunachal Pradesh	3097	2033-34
10	Sawalkote	ROR	Central	J&K	1856	2033-34
11	Kamala (Subansiri Middle)	ROR	Central	Arunachal Pradesh	1720	2033-34
12	Subansiri Upper	ROR	Central	Arunachal Pradesh	1605	2034-35
13	Kurung	ROR	Central	Arunachal Pradesh	320	2035-36
14	New Ganderbal	RoR	State	J&K	93	2029-30
15	Teesta Intermediate	RoR	State	West Bengal	90	2030-31
16	Thana Plaun	RoR	State	Himachal Pradesh	191	2031-32
17	Idukki Extension Scheme	ROR	State	Kerala	800	2034-35
18	Mynthdu Leshka Stage-II	ROR	State	Meghalaya	210	2035-36
19	Anjaw	ROR	Private	Arunachal Pradesh	270	2034-35
20	Demwe Upper St-I	ROR	Private	Arunachal Pradesh	270	2034-35
21	Niare	ROR	Private	Arunachal Pradesh	909	2034-35
22	Oju	ROR	Private	Arunachal Pradesh	2220	2035-36
23	Emra-II	ROR	Private	Arunachal Pradesh	315	2035-36
	Total				**19386**	

Note: a list of candidate PSP plants for the studies has been considered as per the "Roadmap to 100 GW PSP by 2035-36" released by CEA in January 2026. The same is available on CEA's website (cea.nic.in)

List of Nuclear Plants

Sl. No.	Unit	State	Unit No.	Type of Reactor	Capacity (MW)	Anticipated Commissioning date
UNDER CONSTRUCTION PROJECTS						
1	Rajasthan Atomic Power Station (RAPS)	Rajasthan	8	PHWR	700	Mar-26
2	Kudankulam Nuclear Power Plant	Tamil Nadu	3	LWR	1000	Mar-26
3	Kudankulam Nuclear Power Plant	Tamil Nadu	4	LWR	1000	Nov-26
4	Kalpakkam PFBR	Tamil Nadu		FBR	500	Dec-26
5	Kudankulam Nuclear Power Plant	Tamil Nadu	5	LWR	1000	Jun-29
6	Kudankulam Nuclear Power Plant	Tamil Nadu	6	LWR	1000	Mar-30
7	Gorakhpur HAVP (GHAVP)	Haryana	1	PHWR	700	Mar-31
8	Gorakhpur HAVP (GHAVP)	Haryana	2	PHWR	700	Mar-32
				TOTAL	**6600**	
PROJECTS ACCORDED ADMINISTRATIVE APPROVAL						
1	Kaiga Nuclear Power Plant	Karnataka	5	PHWR	700	Mar-31
2	Kaiga Nuclear Power Plant	Karnataka	6	PHWR	700	Mar-32
3	Gorakhpur HAVP (GHAVP)	Haryana	3	PHWR	700	Mar-32
4	Gorakhpur HAVP (GHAVP)	Haryana	4	PHWR	700	Mar-32
5	Chutkha (CHAMPP)	Madhya Pradesh	1	PHWR	700	Mar-32
6	Chutkha (CHAMPP)	Madhya Pradesh	2	PHWR	700	Mar-32
7	Mahi Banswara (MBAPP)	Rajasthan	1	PHWR	700	Mar-32
8	Mahi Banswara (MBAPP)	Rajasthan	2	PHWR	700	Mar-32
9	Mahi Banswara (MBAPP)	Rajasthan	3	PHWR	700	Mar-32
10	Mahi Banswara (MBAPP)	Rajasthan	4	PHWR	700	Mar-32
				TOTAL	**7000**	

Note: The status of generation projects is as of 31st January, 2026. As data for the study had been finalised earlier, there may be some differences in the phasing of generation projects as per the study results. Further, generation projects to be commissioned in the latter part of a financial year have been considered for benefits in the subsequent year, as far as the study is concerned.

Annexure-C: Assumptions and Inputs in the Study

The resource adequacy studies are based on a set of technical and financial assumptions to ensure consistency and comparability of results. Technical assumptions include projected peak electricity demand, electrical energy requirements, renewable generation profiles, conventional generation availability, and transmission network parameters. Financial assumptions cover capital and operational costs of generation and storage technologies, fuel prices, and the cost of transmission augmentation. These assumptions provide a framework for evaluating system adequacy, reliability, and investment needs over the planning horizon, while recognising that deviations in actual conditions may influence the outcomes.

Technical Parameters

Technology	Type	Availability (%)	Ramping (% of Installed Capacity/min)	Minimum Technical (%)
Coal/ Lignite	Existing/Planned	85	1	55
	Candidate	85	1	55
Gas	Existing	90	3	40
Nuclear	Existing/Planned	68	Const. Load	-
Biomass	Existing/Planned	60	1	50
Hydro	Existing/Planned/	As per the available hourly generation profile	10	-
Solar	Existing/Planned		-	-
	Candidate		-	-
Wind	Existing/Planned		-	-
	Candidate		-	-
Pumped Storage Projects	Existing/Planned	95	10	-
	Candidate		10	-
Battery Energy Storage System	Existing/Planned/ Candidate	98	NA	-

Technology	Type	Heat Rate (MCal/MWh)		Auxiliary Consumption (%)
		At max loading	At min loading (55%)	
Coal	Existing /Planned	2300 to 2879	2438 to 3052	7.0
	Candidate (SC & USC)	2060 to 2125	2183 to 2253	6.5
Gas	Existing	2000 to 2900	2260 to 3277	2.5
Nuclear	Existing/ Planned	2777	2777	10
	Candidate	2777	2777	10
Biomass	Existing/ Planned	4200	4450	8
	Candidate	4200	4450	8
Hydro	Existing/ Planned	-	-	0.7
	Candidate	-	-	0.7

Pumped Storage Projects	Existing/ Planned	-	-	Round-trip efficiency 80%
	Candidate	-	-	
BESS	Candidate	-	-	Round-trip efficiency 88%

Transmission Modelling

The study has been conducted with a simplistic representation of the transmission network where states have been represented as individual nodes connected through interstate lines. The State-wise demand profile and RE generation profile have been considered corresponding to the individual State node. As States have been treated as a single node, the modelling of the intra-State network is beyond the scope of the study.

Financial Parameters

The following cost parameters for Candidate generators have been assumed:

Resource	**Capex* (in ₹ Cr/MW)**	**O&M Fixed Cost (in ₹/MW/Year)**	**Construction Time (in years)**	**Amortization /Lifetime (in years)**
Coal	12 Cr/MW	30 Lakhs	4	25
Solar PV	4.5 Cr/MW to 4.0 Cr/MW	1 % of Capex	1	25
Wind (Onshore)	7.5 Cr/MW	1% of Capex	2	25
BESS (4 hour)	5 Cr/MW to 3.6 Cr/MW	1 % of Capex	1	15
PSP (6 hours)	5 Cr/MW	30 Lakhs	4	40
Hydro	As provided in DPR	30 Lakhs	5	40

- Solar PV cost trajectory has been assumed to reduce from INR 4.5 Cr/MW in 2025-26 to INR 4.0 Cr/ MW in 2035-36
- BESS cost trajectory has been assumed to reduce from INR 5 Cr/MW in 2025-26 to INR 3.6 Cr/ MW in 2035-36

State-wise RE potential, Demand, and RE Profile

State-wise renewable energy potential has been considered based on MNRE projections as well as connectivity applications. Similarly, State-wise RE profile has been considered based on the historical generation profile for the last 2 years. For the study, the state-wise demand profile for the FY 2024-25 has been considered.

Cost of transmission system

- Cost of Transmission System associated with RE:

State	Transmission Cost (Rs. Cr/MW)
Rajasthan	3
Gujarat	1.5
Andhra Pradesh	1
Karnataka	1
Maharashtra	1.5
Madhya Pradesh	1.5
Tamil Nadu	1

Cost beyond 2030 for Rajasthan and Gujarat has been considered as Rs 4.2 Cr/MW associated with the HVDC System.

- Transmission cost for Pit head coal-based plants: Rs 1 Cr/MW
- Transmission cost for Load centre coal-based plants: Rs 0.5 Cr/MW
- Transmission cost for hydro plants: Rs 1 Cr/MW

Degradation in the heat rate of coal-based generating units

Cost of degradation of heat rate of coal-based units from full load to part load (approx.INR 0.20/kWh) has been added to RE.

Degradation of BESS:

As witnessed in the recent tenders of BESS, Annual Capacity Degradation to the extent of 2.5% has been considered for BESS and factored into the cost of BESS.

Annexure-D: State-wise Projected Coincident Peak

State-wise Projected Coincident Peak (Solar & Non-Solar Hours) in FY 2026-27 (Corresponding to the projected peak demand as per mid term review of the 20th EPS)

(refer to Chapter 4 Scenario I)

State	Coincident peak Solar Hours (MW)	Coincident peak Non-Solar Hours (MW)
Andhra Pradesh	15240	13181
Arunachal Pradesh	155	154
Assam	1739	2461
Bihar	7535	9009
Chhattisgarh	6562	6357
Delhi	7777	8071
DVC	3664	3798
Goa	721	751
Gujarat	26947	23928
Haryana	12888	12475
Himachal Pradesh	2232	2064
Jammu & Kashmir	3209	2831
Jharkhand	2417	2553
Karnataka	18635	12037
Kerala	3956	4507
Madhya Pradesh	19392	14737
Maharashtra	33985	31601
Manipur	162	167
Meghalaya	306	306
Mizoram	104	111
Nagaland	142	152
Chandigarh	430	411
Odisha	7598	7762
Punjab	14634	13454
Rajasthan	20746	16646
Sikkim	107	77
Puducherry	512	567
Tamil Nadu	18577	18800
Telangana	17025	11208
Tripura	241	375
Uttar Pradesh	30430	32506
Uttarakhand	2651	2763
West Bengal	11397	12580
(DNH & DD)	1661	1665
Sum of all the States-UTs	293770	270065
All India Projected Peak Demand (Solar/Non-Solar)	288602	270318

State-wise Projected Coincident Peak (Solar & Non-Solar Hours) in FY 2027-28 (Corresponding to the projected peak demand as per mid term review of the 20th EPS)
(refer to Chapter 4 Scenario I)

State	Coincident peak Solar Hours (MW)	Coincident peak Non-Solar Hours (MW)
Andhra Pradesh	17332	14954
Arunachal Pradesh	161	161
Assam	1833	2596
Bihar	7943	9512
Chhattisgarh	7004	6750
Delhi	7836	8158
DVC	3833	3969
Goa	754	783
Gujarat	28768	25723
Haryana	13432	13047
Himachal Pradesh	2342	2179
Jammu & Kashmir	3400	2991
Jharkhand	2571	2717
Karnataka	19894	12886
Kerala	4132	4690
Madhya Pradesh	20177	15427
Maharashtra	35184	32802
Manipur	172	177
Meghalaya	326	326
Mizoram	109	116
Nagaland	150	161
Chandigarh	438	420
Odisha	9167	9373
Punjab	15076	13947
Rajasthan	21897	17688
Sikkim	112	81
Puducherry	533	592
Tamil Nadu	19959	20122
Telangana	18278	12043
Tripura	251	388
Uttar Pradesh	31185	33242
Uttarakhand	2801	2925
West Bengal	11829	13016
DNH & DD	1809	1814
Sum of all the States-UTs	310684	285776
All India Projected Peak Demand (Solar/Non-Solar)	305339	286027

State-wise Projected Coincident Peak (Solar & Non-Solar Hours) in FY 2026-27 (Corresponding to the projected peak demand as per recent trends)
(refer to Chapter 4 Scenario II)

State	Coincident peak Solar Hours (MW)	Coincident peak Non-Solar Hours (MW)
Andhra Pradesh	13564	10764
Arunachal Pradesh	147	137
Assam	1632	2223
Bihar	7033	8307
Chhattisgarh	6132	5673
Delhi	7622	7537
DVC	3470	3552
Goa	684	673
Gujarat	24968	21669
Haryana	12462	12360
Himachal Pradesh	2101	1822
Jammu & Kashmir	3050	2585
Jharkhand	2238	2324
Karnataka	17394	9671
Kerala	3781	3805
Madhya Pradesh	18276	13760
Maharashtra	32402	28820
Manipur	151	137
Meghalaya	286	280
Mizoram	98	85
Nagaland	133	140
Chandigarh	416	377
Odisha	6377	6219
Punjab	13996	13510
Rajasthan	19385	15611
Sikkim	102	53
Puducherry	485	477
Tamil Nadu	17408	15757
Telangana	15720	9596
Tripura	229	342
Uttar Pradesh	28855	30479
Uttarakhand	2477	2464
West Bengal	10751	11272
DNH & DD (Dadra & Nagar Haveli	1503	1488
Sum of all the States-UTs	275321.5	243968
All India Projected Peak Demand (Solar/Non-Solar)	269900	240583

State-wise Projected Coincident Peak (Solar & Non-Solar Hours) in FY 2027-28 (Corresponding to the projected peak demand as per recent trends)

(refer to Chapter 4 Scenario II)

State	Coincident peak Solar Hours (MW)	Coincident peak Non-Solar Hours (MW)
Andhra Pradesh	15240	13181
Arunachal Pradesh	155	154
Assam	1739	2461
Bihar	7535	9009
Chhattisgarh	6562	6357
Delhi	7777	8071
DVC	3664	3798
Goa	721	751
Gujarat	26947	23928
Haryana	12888	12475
Himachal Pradesh	2232	2064
Jammu & Kashmir	3209	2831
Jharkhand	2417	2553
Karnataka	18635	12037
Kerala	3956	4507
Madhya Pradesh	19392	14737
Maharashtra	33985	31601
Manipur	162	167
Meghalaya	306	306
Mizoram	104	111
Nagaland	142	152
Chandigarh	430	411
Odisha	7598	7762
Punjab	14634	13454
Rajasthan	20746	16646
Sikkim	107	77
Puducherry	512	567
Tamil Nadu	18577	18800
Telangana	17025	11208
Tripura	241	375
Uttar Pradesh	30430	32506
Uttarakhand	2651	2763
West Bengal	11397	12580
DNH & DD	1661	1665
Sum of all the States-UTs	293770	270065
All India Projected Peak Demand (Solar/Non-Solar)	288602	270318

Annexure-E: Capacity Credit of Solar and Wind (Solar and Non-Solar Hours)

Solar

State	Capacity Credit (p.u.) (Solar Hours)
Gujarat	0.56
Maharashtra	0.56
Karnataka	0.54
Bihar	0.48
Chhattisgarh	0.57
Himachal Pradesh	0.49
Haryana	0.49
Kerala	0.46
Manipur	0.46
Meghalaya	0.33
Mizoram	0.47
Nagaland	0.32
Delhi	0.51
Odisha	0.48
Goa	0.55
Arunachal Pradesh	0.25
Punjab	0.47
Rajasthan	0.57
Jharkhand	0.57
Madhya Pradesh	0.54
Sikkim	0.35
Telangana	0.55
Andhra Pradesh	0.53
Tamil Nadu	0.53
Tripura	0.42
Uttar Pradesh	0.49
Uttarakhand	0.57
West Bengal	0.51
Assam	0.42

Wind

State	Capacity Credit (p.u.) (Solar Hours)	Capacity Credit (p.u.) (Non-Solar Hours)
Karnataka	0.10	0.28
Tamil Nadu	0.12	0.28
Andhra Pradesh	0.09	0.32
Gujarat	0.13	0.25
Madhya Pradesh	0.10	0.23

Note: Capacity credit of Solar generators during non-solar hours has been considered as 0