



Report on Resource Adequacy Plan (Generation) for Chandigarh (2026-27 to 2036-37)

September, 2026



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Disclaimer

In accordance with the Resource Adequacy Guidelines dated 28th June 2023, each Distribution Licensee is mandated to prepare a Resource Adequacy Plan (RAP) for a 10-year horizon, referred to as the Long-Term Distribution Licensee Resource Adequacy Plan (LT-DRAP), which shall be vetted and validated by the Central Electricity Authority (CEA).

In past, the Resource Adequacy Plan (RAP) for a 10-year horizon has been prepared by CEA for UT' of Chandigarh for the period 2025-35 and 2026-36. Now, in continuation to the past RAP, CPDL has conducted Resource Adequacy Plan (RAP) for a 10-year horizon for the period 2026-27 to 2036-37 on rolling basis.

CEA has vetted the report in fulfillment of the requirement stipulated under the Resource Adequacy Guidelines. The vetting has been done solely based on data, inputs and assumptions provided by CPDL. Any change in the data, inputs or assumptions by CPDL may lead to change in the Study/Plan. It is expressly stated that the responsibility for the implementation of the study's recommendations, ensuring the adequacy of electricity resources, and undertaking any related actions including financial implications, if any, rests entirely with the CPDL.

Executive Summary

Ministry of Power had notified the Electricity (Amendment) Rules in December 2022. As per Rule 16 of the Electricity (Amendment) Rules, Ministry of Power has notified Resource Adequacy (RA) Guidelines. According to these Guidelines, Central Electricity Authority (CEA) is entrusted with the responsibility of preparing the Long-Term National Resource Adequacy Plan (LT-NRAP). Further, each Distribution Utility is required to carry out a Long-Term Distribution Licensee Resource Adequacy Plan (LT-DRAP) to reliably meet its peak and energy requirements.

As per the Resource Adequacy Guidelines dated 28th June 2023, each Distribution Licensee shall undertake a Resource Adequacy Plan (RAP) with a 10-year planning horizon, LT-DRAP to meet its own peak electricity demand and electrical energy requirement. This plan shall be vetted/validated by CEA to leverage the benefits of national-level optimization for the Distribution Licensees. The LT-DRAP shall be prepared by the Distribution Licensees on an annual rolling basis, factoring in the already contracted capacity and optimizing the requirement for additional capacity.

Government of India has notified the Renewable Consumption Obligation (RCO) trajectory up to 2029-30 vide gazette notification dated 27th September 2025, which mandates that a specified portion of energy consumption must be met from renewable energy sources.

To support the utility in fulfilling this requirement, CEA, in collaboration with the Utility, initially conducted a Resource Adequacy (RA) study with a planning horizon up to FY 2034-35, based on the data received from the Discom and in compliance with the then prevailing RPO trajectory specified in the Ministry of Power's Office Memorandum dated 22nd July 2022 and its subsequent corrigendum dated 19th September 2022. Subsequently, CEA initiated the second phase of the activity and updated its report in August 2025, extending the projections up to FY 2035-36. This study has now been updated by CPDL through support of CEA and extended to cover the period up to FY 2036-37, incorporating the latest data available with CPDL and planning assumptions. The RCO requirement for the utility has also been assessed in accordance with the recent gazette notified trajectory.

This Resource Adequacy (RA) study assesses Chandigarh Power Distribution Limited (CPDL)'s ability to reliably meet electricity demand over the 2026-27 to 2036-37 planning horizon while supporting India's broader decarbonization objectives. Using the STELLAR software's capacity expansion framework, the study evaluates the requirements across generation and storage under realistic operational and reliability constraints. The modelling demonstrates that thermal generation, wind generation, solar generation, hydro resources combined with Energy Storage Systems (ESS) increasingly provide the adequacy and flexibility services.

Additionally, reliability study has been carried out to determine the probability of unmet demand and hours by implementing the variation in demand, variation in RE and forced outage of thermal generators (Coal/ Lignite) etc.

The electrical energy requirement and peak electricity demand for Chandigarh is increasing with a CAGR of 3.7% from 2026-27 to 2036-37 as forecasted by CPDL. For the purpose of energy projection, CPDL has considered the energy requirement as approved by the Hon'ble JERC up to FY 2029–30, and the demand beyond FY 2029–30 is based on CPDL's forecast in line with Hon'ble JERC mechanism.

The Resource adequacy studies have projected likely optimal capacity mix for future years till 2036-37 which is able to reliably meet the projected electricity demand. Based on the study, the likely total projected contracted capacity for the year 2036-37 is around 1177 MW which consists of 150 MW from coal, 50 MW from gas, 72 MW from nuclear, 373 MW from hydro, 40 MW from wind, 38 MW from solar, 50 MW from Solar + BESS, 121 MW from BESS 4h, 145 MW from Distributed Renewable Energy (DRE) sources and 137 MW from STOA/MTOA. This capacity shall be able to meet the projected demand with prescribed reliability criteria.

Key highlights include:

- Peak electricity demand is projected to rise significantly from 477 MW to 686 MW over the planning horizon, necessitating substantial capacity additions and enhanced operational flexibility.
- Total contracted capacity required by 2037 is 1177 MW, driven primarily by renewable energy and storage investments.
- Hydro emerges as a major contributor to future energy supply to about 373 MW by 2037, and maintaining a stable presence throughout the planning horizon, reflecting its strong adequacy value and reliable generation profile.
- Solar capacity including DRE expands to 183 MW by 2037, while Solar + BESS capacity reaches 50 MW, enhancing the integration of renewable energy by addressing inherent variability and providing additional operational flexibility to the system.
- Coal's contribution towards meeting the electricity demand declines gradually, indicating a transition away from coal as the primary resource.
- A new Solar + BESS project with a capacity of 50 MW is planned by 2029. Subsequently, the BESS capacity is projected to increase significantly, reaching 121 MW by 2037. This expansion will play a critical role in managing renewable energy variability, meeting reserve requirements, and enhancing overall grid reliability, operational flexibility, and system resilience.

Introduction

Ministry of Power has notified Electricity (Amendment) Rules, 2022 in December 2022. Rule 16 (I) 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 have been notified in June, 2023 by Ministry of Power in consultation with Central Electricity Authority.

Resource Adequacy is generally defined as a mechanism to ensure that there is an adequate supply of generation resources to serve expected demand reliably at least cost. A key aspect of resource adequacy planning is to ensure that adequate generation capacities are available, round-the-clock, to reliably serve demand under various scenarios. This naturally translates into the need for ensuring 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 demand-supply situation in the grid precisely due to high seasonality and intermittency in RE generation. Resource Adequacy exercise may also help in assessment of capacity requirement to be tied up or contracted on long term, medium term, and short-term basis.

Further, Ministry of Power vide notification dated 27th September 2025 had notified the RCO trajectory for the states/Discoms. Based on the trajectory specified, hydro, wind and other (solar, biomass etc.) RCO quantum in million units (MUs) has been calculated to find additional quantum of renewable capacity that the states/Discoms have to contract in addition to its existing/planned capacity to meet their RCO targets.

To support the utility in fulfilling the Resource Adequacy Guidelines while complying with the Renewable Consumption Obligation (RCO) notification, CPDL with support of CEA has carried out the RA study for the UT of Chandigarh. The study recommends an optimal resource mix up to FY 2036-37, taking into account technical and financial parameters associated with various generation technologies. It aims to optimize long-term power procurement while ensuring resource adequacy to meet demand on a 24×7 basis, considering variations in demand, variations in RE generation, and forced outage of thermal capacities. The study assesses the reserve margin required by the Utility to account for the various uncertainties such as change in projected demand, change in generation capacity due to RE intermittencies, ensuring that demand can be reliably met throughout the year.

Prior to this, CEA had conducted the RA study for the UT up to FY 2035-36, based on inputs from CPDL and in accordance with the then prevailing RPO trajectory specified in the Ministry of Power’s Office Memorandum dated 22nd July 2022 and its subsequent corrigendum dated 19th September 2022.

1.0 Highlights of the Previous RA Study (Up to FY 2035-36)

1. In the Resource Adequacy (RA) study conducted in August-2025, financial year 2024-25 had been considered as the base year, and the study covered the period from 2025-26 to 2035-36. The fuel-wise contracted capacity by CPDL as on 31st March, 2025 is given in Fig 1.

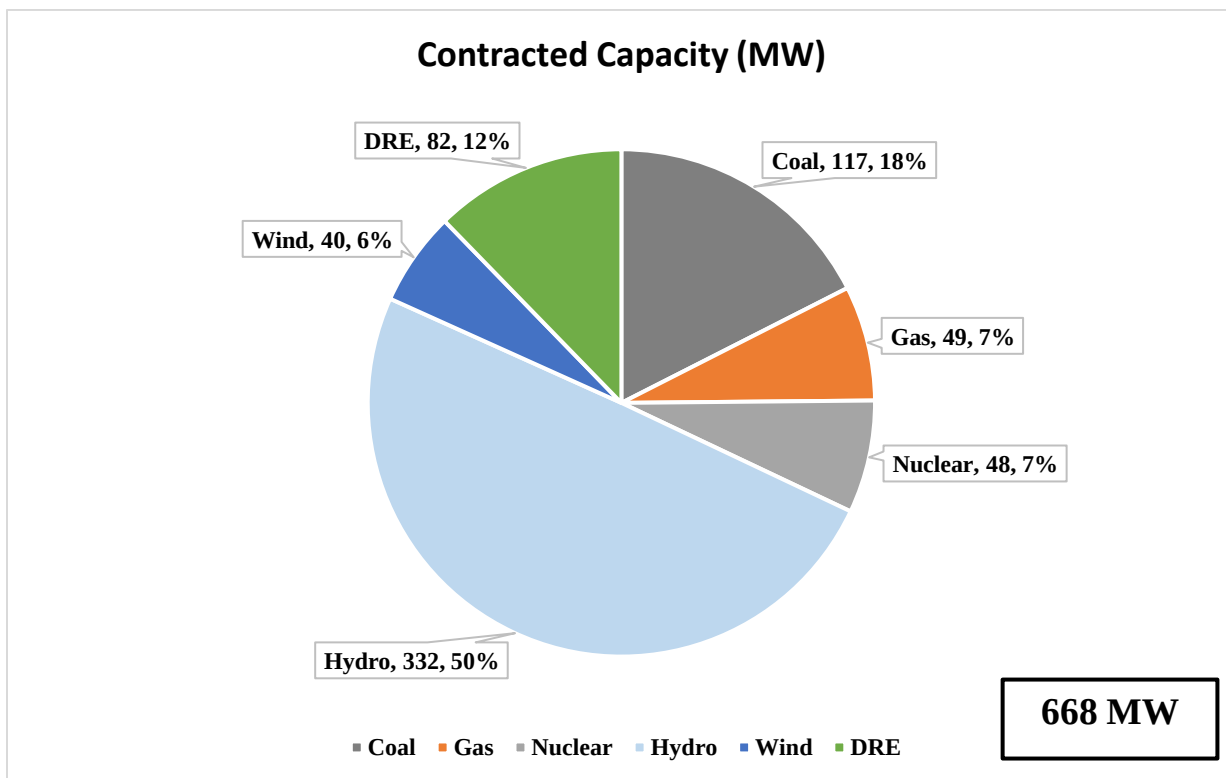


Figure 1: Contract Capacity 2025-26

2. The hourly demand pattern for 2024-25 was analysed and had been considered as a base profile to interpolate the demand for future years.
3. For the peak electricity demand and electrical energy projections, the CPDL projections and the CEA projections as per 20th EPS mid-term review were compared in the study is as under:

Table 1: Peak demand and Energy Projections as per 20th EPS viz-a-viz CPDL

	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36
Peak Demand (in MW)											
CPDL Peak Demand Projections (in MW)	491	511	531	547	564	580	598	616	634	653	673
20 th EPS Mid-term review Peak Demand Projections (MW)	472	488	498	511	524	530	534	542	550	558	570
Energy Requirement (in MU)											

	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36
CPDL Energy Projections (in MU)	2056	2128	2202	2279	2359	2441	2527	2615	2707	2802	2900
20 th EPS Mid-term review Energy Projections (in MU)	1838	1900	1972	2059	2145	2203	2258	2326	2395	2467	2520

- The energy requirement projections of CPDL were higher compared to 20th EPS mid-term review. However, the actual energy requirement in past years including in FY 2024-25 was significantly higher compared to 20th EPS mid-term review. Therefore, the peak demand and energy requirement projections submitted by CPDL were considered for preparation of Resource Adequacy Plan.
- To meet the above projected peak electricity demand and electrical energy requirement reliably, the source-wise projected capacity (in MW) as outlined in the previous report is tabulated below:

Table 3: Projected capacity

Year	COAL	GAS	NUCLEAR	HYDRO	WIND	SOLAR	DRE	STOA
2025/26	117	49	48	334	40	0	82	78
2026/27	117	49	48	359	40	0	82	79
2027/28	117	49	48	359	40	50	82	86
2028/29	117	49	48	359	40	50	82	102
2029/30	117	49	48	359	40	100	82	106
2030/31	117	49	48	359	40	100	85	122
2031/32	117	49	48	359	40	100	88	140
2032/33	117	49	48	359	40	100	91	157
2033/34	117	49	48	359	40	100	94	175
2034/35	117	49	48	359	40	100	98	193
2035/36	117	49	48	359	40	100	101	213

**The STOA/MTOA value represents the peak power requirement in MW and it was recommended that this requirement may be met through power procurement from the market or through bilateral agreements.*

- The year-wise planned and additional capacity contract addition (in MW) for the above tabulated cumulative capacity is detailed below:

Table 4: Year wise planned and additional capacity addition

	SOLAR	DRE
Year	Planned Contracts	Additional Requirement
2025/26	0	0
2026/27	0	0
2027/28	50	0

2028/29	0	0
2029/30	50	1
2030/31	0	3
2031/32	0	3
2032/33	0	3
2033/34	0	3
2034/35	0	3
2035/36	0	3
TOTAL	100	19

2.0 Resource Adequacy study for Chandigarh (from 2026-27 to 2036-37)

2.1 Present Power Scenario in Chandigarh

The power supply position for Chandigarh for 2021-22 to 2025-26 is given in the Table 5.

Table 5: Power Supply Position of Chandigarh

Power Supply Position						
Year	Energy required (MU)	Energy supplied (MU)	Gap (MU)	Peak Demand (MW)	Peak Met (MW)	Demand not met (MW)
2021-22	1606	1606	0	426	426	0
2022-23	1788	1788	0	407	407	0
2023-24	1789	1789	0	411	411	0
2024-25	1952	1952	0	449	449	0
2025-26	1879	1879	0	460	460	0

As of June 2026, the total contracted capacity for Chandigarh is 729 MW. Out of the total contracted capacity (CC), the share of non-fossil fuel-based Contracted Capacity is 72%. The fuel-wise contracted capacity as on June, 2026 is given in Table and Figure below:

Table 6: Fuel-wise Contracted Capacity as on June 26

Source	Contracted Capacity (MW)	Percentage (%)
Coal	150	21%
Gas	50	7%
Nuclear	57	8%
Hydro	337	46%
Wind	40	5%
DRE	95	13%
Total	729	100%

Note- The above capacity is based on power allocation by MoP which consist of power from Firm as well as Unallocated quota. The unallocated quota varies from 14% in summers to 9% in winter.

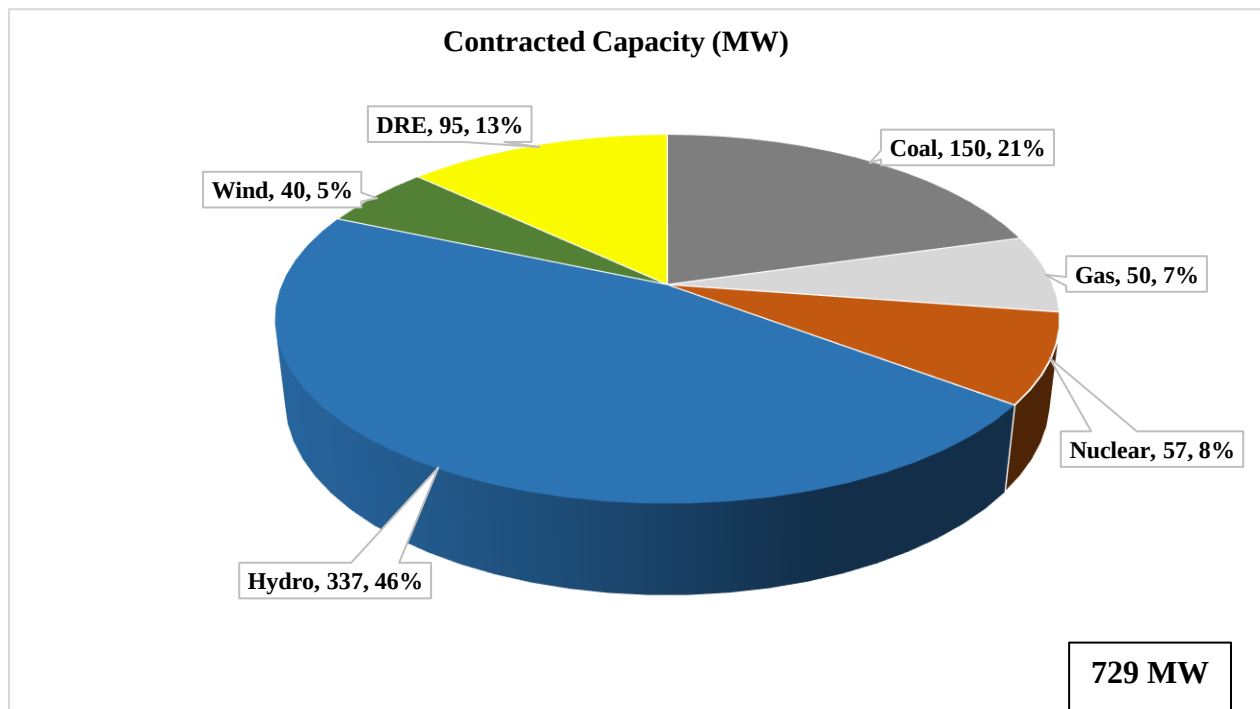


Figure 2 Fuel-wise Contracted Capacity (in MW) as on June'26

2.2 Analysis of Electricity Demand

The FY 2024-25 electricity demand profile has been selected as the baseline for assessment as abnormal weather patterns such as excess rainfall and below-normal temperature in the summer of FY 2025-26 had been experienced. Hourly demand pattern of 2024-25 was analyzed and it was observed that peak electricity demand in Chandigarh occurs during June and July months. Notably, the Union Territory experiences peak electricity demand during the solar hours in most of the months. However, the average hourly electricity demand is highest in the month of June (afternoon hours). Overall, the demand during the solar hours in these months is significantly higher than in the rest of the year.

The month wise variation in average hourly electricity demand observed for the year 2024-25 is shown in Figure 3.

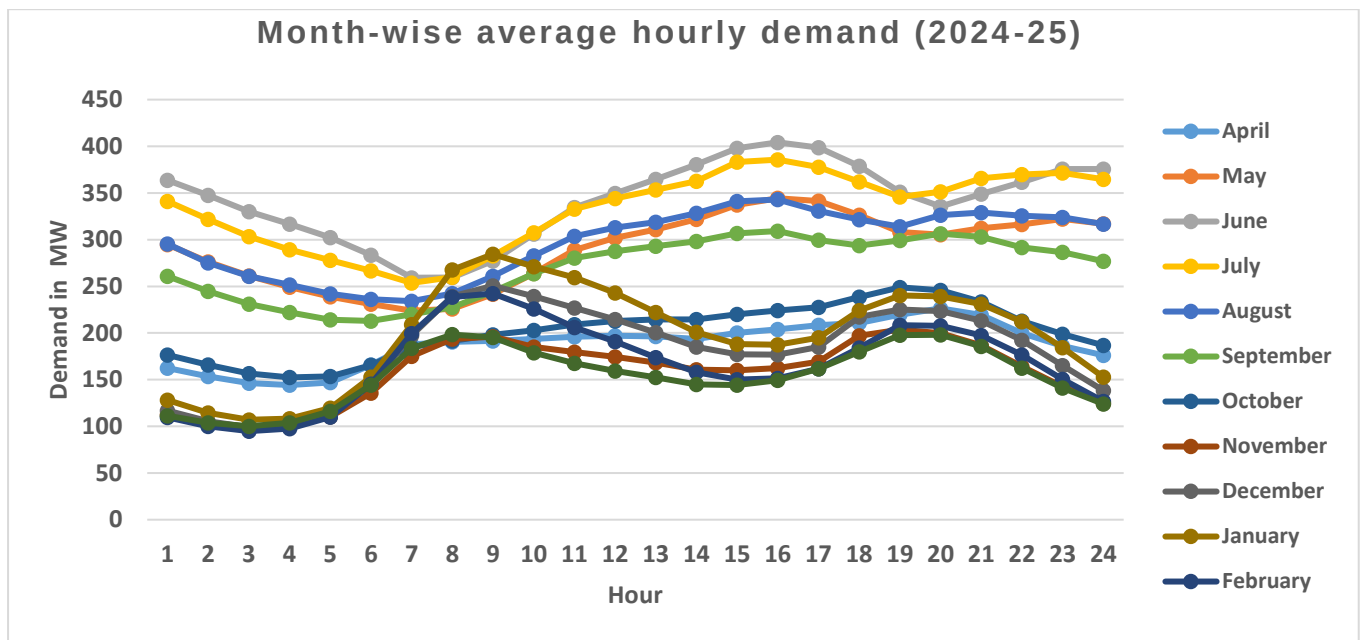


Figure 3: Average Hourly Demand Variation (Month-wise) for 2024-25

From the hourly demand data of 2024-25 the daily peak during solar hours (06:00 to 18:00 hrs.) and non-solar hours are plotted in Figure 4.

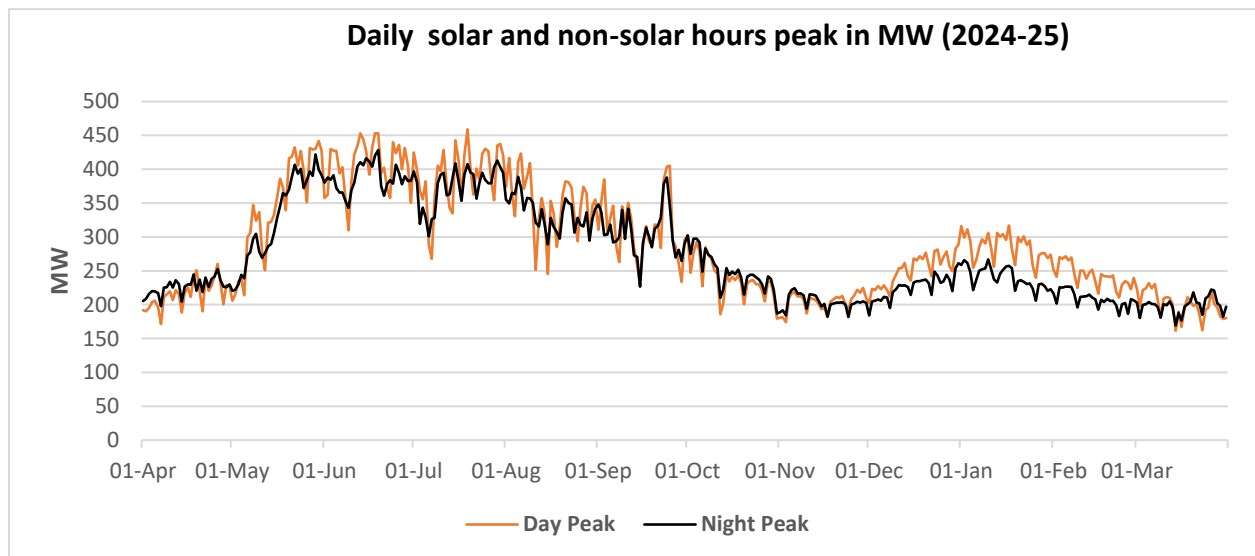


Figure 4: Peak demand in solar and non-solar hours in MW for the year 2024-25

As seen from figure 4, the daily peak demand occurs during solar hours.

The hourly demand pattern of 2024-25 was analysed for finding out the number of occurrences of the peak and near peak demand. Such instances are critical for study purpose as it is necessary to ensure resource adequacy during such instances with an optimal mix of long-term, medium-term and short-term contracts.

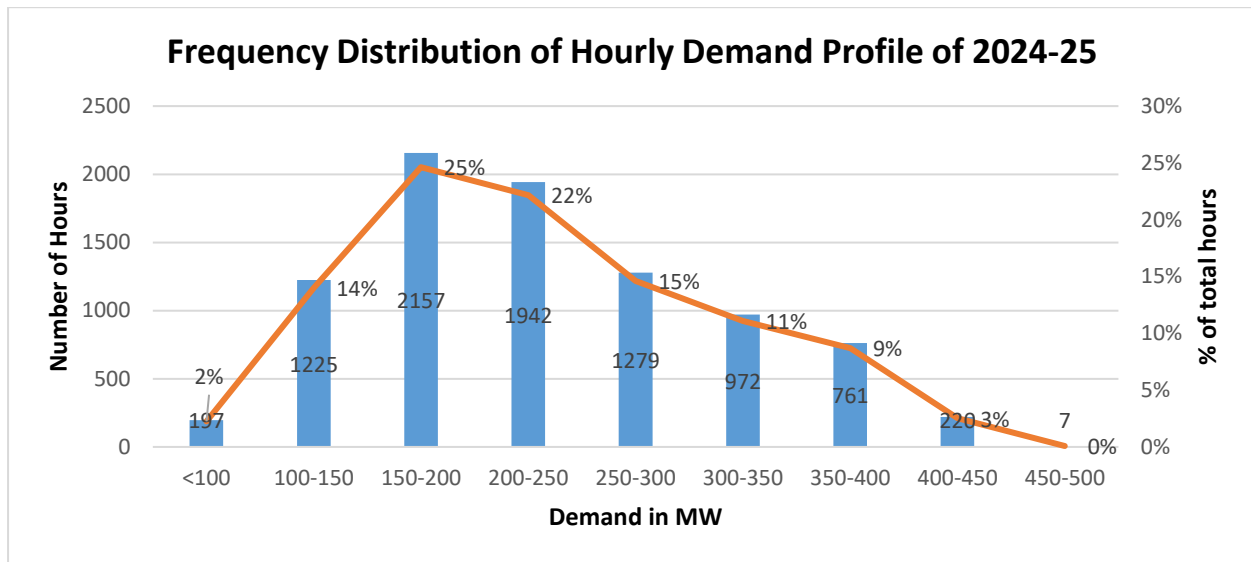


Figure 5 Frequency Distribution of Hourly Demand Profile of 2024-25

3.0 Principles of Generation Planning

The objective of the Generation Planning process is to obtain an optimal generation capacity mix in the least cost manner to meet the demand at every instance of time while ensuring the most efficient use of resources. Planning is therefore an activity encompassing balancing demand and supply at all instances of time and at all locations, which makes it a regular ongoing process.

The major aspects considered in the planning process are:

- i) To Supply 24x7 reliable power to consumers
- ii) To achieve objectives of all policies of the Government of India such as RCO trajectory, RE capacity addition etc.
- iii) To achieve sustainable development.
- iv) To fulfil desired operational characteristics of the system such as reliability and flexibility.
- v) Most efficient use of resources.
- vi) Fuel availability

3.1 Generation Expansion Planning Tool - STELLAR

Central Electricity Authority (CEA) has successfully developed an indigenously built 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 modelling and planning. STELLAR is a state-of-the-art optimization model framework specifically designed to support long-term decision-making in the electricity sector, with a focus on ensuring resource adequacy, operational resilience, and cost-effective system evolution in line with India's energy transition goals.

STELLAR serves as a comprehensive and robust platform for long-term generation and transmission planning, supporting informed policymaking and investment strategies in India's evolving power sector. The salient features of STELLAR include representative-day modelling, co-optimization of energy and ancillary services, demand response modelling, and reliability modelling. The schematic diagram of the software is given in Figure 6.

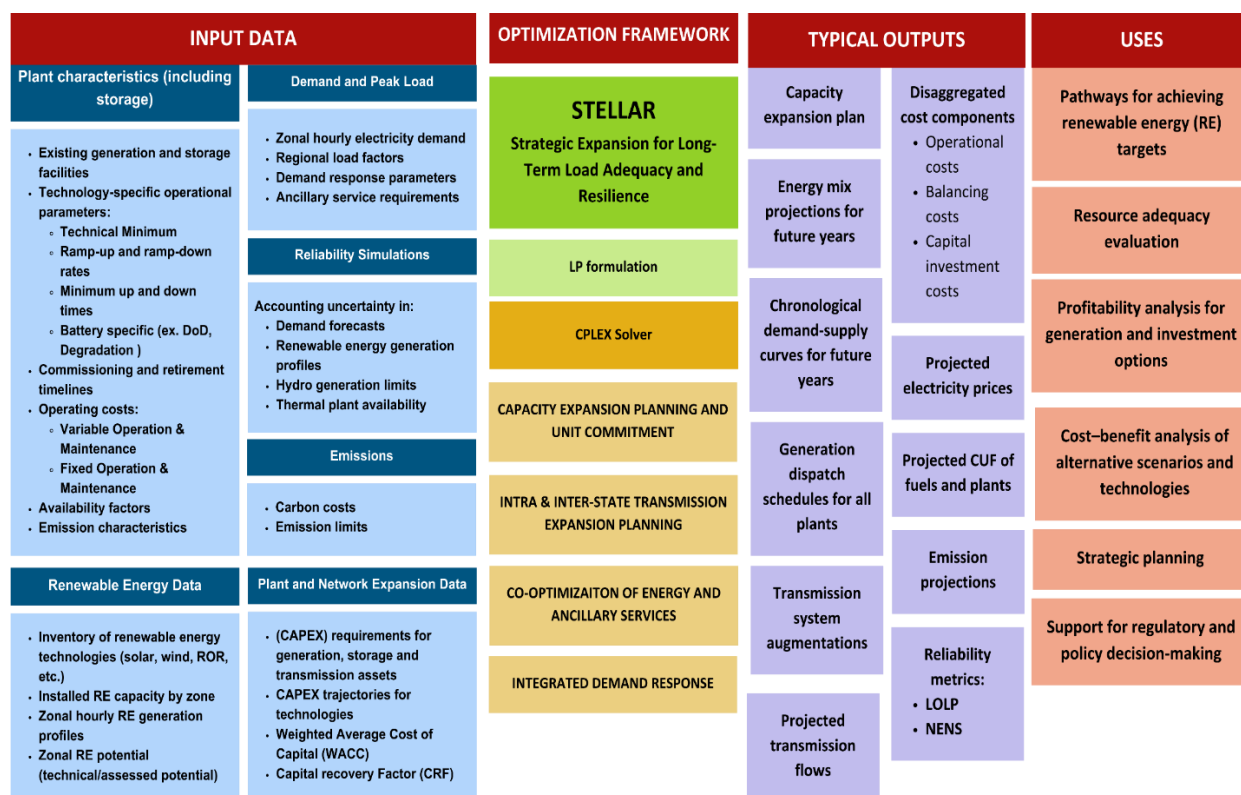


Figure 6: Schematic Diagram

4.0 Reliability Analysis

One of the main criteria of resource adequacy studies is to determine the reliability of the system to meet the demand adequately at every instant of time. This reliability is measured via two indices (i.e.) LOLP (Loss of Load Probability) and EENS (Expected Energy Not Served). These indices have been defined in resource adequacy guidelines as below:

- Loss of Load Probability (LOLP):** Measure of the probability that a system's load may exceed the generation and firm power contracts available to meet that load in a year. E.g., 0.0274 % probability of load being lost.
- Expected Energy Not Served (EENS):** Expected amount of energy (MWh) that may not be served for each year within the planning period under study. It is a summation of the expected number of megawatt hours of demand that may not be served for the year. This is an energy-centric metric that

considers the magnitude and duration of energy being not served, calculated in Mega Watt hours (MWh). The metric can be normalized (i.e., divided by total system energy requirement) to create a Normalized Energy Not Served (NENS) metric.

Monte Carlo /Stochastic simulation has been used to factor-in the uncertainty associated with various generation resources and demand. It is an approach which is used to predict the probability of a variety of outcomes when the potential for random variables is present, as compared to deterministic modelling of economic dispatch model. Monte Carlo simulation helps in analysing the randomness associated with RE resources, demand pattern changes and forced outages of plant. A large number of random samples of these variables are simultaneously simulated to ascertain system reliability indices (i.e. Loss of load probability LOLP & Energy Not Served (ENS)) & the system robustness in case of variation in system parameters.

4.1 Variation in electricity Demand

The variation in demand pattern for the past two years has been analyzed. The hourly demand variation for consecutive years (i.e., 2024-25 and 2025-26) has been analyzed. The Demand pattern variation of 2024-25 and 2025-26 is shown below.

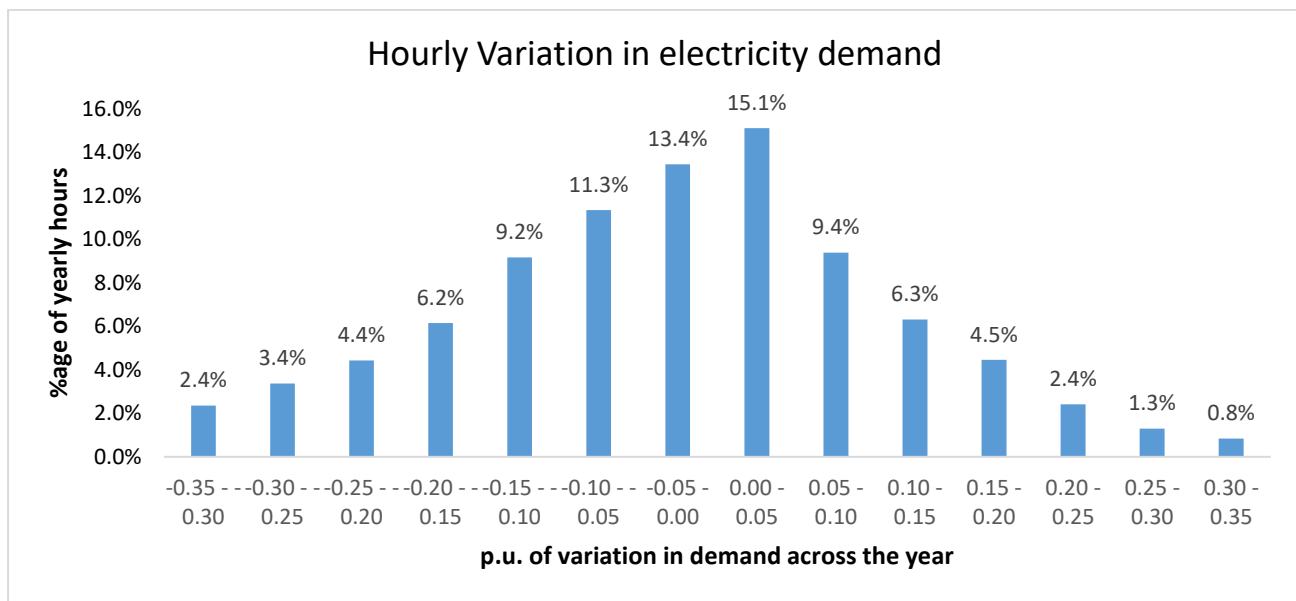


Figure 7 Hourly Variation in Demand across years

It can be observed that the hourly demand variation remains within $\pm 15\%$ for about 65% of the observed instances. The variation is primarily attributed to changes in temperature, weather conditions, demand uncertainty, and random outages of transmission lines and generating units. To capture this behavior in the reliability assessment, the projected hourly demand for future years has been modelled by introducing a normally distributed random variable, such that the demand variation reflects the observed historical pattern, with nearly two-thirds of the observations lying within the $\pm 15\%$ variation band.

4.2 Planning of Reserve Margin

Planning of Reserve Margin is essential to cater to intermittency of variable RE generation and unprecedented changes in electricity demand.

4.3 Inputs/Assumptions for the Study

- i) For the purpose of this study, the Peak demand & electrical energy requirement of Chandigarh, considered by CPDL is tabulated below.

Table 7 Future Demand Projection by CPDL

Financial Year	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37
Peak Demand (in MW)											
Demand Projections (in MW)	477	494	512	531	551	572	593	615	638	662	686
Energy Requirement (in MU)											
Energy Projections (in MU)	2032	2107	2184	2266	2350	2438	2530	2623	2721	2822	2927

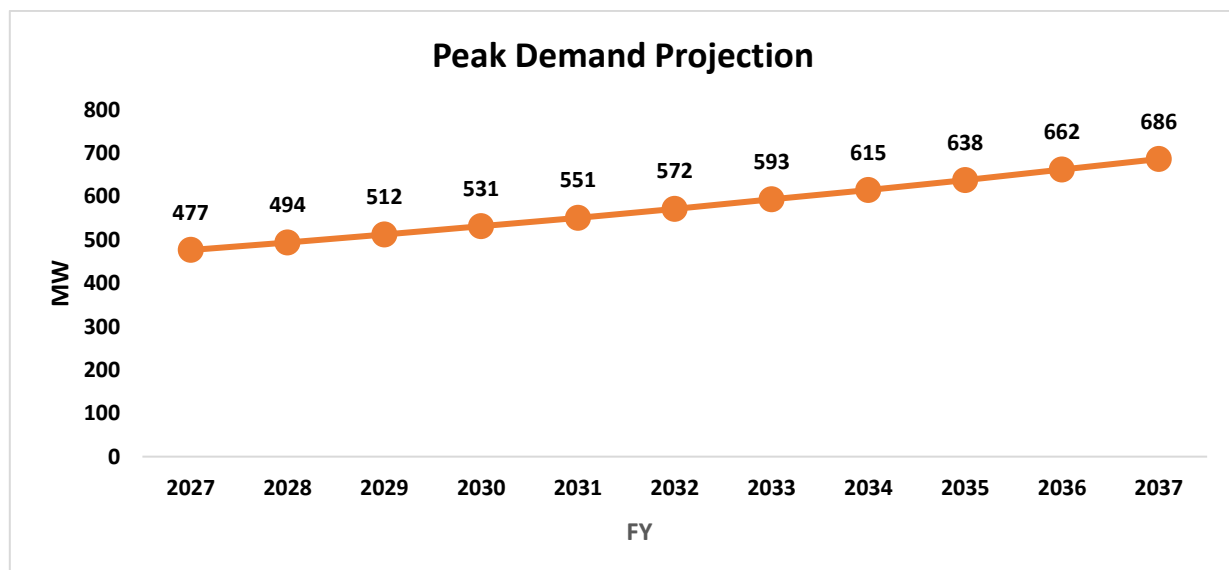


Figure 8: Peak Demand Projections CPDL

The actual peak load for 2024-25 & 2025-26 for Chandigarh, stands at 449 MW & 460 MW respectively

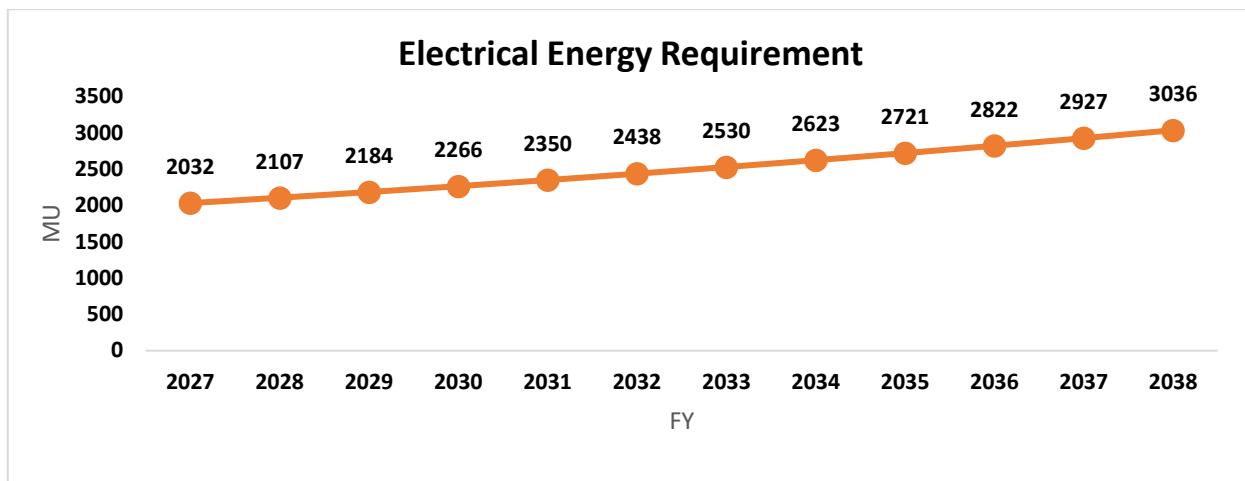


Figure 9: Energy Requirement Projections of CPDL

For the purpose of energy requirement projections, CPDL has considered the energy requirement as approved by the Hon'ble JERC up to FY 2029–30, and the demand beyond FY 2029–30 is based on CPDL's projections.

Future demand profile till the year 2036-37 has been projected using the demand profile for the year 2024-25 as the base profile.

- ii) Availability of Power (Contracted capacity) has been considered as per the allocation as on June 2026 as a base resource availability.
- iii) The actual solar, wind and hydro generation profiles and CUFs have been considered from actual generation of FY 2025-26.
- iv) For Thermal, Nuclear and hydro sources, the normative monthly availability has been considered. Since the MW allocation has been considered as per the allocation of summer season, the winter season's availability has been considered as 80% of the REA availability.
- v) The DRE capacity as on FY 2026-27 is 95 MW and the DRE expansion up to 145 MW has been considered in 2037.
- vi) For resource planning, the higher expansion limits of candidate resources were considered as inputs to the model. These include 300 MW of Solar capacity, 300 MW of Wind capacity, 200 MW of Solar + BESS capacity, 210 MW of standalone BESS capacity, and 60 MW of Hydro capacity.
- vii) No candidate thermal generation capacity has been considered in the planning exercise considering UT Chandigarh Administration's long-term vision of transitioning towards a greener Chandigarh, as well as alignment with the National goals. Accordingly, the planning framework prioritizes renewable energy and energy storage resources to meet the projected demand and resource adequacy requirements in a sustainable, reliable, and cost-effective manner.
- viii) The reserve requirements have been considered as per LT-NRAP published by CEA.

- ix) The capital costs of candidate plants for coal, wind, solar, Nuclear and storage technologies is detailed in the Annexure I and are aligned with current market trends and CEA Planning.
- x) **Representative Day Profiles (Demand And RE)-** Representative-day profiling is central to the interpretation of results. Instead of relying on annual averages, the model uses hourly structures that capture shape effects across day and season. This is critical because adequacy stress emerges from timing mismatch: evening ramps, morning pickup, and periods when variable renewable output diverges from net load. Rather than relying on static annual averages—which often mask critical system stress—the STELLAR model utilizes hourly structures to capture the "shape" of demand and generation across different days and seasons.
- xi) **Renewable Consumption Obligation (RCO) trajectory:** Ministry of Power vide notification (S.O. 4421(E)) on September 27, 2025, under the Energy Conservation Act, 2001, had notified the source wise minimum share of consumption of non-fossil sources (renewable energy) by designated consumers till the year 2029-30.

Table 9 Renewable consumption obligation (RCO) trajectory as per MoP order

Sl. No.	Year	Wind renewable energy	Hydro renewable energy	Other renewable energy	Distributed renewable energy	Total renewable energy
1.	2024-25	0.67 %	0.38 %	27.35 %	1.5 %	29.91 %
2.	2025-26	1.45 %	1.22 %	28.24 %	2.1 %	33.01 %
3.	2026-27	1.97 %	1.34 %	29.94 %	2.7 %	35.95 %
4.	2027-28	2.45 %	1.42 %	31.64 %	3.3 %	38.81 %
5.	2028-29	2.95 %	1.42 %	33.1 %	3.9 %	41.36 %
6.	2029-30	3.48 %	1.33 %	34.02 %	4.5 %	43.33 %

The RCO trajectory has been assumed to remain constant up to FY 2036-37 for the purpose of the study. Hence, the suggested trajectory of Renewable Consumption Requirement up to FY 2036-37 is presented in the table below:

Table 10 Renewable consumption obligation (RCO) trajectory considered for the study

Sl. No.	Year	Wind renewable energy	Hydro renewable energy	Other renewable energy	Distributed renewable energy	Total renewable energy
1	2026-27	1.97 %	1.34 %	29.94 %	2.7 %	35.95 %
2	2027-28	2.45 %	1.42 %	31.64 %	3.3 %	38.81 %
3	2028-29	2.95 %	1.42 %	33.1 %	3.9 %	41.36 %
4	2029-30	3.48 %	1.33 %	34.02 %	4.5 %	43.33 %
5	2030-31	38.83 %			4.5 %	43.33 %

6	2031-32	38.83 %	4.5 %	43.33 %
7	2032-33	38.83 %	4.5 %	43.33 %
8	2033-34	38.83 %	4.5 %	43.33 %
9	2034-35	38.83 %	4.5 %	43.33 %
10	2035-36	38.83 %	4.5 %	43.33 %
11	2036-37	38.83 %	4.5 %	43.33 %

Based on the trajectory specified, RCO quantum in million units (MUs) from hydro, wind, other (Solar, biomass etc.) and distributed renewable energy (DRE) is calculated and tabulated below:

Table 11 Total Energy required to meet RCO (MU)

Sl. No.	Year	Wind renewable energy (MU)	Hydro renewable energy (MU)	Other renewable energy (MU)	Distributed renewable energy (MU)	Total renewable energy (MU)
1	2026-27	34.9	23.7	530.6	47.8	637.1
2	2027-28	43.1	25.0	556.1	58.0	682.1
3	2028-29	54.1	26.1	607.5	71.6	759.1
4	2029-30	66.7	25.5	651.8	86.2	830.2
5	2030-31	774.8			89.8	864.5
6	2031-32	808.2			93.7	901.9
7	2032-33	843.3			97.7	941.1
8	2033-34	879.0			101.9	980.9
9	2034-35	916.7			106.2	1023.0
10	2035-36	955.6			110.7	1066.3
11	2036-37	996.0			115.4	1111.4

Table 12 Renewable Energy Deficit/Surplus

FY	RE Generation required to meet RCO	RE Generation required to meet RCO	RE Generation available/met	RCO met (%)	RCO Surplus (+)/
			(From existing/ planned contracts)		Deficit (-)
	(MU)	(%)	(MU)	(%)	(%)
2026-27	637.1	35.95%	1294	73.01%	37.06%
2027-28	682.1	38.81%	1284	73.08%	34.27%
2028-29	759.1	41.36%	1380	75.17%	33.81%
2029-30	830.2	43.33%	1423	74.30%	30.97%
2030-31	864.5	43.33%	1703	85.35%	42.02%
2031-32	901.9	43.33%	1734	83.33%	40.00%
2032-33	941.1	43.33%	1750	80.59%	37.26%
2033-34	980.9	43.33%	1803	79.65%	36.32%
2034-35	1023.0	43.33%	1865	78.98%	35.65%
2035-36	1066.3	43.33%	1940	78.84%	35.51%
2036-37	1111.4	43.33%	2011	78.42%	35.09%

As indicated in the tables above, the UT will be able to meet its RCO requirements till 2036-37 based on their existing and planned contracts additions envisaged.

5.0 Outcome of the model

5.1 Investment options to meet the unserved energy

To meet the projected electricity demand, investment options (i.e., candidate capacities) are given to the model to find the least cost optimal capacity mix required to meet the demand with RCO obligations. Based on study, the capacity projections for Chandigarh are given below:

Table 13: Year-wise contracted capacity projections (in MW)

Year	COAL	GAS	NUCLEAR	HYDRO	WIND	SOLAR	SOLAR +BESS	BESS	DRE	STOA
2026-27	150	50	57	337	40	0	0	0	95	95
2027-28	150	50	72	339	40	0	0	0	100	99
2028-29	150	50	72	339	40	0	50	0	105	102
2029-30	150	50	72	339	40	0	50	0	110	106
2030-31	150	50	72	339	40	0	50	70	115	110
2031-32	150	50	72	339	40	0	50	107	120	114
2032-33	150	50	72	339	40	3	50	107	125	119
2033-34	150	50	72	339	40	22	50	107	130	123
2034-35	150	50	72	347	40	31	50	107	135	128
2035-36	150	50	72	360	40	36	50	114	140	132
2036-37	150	50	72	373	40	38	50	121	145	137

The projected year-wise contracted capacity mix is given in the figure below:

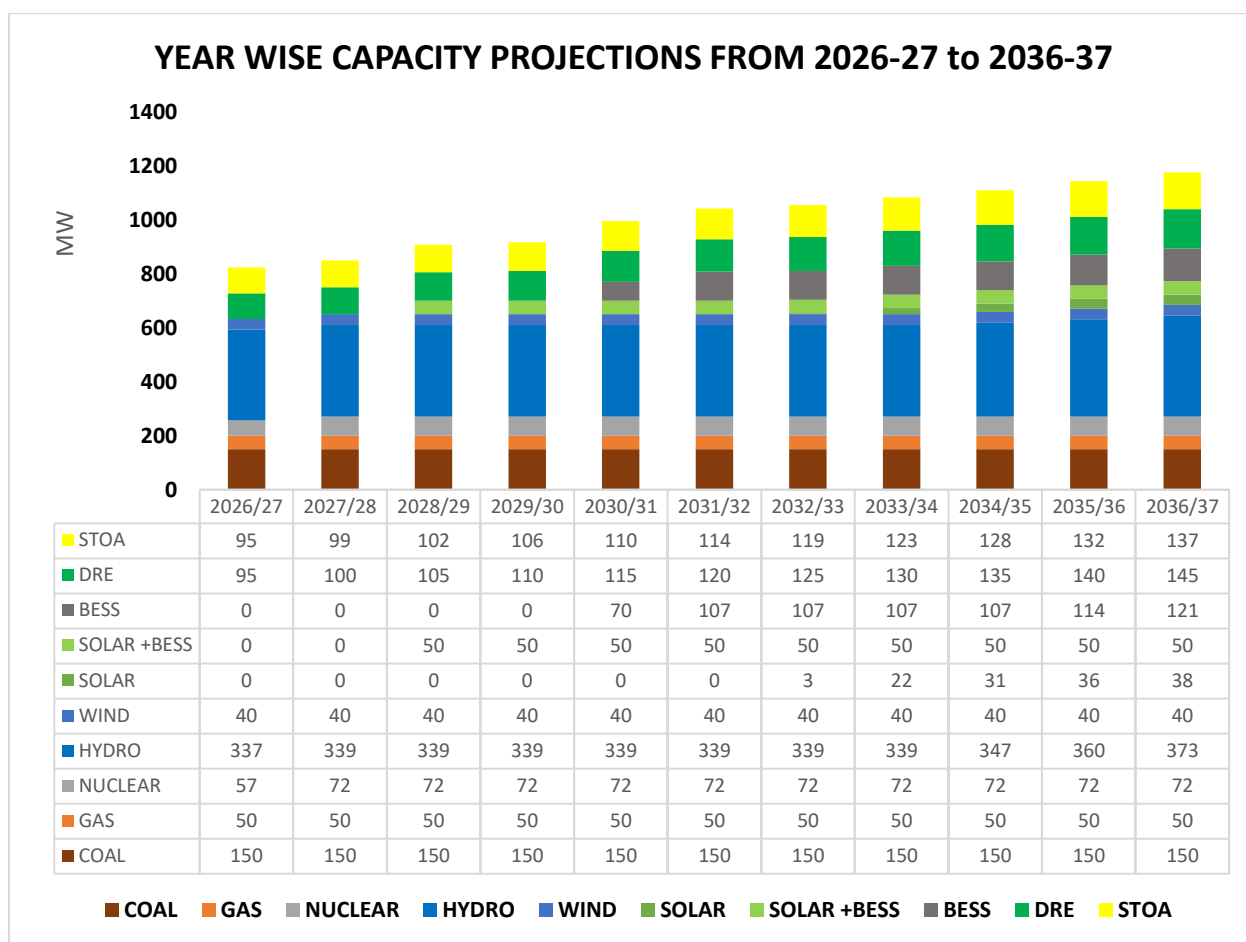


Figure 10 Projected Contracted Capacity Mix Year-wise (MW)

The STOA/MTOA requirement can be fulfilled through power procurement from market or bilateral agreements. The STOA/MTOA value reflects the peak value requirement and seasonal banking requirements in terms of MW.

As per the Resource Adequacy studies, the total projected contracted capacity for FY 2036-37 is estimated at approximately 1177 MW. This comprises 150 MW of coal-based capacity, 50 MW of gas-based capacity, 72 MW of nuclear power, 373 MW of hydro power, 40 MW of wind power, 38 MW of solar power, 50 MW of solar coupled with BESS, 121 MW of standalone BESS, and 145 MW from Distributed Renewable Energy (DRE) sources and 137 MW through MTOA/STOA arrangements. Collectively, this resource portfolio is projected to adequately meet the forecast demand while complying with the prescribed reliability criteria. Based on the planned capacity addition, the likely PRM in the year 2036-37 is about 5%. The energy mix projections indicate a significant transition in Chandigarh's power supply portfolio. The share of coal-based generation is expected to decline from 21% in 2027 to about 17% by 2037, while the contribution from wind power is projected to decrease from 5% to 3% over the same period. In contrast, solar energy is expected to increase from virtually 0% in 2027 to 3% by 2037. Although the share of hydro

power is projected to decline from 56% to 52%, it will continue to serve as a key and dependable source of energy throughout the planning horizon.

It is important to note that any delays or deviations in the commissioning schedule of the planned capacity additions may affect the UT's ability to meet the projected peak demand and energy requirements identified in this study. Such delays could also result in higher costs for ensuring a reliable power supply.

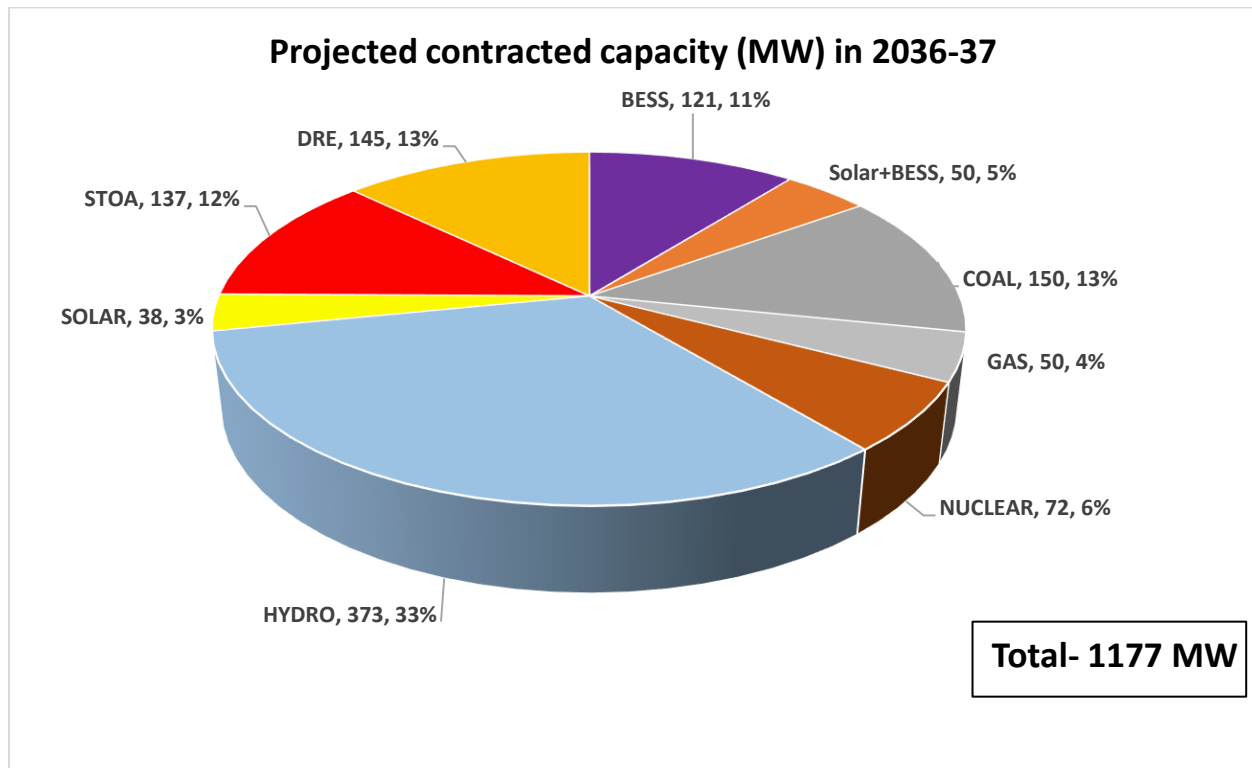


Figure 11 Contracted Capacity Mix in 2036-37

As per the study, the utility needs to contract following capacities (planned and additional) per year till 2036-37 to meet its demand reliably.

Table 15 Year wise Capacity Addition (in MW)

Year	Nuclear	Hydro		Solar	Solar +BESS	BESS
		Planned	Additional	Additional	Planned	Additional
2026-27	0.0	0.0	0.0	0.0	0.0	0.0
2027-28	14.9	2.5	0.0	0.0	0.0	0.0
2028-29	0.0	0.0	0.0	0.0	50.0	0.0
2029-30	0.0	0.0	0.0	0.0	0.0	0.0
2030-31	0.0	0.0	0.0	0.0	0.0	70.0
2031-32	0.0	0.0	0.0	0.0	0.0	37.4
2032-33	0.0	0.0	0.0	3.2	0.0	0.0
2033-34	0.0	0.0	0.0	19.0	0.0	0.0
2034-35	0.0	0.0	7.8	8.5	0.0	0.0
2035-36	0.0	0.0	12.6	5.4	0.0	6.8
2036-37	0.0	0.0	13.4	2.3	0.0	7.0
Total	15	2.5	33.8	38	50	121.2

The share of non-fossil fuel-based capacity in the generation mix is projected to remain between 70-83% from 2026-27 to 2036-37. The projected gross generation mix for the UT is shown in figure's

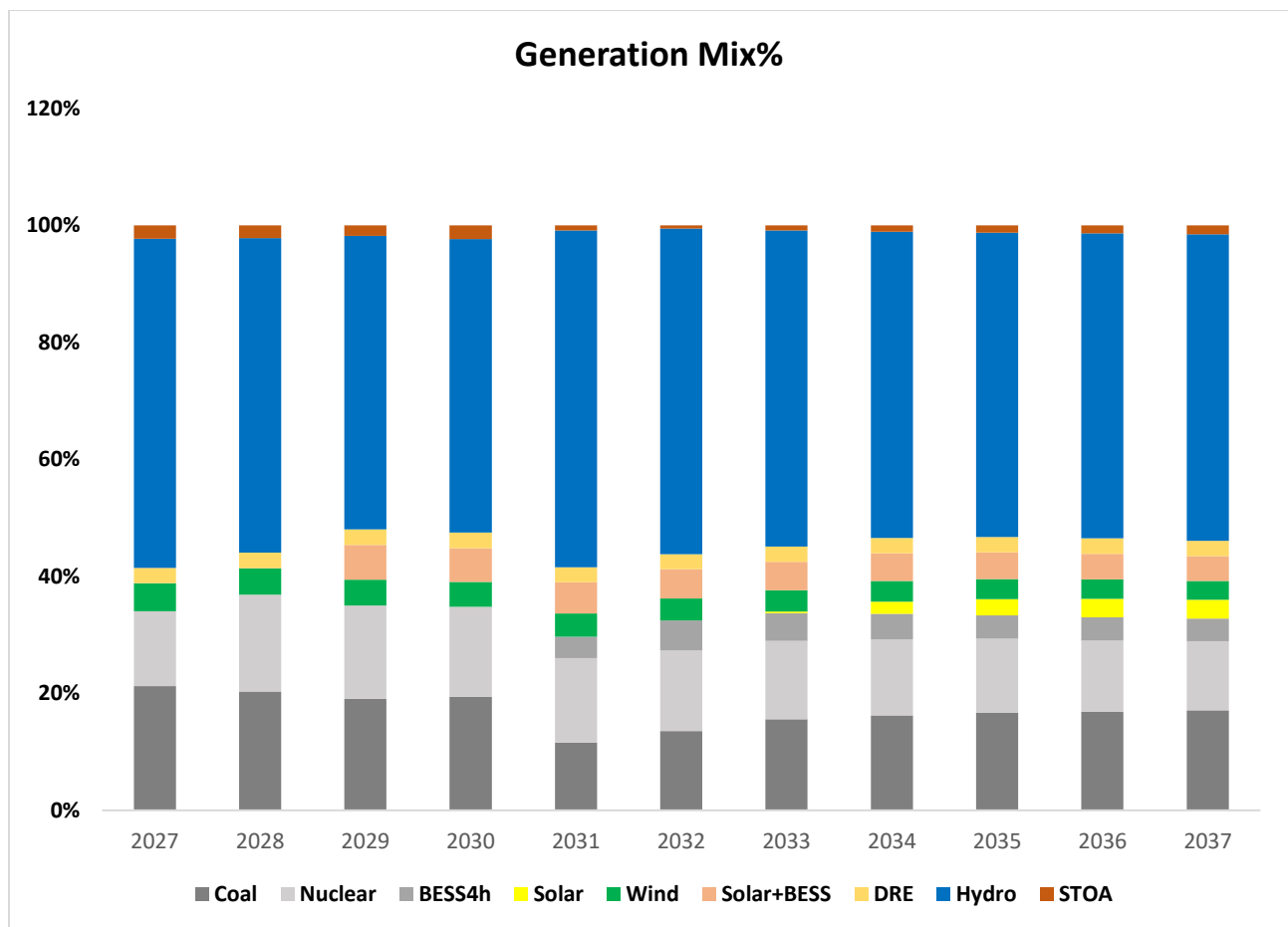


Figure 12 Year-wise projected gross generation mix (in %)

The energy mix projections indicate a significant transformation in Chandigarh’s generation portfolio over the study period. The share of coal-based energy is expected to decline from 21% in 2027 to approximately 17% by 2037. In contrast, the contribution of solar energy is projected to increase from 0% in 2027 to 3% by 2037, while Solar coupled with BESS and standalone BESS are expected to emerge as key resources, contributing 4%, by 2037. This evolution highlights the growing importance of firmed renewable energy and energy storage solutions in the resource mix.

From a resource adequacy perspective, this transition demonstrates that a power system with a high penetration of renewable energy can continue to maintain reliability when supported by adequate storage capacity, flexible resources, and efficient system operations. The results do not indicate a simple replacement of one baseload resource with another; rather, they reflect a strategic redesign of the resource portfolio in which diverse technologies collectively contribute to meeting adequacy and reliability requirements.

The projected trajectory also points to reduced exposure to fuel price volatility over time, as an increasing share of annual energy requirements is met through low marginal-cost renewable and storage-based resources. Consequently, the primary operational focus is expected to shift from securing fuel supplies toward managing system balancing requirements, reserve adequacy, and operational flexibility.

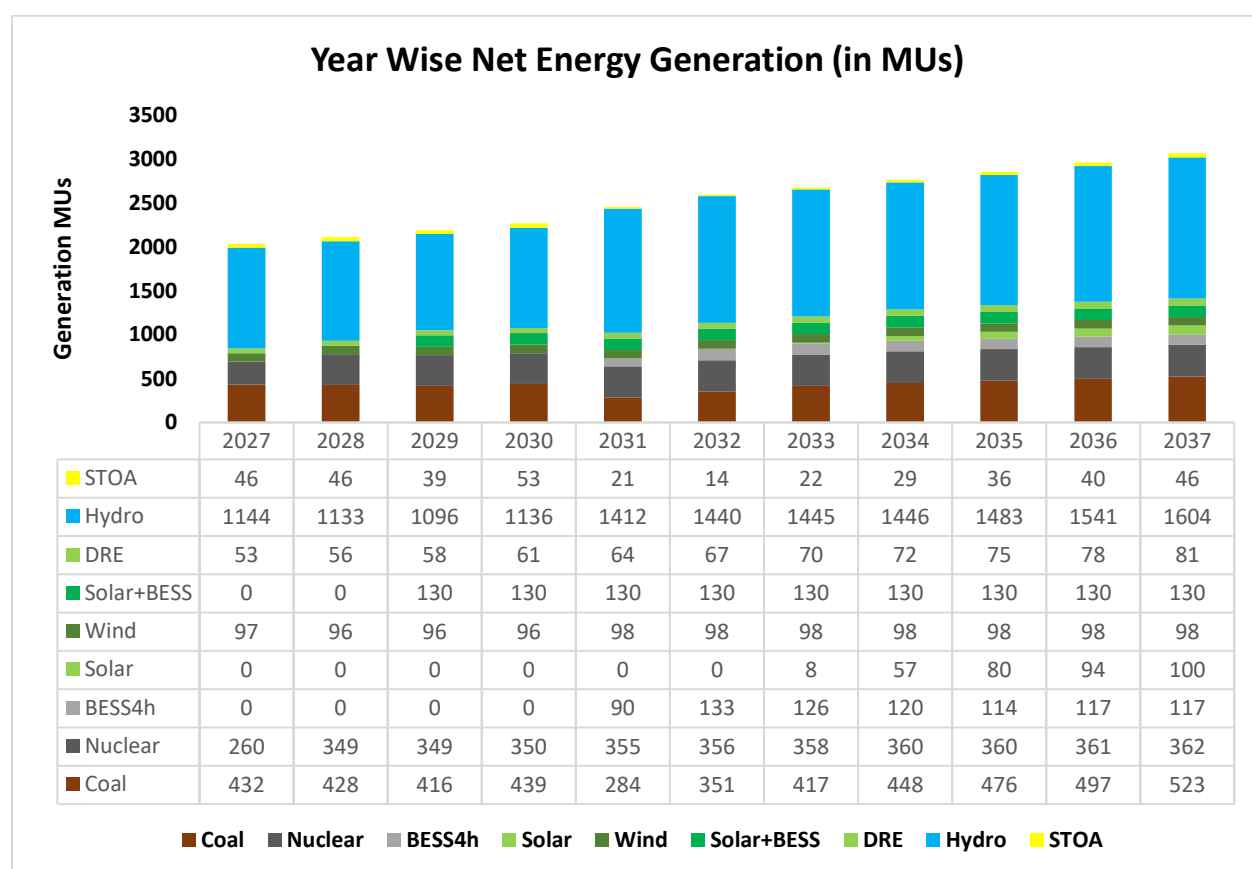


Figure 13 Year-wise projected gross generation (in GWh)

5.2 Unserved Energy Projections

Reliability studies have been conducted based on the projected capacity for the year 2036-37. The analysis confirms that the projected capacity meets the reliability criteria specified in the LT-NRAP, with the Loss of Load Probability (LoLP) and Normalized Energy Not Served (NENS) remaining within the permissible limits of 0.2% and 0.05%, respectively.

5.3 Utilisation

Solar + BESS, BESS, and wind resources maintain stable utilization levels, suggesting that renewable capacity additions are being complemented by adequate flexibility and storage support. This reflects a balanced resource expansion strategy, where renewable energy, storage, hydro resources, and the existing thermal fleet work together to meet adequacy requirements.

From an operational perspective, the role of coal becomes increasingly strategic rather than energy-intensive, with reliability being achieved through a diversified portfolio of renewables, storage, hydro flexibility, and optimal utilization of existing thermal resources.

6.0 Conclusions

Based on the Resource Adequacy studies of Chandigarh up to the year 2036-37, the following conclusions may be drawn:

1. The study has been done based on the hourly demand pattern of the year 2024-25. Based on the demand pattern, it is seen that the peak demand season is typically from June to August with peak demand occurring during solar hours.
2. The study has considered energy requirement projections as per the projections of CPDL, which envisages that the annual electrical energy requirement and Peak electricity demand of the UT is likely to grow at a CAGR of 3.7 % for the period of 2026-27 to 2036-37. The projected peak electricity demand and electrical energy requirement in 2036-37 686 MW and 2927 BU respectively.
3. As per the Resource Adequacy studies, the total projected contracted capacity for FY 2036-37 is estimated at approximately 1177 MW. This comprises 150 MW of coal-based capacity, 50 MW of gas-based capacity, 72 MW of nuclear power, 373 MW of hydro power, 40 MW of wind power, 38 MW of solar power, 50 MW of solar coupled with BESS, 121 MW of standalone BESS, and 145 MW from Distributed Renewable Energy (DRE) sources and 137 MW through MTOA/STOA arrangements. Collectively, this resource portfolio is projected to adequately meet the forecast demand while complying with the prescribed reliability criteria. The energy storage requirement can also be met through power tie up from Hydro PSPs. Based on the planned capacity addition, the likely PRM in the year 2036-37 is about 5%.
4. Other than long term contracts, the UT is likely to contract STOA/MTOA around 71 MW to 137 MW in different years as outlined in the RAP to meet the balance energy requirements in coming years. The STOA/MTOA requirement can be fulfilled through power procurement from market or bilateral agreements. The STOA/MTOA value reflects the peak value requirement and seasonal banking requirements in terms of MW.
5. The projected capacity and generation mix outlined in the report meet the utility's RCO requirements for the years 2026-27 to 2036-37.
6. The current capacity mix of the utility has 27% of contracted capacity from fossil fuel sources. The share of fossil fuel-based capacity is likely to reduce to 19% in 2036-37 and non-fossil fuel-based energy is likely to increase from 73% in 2026-27 to 81% in 2036-37. In 2036-37, the RE based (that includes hydro, solar, wind, Solar + BESS and DRE) capacity are likely to constitute around 62% of the total installed capacity.

7. It is likely that Chandigarh may have surplus capacity available during the months from February to April and October to December which can be shared with other utilities/states through banking / bilateral arrangements.
8. Timely commissioning of planned capacities is critical to ensuring that the UT can meet the projected peak electricity demand and electrical energy requirements identified in this study. Any deviation from the planned schedule may lead to resource shortfalls and could significantly increase the cost of reliably meeting the UT's power demand.

Planned Future Contracts (MW) considered in the study

Sr. No.	Tied capacity name	Type of generation	Expected COD	Tentative CPDL's share (in MW)
1.	RAPP-D	Nuclear	2027-28	14
2.	Subansiri HEP	Hydro	2027-28	2.5
3.	Solar + BESS	Solar + BESS	2028-29	50

Assumption for Resource Adequacy Studies

1. Electricity Demand & peak requirement: As per projections made by CPDL.
2. Demand Profile: Based on hourly demand profile of 2024-25.
3. Existing & Planned Capacity: As per the information shared by the utility.
4. Cost parameters: based on information in Long Term National Resource Adequacy Plan (2026-27 to 2035-36).

RE CUF considered

Hydro	Wind	Solar	Solar + BESS
46%	28%	29%	29%

Technical Parameters

Technology	Type	Availability (%)	Ramping (%/min)	Min. Technical. (%)
Coal/ Lignite	Existing/Planned	85	1	55
Gas	Existing	85	5	0
Nuclear	Existing/Planned	68	Constant Load	-
Biomass	Existing/Planned	60	2	50
Hydro	Existing/Planned/ Candidate	As per available hourly generation profile	100	-
Solar	Existing/Planned		-	-
	Candidate		-	-
Wind	Existing/Planned		-	-
	Candidate		-	-

Transmission Parameters

A single node has been considered for the purpose of study with all generating units and demand connected to the node. No transmission bottleneck has been considered for the study. Interstate ATC limit has not been considered in the study.

Financial Parameters

Following cost parameters have been assumed:

Resource	Capex* (in ₹/MW)	O&M Fixed Cost (in ₹/MW)	Construction Time (in years)	Amortization /Life time (in years)
Solar	4.5 Cr to 4 Cr	1 % of Capex	1	25
Wind (Onshore)	7.5 Cr	1% of Capex	2	25
BESS (4-Hour)	5.0 Cr to 3.6 Cr	1 % of Capex	0.5	15