सत्यमेव जयते

Government of India

Ministry of Power

Central Electricity Authority

Resource Adequacy Plan for Transmission System of Uttarakhand up to the year 2034-35

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Executive Summary

Uttarakhand's growth as a regional commercial and industrial center, along with its prominence as a hub for religious and adventure tourism, has led to a steady rise in electricity demand. A strong transmission system is crucial for Uttarakhand to meet its growing electricity demand and to ensure uninterrupted power supply to the consumers.

In 2024-25, Uttarakhand witnessed an all-time peak demand of 2863 MW, which is about 09% higher than the peak demand of 2635 MW in 2023-24. In the present FY 2025-26 (as of October, 2025), Uttarakhand witnessed an all-time peak demand of 2910 MW in the month of June. As per the revised 20th Electric Power Survey (EPS) Report, peak electricity demand in Uttarakhand is projected to increase to 3917 MW by 2029-30 and to 4707 MW by 2034-35.

At present, there is primarily one state generating company located in Uttarakhand, Uttarakhand Jal Vidyut Nigam Limited (UJVNL), which has an installed hydro generation capacity of about 1500 MW. In addition, gas-based generation of M/s Saravanthi (450 MW) and M/s Gama (225 MW) are also located in Kashipur. However, these gas-based generators do not provide generation on 24x7 basis. Therefore, electricity demand is met through imports from the Northern Grid.

A comprehensive system study for strengthening of the transmission network in Uttarakhand has been carried out by CEA in association with PTCUL, CTUIL, NRLDC, SLDC Uttarakhand and Resource Adequacy Plan has been prepared, indicating the transmission capacity required to be added in Uttarakhand till the year 2034-35. The studies have been carried out on the basis of data/inputs furnished by Uttarakhand (PTCUL).

Based on the studies, the planned 400 kV, 220 kV and 132 kV substations in the state have been reviewed and establishment of new sub-stations have been suggested. Transmission schemes have also been planned to integrate Renewable Energy (RE) generated from large, medium & small hydro projects and solar generation from few solar plants in Uttarakhand with intra-state (Uttarakhand) transmission network. Strengthening the existing transmission infrastructure and augmentation at existing sub-stations with additional interconnecting transformers (ICTs), reconductoring of various 220 kV & 132 kV existing transmission lines etc. with HTLS conductors have also been suggested.

Short circuit studies have also been carried out for the PTCUL transmission network. It has been observed that the fault level at various sub-stations in Uttarakhand is within the designed limits.

At present, the existing intra-state transformation capacity in Uttarakhand is around 5515 MVA (at 220 kV & above voltage level), which is planned to be increased to 11870 MVA by 2029-30 and 14000 MVA by 2034-35.

Similarly, the existing intra-state transmission line length is around 1499 ckm (at 220 kV & above voltage level), which is planned to be increased to 1930 ckm by 2029-30 and 2148 ckm by 2034-35.

To ensure uninterrupted 24x7 power supply to the consumers & evacuation of power from planned hydro projects, implementation of the planned transmission system needs to be expeditiously taken up by PTCUL.

Chapter-1

Power Supply Scenario in Uttarakhand and Projected Electricity Demand

1.1 Background

Uttarakhand, the 27th state of India formed on 9th November 2000, is located in the Himalayan region and is often referred to as the "Devbhumi" (Land of the Gods) due to the presence of several prominent pilgrimage sites, including the Char Dham. The state's terrain is predominantly mountainous, with scattered population centers and significant seasonal variation in population due to tourism and pilgrimage activities. These geographical and demographic characteristics influence electricity demand patterns and require a reliable and resilient transmission system.

Uttarakhand is witnessing a growing demand for electricity, driven by expanding urban areas, essential services, and improving socio-economic conditions. Ensuring reliable power supply to residential regions, commercial establishments, industrial areas, healthcare services, and pilgrimage routes is of critical importance. A robust transmission network plays a key role in supporting the state's development objectives and maintaining uninterrupted power supply.

The Char Dham Yatra period, in particular, results in a substantial temporary rise in electricity demand along specific corridors. The presence of critical facilities such as hospitals, transport infrastructure, communication systems, and public utilities in these regions necessitates adequate redundancy and voltage stability in the transmission network. Strengthening of supply routes towards key pilgrimage towns therefore forms an important consideration in system planning for Uttarakhand.

The state has significant hydroelectric potential, with a large share of hydro power in its generation mix. However, generation availability varies seasonally, leading to surplus power during monsoon months and reduced availability in winter when river inflows decline. To ensure year-round adequacy, Uttarakhand also draws power from the Inter-State Transmission Network. Strengthening the transmission system is therefore essential for both evacuation of hydro power and meeting the state's energy demand during peak conditions.

This requires development of new transmission corridors, augmenting the capacity of existing substations, construction of new inter-state connections and reconductoring of existing

transmission lines to improve network reliability and redundancy. Integration of hydro and distributed solar generation further necessitates coordinated transmission planning for stable and efficient power flow.

A comprehensive system study of the Transmission System of Uttarakhand has been carried out by CEA in association with PTCUL, CTUIL, NRLDC and SLDC Uttarakhand and Resource Adequacy Plan has been prepared indicating the transmission capacity required to be added in Uttarakhand till the year 2034-35.

1.2 Present Power Scenario in Uttarakhand

1.2.1 Installed Generation Capacity

At present, there is primarily one generating company located in Uttarakhand, Uttarakhand Jal Vidyut Nigam Limited (UJVNL). Also, two gas based generation, M/s Saravanthi (450 MW) and M/s Gama (225 MW) are at located in Kashipur. The installed generation capacity including shares allocated from Central Generating Stations, is given in Table 1.1:

Table 1.1: Installed Electricity Generation Capacity

	Capacity (MW)
State Sector	1459.52
Power tied up from Private Generating Stations	2142.41
Allocation from Central Generating Stations	1327.52
Total	**4929.45**

Source: Installed Capacity Report CEA, September, 2025

There are one Distribution Company in Uttarakhand i.e. Uttarakhand Power Corporation Limited (UPCL) which is supplying power to the end users in the state of Uttarakhand.

1.2.2 Electricity Demand of Uttarakhand

Being a hilly state dependent mainly on hydro generation, seasonality contributes to the seasonal and diurnal variation of the electricity demand in the state. In 2024-25, Uttarakhand had witnessed an all-time peak demand of 2863 MW, which is about 09% higher than the peak demand of 2635 MW in 2023-24. Additionally, a shift in the month of peak demand has been

observed recently as peak demand in 2023-24 was observed in the month of January, 2024 and peak demand in 2024-25 was observed in the month of June, 2024.

In 2025-26 (till October, 2025), Uttarakhand witnessed an all-time peak demand of 2910 MW in the month of June. As per the revised 20th Electric Power Survey (EPS) Report, peak electricity demand in Uttarakhand is projected to increase to 3917 MW by 2029-30 and to 4707 MW by 2034-35.

The daily peak demand pattern for the last two financial years (2023-24 and 2024-25) is indicated in Fig 1.1

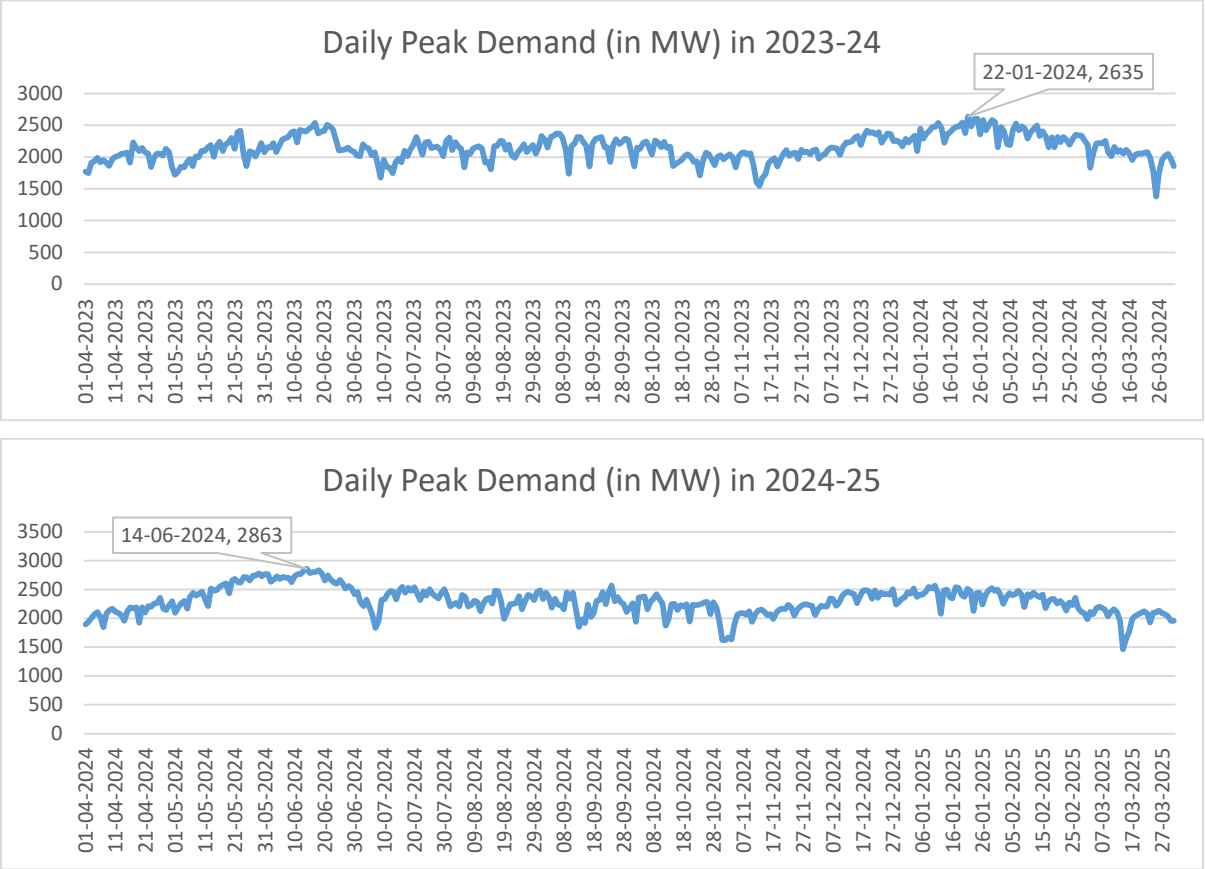
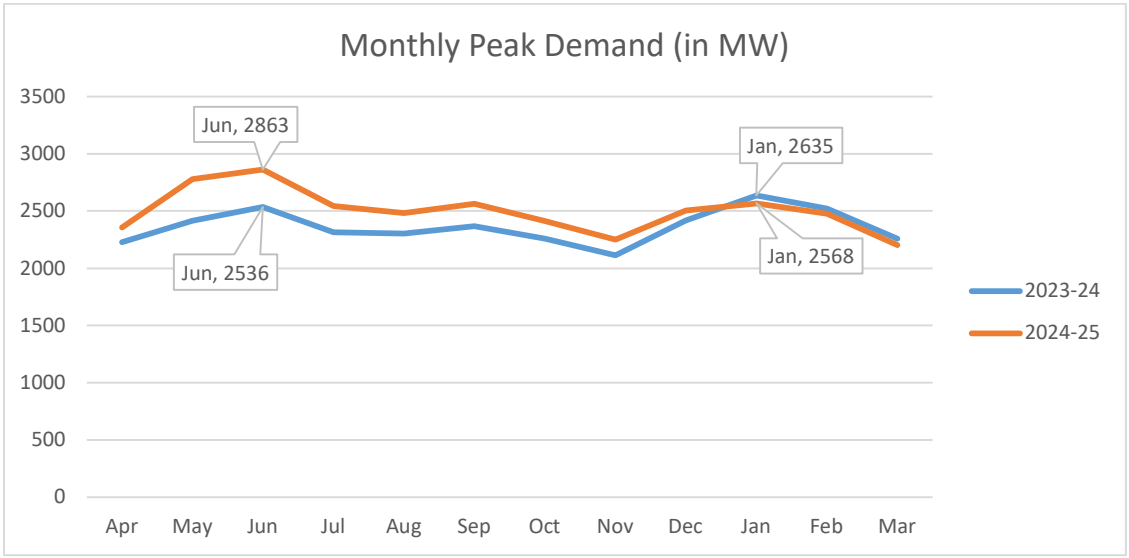


Fig 1.1: Daily peak demand for the 2023-24 and 2024-25

Monthly variation of peak electricity demand in Uttarakhand for the past two years is shown in Fig 1.2:



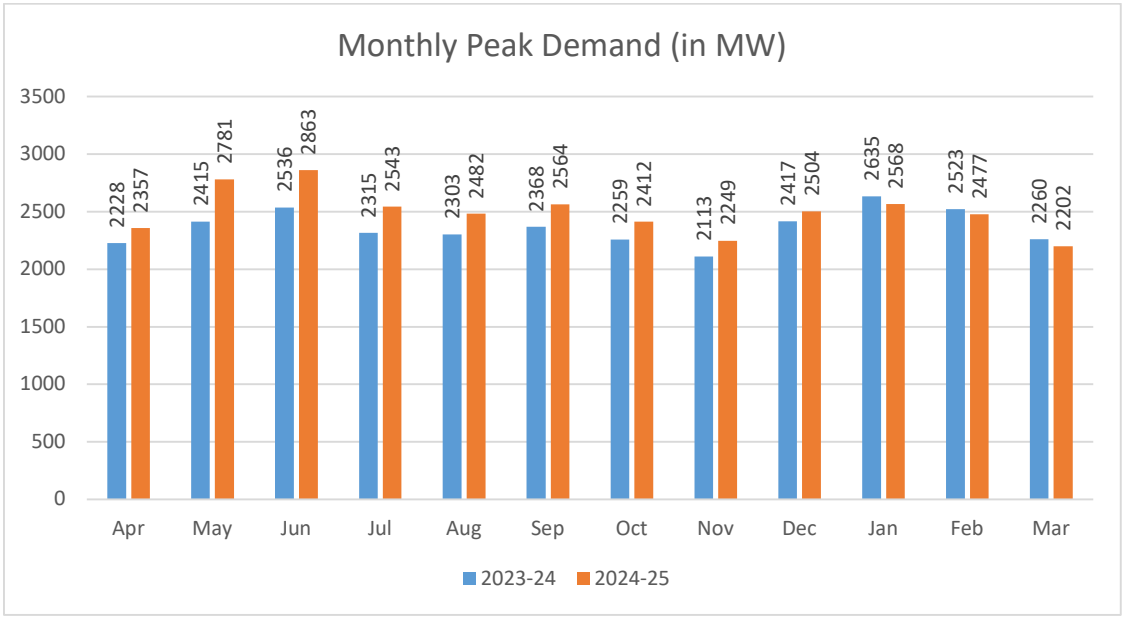


Fig 1.2: Month-wise peak electricity demand in Uttarakhand for past two years

In 2024-25, Uttarakhand had witnessed an all-time peak demand of 2863 MW in the month of June 2024. The hourly demand pattern of Uttarakhand for the month of June 2024 and January 2024 is given in Fig 1.3 and Fig 1.4 below:

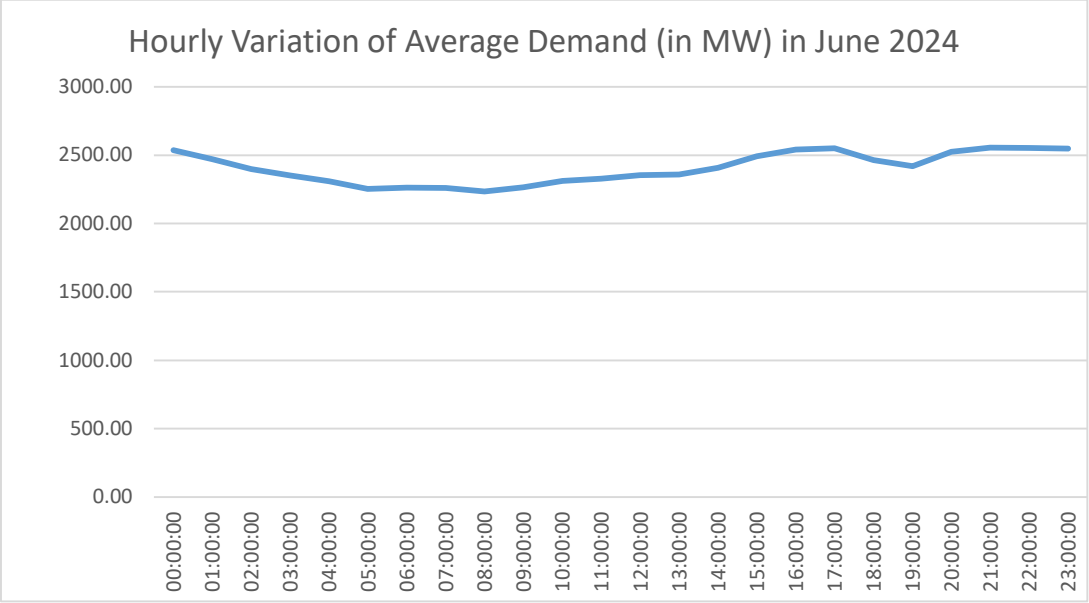


Fig 1.3: Avg. demand pattern of Uttarakhand in the month of June 2024

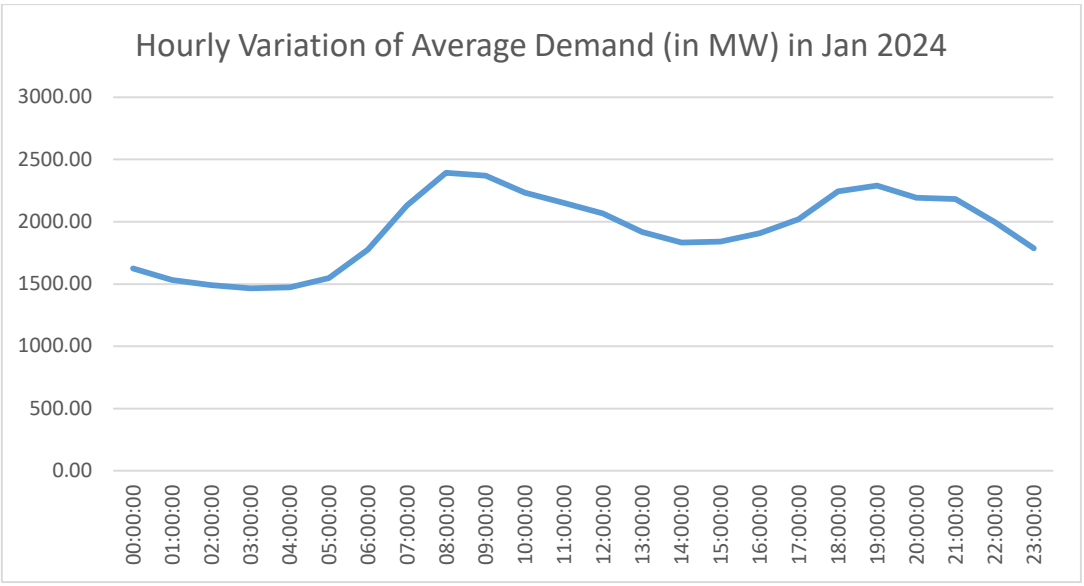


Fig 1.4: Avg. demand pattern of Uttarakhand in the month of January 2024

1.2.3 Existing Transmission Network in Uttarakhand

Uttarakhand has 03 Nos. of 400 kV intra-state substations at Kashipur, Rishikesh & Srinagar/Khandukhal and 03 Nos. 400 kV ISTS sub-stations, namely, Puhana (Roorkee), Sherpur (Dehradun) & Jauljibi (Pithoragarh), which are connected to intra-state substations of PTCUL. Additionally, 765 kV Koteshwar Pool (for evacuation of power from Tehri complex)

and 400 kV Vishnuprayag Station (for evacuation of power from Vishnuprayag HEP) are also present in the state.

At present, Uttarakhand has ATC (Available Transfer Capacity) of 1800 MW against operationalized GNA (General Network Access) of 1402 MW (as of October, 2025).

a) Intra-State Transmission System in Uttarakhand

The details of existing intra-state transmission network in Uttarakhand are given in Table 1.2.

Table 1.2: Existing Intra-State transmission system

Intra-State Transmission System	**400 kV**	**220 kV**	**132 kV**
Number of Sub-stations	3	12	32
Transformation Capacity (MVA) voltage level wise	1815	3700	3800
Transmission line (ckm) (including cable)	418	1081	1857

400 kV InSTS substations:

- 1x240 + 1x315 MVA, 400/220 kV Rishikesh S/s
- 2x315 MVA, 400/220 kV Kashipur S/s
- 2x315 MVA, 400/220 kV Srinagar S/s

b) Inter-State Transmission Network in Uttarakhand

The details of existing Inter-State transmission network in Uttarakhand are given below:

765 kV ISTS substation:

- 765/400 kV, 4x800 MVA Tehri/Koteshwar GIS Pooling station

400 kV ISTS substation:

- 1x500 MVA + 2x315 MVA, 400/220 kV Puhana (Roorkee) S/s
- 2x315 MVA, 400/220 kV Sherpur (Dehradun) S/s
- 2x315 MVA, 400/220 kV Jauljibi (Pithoragarh) S/s

220 kV ISTS substation:

- 3x100 MVA, 220/132 kV Sitarganj S/s
- 2x100 MVA, 220/132 kV Chandak (Pithoragarh) S/s

The existing intra-state transmission network of PTCUL is given in the Fig. 1.5 below:

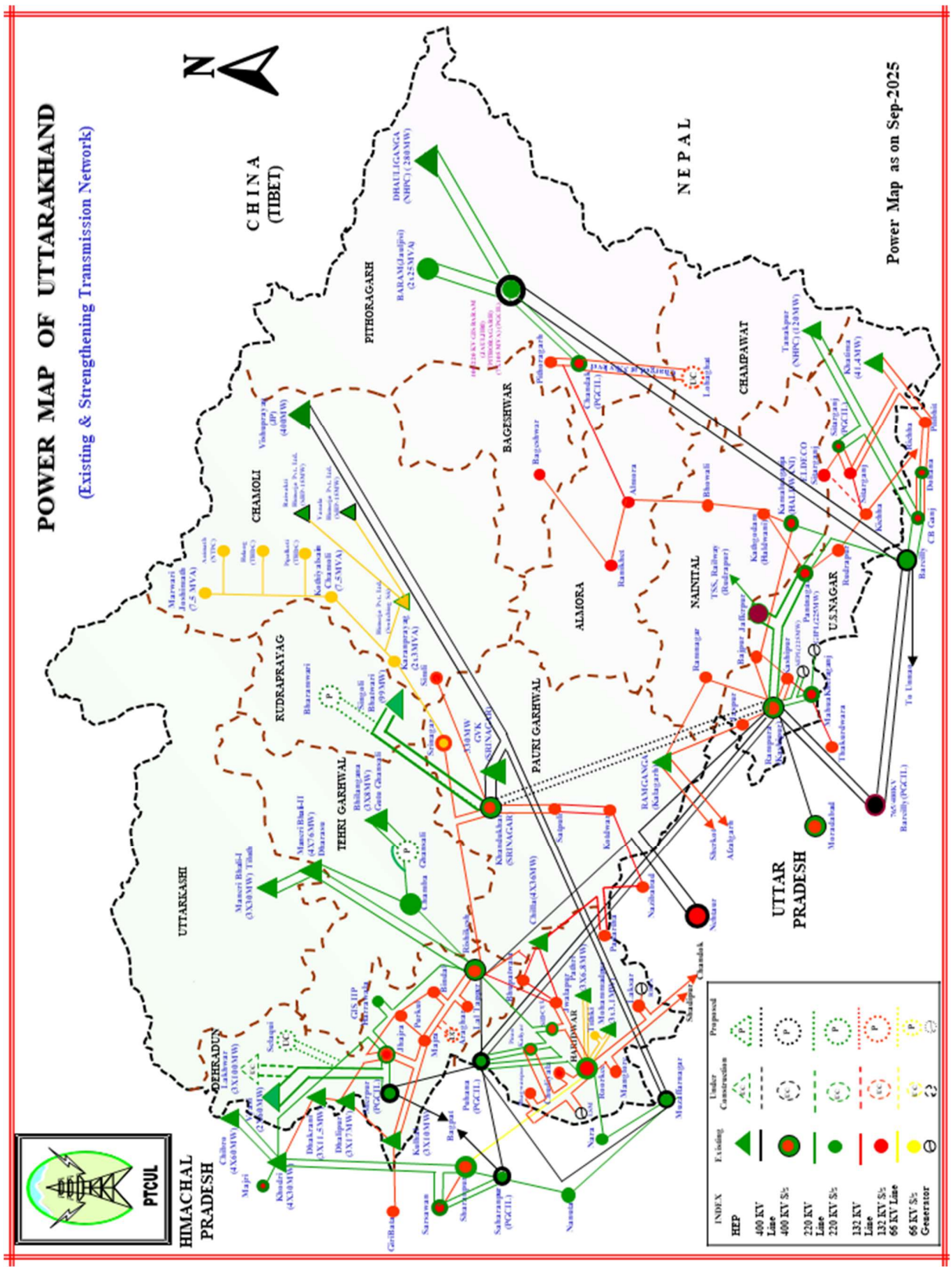


Fig 1.5: Existing intra-state transmission network of PTCUL in Uttarakhand

1.2.4 Constraints in Transmission System in Uttarakhand

The following major constraints are observed and regularly being highlighted by Grid India in the Quarterly Operational Feedback Report:

(i) 'N-1' non-compliance of 400/220 kV, 2x315 MVA ICTs at Kashipur Sub-station: During high demand season of Uttarakhand and less generation at gas stations such as Shravanti and Gamma Infra, 400/220 kV ICTs loading at Kashipur remains 'N-1' non-compliant. The 'N-1' loading limit of Kashipur ICTs is 400 MW and SPS has been implemented. The ICT loading was observed ~ 400 -500 MW for sometimes in Q-1 of 2025-2026. This is also the limiting constraint for import of power by Uttarakhand. To mitigate the constraint, PTCUL has awarded the works for establishment of additional 1x500 MVA, 400/220 kV ICT at Kashipur. Also, establishment of new 400/220 kV Khurpia farm Sub-station has been proposed that would relieve 400/220 kV Kashipur S/s and also relieve the loading of 220 kV Baikunthapur (Barielly) - Pantnagar line.

(ii) High loading of 220 kV lines from Roorkee (PG) Sub-station has been observed during high demand scenario in Uttarakhand state. Earlier, establishment of 400/220/33 kV substation at Landhora in Haridwar district was agreed in 2016 considering the exponential growth in industrial and domestic load. However, owing to land erosion at proposed area and some technical problems due to passage of gas pipeline through the proposed land of the sub-station, the sub-station was not implemented. Accordingly, possibility for construction of 400 kV sub-station at another place was explored and PTCUL has proposed to establish the 400 kV sub-station at the premises of existing 220 kV Roorkee S/s. In addition, 2x160 MVA, 220/132 kV Raipur (Bhagwanpur) S/s with 220 kV D/c line from Roorkee/Puhana (PG) to proposed 220/132 kV Raipur (Bhagwanpur) S/s has also been agreed for implementation.

(iii) Severe low voltages were observed in PTCUL grid due to high demand and less intrastate hydro generation. To mitigate the same, around 190 MVAr capacitor banks are being commissioned by DISCOM in state of Uttarakhand. Further, with commissioning of Koteshwar – Rishikesh 400 kV D/c line, the power supply to Uttarakhand and the voltage profile is expected to improve. This link would provide additional outlet from Tehri/Koteshwar generation complex and would act as an independent feed for providing reliable and quality power supply to Rishikesh area.

In addition, Uttarakhand SLDC has also observed and highlighted several transmission constraints in intra-state network of Uttarakhand such as over loading in a few 132 kV lines and 'N-1' non-compliance of ICTs at various sub-stations and presence of a few 132 kV radial feeders.

The necessary transmission system strengthening required for mitigation of transmission constraints are outlined later in this report. List of 'N-1' non-compliant substations at present is given in Table 1.3.

Table 1.3: List of 'N-1' non-compliant substations

Sl. No.	**Sub-station**	**Existing MVA Capacity**		**Peak load experienced till date (MW)**
		Breakup of Capacity (MVA)	**Total MVA**	
400 kV level (InSTS)				
1.	400/220 kV Kashipur	2x315	630	536
220 kV level (InSTS)				
2.	220/132 kV S/s Rishikesh	2x160	320	260
3.	220/132/33 kV S/s Jhajhra	2x160, 220/132 kV 2x80, 132/33 kV	320 160	270 103
4.	220/132/66/33 kV Roorkee	2x160, 220/132 kV 2x50, 220/33 kV 3x20, 132/66 kV 3x40, 132/33 kV	320 100 60 120	304 98 50 108
5.	220/132/33 kV SIDCUL Haridwar	2x160, 220/132 kV 50+25, 220/33 kV 2x80, 132/33 kV	320 75 160	258 76 164
6.	220/33 kV Chamba	50+25	75	49
7.	220/132/33 kV Piran Kaliyar	2x100, 220/132 kV 2x50, 220/33 kV	200 100	132 74
8.	220/33 kV IIP Harrawala	2x50	100	85
9.	220/132/33 kV SIDCUL Pantnagar	2x160, 220/132 kV 2x50, 220/33 kV 2x80, 132/33 kV	320 100 160	252 60 100
10.	220/132 kV Kamaluaganja / Haldwani	2x100	200	132
11.	220/132/33 kV Mahuakheraganj	2x100	200	142
132 kV level (InSTS)				
1.	132 kV Kathgodam	2x40	80	58

Sl. No.	Sub-station	Existing MVA Capacity		Peak load experienced till date (MW)
2.	132 kV Kiccha	3x40	120	80
3.	132 kV Majra	3x40	120	102
4.	132 kV Rudrapur	2x40+1x20	100	75
5.	132 kV Bhagwanpur	3x40	120	98
6.	132 kV Almora	2x20	40	33
7.	132 kV Ranikhet	2x(3x5)+1x20	50	26
8.	132 kV Bhupatwala	3x40	120	105
9.	132 kV Jwalapur	3x40	120	125
10.	132/66/33 kV Srinagar	20+3x5, 132/66 kV 20+40, 132/33 kV	35 60	28 36
11.	132 kV Kashipur	3x40	120	85
12.	132 kV Bazpur	80+20	100	77
13.	132 kV Ramnagar	40+20	60	56
14.	132 kV Manglore	40+80	120	80
15.	132 kV Laksar	3x40	120	95
16.	132 kV Simli	2x20	40	23
17.	132 kV Bhowali	2x20	40	32
18.	132 kV Purkul	2x40	80	75
19.	132 kV Padartha	2x40	80	58
20.	132 kV Chudiyala	1x20+1x40	60	56
66 kV level (InSTS)				
1.	66 KV Kothiyalsain	1x7.5	7.5	03
2.	66 KV Karanprayag	1x5+1x7.5+1x3	15.5	10
3.	66 KV Thithki	2x15	30	20

Source: PTCUL

PTCUL has highlighted that supply of transformers has been a major issue due to which 'N-1' criteria is not being met at various substations.

Increasing electricity demand of Uttarakhand has to be met through power imported from other states through ISTS network. Further, there is significant difference between the hydro power generation in summer and winter seasons in Uttarakhand. During low hydro generation in

winters, Uttarakhand takes more power through ISTS network. To meet the growing electricity demand, developing new transmission infrastructure, strengthening the existing transmission infrastructure and augmenting the existing substations with additional interconnecting transformers (ICTs) is required.

1.3 Projected Electricity Demand

As per the revised 20th Electric Power Survey (EPS) Report, peak electricity demand in the state of Uttarakhand is projected to increase to 3917 MW by 2029-30 and to 4707 MW by 2034-35 as given in Table 1.4.

Table 1.4: Projected electricity demand in Uttarakhand

Sl. No.	Year	Peak electricity demand in Uttarakhand (MW)
1.	2022-23 (Actual)	2594
2.	2023-24 (Actual)	2635
3.	2024-25 (Actual)	2863
4.	2025-26 (Projection)	3127
5.	2026-27 (Projection)	3347
6.	2027-28 (Projection)	3537
7.	2028-29 (Projection)	3732
8.	2029-30 (Projection)	3917
9.	2030-31 (Projection)	4090
10.	2031-32 (Projection)	4251
11.	2032-33 (Projection)	4413
12.	2033-34 (Projection)	4565
13.	2034-35 (Projection)	4707

The growth in electricity demand is due to rapid urbanization, rising population leading to increased usage of electrical and electronic appliances, especially Air Conditioners in summers and heating appliances in winter seasons. The recent push to Electric Vehicles (EVs), Uttarakhand Rail network, proposed industrial expansions in Uttarakhand contribute towards increase in electricity demand.

Chapter-2

Transmission System Addition by 2029-30

2.1 Load Flow Studies for Preparation of Resource Adequacy Plan of Intra-State Transmission System in Uttarakhand

2.1.1 Scope of Load flow studies:

System studies for the Resource Adequacy plan for Uttarakhand's InSTS have been carried out using PSSE Software. The studies that have been carried out include the following:

(i) Steady state load flow studies

(ii) Contingency Analysis

(iii) Short Circuit Studies

Peak electricity demand in Uttarakhand generally used to occur in winter seasons during evening time. Recently, the peak electricity demand in Uttarakhand has been observed in summers during evening time; however, the difference in the day peak and evening peak has not been much. Hence, for preparation of Resource Adequacy plan of Transmission system in Uttarakhand, both the scenarios i.e. afternoon (solar peak generation scenario) and evening (no solar generation scenario) for winter season (less hydro generation) and summer season (high hydro generation) have been studied.

The load flow studies have been carried out for two time-frames: 2029-30 and 2034-35 for peak electricity demand scenarios occurring during summer and winter seasons. To meet the projected electricity demand, augmentation required in both ISTS as well as Intra-State Transmission System has been worked out.

2.1.2 Transmission Planning Guidelines

(i) Uttarakhand's transmission network has been represented generally at 132 kV and above voltage levels, where loads have been generally considered incidental on 132 kV buses.

(ii) Load power factor has been considered within ± 0.95 as per the Central Electricity Authority (Technical Standards for Connectivity to the Grid) (Amendment) Regulations, 2019.

(iii) 'N-1' criterion is generally followed for providing reliable power supply to the consumers. In certain cases, 'N-1-1' criterion has also been considered to ensure system

robustness against more severe, sequential outage scenarios. Being a Himalayan state, occurrence of natural calamities like landslides, flash floods etc. are common during monsoons; therefore, possible contingencies due to natural disasters have been considered while performing studies in specific cases.

(iv) Transformation capacity of any single sub-station at 132 kV, 220 kV and 400 kV levels has been considered to be limited to 500 MVA, 1000 MVA and 2500 MVA respectively as per the Manual on Transmission Planning Criteria of CEA (2025).

(v) Due to RoW constraints, re-conductoring in the existing 220 and 132 kV lines with higher capacity conductors HTLS (High Temperature Low Sag), having the ampacity more than double of existing ampacity of conductor has been considered.

(vi) The system voltage has been considered within the following limits as per the Manual on Transmission Planning Criteria, 2025:

132 kV	Max 145 kV, Min 122 kV
220 kV	Max 245 kV, Min 198 kV
400 kV	Max 420 kV, Min 380 kV
765 kV	Max 800 kV, Min 728 kV

2.2 Load Flow Studies for the year 2029-30:

(i) The load flow studies have been carried out for three scenarios:

a) Peak electricity demand scenario during summer season in the month of June coinciding with high hydro generation and;

b) Peak electricity demand scenario during winter season in the month of January coinciding with low hydro generation and;

c) Off-peak electricity demand scenario during summer and winter season.

(ii) Peak electricity demand of Uttarakhand in 2029-30 as per revised 20th EPS projections is 3917 MW and the same has been considered for studies.

(iii) For the peak demand scenario of 2029-30, the transmission elements (new lines/ reconductoring of the existing lines and new substations/ICT augmentations) already taken up for implementation by PTCUL have been considered.

(iv) Under-implementation/planned ISTS schemes in Uttarakhand to be commissioned by 2029-30, have been considered in the studies, details of which are given below:

a) ISTS schemes under implementation: Details of ISTS schemes under implementation is given in Table 2.1:

Table 2.1: ISTS schemes under implementation

S. No.	Transmission scheme	Status
1	**Khandukhal (Srinagar) – Rampura (Kashipur) line** Khandukhal (Srinagar) – Rampura (Kashipur) 400 kV D/c line – 192 km	Under Construction (Commissioning timeframe 2026-27)
2	**System strengthening in Northern Region (NRSS XXXVI)** Koteshwar – Rishikesh 400 kV D/c line – 38 km	Under Construction (Commissioning timeframe 2025-26)

(v) Under implementation/Planned InSTS Schemes in Uttarakhand to be commissioned by 2029-30 have been considered in the studies, details of which are given below:

a) Sub-stations: The details of under-implementation/planned InSTS Substations to be commissioned by 2029-30 are given below:

Table 2.2: Details of Under-Implementation InSTS Substations

S. No.	Substation	Commissioning time frame
400 kV Sub-station		
1.	400 kV Pipalkoti Switching Station *(For evacuation of power Tapovan Vishnugarh HEP of NTPC and Vishnugarh Pipalkoti HEP of THDC agreed under UITP)*	2026-27
220 kV Sub-station		
2.	220/132/33 kV Manglore S/s (2x160+2x40 MVA)	2026-27
3.	220/33 kV Selaqui (Dehradun) GIS S/s/ (2x50 MVA)	2026-27
4.	220/33 kV Banbasa Tanakpur S/s (Phase-I) (2x50 MVA)	2026-27
5.	220/33 kV Brahmwari S/s (6x10 MVA)	2026-27
132 kV Sub-station		
6.	132/33 kV Araghar GIS S/s (2x40 MVA)	2026-27
7.	132/33 kV Khatima GIS S/s (2x40 MVA)	2026-27
8.	132/33 kV Lohaghat GIS S/s (2x20 MVA)	2026-27
9.	132/33 kV Dhaulakhera GIS S/s (2x40 MVA)	2026-27

Table 2.3: Details of Planned new InSTS Sub-stations

S. No.	Substation	Commissioning time frame
400 kV Sub-station		
1.	400/220 kV Roorkee Sub-station (2x500 MVA) *(recently agreed in the meeting held on 26.09.2025)*	2028-29
2.	400/220/132/33 kV Khurpia Farm Sub-station (2x500 MVA, 2x160 MVA, 2x80 MVA) *(recently agreed in the meeting held on 26.09.2025)*	2029-30
220 kV Sub-station		
3.	220/33 kV Ghansali S/s (6x10 MVA) (Under UITP scheme)	2027-28
4.	220/132 kV Majra GIS S/s (2x160 MVA) *(to meet the demand of Dehradoon area)*	2027-28
5.	220/132/33 kV Raipur Bhagwanpur S/s (2×160 MVA, 2×40 MVA) *(recently agreed in the meeting held on 26.09.2025)*	2028-29
6.	220/33 kV Munsiyari S/s (6x10 MVA) *(for evacuation of power from SHPs)*	2029-30
132 kV & 66 kV Sub-station		
7.	132/33 kV Sarverkhera S/s (2x40 MVA)	2027-28
8.	66/33 kV Nandprayag GIS Substation (6x10 MVA) (for reliability of supply of power at Char Dham yatra route)	2029-30

b) ICT augmentation: The details of Under implementation ICT augmentation works at InSTS sub-stations to be completed by 2029-30 are given below:

Table 2.4: Details of Under-Implementation ICT augmentations (InSTS)

Sl. No.	Substation	Voltage Level (kV)	Existing Capacity (MVA)	ICTs to be added (MVA)	Status	Timeframe
ICT augmentations at 400 kV level						
1.	Kashipur	400/220	2×315	1×500	Under Implementation	2027-28

Sl. No.	Substation	Voltage Level (kV)	Existing Capacity (MVA)	ICTs to be added (MVA)	Status	Timeframe
ICT augmentations at 220 kV level						
2.	SIDCUL Haridwar	220/33	50+25	1×25 → 1×50*	Under Tendering	20 months from date of award
3.	Jhajhra	220/132	2x160	1x160	Under Implementation	2026-27
ICT augmentations at 132 kV level						
4.	Bazpur	132/33	80+40	1×40 → 1×80*	Commissioned	Sept 2025
5.	Manglore	132/33	2x40	1×40 → 1×80*	Commissioned	Sept 2025
6.	Ramnagar	132/33	40+20	1×20 → 1×40*	Under Implementation	2025-26
7.	Jhajhra	132/33	2x80	1x80	Under Implementation	2026-27
8.	Simli	132/66	-	3x20	Under Implementation	2026-27

**Replacement of existing ICTs*

c) Transmission lines:

Table 2.5: Details of Under-Implementation Transmission Lines (InSTS)

Sl. No.	Transmission Line	Commissioning time frame
400 kV Transmission lines		
1.	Pipalkoti – Srinagar 400 kV D/c line (173 ckm)	2026-27
2.	Pipalkoti (THDC) – Pipalkoti Line 400 kV D/c line (1 ckm)	2026-27
3.	Tapovan Vishnugad – Pipalkoti 400 kV D/c line (36 ckm)	2028-29
220 kV Transmission lines		
4.	LILO of Tanakpur – CB Ganj 220 kV line at proposed 220 kV Banbasa Tanakpur S/s (1 ckm)	2026-27
5.	LILO of Roorkee – Nara 220 kV line at proposed 220 kV Manglore S/s (2 ckm)	2026-27
6.	LILO of Khodri – Jhajra 220 kV S/c line at proposed 220 kV Selaqui (Dehradun) substation (1.4 ckm)	2026-27
7.	Bramhwari – LILO point of Singoli Bhatwari 220 kV D/c line (30 ckm)	2026-27
132 kV		
8.	Bindal – Purkul 132 kV line (11 ckm)	July 2025

Sl. No.	Transmission Line	Commissioning time frame
9.	LILO of Majra - Laltappar 132 kV line at proposed 132 kV Araghar S/s (through 132 kV Underground Cable- 3.6 ckm)	2026-27
10.	Stringing of Pithoragarh – Lohaghat 132 kV line (50 ckm)	2026-27
11.	LILO of Khatima – Sitarganj 132 kV line at 132 kV Khatima-II S/s (2 ckm)	2026-27
12.	LILO of Kathgodam (Haldwani) – Pantnagar 132 kV line at 132 kV Dhaulakhera S/s (1 ckm)	2026-27
13.	LILO of Karanprayag – Kothiyalsain 66 kV line at 132 kV Simli S/s (9.3 ckm)	2026-27

Table 2.6: Details of Planned New Transmission Lines (InSTS)

Sl. No.	Transmission Line	Commissioning time frame
400 kV		
1.	LILO of Puhana – Muzaffarnagar 400 kV Line at 400 kV Roorkee S/s (5 ckm)	2028-29
2.	LILO of Bareilly – Kashipur 400 kV line at 400 kV Khurpia Farm S/s (40 ckm)	2029-30
220 kV		
3.	LILO of Jhajara - IIP 220 kV line at 220 kV Majra S/s (1 ckm)	2027-28
4.	Puhana – Raipur (Bhagwanpur) 220 kV D/c line (Overhead and Underground) (22 ckm)	2028-29
5.	Extension of LILO of Jhajra – Sherpur 220 kV line at Vyasi till 400 kV Sherpur (PGCIL) S/s so as to form Jhajra – Sherpur (PG) 220 kV D/c line and Sherpur (Dehradoon) – Vyasi 220 kV D/c line (5 ckm)	2028-29
6.	LILO of Bareilly – Pantnagar 220 kV line at Khurpia Farm S/s (4 ckm)	2029-30
7.	Baram – Munsiyari 220 kV D/c line (100 ckm)	2029-30
132 kV		
8.	LILO of Kashipur – Mahuwakheraganj 132 kV D/c line at 132 kV Serverkhera S/s (17.4 ckm)	2027-28
9.	LILO of ELDICO – Kichha 132 kV line at 132 kV Sitarganj S/s (10 ckm)	2029-30
10.	Mahuwakheraganj – Jaspur 132 kV D/c line (22.3 ckm)	2029-30

Sl. No.	Transmission Line	Commissioning time frame
11.	LILO of Kicha – Rudrapur 132 kV line at Khurpia Farm S/s (17 ckm)	2029-30
12.	LILO of Bhagwanpur – LSM 132 kV line (OH and UG) at proposed 220/132/33 kV Raipur, Roorkee S/s (17 ckm)	2029-30

Table 2.7: Reconductoring of Existing 220 and 132 kV lines (InSTS) with HTLS conductor

Sl. No.	Transmission Line	Status
1.	Roorkee – Puhana 220 kV line (8.81 km)	Under implementation
2.	Majra – Jhajhra 132 kV line (16 km)	Under implementation
3.	Sitarganj (PGCIL) – ELDECO Sitarganj 132 kV line and Kichha – Sitarganj 132 kV line (53.50 km)	Under implementation

d) Bus reactors: Details of existing bus reactors is given below:

Table 2.8: Existing Bus Reactors

Sl. No.	Sub-station	Voltage Level (kV)	Reactive Power Support (MVAr)
A	**ISTS**		
1.	Koteshwar	765 400	3x80 1x125
2.	Dehradoon	400	1x80
3.	Roorkee	400	1x125
4.	Pithoragarh	220	1x25
B	**InSTS**		
1.	Rishikesh	400	1x50
2.	Khandukhal (Srinagar)	400	1x80

Table 2.9: Bus Reactors Under-Implementation/Planned by PTCUL

Sl. No.	Substation	Voltage Level (kV)	Reactive Power Support (MVAr)	Status
1.	Kashipur	400	1x125	Under Tendering

2.3 Load Flow Study Results:

Based on the load flow studies, following has been observed:

a) The existing, under construction and planned sub-stations by PTCUL by 2029-30 would be required to cater the increasing demand in the state of Uttarakhand and to keep the system 'N-1' complaint. In addition, the following new sub-stations and associated transmission lines may be planned to meet the growing demand of the state and to increase reliability in Kotdwar and Kumaon region of Uttarakhand:

Details of additional new intra-state sub-stations and transmission lines that may be planned, are given in Table 2.10 and Table 2.11.

Table 2.10: Additional New InSTS Sub-stations by 2029-30

Sl. No.	Name of the proposed sub-station	Voltage Level (kV)	Total Capacity (MVA)	Breakup of Capacity (MVA)	Timeframe
400 kV Substation					
1.	400/132 kV Kotdwar GIS S/s	400/132	630	2x315	2029-30
220 kV Substation					
2.	220 kV Barhani (Bajpur) GIS S/s	220/132 132/33	320 80	2x160 2x40	2029-30

Table 2.11: Additional New InSTS Transmission Lines by 2029-30

Sl. No.	Transmission lines	ckm	Timeframe
400 kV Transmission line			
1.	LILO of Vishnuparayag – Muzaffarnagar (UP) 400 kV line at 400 kV Kotdwar S/s #	5	2029-30
220 kV Transmission line			
2.	LILO of 2nd ckt of Kashipur – Pantnagar 220 kV line at Barhani/Bajpur S/s	5	2029-30
132 kV Transmission line			
3.	LILO of Kotdwara – Satpuli 132 kV line at 400/132 kV Kotdwar S/s (2.5 ckm)	2.5	2029-30
4.	LILO of Kotdwara – Padartha 132 kV line at 400/132 kV Kotdwar S/s (2.5 ckm)	2.5	2029-30

 # to be discussed with other stakeholders such as UPPTCL during finalization.

b) Higher loading in some intra-state transmission lines has been observed. Till the commissioning of planned new sub-stations and to make the system 'N-1' complaint, reconductoring of few transmission lines may be required to meet the growing demand and to improve the reliability of supply of electricity in the state. Accordingly, PTCUL may plan the reconductoring of these intra-state transmission lines with HTLS conductor (700 Amp to 1600 Amp at 220 kV for ACSR Zebra Conductor and 400 Amp to 1000 Amps at 132 kV for ACSR Panther conductor). Further, PTCUL may also take up re-conductoring works (with HTLS) for intra-state transmission lines with old and ageing conductors.

Table 2.12: Additional Reconductoring of Existing 220 kV and 132 kV lines (InSTS)

Sl. No.	Transmission Line	Tentative timeframe
1.	SIDUL – Rishikesh 220 kV D/c line (25.09 ckm)	2027-28
2.	Pirankaliyar – SIDCUL 220 kV line (19 ckm)	2027-28
3.	IIP – Rishikesh 220 kV line (31 ckm)	2026-27
4.	Rishikesh - T Point – Bhupatwala 132 kV line (27 ckm)	2026-27
5.	Kathgodam – Bhowali 132 kV line (14.06 ckm)	2026-27
6.	Haldwani – Kathgodam 132 kV line (8.70 ckm)	2026-27
7.	Chilla – Padartha Line (23.14 ckm)	2026-27
8.	Padartha – Najibabad - Kotdwar 132 kV line (66.33 ckm)	2026-27
9.	Bindal – Majra 132 kV line (8.50 ckm)	2027-28
10.	Purkul – Jhajra 132 kV line (21.40 ckm)	2027-28
11.	Kashipur (400) – Kashipur 132 kV (Ckt-I) (6 ckm)	2027-28
12.	Kashipur (400) – Kashipur 132 kV (Ckt-II) (5.50 ckm)	2027-28
13.	SIDCUL - Roorkee, Jwalapur - Roorkee and SIDCUL - Jwalapur 132 kV Ist Ckt (56.84 ckm)	2027-28
14.	Kashipur (400 kV) – Jaspur 132 kV line (18 ckm)	2027-28
15.	Rishikesh – Srinagar 132 kV line (66 ckm)	2027-28
16.	PiranKaliyar – Chudiyala 132 kV line (16 ckm)	2028-29
17.	Chilla – Jwalapur 132 kV line (17 ckm)	2028-29
18.	Khurpia Farm – Kiccha 132 kV line (16 ckm)	2029-30

19.	Roorkee – Thithki – Mohammadpur 66 kV (42.60 ckm)	2026-27

A tapping (T) configuration has been present in the intra-state network at 132 kV Chilla – Bhupatwala – Rishikesh link. In this regard, it may be mentioned that as per Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations, 2023:

There shall not be tapping of another transmission line from the main line for 66 kV and above class of lines: Provided that during natural calamities, tapping may be allowed to ensure emergency power supply to affected areas till normalcy is restored.

Accordingly, PTCUL may explore the possibility for removal of this tapping arrangement through establishment of a switching sub-station near T-point or extending the 132 kV circuit from T-point till Bhupatwala S/s after removal of tapping arrangement.

c) **ICT augmentation (Intra-State):** With increase in electricity demand in the state and considering the sub-station wise projected load indicated by PTCUL, the existing ICTs at many intra-state sub-stations have been observed to be 'N-1' non-complaint and accordingly augmentation of ICTs at those sub-stations has been proposed. Further, PTCUL has informed that ICTs at certain sub-stations are more than 30-35 years old. Accordingly, PTCUL may perform the residual life assessment of those ICTs and take up the replacement work appropriately.

Details of ICT augmentations required at various InSTS substations by 2029-30 is given in Table 2.13.

Table 2.13: Additional ICT augmentations under InSTS by 2029-30

Sl. No.	Sub-station	Voltage Level (kV)	Existing Capacity (MVA)	ICTs to be added (MVA)	Timeframe
ICT augmentations at 400 kV level					
1.	Rishikesh	400/220	240+315	1×500	2029-30
ICT augmentations at 220 kV level					
2.	Pirankaliyar	220/132 220/33	2x100 2x50	2×100 → 2×160* 2×50 → 2×100*	2027-28
3.	IIP Harrawala	220/33	2x50	2×50 → 2×100*	2029-30
4.	Mahuakheraganj	220/132	2x100	2×100 → 2×160*	2029-30

Sl. No.	Sub-station	Voltage Level (kV)	Existing Capacity (MVA)	ICTs to be added (MVA)	Timeframe
5.	Kamaluaganja	220/132	2x100	2×100 → 2×160*	2029-30
ICT augmentations at 132 kV level					
6.	Kichha	132/33	3x40	1×40 → 1×80*	2027-28
7.	Majra	132/33	3x40	1×40 → 1×80*	2027-28
8.	Rudrapur	132/33	2x40+1x20	1×20 → 1×40*	2027-28
9.	Bhagwanpur	132/33	3x40	1×40 → 1×80*	2027-28
10.	Srinagar	132/66 132/33	20+3x5 20+40	1×(3x5) → 1×20* 1×20 → 1×40*	2027-28
11.	Manglore	132/33	80+40	1×40 → 1×80*	2027-28
12.	Laksar	132/33	3x40	1×40 → 1×80*	2027-28
13.	Roorkee	132/33	3x40	1×40 → 1×80*	2027-28
14.	Roorkee	132/66	3x20	1×20 → 1×40*	2027-28
15.	SIDCUL Haridwar	132/33	2x80	1x80	2027-28
16.	Almora	132/33	2x20	1x20	2028-29
17.	Ranikhet	132/33	2(3x5)+1x20	2x(3x5) → 2×20*	2028-29
18.	Bhowali	132/33	2x20+3x5	(3x5) → 3×15*	2028-29
19.	Purkul	132/33	2x40+1x20	1×20 → 1×80*	2028-29
20.	IDPL	132/33	1x12.5+1x20	1×12.5 → 1×40*	2029-30
21.	Bhupatwala	132/33	3x40	1×40 → 1×80*	2029-30
22.	Jwalapur	132/33	3x40	1x80	2029-30
23.	Kashipur	132/33	3x40	1×40 → 1×80*	2029-30
24.	Simli	132/33	2x20	2×20 → 2×40*	2029-30
25.	Kamaluaganja	132/33	3x40	1×40 → 1×80*	2029-30
ICT augmentations at 66 kV level					
26.	Kothiyalsain	66/33	1x7.5	1x7.5	2028-29
27.	Karanprayag	66/33	7.5+5+3	1×3 → 1×7.5*	2028-29

**Replacement of existing ICTs*

d) **Bus reactors (intra-state):** Details of the additional Bus Reactors by 2029-30 is given in Table 2.14.

Table 2.14: Additional Bus Reactors by 2027-28 (InSTS)

Sl. No.	Substation	Voltage Level (kV)	Reactive Power (MVAr)
1.	Kashipur	400	1×125

2.4 Short Circuit Study Analysis

In the short circuit studies carried out for the year 2029-30, the list of substations with corresponding fault level is given below in Table 2.15:

Table 2.15: List of substations with fault level

Substation	Voltage Level (kV)	Fault Level (kA)
Koteshwar	765	24
Koteshwar	400	35
Srinagar (PTCUL)	400	19
Dehradoon	400	29
Khurpia Farm	400	21
Roorkee (Puhana)	400	36
Rishikesh	400	30
Kashipur	400	33
Jauljivi	400	08
Roorkee (PTCUL)	400	26
Srinagar	220	15
Dehradoon	220	23
Khurpia Farm	220	23
Roorkee (Puhana)	220	24
Rishikesh	220	30
Kashipur	220	26
Jauljivi	220	09
Roorkee (PTCUL)	220	20
Haridwar	220	18
Harrawal IIP	220	15

Substation	Voltage Level (kV)	Fault Level (kA)
Ghansali	220	11
Jhajra	220	26
Baram	220	08
Jafarpur	220	15
Pirankaliyar	220	22
Selaqui	220	17
Manglore	220	14
Raipur Bhagwanpur	220	20
Barmhwari	220	07
Majra	220	16
Haldwani/Kamaluaganj	220	07
Pantnagar	220	21
Mahaukheraganj	220	21
Khodri	220	17
Barni Bajpur	220	13

The fault levels at sub-stations in Uttarakhand have been observed within limits; however, it is recommended that all new sub-stations should be planned with higher short circuit capacity as per the CEA Manual on Transmission Planning Criteria, 2025 which is given below:

The maximum short-circuit level on any new substation bus should not exceed 80% of the rated short circuit capacity of the substation equipment. The 20% margin is intended to take care of the increase in short-circuit levels as the system grows. The rated breaking current capability of switchgear at different voltage levels may be taken as given below:

Voltage Level	Rated Breaking Capacity
765 kV	50 kA / 63 kA
400 kV	63 kA / 80 kA
220 kV	40 kA / 50 kA / 63 kA
132 kV	25 kA / 31.5 kA / 40 kA
66kV	31.5 kA

2.5 Summary of Intra-State Transmission Network in Uttarakhand by 2029-30

The details of the intra-state transmission network by 2029-30 is given below in Table 2.16.

Table 2.16: Intra-State Transmission System by 2029-30

Intra-State Transmission System	400 kV level	220 kV level	132 kV level
Sub-stations:			
Existing Substations	3	12	32
New Substations by 2029-30	4	5	4
Total substations by 2029-30	**7**	**17**	**36**
Transformation Capacity (MVA):			
Existing Transformation Capacity (MVA)	1815	3700	3800
Addition in Transformation Capacity (MVA)	3630	2725	1772
Total Transformation Capacity by 2029-30 (MVA)	**5445**	**6425**	**5572**
Transmission Lines:			
Existing Transmission Lines (including cable) (ckm)	418	1081	1857
Addition of Transmission Lines (including cable) by 2029-30 (ckm)	260	171	166
Total transmission lines (including cable) by 2029-30 (ckm)	**678**	**1252**	**2023**

Additionally, reconductoring of existing 220 kV and 132 kV lines as mentioned in table 2.12, is also to be considered.

Chapter-3

Transmission System Addition by 2034-35

3.1 Load Flow Studies for the year 2034-35:

(i) The load flow studies have been carried out for three scenarios:

a) Peak electricity demand scenario during summer season in the month of June coinciding with high hydro generation and;

b) Peak electricity demand scenario during winter season in the month of January coinciding with low hydro generation and;

c) Off-peak electricity demand scenario during summer and winter season.

(ii) Peak electricity demand of Uttarakhand in 2034-35 as per revised 20th EPS projections is 4707 MW.

3.2 Load Flow Study Results:

I. Transmission elements proposed to be added under Intra-State between 2030-31 to 2034-35

a) **New substations:** Details of new substations may be planned for implementation by 2034-35 under intra-state & ISTS are given below:

Table 3.1: New InSTS substations by 2034-35

Sl. No.	Name of the proposed sub-station	Voltage Level (kV)	Total Capacity (MVA)	Breakup of Capacity (MVA)	Time-frame
400 kV Substations					
1.	400 kV SIDCUL (Haridwar) Substation	400/220	1000	2x500	2030-31
2.	Extension at 400 kV Pipalkoti Switching	400/132	60	3x20	2031-32
220 kV Substations					
3.	220/132 kV Almora S/s	220/132	200	2x100	2030-31
4.	220/132 kV Jwalapur S/s	220/132	320	2x160	2030-31
5.	220/33 kV Naugaon S/s	220/33	90	9x10	2031-32
132 kV and 66 kV Substations					
6.	132/33 kV Kapkot S/s	132/33	60	6x10	2030-31

Sl. No.	Name of the proposed sub-station	Voltage Level (kV)	Total Capacity (MVA)	Breakup of Capacity (MVA)	Time-frame
7.	132/33 kV Bhikiyasain (Syalde) S/s	132/33	60	6x10	2030-31
8.	132 kV Bahadrabad Substation	132/33	80	2x40	2031-32
9.	132/66/33 kV Pipalkoti S/s	132/66 66/33	60 20	3x20 2x10	2031-32

Table 3.2: New ISTS substations by 2034-35

Sl. No.	Name of the proposed sub-station	Voltage Level (kV)	Total Capacity (MVA)	Breakup of Capacity (MVA)	Time-frame
220 kV Substation					
1.	220 kV Mori Switching Station	220	-	-	2031-32

b) **Transmission lines:** Details of new transmission lines by 2034-35 under intra-state and ISTS are given below:

Table 3.3: New InSTS Transmission lines by 2034-35

Sl. No.	Transmission lines	ckm	Timeframe
400 kV Transmission lines			
1.	LILO of Rishikesh - Puhana 400 kV line at 400 kV SIDCUL Haridwar S/s	1.7	2030-31
Total (ckm)		**1.7**	
220 kV Transmission lines			
2.	Almora – Jaulgibi 220 kV D/c line	200	2030-31
3.	LILO of SIDCUL – Rishikesh 220 kV line at Jwalapur	5.8	2030-31
4.	LILO of Mori – Dehradun 220 kV D/c line at Naugaon S/s	10	2031-32
Total (ckm)		**215.8**	
132 kV Transmission lines			
5.	LILO of First Circuit of Ranikhet – Bageswar 132 kV	80	2030-31

Sl. No.	Transmission lines	ckm	Timeframe
	line at Bhikiyasain (Syalde) S/s		
6.	LILO of second circuit of Ranikhet – Bageshwar 132 kV line at proposed Kapkot S/s and stringing of second circuit of Ranikhet – Bageshwar 132 kV line	105	2030-31
7.	LILO of Jwalapur – Roorkee 132 kV line at 132 kV Bhadrabad S/s	7	2031-32
8.	LILO of SIDCUL – Roorkee 132 kV line at Bhadrabad S/s	1.3	2031-32
9.	Pipalkoti (400 kV Switching Substation) – Pipalkoti (132/66 kV) GIS Substation 132 kV D/c line	20	2030-31
Total (ckm)		**213.3**	
66 kV Transmission lines			
10.	Construction of LILO of Kothiyalsain – Joshimath 66 kV line at 132/66/33 kV Pipalkoti GIS Sub-station	6	2031-32
Total (ckm)		**6**	

Table 3.4: New ISTS Transmission lines by 2034-35

Sl. No.	Transmission lines	ckm	Timeframe
220 kV Transmission line			
1.	Mori – Dehradun 220 kV D/c line	230	2031-32
Total (ckm)		**230**	

c) **ICT augmentation (InSTS):**

With establishment of new sub-stations and augmentation of ICTs already proposed earlier (till 2029-30), sufficient margin is being created in the intra-state system at 400 kV & 220 kV level to cater to the increased demand in the state. However, addition of large quantum of load like industrial park, data centres etc., reliability of electricity supply at remote regions, may necessitate augmentation of intra-state in those specific areas; accordingly same would be taken up by PTCUL commensurate to requirement of additional demand.

Details of ICT augmentations at various InSTS substations (220 kV level & above) by 2034-35 is given in Table 3.5.

Table 3.5: ICT augmentations by 2034-35 under InSTS

Sl. No.	Sub-station	Voltage Level (kV)	Existing Capacity (MVA)	ICTs to be added (MVA)	Timeframe
ICT augmentations at 220 kV level					
1.	Majra	220/132	2x160	1x160	2033-34
2.	Selaqui	220/33	2x50	2×50 → 2×100*	2032-33
3.	Harrawal IIP	220/33	2x100	1×100	2034-35
4.	SIDCUL Haridwar	220/33	2x50	2×50 → 2×100*	2033-34

Further, requirement of ICT augmentation at 132 kV level at various substations has also been observed by 2034-35; however, the augmentation works needs to be taken up based on the actual demand growth at that particular sub-station. Therefore, the actual loading at the sub-stations needs to be continuously monitored and augmentation works should be planned considering the same.

d) Reconductoring of transmission lines: High loading has been observed in few transmission lines, necessitating the reconductoring with HTLS conductor.

Table 3.6: Reconductoring of Existing 220 kV lines (InSTS) by 2034-35

Sl. No.	Transmission Line	Tentative timeframe
1.	Khurpia Farm – Pantnagar 220 kV line (15 ckm)	2034-35
2.	Khurpia Farm – Baikunthapur/Bareilly (UP) 220 kV line *(natural ISTS line)*	2033-34
3.	Kashipur – Pantnagar 220 kV section (62 ckm)	2034-35

e) **Voltage Regulation:** Low voltages have been observed during certain high demand scenario at sub-stations in certain areas in the state. Therefore, PTCUL to keep the existing Capacitor Banks at the sub-stations at fully operative conditions and additional capacitor banks, if required based on actual voltage profile, to be implemented in the state.

3.3 Short Circuit Study Analysis

In the short circuit studies carried out for the year 2034-35, the list of substations with corresponding fault level is given below in Table 3.7:

Table 3.7: List of substations with fault level

Substation	Voltage Level (kV)	Fault Level (kA)
Koteshwar	765	21
Koteshwar	400	35
Srinagar (PTCUL)	400	14
Dehradoon	400	28
Khurpia Farm	400	16
Roorkee (Puhana)	400	34
Rishikesh	400	30
Kashipur	400	28
Jauljivi	400	09
Roorkee (PTCUL)	400	24
Kotdwar	400	08
Haridwar SIDCUL	400	22
Pipalkoti	400	10

3.4 Summary of Transmission Network in Uttarakhand by 2034-35

The details of the intra-state transmission network by 2034-35 is given below in Table 3.8:

Table 3.8: Intra-State Transmission system by 2034-35

Intra-State Transmission System	400 kV level	220 kV level
Sub-stations:		
No. of Substations by 2029-30	7	17
New Substations by 2034-35	1	3
Total substations by 2034-35	**8**	**20**
Transformation Capacity (MVA):		
Transformation Capacity by 2029-30 (MVA)	5445	6425
Addition in Transformation Capacity (MVA)	1060	1070
Total Transformation Capacity by 2043-35 (MVA)	**6505**	**7495**

Intra-State Transmission System	400 kV level	220 kV level
Transmission Lines:		
Transmission Lines by 2029-30 (including cable) (ckm)	678	1252
Addition of Transmission Lines (including cable) by 2034-35 (ckm)	1.7	215.8
Total transmission lines (including cable) by 2034-35 (ckm)	**680**	**1468**

In addition, reconductoring of existing 220 kV lines as mentioned in table 3.6, is also to be considered. Further, additional electricity demand from data centers is anticipated in the state; however, their locations have not yet been finalized. The resulting increase in electricity requirements may necessitate further augmentation of the transmission system, which can be planned once the locations and exact power requirements of the data centers are confirmed.

3.5 Additional Transmission Network in Uttarakhand beyond 2034-35

Beyond the augmentation in intra-state transmission system up to 2034-35, PTCUL has considered the following intra-state elements in the perspective plan for implementation post-2035. The implementation of following transmission elements to be reviewed based on the actual load growth in Uttarakhand and actual commissioning time frame of hydro generation projects in the state.

Substations: Details of new InSTS substations planned for implementation beyond 2035 are given in Table 3.9.

Table 3.9: New InSTS Substations beyond 2034-35

Sl. No.	Name of the proposed sub-station	Voltage Level (kV)	Total Capacity (MVA)	Breakup of Capacity (MVA)	Timeframe
220 kV Substations					
1.	220/33 kV Thal Nachani S/s	220	60	6x10	2035-36
2.	220/33 kV Tawaghat S/s	220	60	6x10	2036-37
3.	220/132/33 kV Landhora S/s	220/132/33	400	2x160 2x40	2035-36
4.	220/132 kV Banbasa, Tanakpur S/s (Phase-II)	220/132	320	2x160	2035-36

Transmission lines: Details of new InSTS transmission lines beyond 2034-35 are given below in Table 3.10:

Table 3.10: New InSTS Transmission Lines beyond 2034-35

Sl. No.	Transmission lines	ckm	Status
220 kV Transmission lines			
1.	LILO of Almora - Jauljivi 220 kV D/c line at 220 kV Thal S/s	50	2035-36
2.	LILO Dhauliganga - Jauljivi 220 kV line at 220 kV Tawaghat S/s	50	2036-37
3.	220 kV Interconnections for proposed 220 kV Landhora S/s	30	2035-36
Total (ckm)		**130**	
132 kV Transmission lines			
4.	Khatima-II – Banbasa, Tanakpur 132 kV D/c line	25	2035-36
5.	Banbasa,Tanakpur – Lohaghat 132 kV D/c line	80	2035-36
Total (ckm)		**105**	

Chapter-4

Transmission System for Evacuation of Power from Hydro Electric Projects in Uttarakhand

4.1 Background

Uttarakhand is renowned for its scenic beauty and rivers. Uttarakhand has significant hydroelectric potential due to its highly dissected Himalayan terrain and abundant snow and glacier-fed rivers. India's two major rivers viz. Ganga and Yamuna start their journey from here. The Ganga and its tributaries like Alaknanda, Bhagirathi, Mandakini, Pindar, and Dhauliganga as well as the Yamuna and its tributaries like Tons, Pabar etc. provide steep gradients ideal for run-of-river and storage-based hydropower projects. Hydro power stations were subsequently developed over a period of time in Uttarakhand and the state has a very high hydroelectric power potential which is yet to be harnessed.

4.2 Existing Hydro Electric Stations in Uttarakhand

(a) **State Sector:** UJVN Ltd. is a wholly owned corporation of the Government of Uttarakhand, operating hydropower plants ranging in capacity from 1.5 MW to 304 MW, totaling to 1440.60 MW. Details of installed HEPs (above 25 MW Capacity) operated by UJVNL is given in Table 4.1.

Table 4.1: Existing HEPs (above 25 MW Capacity) operated by UJVNL

S. No.	Hydro Electric Project	Capacity (MW)
1	Chibro	240
2	Khodri	120
3	Dhakrani	33.75
4	Dhalipur	51
5	Kulhal	30
6	Vyasi	120
7	Tiloth (Maneri Bhali-I)	90
8	Dharasu (Maneri Bhali-II)	304
9	Chilla Power House	144
10	Khatima	41.4
11	Kalagarh Power House	198
Total		**1372.15 MW**

In addition, many small HEPs (SHPs) are being operated by state entities and are connected with intra-state transmission network at 33kV/66 kV levels.

(b) **Central Sector:** Details of installed HEPs (above 25 MW Capacity) operated by Central entities is given in Table 4.2.

Table 4.2: Existing HEPs (above 25 MW Capacity) operated by CPSUs

S. No.	Hydro Electric Project	Capacity (MW)
1	Tehri Dam (THDC)	1000
2	Koteshwar (THDC)	400
3	Dhauli Ganga (NHPC)	280
4	Tanakpur (NHPC)	94.2
5	Natwar Mori (SJVN)#	60
Total		**1834.2 MW**

 # Evacuation system through intra-state network of Himachal Pradesh

In addition, Tehri PSP (THDC) with installed capacity of 1000 MW (2x500 MW) is being implemented, out of which 500 MW has been commissioned and additional 500 MW is to commissioned by end of 2025-26.

(c) **Private Sector:** Details of installed HEPs (above 25 MW Capacity) operated by Private entities is given in Table 4.3.

Table 4.3: Existing HEPs (above 25 MW Capacity) operated by Private entities

S. No.	Hydro Electric Project	Capacity (MW)
1	Singoli Bhatwari (Renew Power Pvt. Ltd.)	99
2	Vishnuprayag (Jaiprakash Power Ventures Pvt. Ltd.)	400
3	Srinagar (Alaknanda Hydro Power Company Ltd./GVK)	330
Total		**829 MW**

4.3 Upcoming Hydro Electric Projects in Uttarakhand

As stated earlier, Uttarakhand state has a very high hydroelectric power potential which is yet to be developed. However, the progress of development of Hydro Electric Projects in the state has been slow due to various factors. Occurrence of natural disasters halts progress of under

construction HEPs, for example Tapovan Vishnugad HEP of NTPC was severally damaged by Flash floods in 2021. Further, Hon'ble Supreme Court of India in its order in August 2013 prohibited the granting of new environmental and forest clearances for hydroelectric projects in Uttarakhand to study their impact on the state's environment and ecology, especially after the 2013 Kedarnath disaster. Progress of many HEPs is stalled in Uttarakhand as they have put under review by Hon'ble Supreme Court.

The details of upcoming HEPs proposed to be commissioned by 2029-30 in Uttarakhand along with tentative timeframe is given in Table 4.4.

Table 4.4: Upcoming HEPs in Uttarakhand (above 25 MW Capacity) till 2030

S. No.	Hydro Electric Project	Capacity (MW)	Tentative Commissioning
1	Vishnugad Pipalkoti (THDC)	444	2026-27
2	Tapovan Vishnugad (NTPC)	520	2028-29
3	Phatabyung (Statkraft)	76	2026-27

In addition, few small HEPs (SHPs) are proposed to be commissioned till 2029-30, which would be integrated with intra-state transmission network at 33 kV level.

4.4 Transmission system for evacuation of power from HEPs in Uttarakhand

The Uttarakhand Integrated Transmission Project (UITP) was approved by the Central Electricity Authority (CEA) in 2007 to build an optimal power-evacuation network in the state. The scheme envisages evacuating around 5,406 MW of hydropower generation from major river basins in Uttarakhand namely Alaknanda, Bhagirathi, Yamuna, and Sharda. CERC had accorded deemed ISTS Status to UITP Scheme being implemented by PTCUL.

Subsequently, as per the connectivity granted by CTUIL, the UITP scheme was revised and transmission elements under UITP scheme are being implemented by PTCUL commensurate to commissioning of associated with HEPs. Few elements have been agreed to be implemented under ISTS.

Table 4.5: Transmission system for HEPs (to be commissioned till 2029-30)

S. No.	**Transmission Element**	**Present Status & Time Frame**
1	400 kV Srinagar (Khandukhal) substation	Commissioned

S. No.	Transmission Element	Present Status & Time Frame
2	Srinagar S/s – Srinagar HEP (GVK) 400 kV D/c line	Commissioned
3	400 kV Pipalkoti Switching Station	U/C (2026-27)
4	Pipalkoti – Srinagar 400 kV D/c line	U/C (2026-27)
5	Tapovan Vishnugad HEP – Pipalkoti 400 kV D/c line	U/C (2028-29)
6	Vishnugad Pipalkoti (THDC) – Pipalkoti 400 kV D/c line	U/C (2026-27)
7	Srinagar (Khandukhal) – Rampura (Kashipur) 400 kV D/c line *(being implemented under ISTS)*	U/C (2026-27)
8	220 kV Bramhwari S/s	U/C (2026-27)
9	SB LILO point - Bramhwari 220 kV D/c line	U/C (2026-27)

Transmission schemes for evacuation of power from HEPs to be commissioned beyond 2029-30 have already been planned and are to be taken up commensurate to the commissioning of Hydro Electric projects. The schematics of planned transmission schemes are given below:

Fig 4.1: Transmission system for evacuation of power from HEPs in Yamuna River basin:

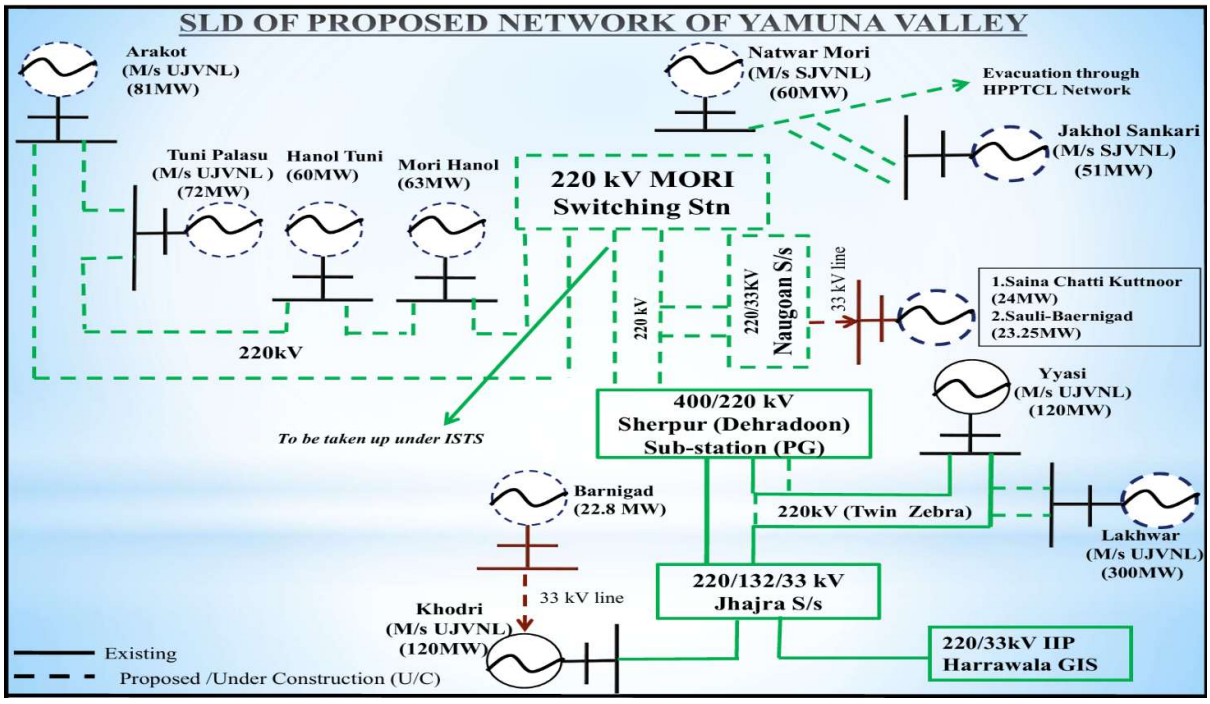


Fig 4.2: Transmission system for evacuation of power from HEPs in Sharda River basin:

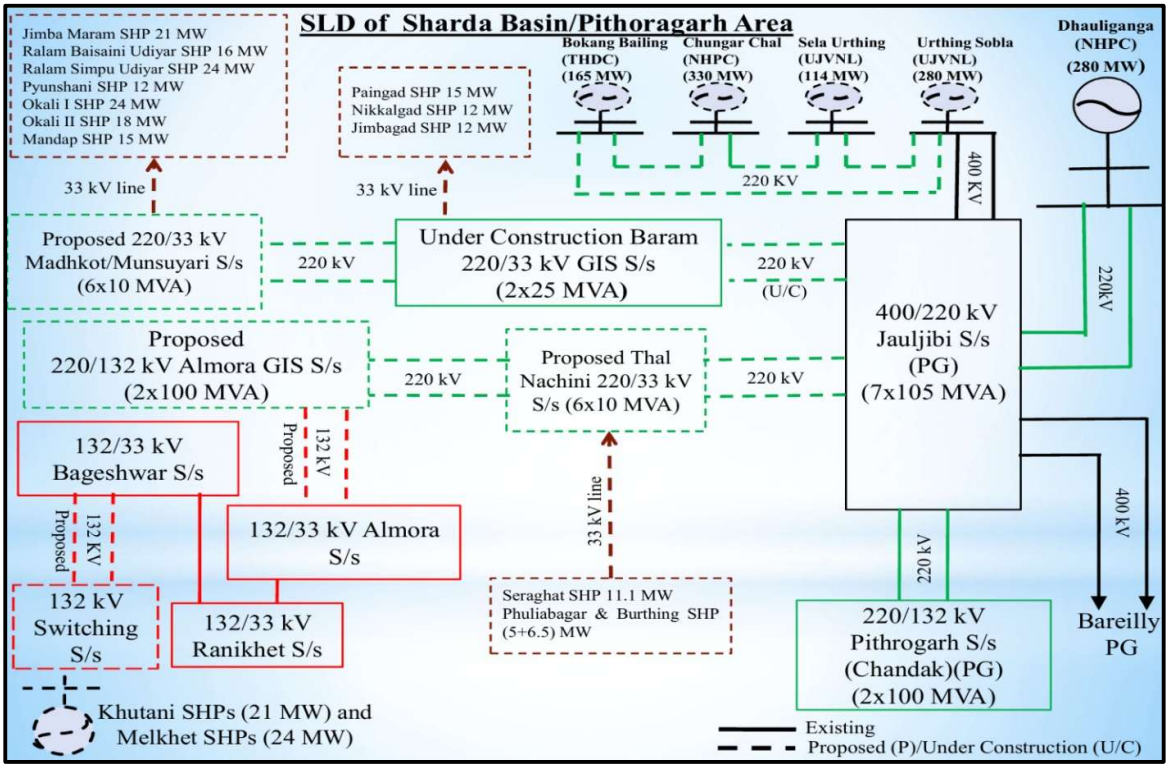
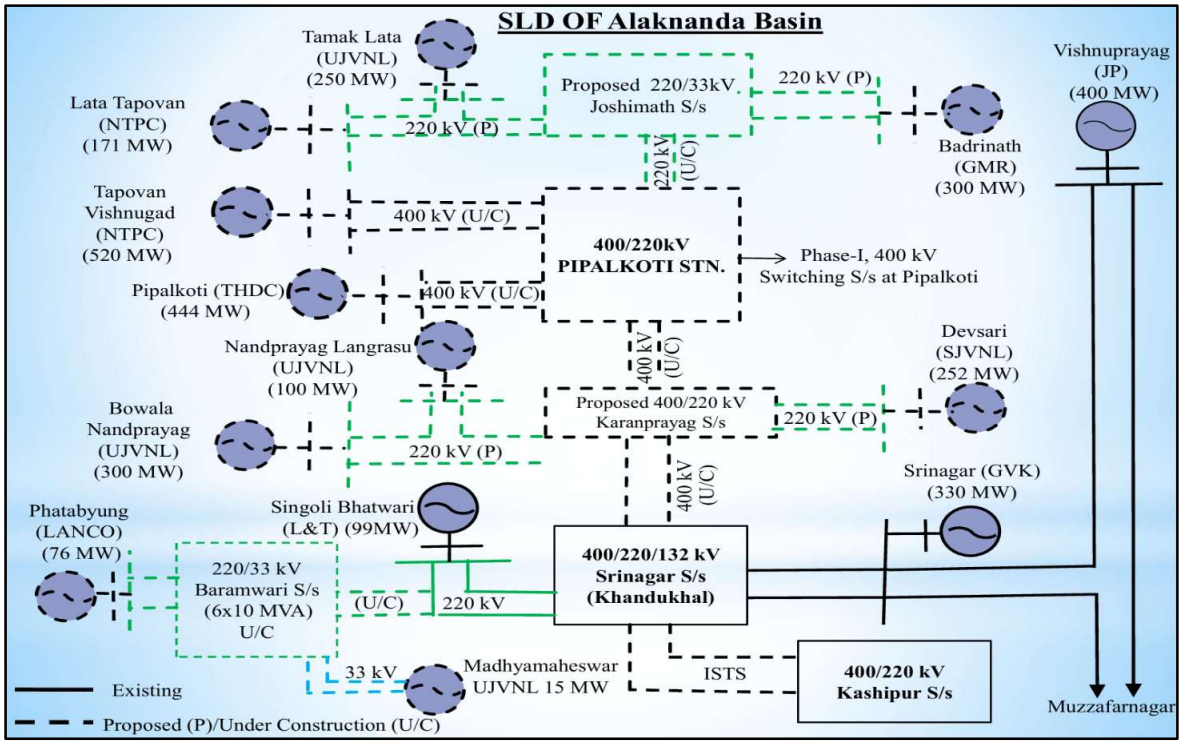


Fig 4.3: Transmission system for evacuation of power from HEPs in Alaknanda River basin:



Chapter-5

Recommendations

1. Intra-State Transmission system augmentation proposed till 2029-30 in the state of Uttarakhand comprises of 597 ckm (132 kV and above) of transmission lines and 8127 MVA of transformation capacity as detailed below:

Augmentation proposed by 2029-30			
	400 kV	**220 kV**	**132 kV**
Transmission Lines (ckm)	260	171	166
Transformation Capacity (MVA)	3630	2725	1772

   In addition, reconductoring of few existing 220 kV and 132 kV lines (about 565 ckm) with HTLS conductors is also required in the same timeframe.

2. The progress of addition of intra-state transmission system in the state has been slow for the last few years due to various reasons necessitating significant augmentation works in the intra-state transmission system till 2029-30. As the delay in the implementation may lead to network congestion and interruption in power supply in the state, all the planned transmission network should be timely implemented. Further, PTCUL should expedite the commissioning of transmission elements proposed for mitigation of transmission constraints in the state.

3. Intra-State Transmission system augmentation (220 kV & above) in Uttarakhand during 2029-30 to 2034-35 comprises of 217 ckm of transmission lines and 2130 MVA of transformation capacity as detailed below:

Augmentation proposed during 2030-31 to 2034-35		
	400 kV	**220 kV**
Transmission lines (ckm)	1.7	215.8
Transformation Capacity (MVA)	1060	1070

   PTCUL may initiate timely actions for approval of the schemes and subsequent award well in time to ensure timely commissioning of the planned transmission schemes. Some of the planned schemes during 2030-31 to 2034-35 timeframe may be reviewed based on actual growth of electricity demand and expected commissioning of proposed hydro generation.

4. The planned transmission schemes for evacuation of power from HEPs are to be taken up commensurate to the scheduled commissioning of Hydro Electric projects. The schemes to be

awarded and implemented considering the actual progress of associated Hydro generation projects.

5. PTCUL should provide appropriate space provisions for 66 kV and 33 kV bays in their grid substations for supply of power to DISCOMs, and new substations should have adequate space provision for extension/augmentation to meet future load growth. Planned 400 kV Substation should have adequate space provision for installation of bus reactor as per future requirement.
6. Transmission schemes which are planned for implementation till 2029-30, 2034-35 and beyond, may be taken up earlier or later as per requirement of Discom, actual load growth, commissioning schedule of hydro projects etc. Accordingly, the Resource Adequacy study for transmission system in the state may be reviewed in the coming years.

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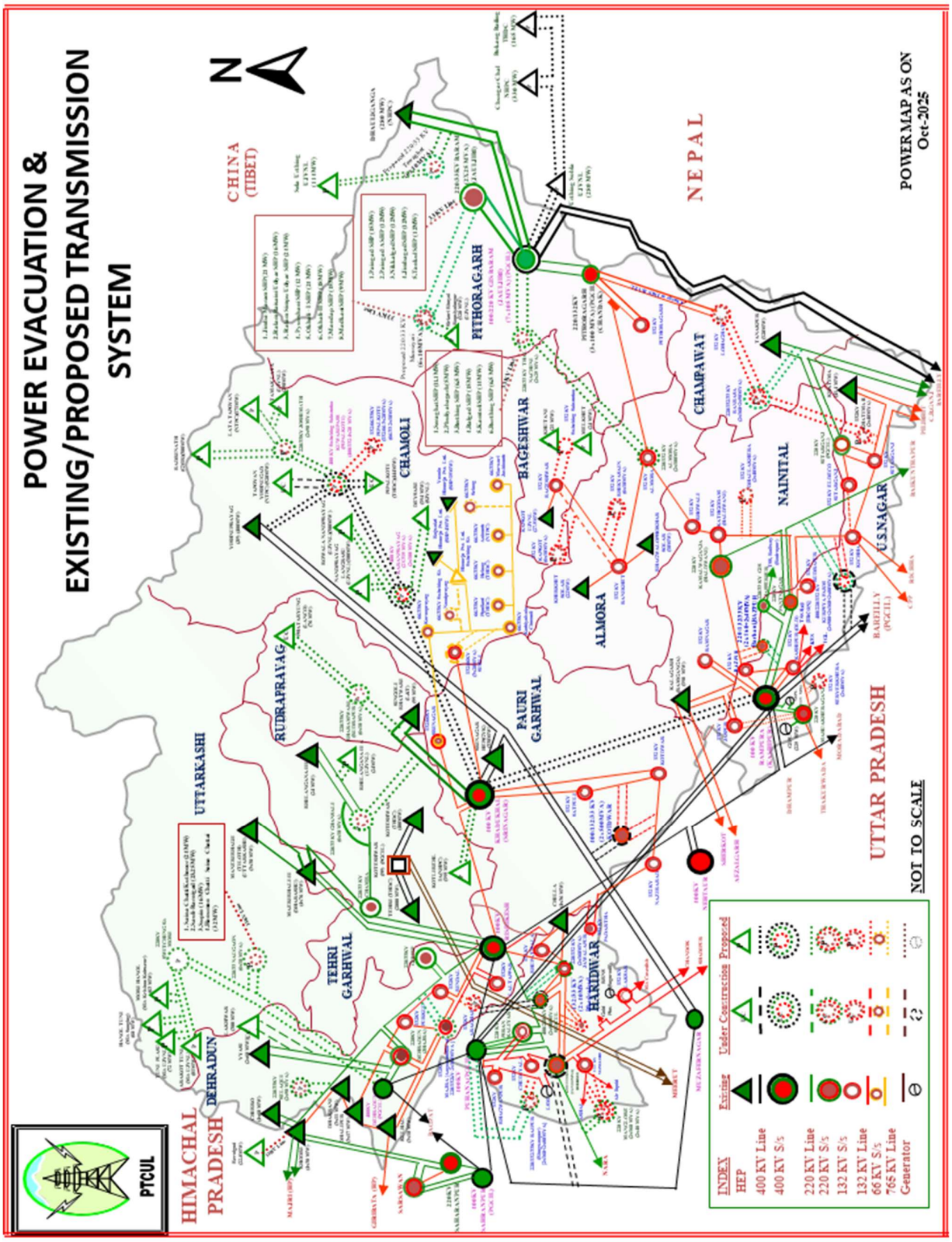

Fig. Power Map (existing and planned network) of Uttarakhand