

सत्यमेव जयते

Government of India

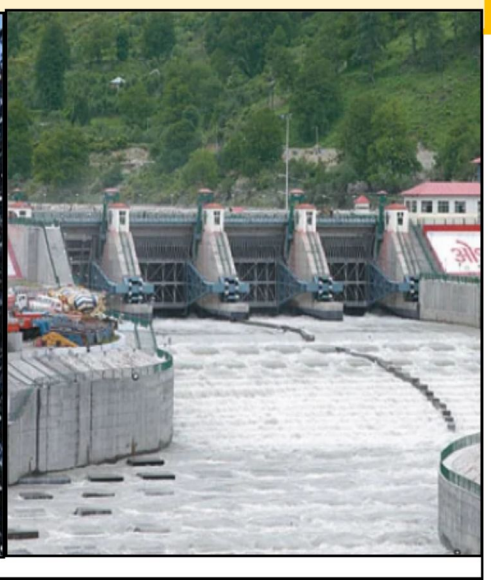
Ministry of Power

Central Electricity Authority

Resource Adequacy Plan for Transmission System of Himachal Pradesh up to the year 2035-36







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Executive Summary

Himachal Pradesh, owing to its vast hydropower potential and increasing electricity demand driven by urbanization, industrial development, infrastructure growth, and tourism activities, requires a reliable and robust transmission network. The state serves not only as a major hydroelectric power-generating region but also as an important contributor to the national grid. Therefore, strengthening the transmission system is essential for efficient evacuation of power from generating stations, meeting the growing demand within the state, and ensuring reliable and uninterrupted power supply to consumers.

In 2025-26, Himachal Pradesh witnessed an all-time peak demand of 2,310 MW, in the month of January, which is about 1.6% higher than the peak demand of 2,273 MW in 2024-25. As per the revised 20th Electric Power Survey (EPS) Report, peak electricity demand in Himachal Pradesh is projected to increase to 3,222 MW by 2030-31 and to about 3,700 MW by 2035-36.

A comprehensive system study for strengthening of the transmission network in Himachal Pradesh has been carried out by CEA in association with HPPTCL, CTUIL, Grid-India and Resource Adequacy Plan has been prepared, indicating the transmission capacity required to be added in Himachal Pradesh till the year 2035-36. The studies have been carried out on the basis of data/inputs furnished by Himachal Pradesh (HPPTCL).

At present, the existing intra-state transformation capacity in Himachal Pradesh is around 6,051 MVA (HPPTCL+ HPSEBL) (at 220 kV & above voltage level), which is planned to be increased to 10,158 MVA by 2030-31 and 11,418 MVA by 2035-36.

Similarly, the existing intra-state transmission line length is around 1100 ckm (HPPTCL+ HPSEBL) (at 220 kV & above voltage level), which is planned to be increased to 1628 ckm by 2030-31 and 2212 ckm by 2035-36.

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 HPPTCL and HPSEBL.

Chapter-1

Power supply scenario in Himachal Pradesh and projected electricity demand

1.1 Background

Himachal Pradesh, affectionately known as Devbhoomi or the Land of the Gods, is a pristine northern Indian state characterized by its dramatic Himalayan landscapes, snow-capped mountain ranges, deep river valleys, and vast alpine pastures. Blessed with perennial rivers such as the Sutlej, Beas, Ravi, Chenab and Yamuna, the state possesses nearly one-fourth of the country's economically exploitable hydropower potential. Despite its relatively small geographical area and population, Himachal Pradesh plays a significant role in India's power sector by generating clean and renewable electricity that not only meets its own requirements but also contributes substantially to the electricity needs of several neighbouring states.

The power supply scenario in Himachal Pradesh is characterized by a unique combination of abundant generation capacity and comparatively modest internal electricity demand. Besides large hydroelectric stations operated by central public sector undertakings and private developers, the state entities such as HPPCL and HPSEBL operates several small and medium hydroelectric projects. In recent years, the state has also initiated the development of solar power projects to diversify its renewable energy portfolio and reduce dependence on seasonal hydropower generation.

Electricity distribution in the state is managed primarily by HPSEBL, which is responsible for supplying reliable and quality power to domestic, commercial, industrial and agricultural consumers through an extensive transmission and distribution network extending across difficult mountainous terrain.

As Himachal Pradesh transitions into a highly industrialized and urbanized economy, its internal electricity requirements are growing at a rapid pace. This steady rise in demand is driven by several critical structural shifts within the state. The southern plains of the state, particularly districts like Solan, Sirmour, and Una, have emerged as major manufacturing hubs. The Baddi-Barotiwala-Nalagarh industrial corridor is one of Asia's largest pharmaceutical clusters. Himachal Pradesh experiences severe, freezing winters and as traditional wood-burning heating is rapidly being replaced by electric space heaters, heat pumps, and water geysers; this creates sharp domestic load spikes during winter.

Despite being a power-surplus state on an annual energy basis, Himachal Pradesh experiences seasonal variations in hydroelectric generation. During the monsoon season, reservoirs and river

flows enable high electricity generation, whereas winter months witness reduced water availability, resulting in comparatively lower hydroelectric output. Consequently, the state relies on power procurement from the national grid during lean hydro periods while exporting surplus electricity during periods of high generation. This highlights the importance of resource diversification through solar power, pumped storage projects, battery energy storage systems and improved interstate transmission infrastructure to ensure year-round supply reliability.

Looking ahead, electricity demand in Himachal Pradesh is projected to grow steadily in line with economic development, industrial expansion, tourism, digital infrastructure and increasing electrification of end-use sectors. Meeting future demand will require continued investment in renewable energy, augmentation in the transmission network, demand-side management, energy efficiency measures and smart grid technologies.

1.2 Present Power Scenario in Himachal Pradesh

1.2.1 Installed Generation Capacity

Himachal Pradesh Power Corporation Limited (HPPCL), is a state-owned company responsible for developing power generation projects in Himachal Pradesh. It has been allotted 22 hydroelectric projects with a total capacity of 2817 MW. In addition to hydropower, HPPCL is expanding into solar energy through the 5 MW Berra Dol Solar Power Project in Bilaspur and the proposed 10 MW Aghlor Solar Power Project in Una. HPPCL plays a key role in promoting renewable energy and strengthening the state's power sector.

Table 1.1: Installed Electricity Generation Capacity

	Capacity (MW)
State Sector	1168.50
Power tied up from Private Generating Stations	2749.44
Allocation from Central Generating Stations	1619.92
Total	**5537.86**

Source: Installed Capacity Report CEA, June, 2026

There is one Distribution Company in Himachal Pradesh, Himachal Pradesh State Electricity Board Limited (HPSEBL), which is responsible for distribution and supply of electricity to consumers across the state.

1.2.2 Electricity Demand of Himachal Pradesh

With respect to electricity demand, Himachal Pradesh has witnessed an all-time high peak demand of 2,310 MW in January, 2026, which is about 1.62 % higher than the peak demand of 2,273 MW in 2024-25. From the analysis of peak demand of Himachal Pradesh for past 10 years, it has been observed that peak demand of Himachal Pradesh has grown @4.5% per year. As per the revised 20th Electric Power Survey (EPS) Report, peak electricity demand is projected to increase to 3,222 MW by 2030-31.

The recorded peak demand of Himachal Pradesh for ten years starting from FY 2015-16 to FY 2024-25 is given in the Table 1.2.

Table 1.2 Recorded Peak Demand of Himachal Pradesh

Sr. No.	Year	Peak Demand (MW)
1	2015-16	1488
2	2016-17	1499
3	2017-18	1594
4	2018-19	1700
5	2019-20	1786
6	2020-21	1932
7	2021-22	2030
8	2022-23	2071
9	2023-24	2181
10	2024-25	2273
11	2025-26	2310

The daily peak demand pattern for the last two financial years (2024-25 and 2025-26) is indicated in figure below:

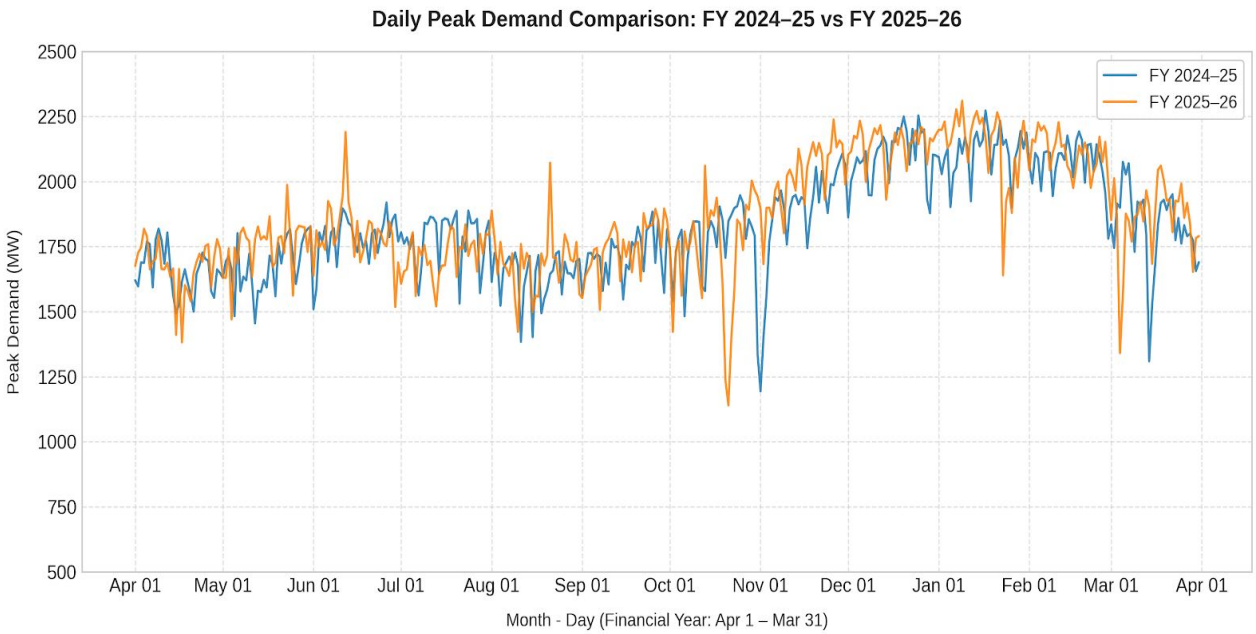


Figure 1.1: Daily peak demand for 2024-25 and 2025-26

Monthly variation of peak electricity demand in Himachal Pradesh for the past two years is shown in figure below:

Figure 1.2: Monthly variation in Paek Demand for 2024-25 and 2025-26

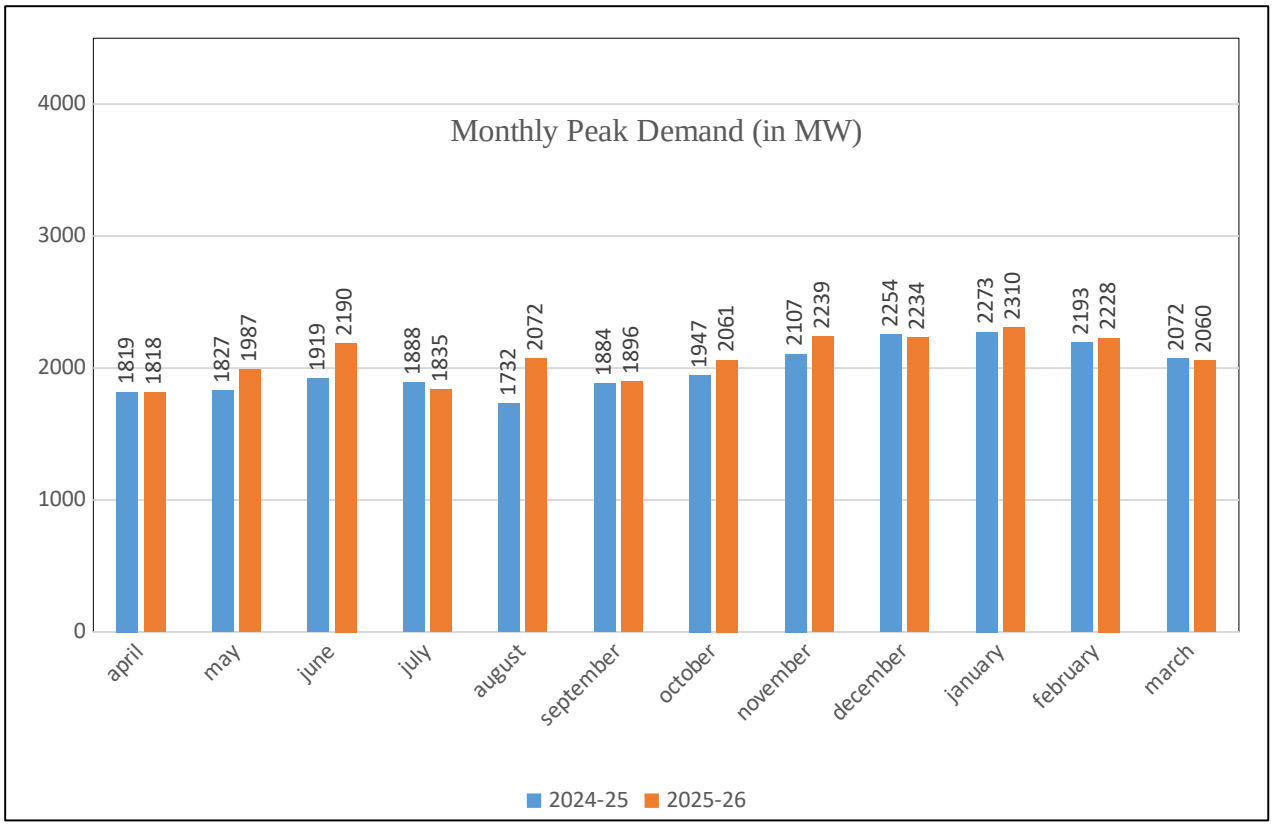


Figure 1.3: Hourly variation in Peak demand (in MW) for the month of January 2026

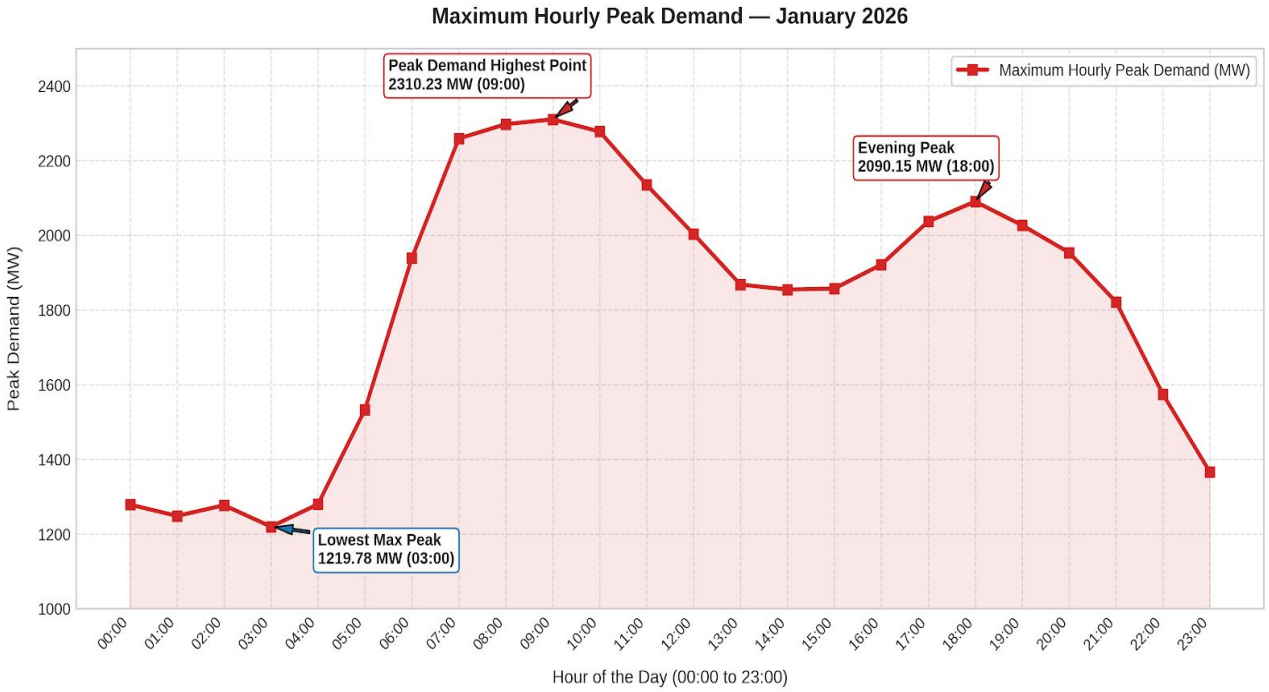
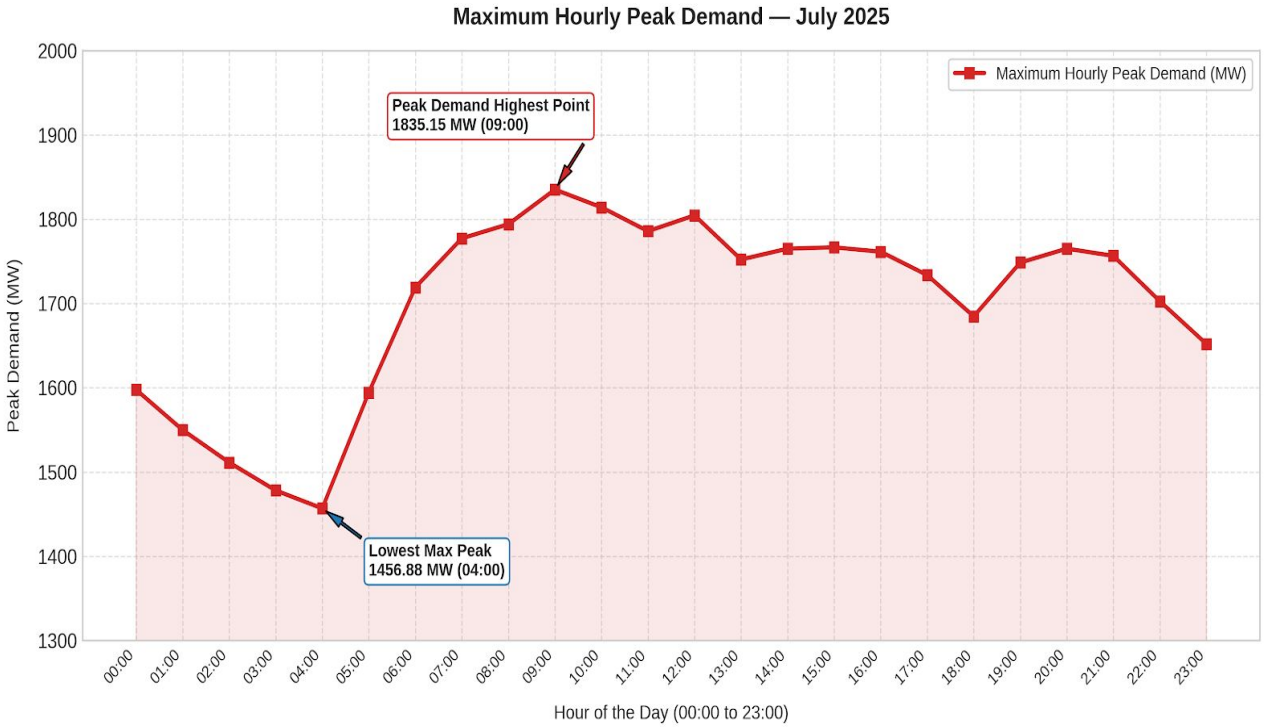


Figure 1.4: Hourly variation in Peak demand (in MW) for the month of July 2025



In 2024-25 and 2025-26, Himachal Pradesh had witnessed an all-time peak demand of 2,273 MW and 2,310 MW in the month of January 2025 and January 2026 respectively.

1.3 Projected Electricity Demand of Himachal Pradesh:

As per the revised 20th Electric Power Survey (EPS) Report, peak electricity demand is projected to increase to 3,593 MW by 2034-35 and expected to reach to 3700 MW by 2035-36. Year-wise projected electricity demand of Himachal Pradesh is given in the Table 1.3 below:

Table 1.3: Projected electricity demand in Himachal Pradesh

Sl. No.	Year	Peak electricity demand in Himachal Pradesh (MW)
1.	2023-24 (Actual)	2181
2.	2024-25 (Actual)	2273
3.	2025-26 (Actual)	2310
4.	2026-27 (Projection)	2729
5.	2027-28 (Projection)	2861
6.	2028-29 (Projection)	2993
7.	2029-30 (Projection)	3114
8.	2030-31 (Projection)	3222
9.	2031-32 (Projection)	3318
10.	2032-33 (Projection)	3418
11.	2033-34 (Projection)	3511
12.	2034-35 (Projection)	3593
13.	2035-36 (envisaged)	3700

1.4 Existing Transmission Network in Himachal Pradesh

Himachal Pradesh has 6 Nos. of 400 kV ISTS substations, comprising Kala Amb, Nalagarh, Hamirpur, Banala (Parbati Pool), Chamera Pooling (Rajera) and Dehar, which facilitate evacuation of hydro generation and import/export of power. In intra-state transmission system, Himachal Pradesh has 03 Nos. of 400 kV sub-stations and 22 No. of 220 kV sub-stations (11 No. of HPPTCL and 11 No. of HPSEBL). Unlike most states where the State Transmission Utility owns and operates the bulk of the EHV transmission network, a significant portion of HP's Extra High Voltage (EHV) network is owned by HPSEBL-the Distribution Licensee and has been classified as

distribution network. As on date, approximately 60-70% of the state's EHV network assets remain with HPSEBL and are classified as distribution infrastructure, while HPPTCL owns and operates approximately 20-30% of the state's EHV assets. The Resource Adequacy Plan for Transmission is mostly confined to the planning, assessment, and development of InSTS by HPPTCL. The demand-side planning for the state including the procurement and resource adequacy of generation or the distribution network including EHV distribution network to meet the statewide load would be addressed in the Long-Term Demand Resource Adequacy Plan (LT-DRAP) prepared by HPSEBL, the Distribution Licensee.

1.4.1 Intra-State Transmission System in Himachal Pradesh

The details of the existing transmission system which includes the number of Grid sub-station (GSS), transformation capacity (MVA), length of transmission lines (circuit kilometer) is shown in Tables below:

Table 1.4: Existing intra-state substations and transformation capacity (MVA) in Himachal Pradesh

S.No.	Voltage level	Existing Intra-State Substation	
		No of S/s.	MVA
1	400 kV	3	1890 (400/220 kV) 326 (220/66 kV) 63.5 (220/33 kV)
3	220 kV	22	2341 (220/132 kV) 1031.5 (220/66 kV) 389 (220/33 kV) 10 (220/11 kV)
	Total	**25**	**400 kV: 1890** **220 kV: 4161**

Table 1.5: Existing intra-state lines (ckm) in Himachal Pradesh

S.No.	Voltage level	(ckm)
1	400 kV	77.7
2	220 kV	1022.689
	Total	**1100.389**

List of 400 kV intra-state substations:

- 2x315 MVA, 400/220 kV + 2x100 MVA, 220/66 kV Wangtoo (Kinnaur) S/s
- 2x315 MVA, 400/220 kV + 63.5 MVA, 220/33 kV Lahal (Chamba) S/s
- 2x315 MVA, 400/220 kV + 2x63 MVA, 220/66 kV Gumma (Shimla) S/s

List of 220 kV intra-state substations (HPPTCL+HPSEBL):

- 1x63 MVA, 220/33 kV Karian (Chamba) GIS
- 1x200 MVA + 1x80/100 MVA, 220/132 kV + 2x31.5 MVA, 132/33 kV Kangoo S/s
- 1×128 MVA, 220/132 kV + 1×100 MVA, 220/33 kV Charor (Kullu) S/s
- 2x100 MVA, 220/132 kV Dehan (Patti) (Kangra) S/s
- 2x100 MVA, 220/132 kV Majra (Chamba) S/s
- 1x200 MVA, 220/132 kV + 2x31.5 MVA, 132/33 kV Kala-Amb (Sirmour) S/s
- 1x100 MVA, 220/66 kV Sunda (Rohru) (Shimla) S/s
- 1x31.5 MVA, 220/33 kV Prini (Kullu) S/s
- 1x100 MVA, 220/33 kV, Phojal (Kullu) GIS S/s
- 1x100 MVA, 220/66 kV Heiling S/s (Chamba)
- 1x31.5 MVA, 220/66 kV + 2x12.5 MVA, 66/22 kV Bhoktoo S/s
- 220 kV Hatkoti (Shimla) Switching station
- 3x80/100 MVA, 220/66 kV + 1x25/31.5 MVA, 220/33 kV Baddi S/s
- 2x160/200 MVA, 220/132 kV Kunihar S/s
- 2x100 MVA, 220/66 kV Kotla (Jeori) S/s
- 2x80/100 MVA, 220/66 kV Uperla Nangal (NLG) S/s
- 1x80/100 MVA, 220/66 kV Mandhala S/s
- 1x150+1x50/63 MVA, 220/132 kV + 2x25/31.5 MVA, 220/33 kV Jassure S/s
- 3x80/100 MVA, 220/132 kV Mattansidh (Hamirpur) S/s
- 1x160/200 MVA, 220/132 kV Nehrian S/s
- 2x80/100 MVA, 220/132 kV + 25/31.5+16/20 MVA, 132/33 kV Girinagar (Majri)
- 1x10 MVA, 220/11 kV Bhaba S/s

1.4.2 Inter-State Transmission system in Himachal Pradesh

The details of existing Inter-State transmission network in Himachal Pradesh is given below.

Table 1.6: Existing ISTS substations and transformation capacity (MVA) in Himachal Pradesh

S.No.	Voltage level	Existing Inter- State transmission system (Substations)	
		No of Substations	MVA

1	400/220 kV	06	4965
	Total	**06**	**4965**

List of 400 kV ISTS substations:

- 2x315 MVA, 400/220 kV Banala (Parbati Pool) (PGCIL)
- 3×315 MVA+1x500, 400/220 kV Nallagarh (PGCIL)
- 2×500 MVA, 400/220 kV Kala Amb (PGCIL)
- 3×315 MVA, 400/220 kV Hamirpur (PGCIL)
- 2×315 MVA, 400/220 kV Chamera Pool (Rajera) (PGCIL)
- 1×315 MVA, 400/220 kV Dehar (BBMB)

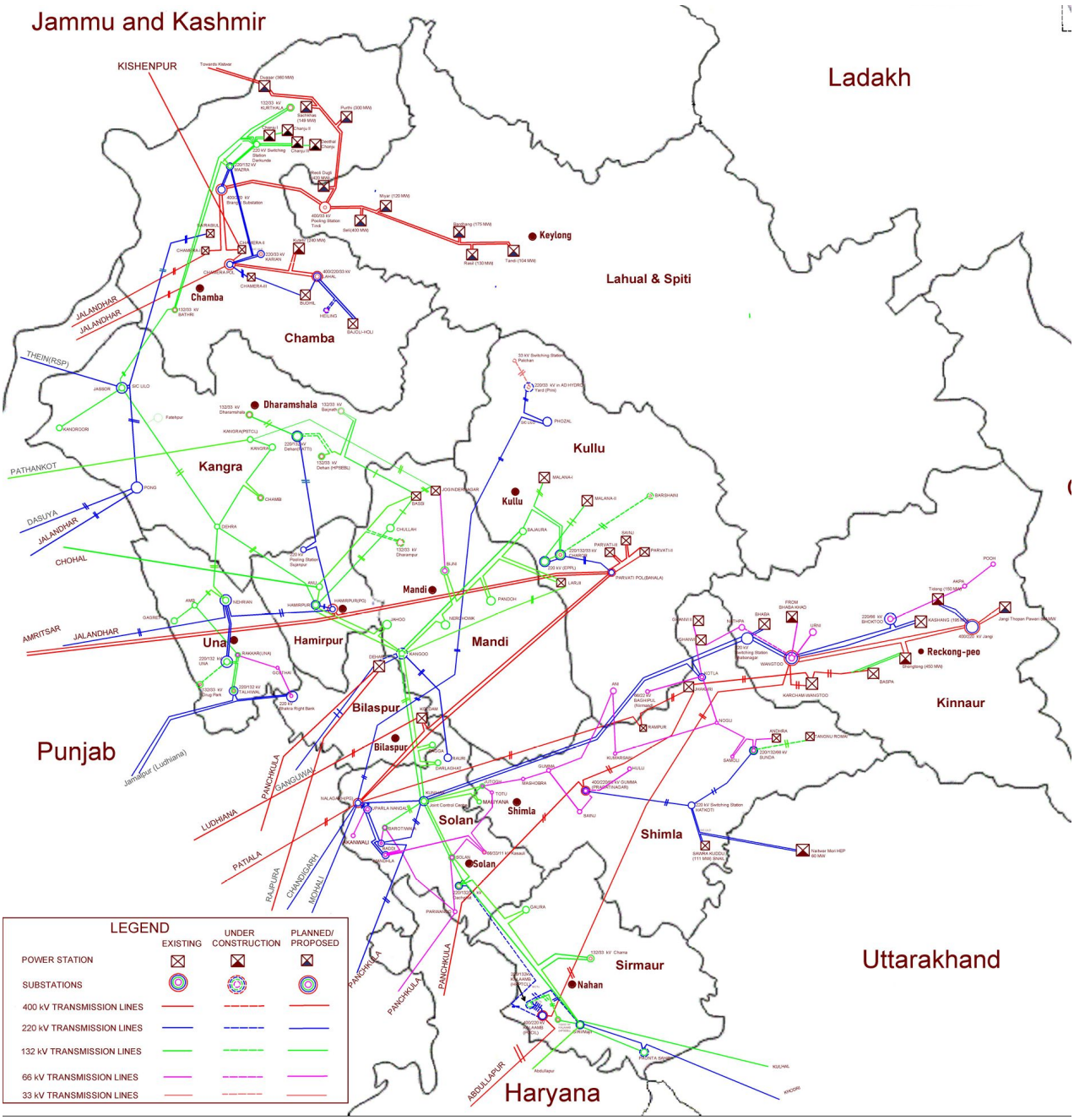


Figure 1.5: Existing intra-state transmission network of HPPTCL in Himachal Pradesh

1.5 Constraints in Transmission/EHV Network in Himachal Pradesh:

The transmission constraints in intra-state EHV system stem mainly from its radial network topology, seasonal hydro generation variability, and limited load absorption within individual subsystems. The key transmission constraints in HPPTCL/HPSEBL EHV network are as follows:

Table 1.7: Constraints in network and possible remedial measures

S.No.	Operational Constraints	Remedial Measures
1	N-1 contingency of 220 kV Nalagarh - Uperla Nangal D/c line during high demand of HP	• Reconductoring Nalagarh-Uperla Nangal D/c line may be planned by HPPTCL • Establishment of 2x160 MVA, 200/66/33 kV Substation at Majholi through Majholi–(Nalagarh) 220 kV D/c line.
2	Loading in following ICTs and lines: • Giri 220/132 kV, 2x100 MVA ICT • Kunihar 220/132 kV, 2x200 MVA ICT • 220 kV Bhaba-Wangtoo 220 kV line • Kalaamb-Kalaamb 132 kV line • Kunihar-Jutog 132 kV line • Hamirpur-Jahu 132 kV line • Amb-Una 132 kV line • Giri-Kala Amb (HPSEBL) 132 kV line	Necessary augmentation in transformation capacity, reconductoring of lines and additional system strengthening schemes to be taken up by HPPTCL (Transmission) and HPSEBL (Distribution)

1.6 Structural gaps in the Transmission/EHV Network in Himachal Pradesh:

Gap I: The Chamba Basin Isolation. The Ravi basin in Chamba district hosts a substantial and growing portfolio of hydro generation, including ISTS-classified projects at Chamera Pooling Station and several state-embedded generators whose output is delivered to HPPTCL's InSTS. The entirety of this generation is evacuated exclusively through the 400 kV ISTS network at Chamera, which already stressed, limiting the despatch flexibility of state-embedded generators. HPPTCL's InSTS provides no alternative path. The only transmission link connecting Chamba district to the rest of Himachal Pradesh at the intra-state level is a single 132 kV circuit of HPSEBL(DISCOM) operating at near-saturation capacity. This isolation will become an acute and persistent operational constraint as additional state-embedded generation in the Ravi basin is commissioned. Chamba has no 220 kV or higher connectivity to the state's own load centres in Kangra, Una, or the BBN belt.

Gap II: Solar Generation Stranded in the Plains Belt. The flat terrace lands of Kangra, Una, and Solan districts along the Himachal Pradesh–Punjab border present the best solar resource in the state: high irradiation, accessible terrain, and proximity to load centres in the plains. However, the existing InSTS has no infrastructure capable of evacuating solar potential at scale in this belt. Solar generators can only connect at 33 kV or 66/132 kV to HPSEBL's distribution network, which has limited headroom. Without a 220 kV spine running through the Kangra-Una plains belt, solar

development will remain severely constrained irrespective of the quality of the resource and the strength of developer interest.

Gap III: **Load Growth in the Plains and Capital Area Unserviceable from InSTS.** The districts of Kangra, Una, Shimla, and Solan are experiencing demand growth driven by urbanisation, industrial development, and the expansion of government and tourism economies. The BBN (Baddi-Barotiwala-Nalagarh) industrial cluster in Solan district is the largest industrial area in the state. Shimla, the capital of Himachal Pradesh, and the Solan area on the Shimla-Chandigarh highway, have rapidly expanding power requirements driven by institutional load, and commercial/residential development and tourism infrastructure. Currently, these load centres are served entirely through HPSEBL's 132 kV EHV distribution network, which is increasingly stressed. As demand grows toward the 2035-36 horizon, the 132 kV HPSEBL network-which seems inadequate to fulfill demand at peak-will be entirely insufficient, and InSTS-level supply infrastructure will become indispensable.

Measures/Plan to fill the gaps: Each of the three structural gaps identified above shares a common underlying cause that the InSTS has no east-west transmission backbone. All existing 220 kV and above infrastructure runs predominantly north-to-south, from basin to ISTS periphery. Chamba in the north-west and Una/Kangra in the southwest have no 220 kV path between them. The Pabbar basin in the east has no 220 kV path to Solan or Kala Amb. Shimla, the capital of Himachal Pradesh, has no InSTS supply point at all. The 2035-36 planning horizon therefore calls for a fundamental evolution in HPPTCL's transmission planning philosophy: from a uni-directional, basin-wise generation export architecture to a multi-directional, integrated intra-state transmission grid capable of moving power in any direction - from hydro basins to load centres, from solar generators in the west to pumped storage sites in the east, and from surplus sub-systems to deficit ones, all within the InSTS without dependence on the ISTS as an intermediary.

Chapter-2

Transmission System Requirement by 2030-31

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

2.1.1 Scope of Load flow studies:

System studies for the Resource Adequacy plan for Himachal Pradesh's intra-state transmission system 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

Peak electricity demand in Himachal Pradesh generally used to occur in winter seasons during morning time; however, the difference in the day peak and evening peak has not been much. The peak demand in winter season coincides with lean hydro generation in the state. Hence, for preparation of Resource Adequacy plan of Transmission system in Himachal Pradesh, both the scenarios i.e. winter (low hydro generation) and summer (high hydro generation) have been studied.

The load flow studies have been carried out for two time-frames: 2030-31 and 2035-36 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) Himachal Pradesh's transmission network has been represented generally at 132 kV and above voltage levels, where loads have been considered incidental on 132 kV as well as 220 kV level 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.

(iv) Transformation capacity of any single sub-station at 220 kV and 400 kV levels has been considered to be limited to 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

2.2 Load Flow Studies for the year 2030-31:

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

a) Peak electricity demand scenario during summer season in the month of June/July 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) Peak solar hour scenario in both winter and summer seasons and;

d) Off peak (Night) scenario in both winter and summer seasons.

(ii) Peak electricity demand of Himachal Pradesh in 2030-31 as per revised 20th EPS projections is 3222 MW and the same has been considered for studies.

(iii) For the peak demand scenario of 2030-31, the transmission elements (new lines/ reconductoring of the existing lines and new substations/ICT augmentations) already taken up for implementation by HPPTCL and HPSEBL have been considered.

(iv) Under implementation/Planned ISTS Schemes in Himachal Pradesh to be commissioned by 2030-31 have been considered in the studies, details of which are given below:

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

Table 2.1: Under implementation/under bidding/planned ISTS schemes

S. No.	Transmission scheme	Status
1	**Transmission scheme for evacuation of power from Sunni Dam HEP (382 MW) & Luhri Stage-I (210 MW)** • Establishment of 10x105 MVA, 400/220 kV Nange Pooling Station (GIS) • Nange (GIS) Pooling Station-Koldam 400 kV D/c line (only one circuit is to be terminated at Koldam while second circuit would be connected to bypassed circuit of Koldam-Ropar/Ludhiana 400 kV D/c line) (line length~50 km) • Bypassing one ckt of Koldam-Ropar/Ludhiana 400kV D/c line at Koldam and connecting it with one circuit of Nange-Koldam 400kV D/c line, thus forming Nange-Ropar/Ludhiana one line	Under Bidding (Time frame 2029-30)
2	**Transmission system for evacuation of power from Shongtong Karcham HEP (450 MW) and Tidong HEP (150 MW)** • Establishment of 2x315 MVA, 400/220 kV GIS Pooling Station at Jhangi • 400 kV Jhangi PS – Wangtoo D/c line (Quad) • LILO of one circuit of Jhangi PS - Wangtoo (HPPTCL) 400 kV D/c line at Shongtong HEP • Panchkula - Wangtoo (HPPTCL) 400 kV D/c line	Under Bidding (Timeframe 2029-30)

(v) Under implementation/Planned In-STS Schemes in Himachal Pradesh to be commissioned by 2030-31 have been considered in the studies, details of which are given below:

a) Sub-stations: The details of under-implementation/planned In-STS Substations to be commissioned by 2030-31 are given below:

Table 2.2: Details of Under-Implementation/planned In-STS substations in Himachal Pradesh

S.No.	Sub-station	MVA	Status	Time-frame
220 kV level				
1	160/200 MVA, 220/132 kV Paonta Sahib S/s	200	Under-Construction	2028-29
2	2×100 MVA, 220/132 kV Una (Pekhubala) S/s	200	Under-Construction	2028-29
3	2×160 MVA, 220/66 kV Akkanwali S/s	320	Planned	2029-30
4	2×160 MVA, 220/66 kV + 3x100 MVA, 220/33 kV Majholi S/s	620	Planned	2029-30
5	2×200 MVA, 220/132 kV + 2x50 MVA, 220/66 kV Solan (New)	500	Planned	2029-30
6	2x100 MVA, 220/132 kV Kangra S/s	200	Planned	2029-30
7	2x100 MVA, 220/132 kV + 2×31.5 MVA 132/33 kV Larji S/s-Phase I	200	Planned	2029-30
8	2x50/63 MVA, 220/66 kV Renukaji S/s	126	Planned	2030-31
	Total	**2366**		
132 kV level				
1	2x25/31.5 MVA, 132/33 kV Barsaini S/s	63	Under Construction	2027-28
2	2x25/31.5 MVA, 132/33 kV Baijnath S/s	63	Under Construction	2028-29
3	2x31.5 MVA, 132/33 kV GIS near Dharamshala	63	Under Construction	2028-29

b) ICT augmentation: The details of Under implementation/planned ICT augmentation works at In-STS Substations to be commissioned by 2029-30 are given below:

Table 2.3: Details of Under-Implementation/planned ICT augmentations (InSTS)

S. No.	Substation	Voltage Level (kV)	Existing Capacity (MVA)	Augmentation (MVA)	Status	Timeframe

220 kV level						
1	Kala Amb (Andheri) S/s	220/132	1x200	1x200	Planned	2028-29
2	Kunihar S/s	220/132	2x200	1x200	Under Construction	2028-29
3	Karian S/s	220/33	1x50/63	1x50/63	Under Construction	2027-28
	Total			463		**Total**
132 kV level						
1	Kurthala S/S	132/33kV	1 x 63	1 x 63	Under Construction	2028-29

c) Transmission lines:

Table 2.4: Under-Implementation/planned In-STS lines in Himachal Pradesh

S.No.	Transmission Line	ckm	Status	Time-frame
220 kV				
1	LILO of both circuits of Khodri–Majri 220 kV D/c line at Paonta Sahib	8	Under-Construction	2028-29
2	Nehrian–Una 220 kV D/c line	70	Under-Construction	2028-29
3	Nalagarh (PG)–Kunihar 220 kV D/c line (Twin Moose)	76	Under-Construction	2028-29
4	LILO of one circuit of Nalagarh(PG)–Kunihar 220 kV D/c line at Akkanwali	25	Planned	2029-30
5	Nalagarh (PG)–Majholi 220 kV D/c line	38	Planned	2029-30
6	Jamta–Giri 220 kV D/c line	48	Planned	2029-30
7	Gumma–Solan 220 kV D/c line (high capacity)	100	Planned	2029-30
8	Mazra/Karian-Kangra 220 kV D/c line	140	Planned	2029-30
9	LILO of one circuit of Charor-Banala 220 kV D/c line at Larji	12	Planned	2029-30
10	LILO of Kala Amb–Giri 220 kV line at Renukaji	10	Planned	2030-31

	Total	**527**		
132 kV				
1	LILO of Maliana–Jathia Devi 132 kV S/c line at Solan	30	Planned	2029-30
2	Barsaini – Charor 132 kV D/c line	35	Under Construction	2027-28
3	LILO of 132 kV Dehan (Patti) – Bassi line at Baijnath	14	Under Construction	2028-29
4	Dehan (Patti) – Dharamshala 132 kV D/c line	60	Under Construction	2028-29
5	LILO point ((interconnecting Chanju-I and Kuthala Bathri line) - Mazra 132 kV D/c line	58	Under Construction	2027-28

d) Augmentation Planned by **HPSEBL (Distribution EHV Network)**: The details of augmentation work at EHV level planned by HPSEBL and considered in the studies are given below:

Table 2.5: Augmentation of ICTs at existing EHV Sub-stations (HPSEBL)

S. No.	Substation	Voltage Level (kV)	Augmentation (MVA)
220 kV level			
1	Nehrian	220/132	1x160/200
2	Uperla Nangal	220/66	1x80/100
3	Girinager/Majri	220/132	1x100
4	Baddi	220/132	1x80/100
5	Baddi	220/33	1x50/63
6	Mandhala	220/66	1x80/100
	Total		**663**
132 kV level			
1	Una S/s	132/33	2x25/31.5→2x50/63
2	Dehra	132/33	2x16/20→2x25/31.5
3	Jutogh	132/33	2x31.5→2x50/63
4	Gondpur, Paonta Sahib	132/33	2x25/31.5→2x50/63
5	Johro	132/33	2x25/31.5→2x50/63

6	Gaura	132/33	1x16/20→1x50/63
7	Kangra	132/33	2x25/31.5→2x50/63
8	Fatehpur	132/33	1x50/63
9	Nadaun	132/33	1x25/31.5
10	Bajaura	132/33	2x25/31.5→2x50/63
11	Jahu	132/33	1x25/31.5
11	Kurthala	132/33	1x50/63

Table 2.5: Reconductoring of EHV lines (distribution) with HTLS conductor:

S.No.	EHV line (HPSEBL)	ckm
1	Girinagar - Kala Amb 132 kV S/c line	98.75
2	Girinagar - Gondpur 132 kV S/c line	53.52
3	Kunihar - Jutogh 132 kV S/c line (Ckt-1)	47.52
4	Kunihar - Jutogh 132 kV S/c line (Ckt-2)	47.43
5	Kunihar - Barotiwala 132 kV D/c line	160.68
6	Kunihar - Solan 132 kV S/c line (Ckt-1)	67.98
7	Kunihar - Solan 132 kV S/c line (Ckt-2)	61.99
8	Kunihar – Bhaba(Wangtoo) 220 kV D/c line	647.21
9	Mattansidh - Kangoo 132 kV D/c line	130.21
10	Amb - Una 132 kV S/c line	97.23
11	Nehrian - Amb 132 kV D/c line	7.42
12	Stringing of 2nd ckt on Una - Tahliwal S/c line on D/c towers	52.53
13	Kangoo-Bijni-Larji 132 kV D/c line (ckt no.1)	328.77
14	Kangoo-Ratti-Bijni 132 kV D/c line (ckt no.2) Pandoh-Bijni	117.42
15	Kharshi - Bagga 132 kV D/c LILO line (ckt no.1)	16.33
16	Larji - Kangoo 132 kV D/c line (ckt no.1)	345.00
17	Bathri - Jassure 132 kV D/c line	119.09
18	Dehra - Kangra 132 kV S/c line	92.70
19	Larji - Bajaura 132 kV D/c line (ckt no.1)	123.97
20	Mazra - Bathri 132 kV D/c line	60

2.3 Load Flow Study Results:

Based on the load flow studies, following was observed:

(i) The existing, under construction and planned sub-stations by HPPTCL by 2030-31 would be sufficient to cater the demand in the state of Himachal Pradesh.

a) In addition to the already planned works, the following augmentation in the ISTS/In-STS network may be required by 2030-31 for reliable supply of power in the state of Himachal Pradesh:

Sl. No.	Name of Sub-station	Voltage (kV)	MVA
ISTS			
1	Nalagarh (PG)	400/220	500 (5th) or 315(1st)→500
Intra-state / Distribution EHV			
1	Gumma	400/220	315 (3rd)
2	Kangoo	220/132	200 (2nd)
3	Uperla Nangal	220/66	80/100 (4th)

Table 2.6: Transformation augmentation works by 2030-31

b) Augmentation with 2nd ICT at few sub-stations has been recommended for making the system N-1 compliant. In addition, requirement of ICT augmentation at the sub-stations 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.

c) As significant part of EHV network is been operated by HPSEBL as a distribution network, necessary augmentations also required to be taken by HPSEBL based on the actual demand growth.

2.4 Summary of Intra-State Transmission Network in Himachal Pradesh by 2030-31

Transformation capacity (MVA) and transmission lines (ckm) to be added under intra-state transmission system / EHV system in the state of Himachal Pradesh during 2026-27 to 2030-31 is given below:

Table 2.7: Summary of EHV network augmentation in Himachal Pradesh

Intra-State Transmission System / EHV system	400 kV level	220 kV level	Total
Sub-stations:			
Existing Substations	3	22	25
New Substations by 2030-31	0	08	08
Total substations by 2030-31	3	30	33
Transformation Capacity (MVA):			
Existing Transformation Capacity (MVA)	1890	4161	6051
Addition in Transformation Capacity (MVA) by 2030-31	315	3792	4107
Total Transformation Capacity by 2030-31 (MVA)	2205	7953	10158
Transmission Lines:			
Existing Transmission Lines (ckm)	77.7	1022.7	1100.4
Addition of Transmission Lines by 2030-31(ckm)	0	527	527
Total transmission lines by 2030-31 (ckm)	77.7	1549.7	1627.4

Additionally, reconductoring of existing intra-state lines is also to be considered.

Chapter-3

Transmission System addition planned by 2035-36

3.1 Load Flow Studies for the year 2035-36:

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

a) Peak electricity demand scenario during summer season in the month of June/July 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) Peak solar hour scenario in both winter and summer seasons

d) Off peak (Night) scenario in both winter and summer seasons

(ii) Peak electricity demand of Himachal Pradesh in 2034-35 as per revised 20th EPS projections is 3593 MW. Further, the peak electricity demand in 2035-36 for load flow studies has been considered as 3700 MW.

(iii) The transmission elements (new lines/reconductoring of the existing lines and new substations/ICT augmentations) planned by HPPTCL have been considered. The details are given below:

Table 3.1: Details of planned In-STS substations in Himachal Pradesh

S.No.	Sub-station	Voltage (kV)	MVA	Status	Time-frame
1	2×160 MVA, 220/66 kV Kangra Solar Pooling S/s *(Conditional on Solar Connectivity)*	220/66	320	Planned	2030-32
2	2×160 MVA, 220/66 kV Una Solar Pooling S/s *(Conditional on Solar Connectivity)*	220/66	320	Planned	2030-32
3	220 kV Nalagarh Switching Station	220		Planned	2033-35
4	132 kV Nakror Switching S/s *(Conditional on hydro commissioning)*	132		Planned	2035-36

	Total		**640**		

Table 3.2: Details of Planned In-STS transmission lines in Himachal Pradesh

S.No.	Transmission line	ckm	Status	Time-frame
220 kV level				
1	Kangra SP - Una SP 220 kV D/c line	140	Planned	2030-32
2	LILO of 220 kV Nehrian-Una at Una SP	4	Planned	2030-32
3	Solan–Kunihar 220 kV D/c line	50	Planned	2032-35
4	Solan–Renukaji 220 kV D/c line	100	Planned	2035-36
5	LILO of both circuits of AD Hydro–Nalagarh(PG) 220 kV D/c line at Larji and at Kangoo S/s	20	Planned	2030-32
6	Nalagarh Switching Station interconnection with Nalagarh (PG), Kunihar S/s, Akkanwali S/s and Upar Nangal S/s – High Capacity	110	Planned	2033-35
7	Majholi–Akkanwali 220 kV D/c line	30	Planned	2033-36
8	Una–Nalagarh Switching Station 220 kV D/c line *(conditional on solar quantum at Una)*	130	Planned	2034-35
	Total	**584**		
132 kV level				
1	Kurthala–Nakror 132 kV S/c line on D/c towers *(conditional)*	15	Planned	2034-35

3.2 Load Flow Study Results:

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

(i) The existing, under construction and planned sub-stations for state of Himachal Pradesh by 2035-36 would be required to cater the increasing demand. Further, it is recommended that new sub-stations may be planned taking into account N-1 contingency of the ICTs and sufficient reactive compensation.

(ii) Few intra-state sub-stations may get N-1 non-complaint in certain contingency scenario; therefore, HPPTCL to monitor real time loading and plan augmentation accordingly. Requirement of ICT augmentation at 132 kV level at various substations has also been observed by 2035-36; 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.

(iii) A new 220 kV or 400 kV Sub-station could be planned in the remote region of Lahaul & Spiti to meet the demand of the district particularly during Winter season. The location and timeframe of the Sub-station along with its inter-connection to be decided based on the actual demand growth in the region. Also, possibilities need to explored and thoroughly studied considering the geographical challenges associated with implementation of the project.

(iv) The transmission system associated with 1,650 MW Renukaji PSP (Sirmour district) i.e. upgradation of Renukaji (220 kV) sub-station to 400 kV level and a high-capacity 400 kV ISTS interconnection with Kala Amb/Wangtoo-Panchkula and the evacuation connectivity for the proposed Thana Pulan Hydro & Pumped Storage Project (660 MW) which is planned through a 220 kV Pooling Substation at Sujanpur, integrated with the 220 kV Dehan–Hamirpur(PG) network, would be taken up based on the realistic commissioning timelines of the PSPs.

(v) In addition to the already planned works, the following augmentation in the network may be required by 2035-36 for reliable supply of power in the state of Himachal Pradesh:

Sl. No.	Name of Sub-station	Voltage (kV)	MVA
ISTS			
1	Nalagarh (PG)	400/220	315 → 500
Intra-state			
1	Majholi	220/66	160 (3rd)
2	Akkanwali	220/66	160 (3rd)
3	Uperla Nangal	220/66	80/100 (4th)
4	Una (Pekhubala)	220/132	200 (3rd)

Table 3.3: Transformation augmentation works by 2035-36

3.3 Summary of Transmission Network in Himachal Pradesh by 2035-36

Transformation capacity (MVA) and transmission lines (ckm) to be added under intra-state network of state of Himachal Pradesh during 2030-31 to 2035-36 is given below:

Table 3.4: EHV system to be added under intra-state in Himachal Pradesh

Intra-State Transmission System	400 kV level	220 kV level	Total
Sub-stations:			
Substations by 2030-31	3	30	33
New Substations addition	0	3	3
Total substations by 2035-36	**3**	**33**	**36**
Transformation Capacity (MVA):			
Transformation Capacity (MVA) by 2030-31	2205	7953	10158
Addition in Transformation Capacity (MVA)	0	1260	1260
Total Transformation Capacity by 2035-36 (MVA)	**2205**	**9213**	**11418**
Transmission Lines:			
Transmission Lines (ckm) by 2030-31	77.7	1549.7	1627.4
Addition of Transmission Lines (ckm)	0	584	584
Total transmission lines by 2035-36 (ckm)	**77.7**	**2133.7**	**2211.4**

Chapter-4
Transmission System for Evacuation of Power from Hydro Electric Projects in Himachal Pradesh

4.1 Background

Himachal Pradesh is renowned for its mountainous landscape, perennial rivers, and abundant water resources. The State possesses significant hydroelectric potential owing to its rugged Himalayan terrain, steep river gradients, and substantial snow and glacier-fed river systems. Major rivers such as the Sutlej, Beas, Ravi, Chenab, and Yamuna, along with their numerous tributaries, provide favorable conditions for the development of both run-of-river and storage-based hydroelectric projects. Over the years, several large hydroelectric projects have been developed in the State, and these projects have played a significant role in meeting the power requirements of the northern region and strengthening the national grid.

Himachal Pradesh is one of the leading hydro power generating states in India, with a large proportion of its estimated hydroelectric potential already harnessed. The State continues to play a vital role in India's renewable energy sector and contributes significantly to the generation of clean and sustainable electricity.

4.2 Existing Hydroelectric projects in Himachal Pradesh

(a) State Sector: Details of installed HEPs (above 25 MW) operated by state entities:

Table 4.1: Existing HEPs (above 25 MW Capacity) of state entities in operation

S.No.	Hydro-Electric Project	Capacity (in MW)
	HPSEBL	
1	Bassi	66
2	Giri Bara	60
3	Larji	126
4	Sanjay	120
	Total HPSEBL	**372**
	HPPCL	
1	Kashang Stage-I	65
2	Sainj	100
3	Swara Kuddu	111

	Total HPPCL	**276**
	Total (HPSEBL+HPPCL)	**648**

(b) Central Sector: Details of installed HEPs (above 25 MW) operated by central entities:

Table 4.2: Existing HEPs (above 25 MW Capacity) of central entities in operation

S.No.	Hydro-Electric Project	Capacity (in MW)
	BBMB	
1	Bhakra Left	630
2	Bhakra Right	785
3	Dehar	990
4	Pong	396
	Total BBMB	**2801**
	NHPC	
1	Baira Siul	180
2	Chamera I	540
3	Chamera II	300
4	Chamera III	231
5	Parbati III	520
6	Parbati II	800
	Total NHPC	**2571**
	SJVN	
1	Nathpa Jhakri	1500
2	Rampur	412.02
	Total SJVN	**1912.02**
	NTPC	
1	Koldam	800
	Total NTPC	**800**
	Total Central Sector	**8084.02**

(c) Private Sector: Details of installed HEPs (above 25 MW) operated by private entities:

Table 4.3: Existing HEPs (above 25 MW Capacity) of private entities in operation

S.No.	Hydro-Electric Project	Capacity (in MW)

1	Malana (MPCL)	86
2	Budhil (GBHPPL)	70
3	Malana II (EPPL)	100
4	Chanju-I (IA Energy)	36
5	Allain Duhangan (ADHPL)	192
6	Baspa (HBPCL)	300
7	Karcham Wangtoo (JSWHEL)	1045
8	Kutehr (JSWHEL)	240
9	Tidong-I (JSWHEL)	150
10	Sorang (HSPPL)	100
11	Bajoli Holi (GMR Bajoli Holi Hydro Power Pvt. Ltd.)	180
	Total	**2499**

4.3 Upcoming Hydroelectric projects in Himachal Pradesh

Table 4.4: Upcoming HEPs (above 25 MW Capacity) by 2030-31

S.No.	Hydro-Electric Project	Capacity (in MW)	Time frame
1	Luhri-I (SJVN)	210	2029-30
2	Dhaulasidh (SJVN)	66	2026-27
3	Sunni Dam (SJVN)	382	2029-30
4	Shongtong Karcham (HPPCL)	450	2028-29
5	Chanju-III (HPPCL)	48	2027-28

Table 4.5: HEPs (above 25 MW Capacity) expected to commission beyond 2030-31

S.No.	Hydro-Electric Project	Capacity (in MW)
1	Dugar (NHPC)	500
2	Reoli Dugli (SJVN)	458
3	Purthi (SJVN)	224
4	Bardang (SJVN)	158
5	Tangnu Romai-I (Pvt.)	44
6	Kashang-II, III (HPPCL)	130
7	Thana Plaun (HPPCL)	191

4.4 Basin-wise evacuation system of hydroelectric generation in Himachal Pradesh

- **Upper Satluj Hydro Generation Evacuation Corridor:**

  This is the largest ISTS transmission corridor in Himachal Pradesh, developed for evacuation of power from the Upper Satluj hydroelectric projects, including Nathpa–Jhakri (1,500 MW), Karcham–Wangtoo (1,000 MW), Rampur (412 MW) and other generating stations.

  It comprises the 400 kV Karcham–Wangtoo (HPPTCL)–Kalaamb–Abdullapur, Jhakri–Gumma–Panchkula and Jhakri–Rampur–Nalagarh transmission lines, along with the under-implementation 400 kV Jangi Pooling–Wangtoo (HPPTCL)–Panchkula line, which will strengthen power evacuation from the Upper Satluj region.

- **Parbati–Koldam Hydro Generation Evacuation Corridor:**

  This corridor facilitates evacuation of power from the Parbati-II & III (800 MW), Koldam (800 MW), Luhri Stage-I & II and other Middle Satluj hydroelectric projects through the Banala (Parbati Pool) 400/220 kV pooling station. It comprises the 400 kV Banala (PGCIL)–Koldam–Nalagarh, Banala–Hamirpur–Jalandhar–Amritsar and Koldam–Ludhiana transmission lines, along with the under-construction 400 kV Luhri Pooling–Koldam line, thereby strengthening power evacuation from the Parbati and Middle Satluj hydro generation complex.

- **Ravi Basin Hydro Generation Evacuation Corridor:**

  This corridor facilitates evacuation of power from the Ravi Basin hydroelectric projects, including Chamera-I (540 MW), Chamera-II (300 MW), Chamera-III (231 MW) and Budhil HEPs. It comprises the 400 kV Chamera Pooling (Rajera)–Jalandhar, Chamera-I–Jalandhar and Chamera Complex–Kishenpur transmission lines, thereby strengthening power evacuation from the Ravi Basin hydro generation complex.

- **Bharmour Subsystem:**

  The Bharmour subsystem comprises Kutehr HEP (240 MW), Bajoli Holi HEP (180 MW), Holi-II HEP, Chirchind HEP, and the Heiling hydroelectric projects, including Kuwarsi-I, Kuwarsi-II and Salun HEPs (33.9 MW). Power generated from these projects is evacuated through the 400 kV Chamera Pooling (PGCIL) ISTS substation, while HPSEBL draws its allocated power share at the Lahal 33 kV and Heiling 66 kV delivery points.

- **Pabbar Basin Subsystem:**

The Pabbar Basin subsystem comprises Sawra Kuddu HEP (111 MW), Naitwar Mori HEP (60 MW) and the LILO of the 400 kV Jhakri–Panchkula ISTS line at Gumma Substation. Power from these projects is evacuated through the ISTS network, while the 220/132 kV Sunda Substation provides step-down supply to HPSEBL's 66 kV network serving the Rohru area.

- **Upper Satluj Subsystem:**

  The Upper Satluj subsystem comprises Kashang Stage-I HEP (65 MW), Tidong-I HEP (100 MW), Wanger Hompte HEP, Selti Masrang HEP, Rala HEP, the Urni hydroelectric projects (Raura, Shaung and Brua), and the Bhoktoo arm (Tangling HEP). The subsystem is interconnected with the ISTS through the LILO of the 400 kV Karcham–Kalaamb–Abdullapur line at Wangtoo Substation, enabling power evacuation, while HPSEBL draws power at the Wangtoo 220 kV and 66 kV buses, Urni 66 kV generation pooling station, and the Bhoktoo 22 kV bus.

- **Hamirpur–Dehan Subsystem:**

  The Hamirpur–Dehan subsystem comprises the 400/220 kV PGCIL Hamirpur ISTS Substation, Dhaulasidh HEP, Thana Pulan HEP and Triveni Mahadev HEP. The 220 kV Hamirpur–Dehan D/C line facilitates evacuation of power from these hydro projects and delivers ISTS power to the 220/132 kV Dehan (Patti) Substation, from where HPSEBL draws power at the 132 kV level for the Kangra, Hamirpur, Patti and Bangana areas.

- **Chandra Bhaga basin Subsystem:**

  The proposed Chandra Bhaga basin Subsystem comprises of 400 kV High-Capacity D/c line transversing through along the Chandrabhaga river connecting every hydroelectric project in the basin such as Dugar, Reoli Dugli, Bardang, Purtrhi and other HEPs. The evacuation masterplan envisages a 400 kV Switching station near Tindi and 400 kV High-Capacity line interconnection with Kishtwar S/s; also, Tindi SS would be connected with Chamera system/Punjab system. The transmission system would be taken up for implementation upon the visibility of commissioning of the associated HEPs.

4.5 Basin-wise Generation Evacuation Adequacy Status of intra-state system

HPPTCL's Intra-State Transmission System (InSTS) is, in its fundamental character, a generation evacuation system. Over the past decade, HPPTCL has made substantial and systematic investments in basin-wise evacuation infrastructure. The adequacy of intra-state transmission

system for evacuation of power from RE sources in the state of Himachal Pradesh is tabulated below:

Table 4.6: Generation Evacuation Adequacy: Basin-wise Status

Basin / Subsystem	Key Evacuation Infrastructure (In-STS)	Status and Remarks
Pabbar Basin (Sunda–Hatkoti–Gumma)	*Sunda 220/132/33 kV SS; Hatkoti–Gumma 220 kV D/C; 400/220 kV Gumma (PGCIL)*	Fully commissioned. Adequate capacity for all identified HEPs in the Pabbar basin, including Sawra Kuddu (111 MW) and Naitwar Mori (60 MW). No further evacuation infrastructure required within the planning horizon.
Upper Satluj Basin (Wangtoo–Bhoktoo–Urni)	*400/220/66 kV Wangtoo SS (PGCIL); 220/66 kV Bhoktoo SS; 66 kV Urni SW; Kashang–Wangtoo 220 kV*	InSTS evacuation infrastructure complete. The ISTS component — Jangi Pooling SS (PGCIL, under development) and the Jangi–Wangtoo–Panchkula 400 kV corridor — will complete the full basin evacuation chain. Upstream Spiti and Upper Kinnaur HEP development is beyond the 10-year planning horizon.
Beas Basin (Kangoo–Pandoh–Prini)	*220/132 kV Kangoo SS; 33 kV Palchan SW; 220 kV AD Hydro–Nalagarh corridor*	Beas basin evacuation infrastructure complete. Pandoh and Chambi (132/33 kV) serve islanded sub-systems adequately. The Larji Phase II scheme will further integrate the Beas valley into the Trans-Himachal Grid at Kangoo as a 3-system interchange — a grid integration upgrade, not an evacuation necessity.
Parbati Basin (Charor–Banala)	*220/132/33 kV Charor SS; Charor–Banala 220 kV D/C; 132 kV Barsaini SS + Barsaini–Charor TL (U/C)*	Major evacuation infrastructure commissioned: Charor SS and Charor–Banala 220 kV D/C are operational, enabling evacuation of Malana-II (100 MW) and other Parbati basin projects. The 132 kV Barsaini SS and Barsaini–Charor line are under construction; expected commissioning within 1–2 years, completing the full basin evacuation plan.
Middle Beas / Palampur Area (Dehan–Hamirpur)	*220/33 kV Dehan SS; 220 kV Dehan–Hamirpur D/C; Sujanpur 220 kV SW (pipeline);*	Dehan SS and Dehan–Hamirpur D/C corridor provide evacuation for Dhaulasidh (66 MW) and Thana Pulan (30 MW) HEPs, with Sujanpur 220 kV SS in the pipeline for the future Thana Pulan PSP (660 MW). Baijnath 132/33 kV pooling station under GEC-II provides

Basin / Subsystem	Key Evacuation Infrastructure (In-STS)	Status and Remarks
	Baijnath 132/33 kV (GEC-II, U/C)	pooling for small HEPs in the Palampur area. Evacuation plan complete for the horizon.
Upper Ravi / Bharmour (Lahal–Karian)	*400/220/33 kV Lahal (Chamera Pooling) SS; Mazra–Karian 220 kV; Bajoli Holi–Lahal 220 kV*	Fully commissioned. Adequate capacity for all identified HEPs including Kutehr (240 MW) and Bajoli Holi (180 MW). Chamera Pooling (400/220 kV, PGCIL) provides the ISTS interface. No further InSTS evacuation infrastructure required.
Teesa Valley / Chamba (Karian–Rajera)	*220/33 kV Karian–Rajera arm; 132 kV Nakror SW; Kurthala–Banjal link; Nakror–Mazra TL*	Teesa valley / Chamba evacuation system complete: 132 kV Nakror SW, Kurthala interconnect, and Nakror–Mazra TL provide evacuation for Chanju-III and associated projects. The Chamba–Kangra 220 kV link adds redundancy and removes the current single-path dependence on the ISTS for Chamba generation.
Kangra District / Trans-Himachal (Solar + Hydro)	*Chamba–Kangra 220 kV link; Kangra Solar Pooling SS; Una Solar Pooling SS*	The Trans-Himachal 220 kV Green Energy Corridor provides the planned evacuation infrastructure for renewable energy in Kangra and Una districts. The Chamba–Kangra 220 kV link (Phase 1) is the mandatory foundation. Solar Pooling Substations at Kangra and Una are conditional on developer commitments Together, these schemes complete the generation evacuation plan for the entire InSTS.

Chapter-5
Recommendations

1. Intra-State system augmentation proposed till 2035-36 in the state of Himachal Pradesh comprises of 1111 ckm (220 kV and above) of lines and 5367 MVA of transformation capacity. This augmentation is proposed in both EHV network i.e. Intra-state transmission (HPPTCL) and intra-state distribution (HPSEBL) system.
2. All the planned transmission network should be timely implemented and HPPTCL should expedite the transmission elements proposed for mitigation of transmission constraints in the state.

   As significant part of EHV system is being operated by HPSEBL (Distribution licensee) in Himachal Pradesh, appropriate augmentation works in the system is also needs to be carried out by HPSEBL.
3. Action must be initiated by HPPTCL 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 2035-36 timeframe may be reviewed based on growth of electricity demand and expected commissioning of proposed solar and hydro generators etc.
4. HPPTCL should provide appropriate space provisions for 66 kV and 33 kV bays in their 220 kV and 132 kV grid substations for supply of power to DISCOMs, and new substations should have adequate space provision for extension/augmentation to meet future load growth.
5. Projects which are planned for the time frame beyond 2030-31 and 2035-36, may be taken up earlier or later as per the RE evacuation plan and requirement of Discom. Accordingly, the Resource Adequacy study for transmission system in the state may be reviewed in the coming years.

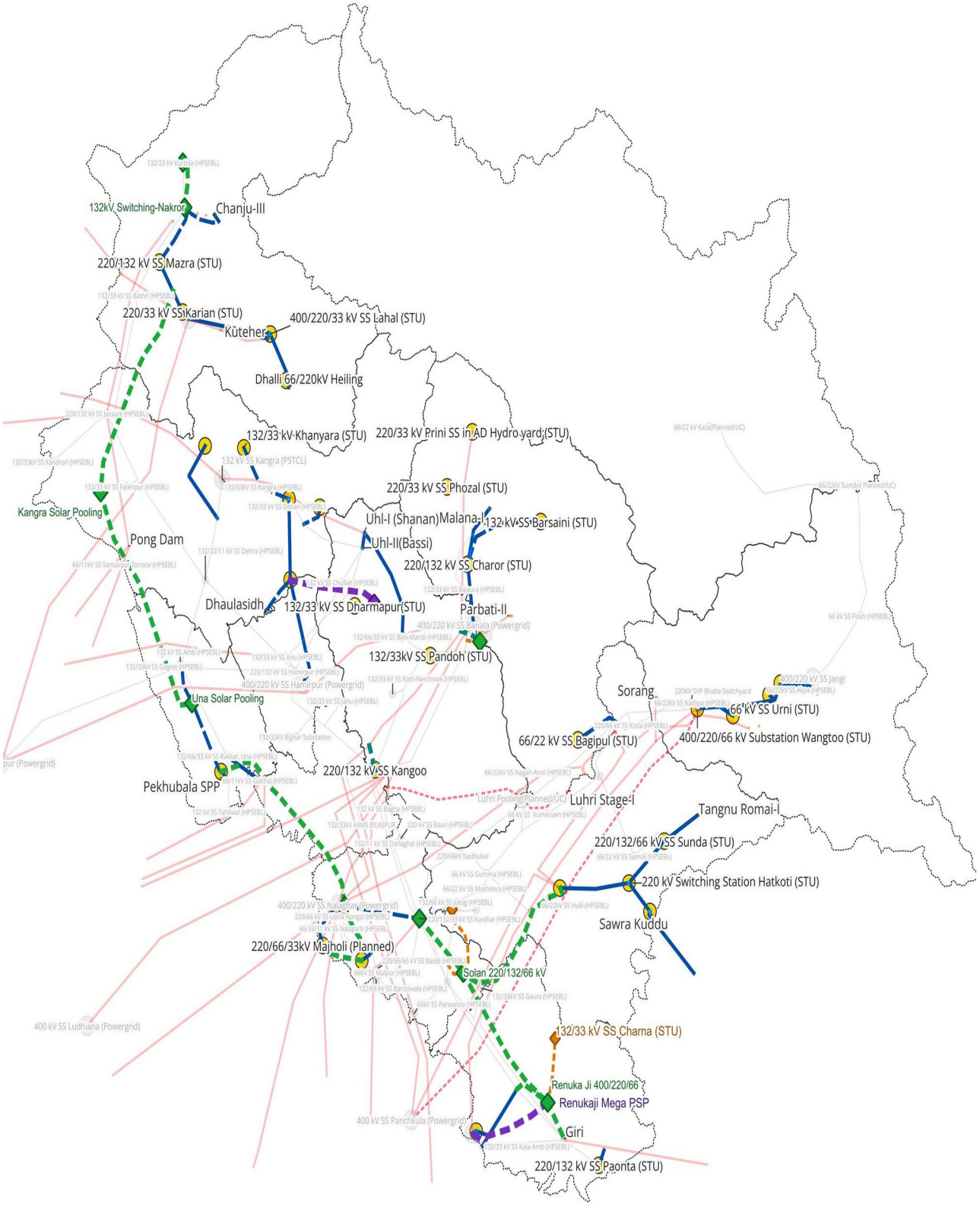


Fig. Power Map (existing and planned network) of Himachal Pradesh