सेंट्रल ट्रांसमिशन यूटिलिटी ऑफ इंडिया लिमिटेड
(पावर ग्रिड कॉर्पोरेशन ऑफ इंडिया लिमिटेड के स्वामित्व में)
(भारत सरकार का उद्यम)
CENTRAL TRANSMISSION UTILITY OF INDIA LTD.
(A wholly owned subsidiary of Power Grid Corporation of India Limited)
(A Government of India Enterprise)

Ref: CTU/N/00/CMETS_NR/40 **Date:** 30-09-2025

As per distribution list

Subject: 40th Consultation Meeting for Evolving Transmission Schemes in Northern Region-Minutes of Meeting

Dear Sir/Ma'am,

Please find enclosed the minutes of the 40th Consultation Meeting for Evolving Transmission Schemes in Northern Region held on 12th September 2025 (Friday) through virtual mode.

The minutes are also available at CTU website (www.ctuil.in)

Thanking you,

Yours faithfully,

30.9.25

(Sandeep Kumawat)
DGM(CTUIL)

Distribution List:

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Minutes for 40th Consultation Meeting for Evolving Transmission Schemes in Northern Region held on 12.09.2025

Confirmation of Minutes:

It was informed that the minutes of 39th Consultation Meeting for Evolving Transmission Schemes in Northern Region (CMETS-NR) held through VC on 28/07/2025 was circulated vide CTU letter dated 08.09.2025. Regarding the minutes, Grid India vide mail dated 09.09.2025 suggested to incorporate the change in minutes as below:

(i) In the 3rd Para under discussions of GNA_{RE} application of Hindustan Zinc Ltd.(App. No. 2200002025) at Page No. 59, it is mentioned that

"*NRLDC informed that currently there is issues in loading of Anta-Kota line & Anta-Chabbra line due to which the Anta-Kota line is frequently opened during operation".*

The above sentence shall be replaced as

"NRLDC informed that due to high loading of 400kV Anta-Kota line, 400kV Anta-Chhabra and 400kV Anta-Kota line is bypassed at 400kV Anta and the lines are in service as 400kV Chhabra-Kota line (bypassed at 400kV Anta) as agreed in 154th OCC meeting of NRPC held on 18.12.2018"

No other comments were received on the minutes. Accordingly, minutes of 39th CMETS NR meeting were confirmed with above corrections.

A. Connectivity & GNA Applications Agenda

It was informed that in view of notification & effectiveness of 3rd Amendment of Connectivity & GNA Regulations 2022, the transition process is to be carried out for applicable entities. Accordingly, the applications shall be processed after the completion of transition process. In the meantime, the applicants may provide necessary data as per the requirements mentioned in 3rd amendment of GNA Regulations 2022.

A1 Connectivity Application deferred in the previous CMETS NR meeting.

Sl. No.	Application No. & Date	Name of Applicant	Project Location	Nature of Applicant	Installed Capacity (MW)	Criterion for applying	Connectivity Quantum (MW)	Start Date of Connectivity (As per Application)	Connectivity Location (As per Application)
1.	2200001981 (28.04.2025)	THDC India Limited	Bulandshahr distt. Uttar Pradesh	REGS with installed capacity of 5 MW & above applying for Connectivity through electrical system of a generating station already having Connectivity to ISTS	11 (Solar)	Land BG route	11	15.06.2025	Aligarh (PG) S/s
2.	2200002060 (20.05.2025)	ACME Greentech Urja Private Limited	Jaisalmer distt. Rajasthan	Generating station(s), including REGS(s), without ESS	2182 (Solar)	Land BG route	2182	28.12.2028	Ramgarh SS
3.	2200002062 (20.05.2025)	RJS Renewables Private Limited	Jaisalmer distt. Rajasthan	Generating station(s), including REGS(s), without ESS	150(Solar)	Land Route	150	20.04.2028	Ramgarh-II

A2. Application for grant of GNA_{RE} deferred in the 38th CMETS NR meeting

Sl No.	Application No. & Date	Name of the Applicant	Nature of applicant	GNA_{RE} within Region (MW)	GNA_{RE} outside Region (MW)	Total GNA_{RE} Required (MW)	Start date of GNA_{RE}	End date of GNA_{RE}
1.	2200001595 (06-02-2025)	Hindustan Zinc Limited	Bulk consumer seeking to connect to ISTS directly	5.0	215.0	220	30- 06- 2027	30- 06- 2052
2.	2200002025 (17.05.2025)	Hindustan Zinc Limited	Bulk consumer seeking to connect to ISTS directly	5	175	180	01.02.2027	31.01.2052

A3.A3. Applications for Connectivity to ISTS under CERC (Connectivity and General Network Access to the inter-State Transmission System) Regulations, 2022 received in Jun'25

Sl. No.	Application No. & Date	Applicant	Project Location	Nature of Applicant	Installed Capacity (MW)	Criterion for applying	Connectivity Quantum (MW)	Start Date of Connectivity (As per Application)	Nearest Pooling Station (As per Application)
1.	2200002130 (06.06.2025)	Ashoka Renewable Energy 1 Private Limited	Jaisalmer distt. Rajasthan	Generating station(s), including REGS(s), without ESS	150 (Wind)	Land BG Route	150	01.10.2030	Ramgarh II PS
2.	2200002136 (10.06.2025)	Jindal Green Private Limited	Barmer distt. Rajasthan	Generating station(s), including REGS(s), without ESS	350 (Solar)	Land BG Route	350	30.06.2031	Barmer-IV PS
3.	2200002150 (11.06.2025)	Jindal Green Private Limited	Barmer distt. Rajasthan	Generating station(s), including REGS(s), without ESS	300 (Solar)	Land BG Route	300	30.09.2031	Barmer-IV PS
4.	2200002154 (11.06.2025)	ReNew Solar Power Private Limited	Jaisalmer distt. Rajasthan	Generating station(s), including REGS(s), without ESS	300 (Solar)	Land BG Route	300	31.03.2028	Bhadla-V PS
5.	2200002153 (11.06.2025)	ReNew Solar Power Private Limited	Bikaner distt. Rajasthan	Generating station(s), including REGS(s), without ESS	300 (Solar)	Land BG Route	300	30.06.2028	Bhadla-V PS
6.	2200002152 (11.06.2025)	ReNew Solar Power Private Limited	Bikaner distt. Rajasthan	Generating station(s), including REGS(s), without ESS	300 (Solar)	Land BG Route	300	30.09.2028	Bhadla-V PS
7.	2200002151 (11.06.2025)	ReNew Solar Power Private Limited	Bikaner distt. Rajasthan	Generating station(s), including REGS(s), without ESS	300 (Solar)	Land BG Route	300	31.12.2028	Bhadla -V PS
8.	2200002155 (12.06.2025)	Jorhat Solar Power Private Limited	Jodhpur distt. Rajasthan	Generating station(s), including REGS(s), without ESS	400 (Solar)	Land Route	400	31.03.2030	Bhadla-V PS
9.	2200002164 (13.06.2025)	ReNew Solar Power Private Limited	Bikaner distt. Rajasthan	Generating station(s), including REGS(s), without ESS	300 (Solar)	Land BG Route	300	31.03.2029	Bhadla-V PS
10.	2200002166 (13.06.2025)	ReNew Solar Power Private Limited	Bikaner distt. Rajasthan	Generating station(s), including REGS(s), without ESS	300 (Solar)	Land BG Route	300	30.06.2029	Bhadla-V PS
11.	2200002165 (13.06.2025)	ReNew Solar Power Private Limited	Bikaner distt. Rajasthan	Generating station(s), including REGS(s), without ESS	200 (Solar)	Land BG Route	200	30.09.2029	Bhadla-V PS
12.	2200002162	ReNew Solar Power Private Limited	Barmer distt. ,Rajasthan	Generating station(s), including REGS(s), without ESS	300 (Solar)	Land BG Route	300	30.09.2027	Barmer-IV PS

Sl. No.	Application No. & Date	Applicant	Project Location	Nature of Applicant	Installed Capacity (MW)	Criterion for applying	Connectivity Quantum (MW)	Start Date of Connectivity (As per Application)	Nearest Pooling Station (As per Application)
	(13.06.2025)								
13.	2200002163 (13.06.2025)	ReNew Solar Power Private Limited	Bikaner distt. Rajasthan	Generating station(s), including REGS(s), without ESS	100 (Solar)	LOA or PPA	100	30.06.2027	Bhadla-V PS
14.	2200002174 (18.06.2025)	Balasore Solar Power Private Limited	Phalodi distt. Rajasthan	Generating station(s), including REGS(s), without ESS	300 (Solar)	Land Route	300	31.03.2030	Bhadla V PS
15.	2200002181 (20.06.2025)	NHPC Limited	Kishtwar distt. Jammu and Kashmir	Generating station(s), including REGS(s), without ESS	260 (Hydro)	NA	260	31.05.2029	Kishtwar PS
16.	2200002194 (23.06.2025)	Vannur Solar Power Private Limited	Barmer distt. Rajasthan	Generating station(s), including REGS(s), without ESS	275 (Solar)	Land Route	275	31.10.2030	Barmer IV PS
17.	2200002179 (24.06.2025)	Chenab Valley Power Projects Limited	Kishtwar distt. Jammu and Kashmir	Generating station(s), including REGS(s), without ESS	540 (Hydro)	NA	540	31.12.2027	Kishtwar PS
18.	2200002201 (27.06.2025)	Tata Power Renewable Energy Limited	Jaisalmer distt. Rajasthan	Generating station(s), including REGS(s), without ESS	1000 (Solar)	Land BG Route	1000	31.03.2030	Ramgarh-III PS
19.	2200002217 (30.06.2025)	Adani Renewable Energy Holding Twelve Limited	Jaisalmer distt. Rajasthan	Generating station(s), including REGS(s), without ESS through a lead generator	173.33 (Solar)	LOA or PPA	173.33	15.06.2027	Ramgarh-III / Ramgarh-IV PS

A4. Application for Addition of Generation Capacity within the Quantum of Connectivity Granted under Regulation 5.2 received in Jun'25

Sl. No.	Application No. & Date	Applicant	Project Location	Nature of Applicant	App. No. & Conn. Quantum (MW) of already granted Connectivity	Planned additional capacity (MW)	Date from which additional generation capacity will be added	Connectivity Granted at
1.	2200002123 (05.06.2025)	Juniper Green Cosmic Private Limited	Bikaner distt. Rajasthan	Generating station(s), including REGS(s), without ESS	Stage-II: 1200003740 (100 MW) LTA: 0412100008(100 MW)	16 (BESS)	31.12.2025	220 kV Bikaner-II PS
2.	2200002125 (05.06.2025)	Juniper Green Stellar Private Limited	Barmer distt. Rajasthan	Generating station(s), including REGS(s), with ESS	0412100010 (150 MW)	28.75 (BESS)	30.04.2026	220 kV Fatehgarh-IV (Sec-I) PS
3.	2200002126 (05.06.2025)	Juniper Green Stellar Private Limited	Barmer distt. Rajasthan	(Generating station(s), including REGS(s), with ESS	0412100011 (65 MW)	17.50 (BESS)	30.04.2026	220 kV Fatehgarh-IV (Sec-I) PS
4.	2200002127 (05.06.2025)	Juniper Green Stellar Private Limited	Barmer distt. Rajasthan	Generating station(s), including REGS(s), with ESS	0412100009 (150 MW)	11.25 (BESS)	31.03.2026	220 kV Fatehgarh-IV (Sec I) PS
5.	2200002140 (11.06.2025)	Enren-I Energy Private Limited	Barmer distt. Rajasthan	Generating station(s), including REGS(s), without ESS	2200000286 (300 MW)	150 MW (BESS)	28.02.2026	Barmer-I PS

A5A5. Application for grant of GNA_{RE} received in Jun'25

Sl No.	Application No. & Date	Name of the Applicant	Nature of applicant	GNA_{RE} within Region (MW)	GNA_{RE} outside Region (MW)	Total GNA_{RE} Required (MW)	Start date of GNA_{RE}	End date of GNA_{RE}
1.	2200002213 (30.06.2025)	STT Global Data Centres India Private Limited	Drawee entity connected to Intra State	0	2	2	01.07.2025	30.04.2050
2.	2200002215 (30.06.2025)	STT Global Data Centres India Private Limited	Drawee entity connected to Intra State	0	7	7	01.07.2025	31.03.2035

A6.A6. Applications for Connectivity to ISTS under CERC (Connectivity and General Network Access to the inter-State Transmission System) Regulations, 2022 received in July'25

Sl. No.	Application No. & Date	Applicant	Project Location	Nature of Applicant	Installed Capacity (MW)	Criterion for applying	Connectivity Quantum (MW)	Start Date of Connectivity (As per Application)	Nearest Pooling Station (As per Application)
1.	2200002227 (07.07.2025)	Unique Hybrid Renewable Energy 3 Private Limited	Barmer distt. Rajasthan	Generating station(s), including REGS(s), without ESS	300 (Solar)	Land BG route	300	01.10.2030	Barmer III PS
2.	2200002238 (09.07.2025)	BN Dispatchable-5 Private Limited	Jaisalmer distt. Rajasthan	Generating station(s), including REGS(s), with ESS (BESS)	200 (Wind), 150 (Solar) 100 (BESS)	Land BG route	350	30.06.2028	Ramgarh-II PS / Ramgarh-III PS
3.	2200002243 (11.07.2025)	Purvah Green Power Private Limited	Bikaner distt. Rajasthan	Generating station(s), including REGS(s), without ESS	300 (Solar)	Land BG route	300	01.01.2029	Bikaner IV/V/VI PS
4.	2200002248 (14.07.2025)	Purvah Green Power Private Limited	Bikaner distt. Rajasthan	Generating station(s), including REGS(s), without ESS	300 (Solar)	Land BG route	300	01.07.2029	Bikaner IV/V/VI PS
5.	2200002295 (30.07.2025)	NHPC Limited (Uri-I Stage-II HEP)	URI, Baramulla distt, J&K	Generating station(s), including REGS(s), without ESS	240 (Hydro)	-	240	31.03.2029	Amargarh PS

A7A7. Application for Addition of Generation Capacity within the Quantum of Connectivity Granted under Regulation 5.2 received in July'25

Sl. No.	Application No. & Date	Applicant	Project Location	Nature of Applicant	App. No. & Conn. Quantum (MW) of already granted Connectivity	Planned additional capacity (MW)	Date from which additional capacity will be added	Connectivity Granted at
1.	2200002249 (15.07.2025)	Serentica Renewables India Private Limited	Jaisalmer distt. Rajasthan	Generating station(s), including REGS(s), without ESS	0212100034 (300 MW)	200 (Wind)	30.06.2028	400 kV Fatehgarh III PS
2.	2200002250 (15.07.2025)	Serentica Renewables India Private Limited	Jaisalmer distt. Rajasthan	Generating station(s), including REGS(s), without ESS	0212100036 (300 MW)	200 (Wind)	30.06.2028	400 kV Fatehgarh III PS
3.	2200002251 (15.07.2025)	Serentica Renewables India Private Limited	Jaisalmer distt. Rajasthan	Generating station(s), including REGS(s), without ESS	2200000020 (300 MW)	200 (Wind)	30.06.2028	400 kV Fatehgarh III PS
4.	2200002280 (22.07.2025)	ACME Heergarh Powertech Private Limited	Jodhpur distt. Rajasthan	Generating station(s), including REGS(s), without ESS	1200002471 (300 MW)	300 (BESS) 240 (Solar)	01.11.2025, 01.01.2027	220 kV Bhadla-II PS
5.	2200002294 (30.07.2025)	AM Green Energy Private Limited	Bikaner distt. Rajasthan	Generating station(s), including REGS(s), without ESS	2200000319 (300 MW)	100 (Solar) 125 (BESS)	31.12.2027	220 kV Bikaner-IV PS

A8.A8. Application for grant of GNA_{RE} received in July'25

Sl No.	Application No. & Date	Name of the Applicant	Nature of applicant	GNA_{RE} within Region (MW)	GNA_{RE} outside Region (MW)	Total GNA_{RE} Required (MW)	Start date of GNA_{RE}	End date of GNA_{RE}
1	2200002261 (17.07.2025)	Panipat Green Hydrogen Private Limited	Bulk consumer (including Green Hydrogen / Green Ammonia) seeking to connect to ISTS directly	0	99	99	25.08.2027	25.12.2052

Network Expansion Scheme

1. PSTCL proposal regarding revision in scope of work for 400kV Wadala Granthian

It was stated that PSTCL vide letter dated 20.05.25 submitted agenda for revision in scope of work for 400kV Wadala Granthian (copy of PSTCL letter is enclosed in **Annexure-A1**). In the agenda PSTCL mentioned that, originally 400kV Wadala Granthian substation was proposed to be planned with 2 Nos. 500 MVA, 400/220 kV ICTs along with LILO of one circuit of 400kV Moga-Kishenpur line in stage 1 and 1 No. 500 MVA 400/220 kV ICT along with LILO of 2nd circuit of 400kV Moga-Kishenpur line in Stage-2. Moga-Kishenpur is a 765kV line which is charged at 400kV. However, it was learned from CTU that the Moga-Kishenpur line would eventually be charged at 765 kV level due to the evacuation of some upcoming hydro generation in the J&K area.

In accordance with the above, PSTCL explored alternative proposals for 400 kV connectivity to Wadala Granthian, including the LILO of the 400 kV Samba—Jalandhar D/C line and the 400 kV Amritsar—Parbati line. Further PSTCL in the letter also mentioned that, according to the minutes of the 28th CMETS meeting, and following the implementation of the Rattle HEP evacuation scheme approved therein, the single circuit 400kV Jalandhar—Samba (Quad) line and the single circuit 400kV Nakodar—Samba (Quad) line remains available for LILO in 2026-27 timeframe, at the 400kV Wadala Granthian substation. Therefore, the load flow study was carried out considering both the 400kV Samba-Jalandhar and 400kV Samba-Nakodar lines, and the results are feasible.

Accordingly, the feeding arrangement will involve the LILO of either the 400 kV S/C Jalandhar—Samba line (Quad) or the 400 kV S/C Samba—Nakodar line (Quad) depending upon the alignment of 400 kV Wadala Granthian w.r.t these lines. Upon completion of the proposed 400 kV Samba—Jalandhar and 400 kV Samba—Nakodar circuits by CTU under the Ratle HEP evacuation scheme, the specific line to be LILOed at 400 kV Wadala Granthian (either 400 kV S/C Jalandhar—Samba line (Quad) or 400 kV S/C Samba—Nakodar line (Quad)) will be finalized based on the orientation of 400kV Wadala Granthian.

PSTCL further stated that as per these studies, while single circuit LILO of 400kV line is sufficient to meet with loads at 400kV Wadala Granthian, however, in case in future, if single circuit LILO has some reliability issues due to further load growth and ATC/TTC enhancements in coming 4-5 years down the lane, the same will be considered at that time. At that stage, Stage-2 can be planned, which shall include the installation of 2nd 500 MVA, 400/220kV ICT and LILO of 400kV Amritsar-Parbati line or any other suitable line, depending on the prevalent conditions at that time.

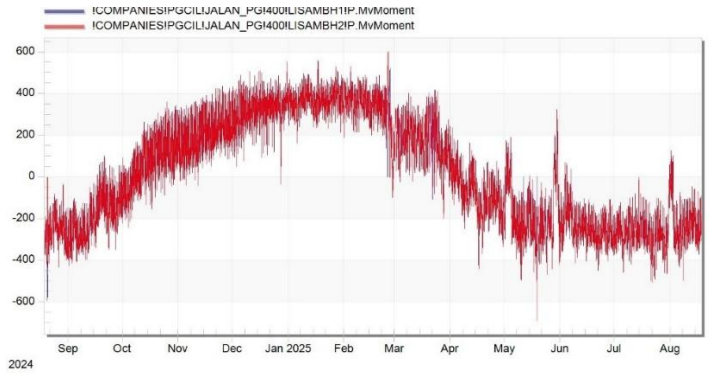
In view of the above, PSTCL requested that the proposal of 400kV Wadala Granthian with 1x500MVA, 400/220kV ICT and LILO of 400kV Samba-Jalandhar line (Quad moose) or LILO of 400kV Samba-Nakodar line (Quad moose) may be approved.

CTU vide mail dated 30.05.25 to CEA & Grid-India requested to provide their observation on PSTCL proposal. Grid-India vide mail dated 04.06.2025 requested to clarify whether existing 220kV Wadala Granthian S/S would be upgraded to 400kV or new 400/220KV substation would be created with new 220kV lines. In either

case, it is important to take into account underlying 220kV network in simulation studies. It becomes all the more important for Punjab as it is a separate bid-area in IEX and its schedule is restricted to ATC/TTC limits jointly assessed by NRLDC and Punjab SLDC and Grid-India also mentioned that PSS/E base case file may also be shared for the proposed network for further studies/comments.

CTU vide mail 04.06.25 shared PSTCL's PSSE file to CEA & Grid-India. Further PSTCL vide mail 12.06.25 clarified that the 400 kV Wadala Granthian substation will be constructed within the yard of the existing 220 kV Wadala Granthian substation, as there is available land. The 220 kV bus of the new 400 kV Wadala Granthian substation will be connected to the existing 220 kV Wadala Granthian bus using appropriate methods based on site conditions.

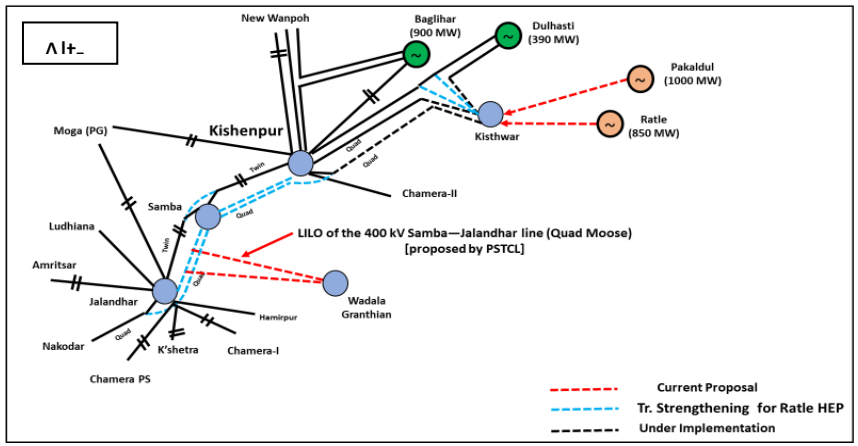
Further Grid India vide mail dated 18.08.25 commented that proposal seems to be in order based on the present loading conditions in the area. However, to ensure N-1 compliance at the approval itself, it is suggested that 2x500MVA ICTs may be planned at 400/220kV Wadala Granthian S/s. Grid India shares the loading pattern of existing 400kV Jalandhar-Samba D/C line (Twin Moose) is as under:

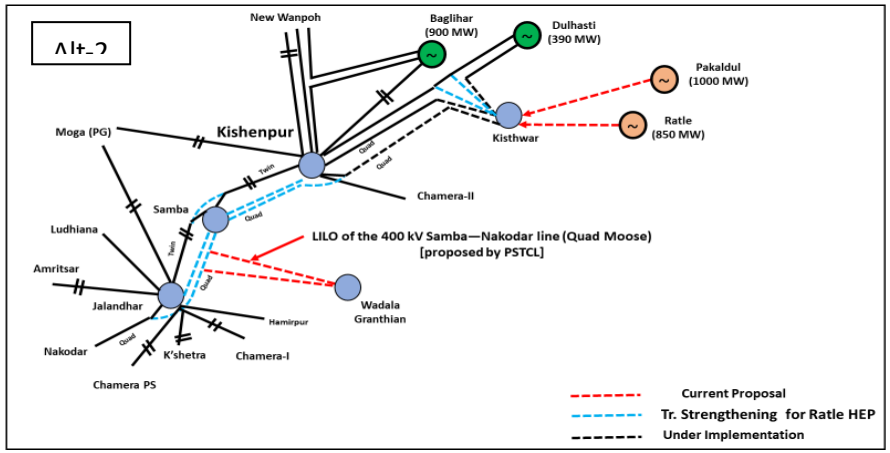


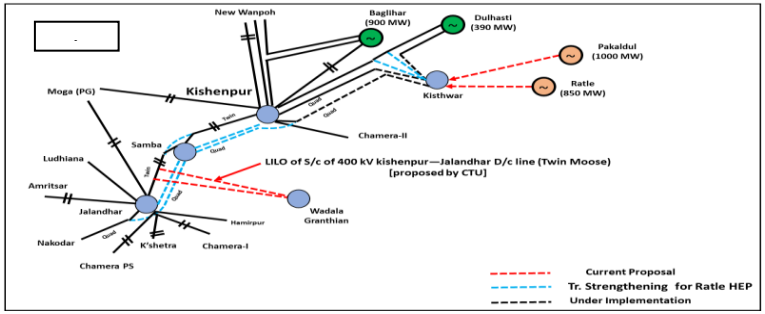
The above transmission line shall be bypassed at Samba (PG) S/s to form 400 kV Kishenpur—Jalandhar D/c line (Twin Moose) (bypassing of 400kV Kishenpur-Samba & Samba-Jalandhar D/c line) as part of Transmission scheme for evacuation of power from Ratle HEP (850 MW) & Kiru (624 MW) HEP scheme.

It was stated that proposal was examined in scenario-4 and scenario-5 of 2029-30 timeframe and various possible alternatives are proposed for the connectivity of 400 kV Wadala Granthian substation, which are as under :

1. Allt-1 : LILO of the 400 kV Samba—Jalandhar line (Quad Moose)
2. Alt 2: LILO of the 400 kV Samba—Nakodar line (Quad Moose)
3. Alt 3: LILO of one ckt. of 400 kV kishenpur—Jalandhar D/c line (Twin Moose)







In all the alternatives, loading is in order considering 1x500 MVA 400/220 kV ICT at Wadala Granthian Substation (suggested by PSTCL). Result of system studies is enclosed in **Exhibit-I.**

Results of ICTs loading from the studies for above mentioned 3 alternatives are as under:

Case	400/220 kV ICT Loading (under N-1) (in MW)					
	Sc-4 (June Solar max)		Sc-5 (June evening peak)		Sc-7 (Feb Solar max)	
	Kishenpur ICT 3x315 MVA	Wadala ICT 1x500 MVA	Kishenpur ICT 3x315 MVA	Wadala ICT 1x500 MVA	Kishenpur ICT 3x315 MVA	Wadala ICT 1x500 MVA

Base Case	3x236 (2x287)	NA	3x162 (2x197)	NA	3x289 (2x352)	NA
Alt-1: LILO of 400kV Samba-Jalandhar (Quad)	3X221 (2x269)	1x500	3x148 (2x180)	1x483	3x279 (2x339)	1x335
Alt-2: LILO of 400kV Samba-Nakodar (Quad)	3x223 (2x271)	1x464	3x151 (2x184)	1x412	3x279 (2x339)	1x340
Alt 3: LILO of 400kV kishenpur-Jalandhar (Twin)	3x218 (2x265)	1x499	3x147 (2x178)	1x472	3x275 (2x334)	1x352

From the CTU studies, it emerged that in all alternative's, ICTs at Kishenpur S/s shall relieve to 15-20MW/ICT (in N-1 contingency) with 1x500 MVA 400/220 kV ICT at Wadala Granthian. In the meeting CTU stated that Loading of Kishenpur ICT almost breaches to N-1 limit. Further Grid-India added that as per the latest ICT Loading data, Kishenpur ICT Loading is above 800MW. Grid-India stated that 400/220kV Siot S/s is approved S/s and under bidding. With implementation of Siot S/s and downstream 220kV network, there is possibility that loading of Kishenpur ICTs may reduces. CTUIL stated that requirement of Kishenpur ICT augmentation may be reviewed based on JKPTCL inputs regarding drawl requirement from Siot S/s and Kishenpur S/s and considering future planning proposal i.e. upgradation of 400kV Kishenpur-Moga D/c line at 765kV level. Loading of Kishenpur ICT data of Aug 23 to June 24 is as under :

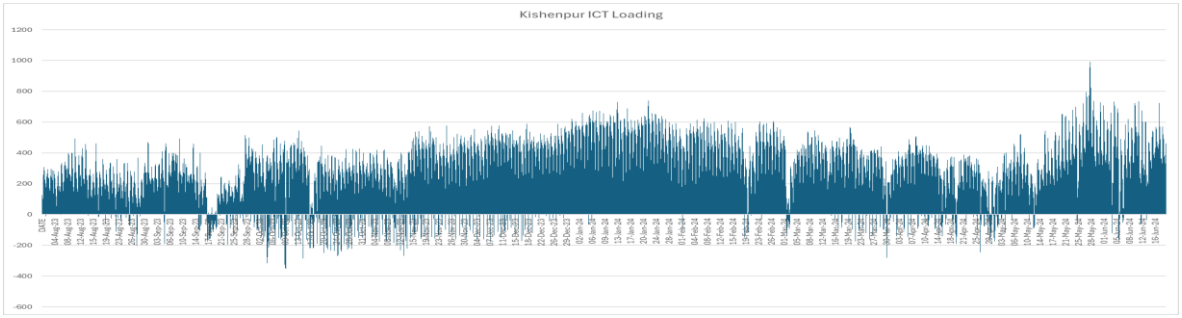


Fig: Loading of Kishenpur 400/220kv ICT (Sourec-Grid-India)

In the meeting CTU stated that considering high loading of 400/220kV ICT at Wadala Granthian S/s, it is recommended that 400kV substation is being implemented with 2x500MVA ICT. With 2x500 MVA 400/220 kV ICTs at Wadala Granthian, loading of 400/220 kV ICTs at Kishenpur S/s relieve to 25-30MW/ICT in N-1 condition in various scenarios.

It was informed that in alternative-1 & 2, LILO is proposed through 400kV Quad line, whereas in alternative-3 LILO is proposed through twin lines. Transmission lines depicted in alternative 1 & 2 are under implementation line as part of Transmission scheme for evacuation of power from Ratle and Kiru HEP whereas transmission line in alternative 3 is an existing line (will be formed by bypassing of 400kV Kishenpur-Samba line & 400kV Samba-Jalandhar line at Samba S/s). Considering loading limits of line, it is recommended that LILO is to be carried out through Quad line (Alt-1 or Alt-2) as more margins will be available in future for additional drawl of power from proposed 400/220kV Wadala Granthian S/s.

In the meeting CTU asked about type of conductor proposed for the LILO at 400kV Wadala Granthian S/s, PSTCL informed that LILO is being carried out through Quad Moose conductor. Considering configuration of proposed LILO line conductor as well as future drawl requirement, CTU stated that LILO of 400kV Samba-Jalandhar (Quad) line or LILO of 400kV Samba-Nakodar (Quad) line is more technically suitable. PSTCL and Grid-India agreed on the same.

PSTCL stated that LILO length at will be almost similar for proposed alternatives (1 & 2), however they have apprehension about exact orientation of original line mentioned in alternative-1 & 2 (to avoid crossing during LILO at 400kV Wadala Granthian) . CTUIL stated that 400kV Samba-Jalandhar (Quad) line & 400kV Samba-Nakodar (Quad) line are under implementation and on the receipt of route map for these lines from the TSP, CTUIL will share the route with PSTCL and PSTCL may opt LILO of any of 400kV line at 400kV Wadala Granthian S/s based on line route orientation .

Considering above following intra state scheme is agreed to be implemented by PSTCL:

- Alt-1 : LILO of the 400 kV Samba—Jalandhar line (Quad Moose) at 400kV Wadala Granthian

or

- Alt 2: LILO of the 400 kV Samba—Nakodar line (Quad Moose) at 400kV Wadala Granthian

Based on receipt of route map for these lines from the TSP, PSTCL may opt one of alternative for proposed LILO at 400kV Wadala Granthian S/s and inform the same to CEA, CTU and Grid-India after finalization

The proposal of establishment of 400/220 kV, 1x500MVA ICT Wadala Granthian S/s is intra state in nature therefore, CEA is requested to provide approval based on deliberation in present meeting.

2. Installation of Bus reactors at various 400kV substations by PSTCL as part of Intra state scheme

It was stated that in the CMETS-NR meeting it was stated that Northern region experiences large variations in demand over various seasons and time of day. The demand in NR varies from 102GW in Summer evening peak to 41GW in Winter night off peak time in 2026-27 timeframe. Additionally, NR has huge RE generation (mainly wind and solar) envisaged in Western Rajasthan. At present, NR has RE capacity of about 73 GW and huge capacity addition in RE is envisaged (about 40GW in next 2-3 years in Rajasthan in ISTS). Similarly, NR has 22GW of existing hydro capacity and more large-scale hydro generation projects envisaged in J&K, Himachal Pradesh and Uttarakhand in next 4-5 years. As no solar generation available in evening and night time as well as wind and hydro generation is also minimal in winter season, high voltage are observed in studies in various planning scenarios in 2026-27 time-frame.

In the 4th NRPC (TP) meeting held on 5.10.2021 and 12.10.2021, issue of high voltage and requirement of reactive compensation at the various substations in NR was discussed along with agenda of installation of line reactors as discussed in 3rd NRPC (TP) meeting. In above meeting, POSOCO also analysed the issue of high voltages in Northern region and made a presentation highlighting the various nodes (44 nos.) in NR which are experiencing high voltages for which POSOCO proposed bus reactors at 39 nos. of nodes. After deliberations in above meeting, following was agreed:

- STUs would provide inputs regarding the reactors planned at various intra-state substations in the respective states along with their implementation timelines.
- STUs would explore the possibility of installation of reactors at the node mentioned in meeting and accordingly intimate to CEA and CTUIL
- Based on the inputs from STUs, CTUIL would carry out the studies to assess the requirement of reactive compensation at various nodes in Northern Region to overcome the issue of high voltages

It was deliberated in 8th CMETS-NR that in order to curb the issue of high voltage, adequate reactive compensation in the identified pockets need to be installed, the details of which are mentioned as under:

S,No.	Pocket/State	No of Substations on which HV observed in studies	HV observed in operational feedback report (POSOCO)	New 125MVAr (420kV) bus reactors proposed based on studies	Remarks
1	Punjab	15 nos. (all 400kV substations)	9 nos.	4 nos. (Makhu, Rajpura, Mukatsar/ Behman Singh (Malkana), and Dhanansu)	High voltage observed in night off peak scenario of Q1 (Apr-Jun), Q3(Sep-Dec) and Q4(Jan-Mar) (more prevailing in winters) due to large variation in demand from peak paddy season in monsoon to winter night off-peak

PSTCL vide its letter dated 20.03.2025 (enclosed in **Annexure-A2**) informed the status of installed reactors and confirmed the availability of space for installation of additional reactors at identified 400kV substations in Punjab and accordingly the reactive compensation studies were conducted.

As a part of study, additional bus reactors were considered at various 400kV substations as per the following table:

STU Substation	Proposed Reactor
400/220kV Nakodar	1 No. of 125 MVAR Bus Reactor at 400kV
400/220kV Behman Jassa Singh	1 No. of 125 MVAR Bus Reactor at 400kV
400/220kV Muktsar	1 No. of 125 MVAR Bus Reactor at 400kV
400/220kV Rajpura	1 No. of 125 MVAR Bus Reactor at 400kV
400/220/66kV Dhanansu	1 No. of 125 MVAR Bus Reactor at 400kV
400/220 Makhu	1 No. of 125 MVAR Bus Reactor at 400kV
400/220 Dhuri	1 No. of 125 MVAR Bus Reactor at 400kV

Studies were carried out in Scenario -9 (winter night off peak). The results of the study are summarized in the table mentioned below:

Substation	Existing Reactors	Base Case Voltage(pu)	Voltage(pu) after proposed reactors 125MVAR reactor at 400kV level

400/220kV Nakodar	80MVAR at 400kV 25MVAR at 220kV	1.06	1.03
400/220kV Behman Jassa Singh	Nil	1.07	1.03
400/220kV Muktsar	80MVAR at 400kV	1.06	1.02
400/220kV Rajpura	Nil	1.06	1.03
400/220/66kV Dhanansu	Nil	1.05	1.02
400/220 Makhu	80MVAR at 400kV	1.06	1.02
400/220 Dhuri	125MVAR at 400kV 25MVAR at 220kV	1.06	1.02

From the studies, it is envisaged that with proposed bus reactors, there is significant reduction in voltages and voltages at the above-mentioned buses comes within limits after consideration of reactors at the identified substations. The effect of considering bus reactor at Ropar S/s is minimal (0.01pu) on voltage level of buses under study.

In the meeting PSTCL/Punjab SLDC emphasize on the requirement of Bus reactor at the above-mentioned substations, further issue of high voltage is more frequent at 400/220 Makhu S/s.On the CTU query regarding implementation timeframe and phasing of proposed scheme, PSTCL mentioned after approval in CMETS-NR meeting, implementation modalities will be finalized by management's including phasing of bus reactors.

Grid-India agreed on the proposal and highlighted the issue of high voltage issue in Punjab and stated that due to high voltage, no. of transmission lines kept open in night time in winter season. Grid-India further added that in case of phasing, bus reactor at 400/220kV Rajpura S/s & 400/220/66kV Dhanansu S/s may be taken at later stage as Rajpura S/s is connected with thermal generation

CEA agreed on the proposal and stated that Installation of Bus reactors proposal at other remaining states in NR may also be explored. CTU replied that inputs from all STUs was already requested regarding space availability for installation of bus reactors. Based on the inputs from STUs, CTUIL would carry out the studies to assess the requirement of reactive compensation at various nodes in Northern Region to overcome the issue of high voltages. At present inputs from Punjab has been received and taken up for approval in meeting.

After deliberations, following Bus reactor proposal was agreed to be taken up for implementation under Intra State scheme by PSTCL. Details of the scheme is as under:

S.No	Substation	Proposed Reactor
1	400/220kV Nakodar	1 No. of 125 MVAR Bus Reactor at 400kV
2	400/220kV Behman Jassa Singh	1 No. of 125 MVAR Bus Reactor at 400kV
3	400/220kV Muktsar	1 No. of 125 MVAR Bus Reactor at 400kV
4	400/220kV Rajpura	1 No. of 125 MVAR Bus Reactor at 400kV
5	400/220/66kV Dhanansu	1 No. of 125 MVAR Bus Reactor at 400kV
6	400/220 Makhu	1 No. of 125 MVAR Bus Reactor at 400kV
7	400/220 Dhuri	1 No. of 125 MVAR Bus Reactor at 400kV

3. <u>Transmission system proposed by RVPN for evacuation of 13255 MW of RE and 2400 MW power from thermal power plants in Kawai-Kalisindh-Chhabra Generation Complex (Chhabra TPS U7 & U8: 2x800 MW, Kalisindh TPS U3: 1x800 MW)</u>

In the CMETS-NR meeting it was stated that A meeting was held on 18.06.2025 to discuss the transmission system proposed by RVPN for evacuation of 13255 MW of RE power and 2400 MW power from thermal power plants in Kawai-Kalisindh-Chhabra Generation Complex (Chhabra TPS U7 & U8: 2x800 MW, Kalisindh TPS U3: 1x800 MW). Minutes of this meeting was circulated by CEA vide letter dated 03.07.2025 (copy of minutes is enclosed in **Annexure-A3**).

Transmission system/scheme discussed in above mentioned meeting also includes LILO of some of the ISTS lines at RVPN's Proposed S/s as part of intra state scheme. Details of such Transmission system/scheme are as under:

(A) 400/220 kV Amber (Jaipur North) S/s along with associated lines:

(a) Amber (Jaipur North) S/s with 2x500 MVA, 400/220 kV ICTs
(b) LILO of circuit-I of Sikar (PG)-Bassi (PG) 400 kV D/c line at Amber (Twin Moose) (LILO length: 1 km)
(c) LILO of circuit-II of Sikar (PG)-Bassi (PG) 400 kV D/c line at Amber (Twin Moose) (LILO length: 1 km)
(d) LILO of Manoharpur-VKIA 220 kV S/c line at Amber (LILO Length: 0.5 km)
(e) LILO of Manoharpur-Kukas 220 kV S/c line at Amber (LILO length: 0.5 km)
(f) Future space provision at Amber (Jaipur North) S/s for 3x500 MVA 400/220 kV ICTs, 6 Nos. 400 kV line bays, 8 Nos. 220 kV line bays, 125 MVAR 420 kV bus reactor

In this Transmission system 400kV Sikar (PG)-Bassi (PG) D/c lines are ISTS in nature, hence proposal was taken up in CMETS-NR meeting.

Considering above following intra state scheme is to be implemented by RVPNL:

(i) LILO of circuit-I of Sikar (PG)-Bassi (PG) 400 kV D/c line at Amber (Twin Moose) (LILO length: 1 km)
(ii) LILO of circuit-II of Sikar (PG)-Bassi (PG) 400 kV D/c line at Amber (Twin Moose) (LILO length: 1 km)

(B) 765/400 kV Ajarka (Alwar) S/s along with associated transmission lines:

(a) Ajarka (Alwar) S/s with 3x1500 MVA 765/400 kV ICTs, 2x500 MVA 400/220 kV ICTs, 240 MVAR 765 kV bus reactor and 125 MVAR 420 kV bus reactor
(b) Ajarka (Alwar) - Hindaun 765 kV D/c line (160 km) (Hex Zebra) with 2x240 MVAR 765 kV switchable line reactors at Ajarka end of line.
(c) LILO of one circuit of Sikar-Aligarh 765 kV D/c line (Hex Zebra AL-59) at Ajarka (Alwar) (LILO length: 18 km
(d) Ajarka (Alwar) - Alwar (PPP) 400 kV D/c line (Twin Moose) (100 km)
(e) LILO of Neemrana - Kotputli 220 kV S/c line at 765 kV Ajarka (Alwar) (LILO length: 20 km)
(f) LILO of Neemrana-Behror 220 kV S/c line at 765 kV Ajarka (Alwar) (LILO length: 20 km)
(g) Construction of 02 Nos. 400 kV bays at 400 kV Alwar (PPP) S/s for termination of Ajarka (Alwar) - Alwar (PPP) 400 kV D/c line (Twin Moose)
(h) Future space provisions at Ajarka (Alwar) S/s for 3x1500 MVA 765/400 kV ICTs, 3x500 MVA 400/220 kV ICTs, 4 Nos. 765 kV line bays, 6 Nos. 400 kV line bays, +/-300 MVAR 400 kV Statcom, 8 Nos 220 kV line bays

In this Transmission system LILO of one circuit of 765kV Sikar-II-Aligarh D/c line (Hex Zebra AL-59) at Ajarka (Alwar) are ISTS in nature, hence proposal was taken up in CMETS-NR meeting

Considering above following intra state scheme is to be implemented by RVPNL:

(i) LILO of one circuit of Sikar-II-Aligarh 765 kV D/c line (Hex Zebra AL 59) at Ajarka (Alwar) (LILO length: 18 km

(C) 400/220 kV Kushkhera/Bhiwadi S/s along with associated transmission lines:

(a) Kushkhera/Bhiwadi S/s with 2x500 MVA, 400/220 kV ICTs and 125 MVAR, 420 kV bus reactor
(b) Ajarka - Kushkhera/Bhiwadi 400 kV D/c line (Quad Moose) (34 km)
(c) LILO of both circuits of Neemrana (PG) - Bhiwadi (PG) 400 kV D/c line at Kushkhera/Bhiwadi (Twin Moose) (LILO length: 6 km)
(d) LILO of Alwar-Karoli 220 kV S/c line at Kushkhera/Bhiwadi (LILO length: 5 km)
(e) LILO of KG Bas-Kushkhera 220 kV S/c line at Kushkhera/Bhiwadi (LILO length: 5 km)
(f) Construction of 02 Nos. 400 kV bays at Ajarka for termination of Ajarka - Kushkhera/Bhiwadi 400 kV D/c line (Quad Moose)
(g) Future space provision at Kushkhera/Bhiwadi S/s for 3x500 MVA 400/220 kV ICTs, 4 Nos. 400 kV line bays, 8 Nos. 220 kV line bays

In this Transmission system LILO of both circuits of 400kV Neemrana (PG) - Bhiwadi (PG) D/c line at Kushkhera/Bhiwadi are ISTS in nature, hence proposal was taken up in CMETS-NR meeting

Considering above following intra state scheme is to be implemented by RVPNL:

(a) LILO of both circuits of Neemrana (PG) - Bhiwadi (PG) 400 kV D/c line at Kushkhera/Bhiwadi (Twin Moose) (LILO length: 6 km)

4. Transmission system for evacuation of 5GW RE power from Renewable Energy Parks in Leh

It was stated that Transmission system for evacuation of 5GW RE power from Renewable Energy Parks in Leh. Based on the recommendations of the 7th NCT meeting, MOP vide letter dated 13.01.22 approved transmission system for evacuation of RE power from Renewable Energy Parks in Leh (Pang) [5 GW Leh-Kaithal Transmission corridor] for implementation under RTM by POWERGRID with implementation time frame of 5 years from approval i.e. approval of the Central Government for providing Central Grant for part funding of the project. The scheme comprised of ±350kV HVDC system (VSC) between Pang & Kaithal PS, AC system strengthening in Ladakh to provide RE power to Ladakh and J&K through 220kV Pang – Leh (Phyang) S/c line and EHVAC system for dispersal of power to load centres towards Modipuram at 765kV level and Bahadurgarh at 400kV level.

Further, Delinking of EHVAC system beyond Kaithal from Transmission system for evacuation of RE power was approved in 17th NCT meeting held on 29.04.24 with Implementation Timeframe of Mar'30 for HVDC System and 24 months from SPV transfer for EHVAC System (AC system would be required in the matching timeframe of the HVDC system i.e. 31.03.2030). Earlier, VSC based HVDC scheme was considered over EHVAC system due to limited transmission corridor availability, low SCR at pang bus, point to point controlled power transfer from Pang to Kaithal, independent reactive power control, etc. Subsequently, due to various design, contractual and technical issues (as informed by OEM to POWERGRID), bidding of the VSC HVDC scheme (Pang-Kaithal) scheme could not yet be concluded.

To deliberate on above issues with POWERGRID and OEMs and to explore feasibility of EHVAC scheme, various meetings were held on 08.08.25, 14.08.25 & 27.08.25 under the Chairmanship of Chairperson (CEA) amongst CEA, CTU, Grid-India and POWERGRID /OEMs. As per deliberation in meeting, primary challenges in implementation of transmission system are as under:

- Excessive Altitude [4700m] and rarified air resulting in enhanced requitements of Insulation.
- Extreme Environmental Conditions - low temperatures [-35 deg] and low oxygen levels
- High level of UV and cosmic radiation- higher failure rate of power electronic devices
- Limited corridors for laying transmission lines
- Non-existent transportation infrastructure for moving heavy equipment
- Weak network strength - Low Short Circuit level at the Leh/Pang area
- Presence of multiple inverter based resources- Requires matching fixed and dynamic reactive compensation

Pang-Kaithal VSC HVDC scheme was one of its kind in the entire world due to the involvement of extreme high altitude. Accordingly it was decided to carry out Front End Engineering Design (FEED) Study in two stages; (i) Network Level and (ii) equipment Level. The FEED-1 studies (Front end engineering and design study) were carried out by OEMs comprised network studies i.e load flow, short circuit, reactive power support requirement, harmonics studies, filter requirement, dynamic studies, temporary and transient overvoltage studies, lightening and switching overvoltage studies etc. As per FEED-1 studies, following results were emerged:

- Complex Geography of Pang PS (at 4700m altitude and low temperature [-35 degree]) - No VSC HVDC solutions were available at such high altitude
- Design and performance challenges of equipment to be adopted for such altitude – exemption from performance requirements
- Transportation and logistics concerns
- Additional time requirement as well as scope exclusion requirements
- Other technical challenges i.e. working at derated voltage (leads to requirement of more no. of semiconductor devices to maintain voltage)

Based on FEED-1 study recommendations and inputs received, cost of VSC HVDC option was worked out to about Rs 43,456 Cr. The FEED-2 (equipment design studies) was included as part of pre bid studies. Output of FEED 1 shall be input for FEED 2 studies as various system parameters & dynamic conditions derived from FEED 1 shall determine design parameters of HVDC equipment to be installed at Pang. Considering above facts, Joint Studies were carried out amongst CEA, CTU, Grid-India & POWERGRID on 07.08.25 and 13.08.25 to explore feasibility of EHVAC options for evacuation of power from Pang to various load centres of Northern region. The studies were carried out in solar maximized scenario in 2030 timeframe. The outcome of studies were further discussed in meetings convened by CEA held on 07.08.25, 13.08.25 & 26.08.25 wherein the EHVAC scheme was finalized. As part of EHVAC proposal, a 400/220kV pooling station at Pang is proposed with its 400kV interconnections to RE developer pooling stations i.e. 400kV PS1, PS2 & PS3 for integration of RE power.

For evacuation of power from Pang PS, 400kV Sundernagar PS in Himachal Pradesh along with its 400kV interconnection to Pang PS through 2xD/c line with 45% FSC at Sundernagar end is being proposed. For further dispersal of power from Sundernagar to NR load centres various options were explored. As part of the scheme, 400kV Sundernagar is proposed to be interconnected to Saharanpur S/s through 400kV D/c line and 400kV Kaithal S/s through 2x D/c line with 45% FSC at Kaithal end. Further, 765/400kV Kaithal PS is proposed to be interconnected to Bahadurgarh & Modipuram

S/s through 400kV D/c lines. Further to provide RE power to Ladakh and J&K, 220kV Pang – Leh (Phyang) S/c line is also proposed as part of the EHVAC system.

To mitigate high loading at 220kV Leh (Phyang) - Khalsti-Kargil- Drass- Alusteng section, following measures were suggested as a separate strengthening scheme in matching timeframe of the EHVAC scheme :

- Reconductoring of 220kV Leh (Phyang)- Khalsti-Kargil-Drass-Alusteng section with HTLS line or additional 220kV corridor from Leh to Alusteng
- Suitable sectionlization arrangement at Pang generation end or Alusteng/Drass end to control loading on 220kV section (from Pang to Alusteng)

To maintain angular and voltage stability in base case as well as in various contingency scenarios, 8 nos. Syncon units (125MVAr) are proposed at Pang PS and 1 no. of SynCon unit (75MVAr) each at Leh, Kargil and Khalsti S/s. Establishment of 400/220kV PS-1,PS-2 & PS-3 along with 18 Nos. SynCons of 125 MVAr per unit (viz. 6 units at each PS) at 220 kV level (i.e. total of ± 125 x 18 = 2250 MVAr with suitable inertia) is considered in RE Developers scope. For ease of implementation and to gain operational experience, transmission scheme is phased out in two phases. The Ph-I (1.67GW evacuation capacity) and Ph-II (2.33GW evacuation capacity) covers all the transmission elements of scheme, whereas for Ph-III generation of 1 GW, requirement of additional SynCons/400kV interconnection will be identified based on Operational performance/Feedback. The proposal is already deliberated and agreed in special NRPC meeting held on 03.08.25.

Scope of the scheme:

Phase-I : 1.67GW evacuation capacity

Sl. No.	Description of Transmission Element	Scope of work (Type of Substation/Conductor capacity/km/no. of bays etc.)
1	400kV PS-1 - Pang Pooling Station D/c (Quad) line along with line bays at Pang Pooling Station Note: Establishment of 400/220kV PS-1 S/s along with 400kV GIS line bays (2 nos) at PS-1 is under RE developer scope	Line Length ~7 km (Quad Moose)
2	Establishment of 400/220kV, 2x315MVA Pooling Station at Pang along with 1x125MVAr, 420kV bus reactor. **Future provisions :** ➢ 400 kV line bays –10 nos. (out of above, 4 nos. to be utilized for PS2 & PS3 interconnection in Ph-II scheme) ➢ 400/220 kV 315 MVA ICTs along with bays- 2 Nos. ➢ 400 kV Sectionalization bays: 2 set	**Pang PS - GIS** • 400/220 kV 315 MVA ICTs- 2 Nos. (7x105 MVA unit including one spare unit) • 400kV line bays – 6 nos. (for 400kV D/c interconnection PS1 and 2xD/c interconnection with Sundernagar S/s) • 400 kV ICT bays- 2 Nos. • 220 kV ICT bays - 2 Nos.

	➢ 400 kV Bus Reactor along with bays: 1 No. ➢ 220kV Sectionalization bay: 1 set ➢ 220 kV BC (1 Nos.) ➢ 220kV line bays – 4 nos. ➢ 10 nos. of SynCon units* at 400kV level along with 10 nos. of 400kV bays (out of above, 6 nos. SynCon units along with 400kV bays shall be utilized in Ph-II scheme) *1 No. of SynCon unit comprises dynamic support of +125MVAr/-95MVAr (Minimum), Short circuit contribution at PCC of 750MVA (Minimum) (Value of inertia (MW-Sec) specified separately)	• 125 MVAr Bus Reactor-1 No. • 400 kV Bus reactor bay- 1 No. • 220kV line bay (GIS) – 1 no. (for Leh (Phyang) interconnection) • 220 kV BC bay - 1 No.
3	Establishment of 400kV Switching station near Sundar Nagar along with 2x125MVAr, 420kV bus reactor. **Future provisions :** ➢ 400 kV line bays along with switchable line reactors –6 Nos. (Out of above, 2 nos. to be utilized for Kaithal interconnection in Ph-II scheme) ➢ 400 kV Sectionalization bays: 1 set ➢ 400/220 kV 315 MVA ICTs along with bays- 2 Nos ➢ 220kv line bays – 4 nos. ➢ 220 kV BC (1 No.)	**Sundar Nagar S/s - GIS** • 400kV line bays – 8 nos. (for 400kV 2xD/c interconnection with Pang S/s & 400kV D/c interconnection with Kaithal S/s & Saharanpur S/s) • 125 MVAr Bus Reactor-2 Nos. • 400 kV Bus reactor bay- 2 Nos.
4	Establishment of 400kV Kaithal substation along with 1x125MVAr, 420kV bus reactor **Future provisions :** ➢ 765/400 kV 1500 MVA ICTs- 4 Nos. ➢ 765 kV line bays along with switchable line reactor –8 Nos. ➢ 400 kV line bays along with switchable line reactor –10 Nos. (4 Nos. to be utilized for Sunder Nagar (2nd D/c) & Modipuram interconnection in Ph-II scheme) ➢ 765 kV Bus Reactor along with bays: 1 No ➢ 400 kV Bus Reactor along with bays: 1 No. ➢ 400 kV Sectionalization bays: 1 set ➢ 400/220 kV ICT along with bays-2 Nos. ➢ 220 kV line bays -4 Nos. ➢ 220kV Sectionalization bay – 1 no. ➢ 220kV BC (1 nos.) & TBC (2 nos.)	Kaithal S/s - AIS • 400kV line bays – 4 nos. (for 400kV D/c interconnection with Sunder Nagar S/s and Bahadurgarh S/s) • 125 MVAr Bus Reactor-1 Nos. • 400 kV Bus reactor bay- 1 Nos.

	➢ STATCOM (2x±300MVAr) along with MSC (4x125 MVAr) & MSR (2x125 MVAr) along with 400kV bays (2nos.)	
5	2 No. of Syncon units* at 400kV level at Pang PS *1 No. of SynCon unit comprises dynamic support of +125MVAr/-95MVAr (Minimum), Short circuit contribution at PCC of 750MVA (Minimum) (Value of inertia (MW-Sec) shall be specified separately)	SynCon units – 2 Nos. • 400kV bays for SynCon units –2 Nos.
6	220kV Pang – Leh (Phyang) (PG) S/c line (Deer conductor) on D/c towers along with line bays at both ends	Line Length ~149 km • 220 kV line bays (GIS) at Leh (Phyang) S/s- 1 No.
7	400kV Pang PS - Sundar Nagar 2xD/c line along with 63MVAr switchable line reactor on each ckt. at both ends.	Line Length ~ 273km (Quad Moose) • 420 kV, 63 MVAr switchable line reactors at Pang PS end– 4 Nos. • Switching equipment for 420kV, 63MVAr switchable line reactors at Pang PS end – 4 Nos. • 420 kV, 63 MVAr switchable line reactors at Sundar Nagar PS end– 4 Nos. • Switching equipment for 420kV, 63MVAr switchable line reactors at Sundar Nagar PS end – 4 Nos.
8	400kV Sundar Nagar – Kaithal D/c line along with 50MVAr switchable line reactor on each ckt at both ends.	Line Length ~ 252km (Quad Moose) • 420 kV, 50 MVAr switchable line reactors at Sundar Nagar PS end– 2 Nos. • Switching equipment for 420kV, 50MVAr switchable line reactors at Sundar Nagar PS end – 2 Nos. • 420 kV, 50 MVAr switchable line reactors at Kaithal S/s end– 2 Nos. • Switching equipment for 420kV, 50MVAr switchable line reactors at Kaithal S/s end – 2 Nos.
9	400kV Sundar Nagar - Saharanpur D/c line along with 50MVAr switchable line reactor on each ckt. at both ends.	Line Length ~ 220km (Quad Moose) • 400kV line bays at Saharanpur S/s – 2 Nos. • 420 kV, 50 MVAr switchable line reactors at Sundar Nagar PS end– 2 Nos. • Switching equipment for 420kV, 50MVAr switchable line reactors at Sundar Nagar PS end – 2 Nos. • 420 kV, 50 MVAr switchable line reactors at Saharanpur S/s end– 2 Nos.

		• Switching equipment for 420kV, 50MVAr switchable line reactors at Saharanpur S/s end – 2 Nos.
10	1 No. of Syncon unit* at 220kV level of Khalsti S/s *1 No. of SynCon unit comprises dynamic support of ±75MVAr (Minimum), Short circuit contribution at PCC of 450MVA (Minimum) (Value of inertia (MW-Sec) shall be specified separately)	SynCon unit – 1 Nos. • 220kV bay (GIS) at Khalsti S/s – 1 No. (for SynCon)
11	Kaithal - Bahadurgarh (PG) 400 kV D/C Line	Line Length ~170 km (Quad) • 400kV line bays at Bahadurgarh (PG) S/s – 2 nos.

Phase-II: 2.33 GW evacuation capacity

Sl. No.	Description of Transmission Element	Scope of work (Type of Substation/Conductor capacity/km/no. of bays etc.)
1	400kV PS-2- Pang Pooling Station D/c line along with line bays at Pang Pooling Station Note: Establishment of 400/220kV PS-2 S/s along with 400kV GIS line bays (2 Nos) at PS-2 is under RE developer scope	Line Length ~27 km (Quad Moose) • 400kV line bays (GIS) at Pang PS – 2 nos. (for 400kV D/c interconnection with PS2)
2	400kV PS-3 - Pang Pooling Station D/c line along with line bays at Pang Pooling Station Note: Establishment of 400/220kV PS-3 S/s along with 400kV GIS line bays (2 Nos) at PS-3 is under RE developer scope	Line Length ~41 km (Quad Moose) • 400kV line bays (GIS) at Pang PS – 2 nos. (for 400kV D/c interconnection with PS3)
3	400kV Sundar Nagar – Kaithal 2nd D/c line along with 50MVAr switchable line reactor on each ckt at both ends and line bays at both ends.	Line Length ~ 252km (Quad Moose) • 400kV line bays (GIS) at Sundar Nagar S/s – 2 nos. • 400kV line bays at Kaithal S/s – 2 nos. • 420 kV, 50 MVAr switchable line reactors at Sundar Nagar PS end– 2 Nos. • Switching equipment for 420kV, 50MVAr switchable line reactors at Sundar Nagar PS end – 2 Nos. • 420 kV, 50 MVAr switchable line reactors at Kaithal S/s end– 2 Nos. • Switching equipment for 420kV, 50MVAr switchable line reactors at Kaithal S/s end – 2 Nos.
4	FSC (45%) on all four ckts. of 400kV Pang PS –Sundar Nagar 2xD/c line at Sunder Nagar end.	FSC (45%) – 4 Nos. (at Sunder Nagar end)

5	FSC (45%) on all four ckts. of 400kV Sundar Nagar – Kaithal 2xD/c line at Kaithal end.	FSC (45%) – 4 Nos. (at Kaithal end)
6	6 No. of SynCon units* at 400kV level of Pang PS *1 No. of SynCon unit comprises dynamic support of +125MVAr/-95MVAr (Minimum), Short circuit contribution at PCC of 750MVA (Minimum) (Value of inertia (MW-Sec) shall be specified separately)	SynCon units – 6 Nos. • 400kV bays (GIS) at Pang PS– 6 no. (for SynCons)
7	1 No. of SynCon unit* each at 220kV level of Leh (Phyang) and Kargil S/s *1 No. of SynCon unit comprises dynamic support of ±75MVAr (Minimum), Short circuit contribution at PCC of 450MVA (Minimum) (Value of inertia (MW-Sec) shall be specified separately)	Syncon unit – 2 nos. • 220kV bay (GIS) at Leh (Phyang) S/s– 1 no. (for SynCon) • 220kV bay (GIS) at Kargil S/s– 1 no. (for SynCon)
8	Kaithal - Modipuram (Meerut) (UPPTCL) 400kV D/C Line along with 1x80MVAr switchable line reactor on each ckt at Kaithal end	Line Length ~210 km (Quad Moose) • 400kV line bays at Kaithal S/s – 2 nos. • 400kV line bays at Modipuram S/s– 2 nos. (GIS) • 420 kV, 80 MVAr switchable line reactors at Kaithal S/s end– 2 Nos. • Switching equipment for 420kV, 80MVAr switchable line reactors at Kaithal S/s end – 2 Nos.

For Phase-III (1 GW evacuation capacity), Space is already kept (as part of future scope) at Pang PS and Sunder Nagar S/s for implementation of future augmentation requirements based on Operational Feedback as below:

- Space for 4x125MVAr SynCon at 400kV Pang along with associated bays.
- Space for 4 Nos. of 400 kV line bays along with line reactor at Sundarnagar S/s for any future 400kV interconnections

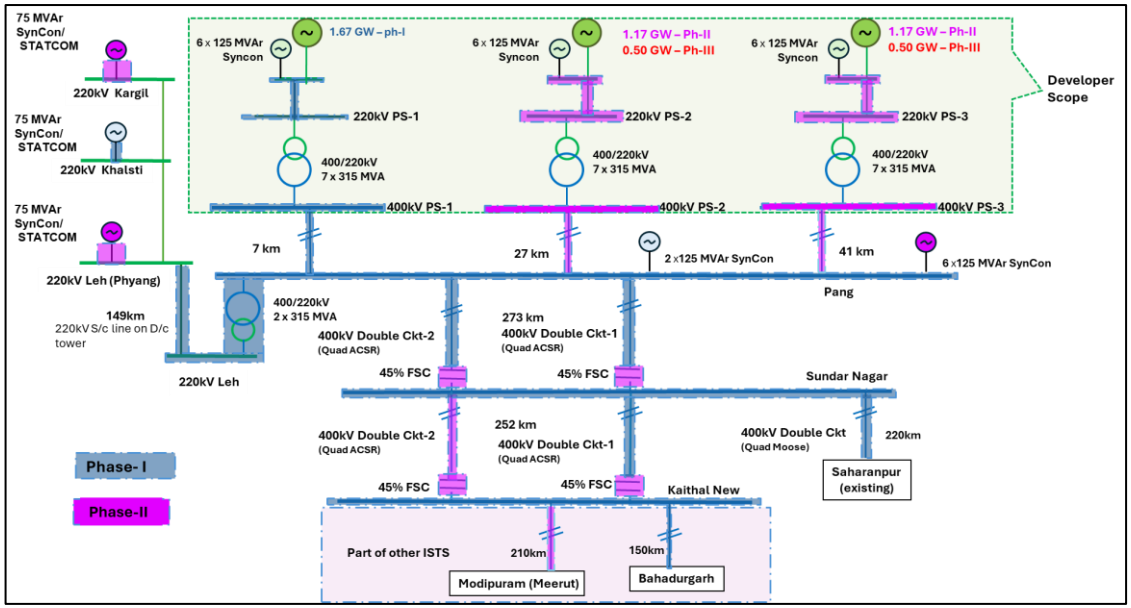


Fig: Transmission system for evacuation of 5GW RE power from Renewable Energy Parks in Leh

5. Approval of Incidental ISTS system for strengthening of Transmission System for Baddi-Barotiwala-Nalagarh Industrial area:

It was stated that HPPTCL vide its letter 26.05.2025 submitted the agenda for approval of incidental ISTS system for strengthening of Transmission system in Baddi-Barotiwala-Nalagarh Industrial area in Solan Distt. of Himachal Pradesh (copy of letter is enclosed in **Annexure A4**).

The Baddi, Barotiwala, and Nalagarh (BBN) industrial area in Himachal Pradesh is currently powered through the 400/220 kV Nalagarh PG Substation and partially from Kunihar and Pinjore Substations, with a peak load of 450 MVA. With an expected increase of 200 MVA due to the upcoming Medical Devices Park at Majholi and other industrial developments, HPPTCL has proposed:

1. Termination of an already constructed 400 kV D/c line from 400/220kV Nalagarh PG S/s to 220/132 kV Kunihar S/s at 220 kV to form a ring network enhancing system reliability.
2. Construction of 220kV D/c Line from Nalagarh PG S/s to proposed 100 MVA 220 kV Majholi S/s.

Thus, HPPTCL seeks approval for 4 Nos. of 220 kV ISTS line bays at Nalagarh PG S/s for termination of above lines. Upon confirmation of space availability at Nalagarh S/s, Powergrid vide its mail dated 15.07.2025 informed that:

1. There is no space available adjacent to the existing 220kV Switchyard area.
2. Future extension in GIS is possible for which 220kV buses need to be extended through GIB to available land within substation boundary. The area has dense trees for which Forest approval shall be required.

In the meeting HPPTCL informed that, earlier Kunihar S/s was proposed as 400kV S/s. Subsequently 400kV Nalagarh (PG)-Kunihar D/c line is already constructed with one ckt strung. However, later on Wangtoo S/s is being integrated with Kunihar S/s at 220kV level so there is no requirement envisaged for interconnection of Kunihar S/s with Nalagarh S/s at 400kV level. Subsequently HPPTCL decided that 400kV Nalagarh (PG)-Kunihar D/c line with twin moose conductor will be charged at 220kV level as an additional source of supply for Kunihar S/s from Nalagarh S/s end. HPPTCL further added that according to their study Kunihar S/s will draw about 70MVA power from Nalagarh S/s via 220kV D/c line. HPPTCL stated that, they will strung 2nd ckt. (additional ckt) of 400kV Nalagarh (PG)-Kunihar D/c line followed by reorientation of towers between Nalagarh S/s & Kunihar S/s and will charged that on 220kV level.

Further proposal for establishment of 220/33kV Majholi S/s along with Majholi – Reru (Nalagarh-ISTS) 220 kV D/c line was deliberated in CEA meeting held on 28.08.25 for evacuation of 98 MW RE (Solar) power in Solan area as part of GEC-III scheme. In the meeting, HPPCTL stated that about 98 MW solar projects are coming up on the Punjab–Himachal border between Ropar and Nalagarh and as only 33 kV connectivity exists at present in that area, a new 220 kV system with a pooling station at Majholi has been proposed. HPPTCL stated that they are envisaged 100MVA drawl requirement from above interconnection and therefore in totality 170MVA drawl is required from Majholi and Kunihar interconnection. Further 220kV Upperla nangal - Nalagarh (ISTS) D/c line is breaching N-1 limit and therefore reconductoring of above line along with terminal equipment upgradation at both ends are also required.

Grid-India stated that for Kunihar and Majholi interconnection, 4 nos. of 220kV line bays are required by HPPTCL, therefore requirement from PSTCL also needs to be checked before approval. PSTCL requested to share load flow file to examine the flows in Punjab considering above proposal. HPPTCL agreed for the same.

Grid-India further stated that HPPTCL may explore the possibility to optimize the transmission system by either implementing 220kV Nalagarh-Kunihar D/c line or reconductoring of 220kV Upperla nangal - Nalagarh (ISTS) D/c line. HPPTCL stated that 220kv Kunihar to Nalagarh D/c interconnection is in advance stage for which timeline of 220kV bays will be convened to CTUIL separately. At present Kunihar S/s is fed through Wangtoo S/s to meet the demand of Shimla city, however to provide redundant power supply to Kunihar S/s, additional 220kV feed from Nalagarh S/s is required. In winter scenario Kunihar S/s feed to Baddi area.

HPPTCL stated that they already examined the composite scheme comprising 220kV D/c interconnection of Kunihar and Majholi S/s with Nalagarh S/s and reconductoring of 220kV Upperla nangal - Nalagarh (ISTS) D/c line and all the elements are required to meet the long-term demand in future.

CTUIL stated that 400 kV Nalagarh serve as drawl point for Himachal, Punjab, Chandigarh and presently only about 300 MW drawl margin is available at 400 kV Nalagarh station with commissioning of new 500 MVA, 400/220 kV ICT. With HPPTCL proposal of new interconnection with Majholi, Kunihar and re-conductoring of 220 kV lines to Upperla nangal from Nalagarh may cause constraint at 400/220 kV ICTs at Nalagarh. HPPTCL stated that considering drawl requirement from above proposal, overloading of ICTs is not envisaged, however suitable measures will be taken by HPPTCL in case of overloading of 400/220kV ICTs at Nalagarh S/s due to above proposed scheme. Grid-India agreed on the same and stated that 315MVA ICTs also may be replaced in case of ICT augmentation requirement in future.

Further HPPTCL stated that there is bay upgradation requirement at Upperla nangal and Nalagarh end. CTUIL stated that bay upgradation works in Upperla nangal needs to be carried out by HPPTCL, however Nalagarh end bay was implemented in ISTS, thefrore HPPTCL may take up the matter in NRPC meeting after approval in CMETS-NR meeting.

HPPTCL informed that drawl by Majholi will not be an additional drawl rather it's shifting of load, with interconnecting Majholi area directly through 220 kV system. HPPTCL added that the total additional drawl envisaged by HP from Nalagarh with new proposed interconnection would be around 200 MW.

In the meeting, it was concluded that as the 400/220 kV Nalagarh S/s is an important drawl point for HP and nearby states, it was agreed that loadings of its 400/220 kV ICTs to be monitored regularly and augmentation of existing 315 MVA ICTs to 500 MVA may be proposed, if required. POWERGRID may confirm the space requirement for 400/220KV ICT augmentation (5th ICT) at Nalagarh (PG) S/s. Based on HPPTCL request and deliberation in the meeting, 220kV Nalagarh (PG) – Kunihar 220 kV D/c line agreed in the meeting for implementation by HPPTCL. As proposal of 220kV Nalagarh (PG) – Kunihar 220 kV D/c line and reconductoring of 220kV Upperla nangal - Nalagarh (ISTS) D/c line is intra state in nature, CEA may provide approval based on deliberation in CMETS-NR meeting

Considering above following transmission scheme was agreed to be implemented in inter state :

- 2 nos. 220kv line bays (GIS) at 400/220kv Nalagarh S/s

It was decided that bay implementation timeline for bays will be decided based on discussion with Powergrid and intimated to HPPTCL. Based on implementation time required for bays, HPPTCL shall inform to CTUIL to takeup the implementation works.

6. Transmission scheme for evacuation of power as part of Rajasthan REZ Ph-IV (Part-6 : 6GW) (Bikaner Complex) (Bikaner V: 6GW)

It was stated that Renewable Energy Zones (REZs) were identified by MNRE/SECI with a total capacity of 181.5 GW for likely benefits by the year 2030 in eight states, which includes 75GW REZ potential in Rajasthan comprising of 15 GW Wind and 60 GW Solar. In this regard a Committee on Transmission Planning for RE was constituted by MOP for planning of the requisite Inter State Transmission System required for the targeted RE capacity by 2030 for which a Comprehensive transmission plan for evacuation of 75GW RE potential from Rajasthan evolved.

Details of schemes approved/Under Planning scheme as part of above is as under:

S.No	Transmission Scheme	RE Potential	Status
A	**Under Bidding/ Approved**		
1	Rajasthan REZ Ph-IV (Part-1 :7.7GW) (Bikaner Complex)	14 GW (Solar 14GW, BESS:6GW) Bikaner-II : 3.7GW Bikaner-III: 4GW	Under Implementation

2	Rajasthan REZ Ph-IV (Part-2 :5.5GW) (Jaisalmer/Barmer Complex)	5.5GW (Solar) Fatehgarh-IV: 4 GW Barmer-I: 1.5 GW	
3	Rajasthan REZ Ph-IV (Part-3 :6GW) (Bikaner Complex)	6 GW (Solar) Bikaner-IV:6GW	
4	Rajasthan REZ Ph-IV (Part-4 :3.5GW) (Jaisalmer/Barmer Complex)	3.5 GW (Solar) Fatehgarh-IV: 1 GW Barmer-I: 2.5 GW	
5	Rajasthan REZ Ph-V (Part-1: 4GW) (Sirohi/Nagaur Complex)	4 GW (Solar) Sirohi: 2 GW Nagaur: 2 GW	
B	**Planned/Under Planning**		
1	Rajasthan REZ Ph-IV (Part-5 : 6GW) (Barmer Complex)	6 GW (Solar) Barmer-II : 6GW	Under Bidding
2	**Rajasthan REZ Ph-IV (Part-6 : 6GW) (Bikaner Complex)**	**6 GW (Solar)** **Bikaner-V: 6 GW**	To be taken up in this meeting
3	Rajasthan REZ Ph-IV (Part-7 : 6GW) (Bhadla Complex)	6 GW (Solar) Bhadla-IV: 6 GW	HVDC Timeframe : 2030-31
4	Rajasthan REZ Ph-V (Part-2 : 6GW) (Ramgarh Complex)	6 GW (Solar) Ramgarh-II: 6 GW	HVDC Timeframe : 2030-31

Transmission scheme for Rajasthan REZ Ph-IV (Part-6 : 6GW) (Bikaner Complex)

It was stated that Transmission scheme evolved and under implementation for about 7.7GW (Solar) in Bikaner complex (14 GW potential along with 6 GW BESS) in Rajasthan for RE potential identified at Bikaner complex as part of committee report. Further due to non-materialization of BESS (linked with RE), transmission scheme for Rajasthan REZ Ph-IV (Part-6: 6GW) (Bikaner Complex) [Bikaner-IV:6GW] scheme had evolved. The scheme is also under implementation. At present connectivity of about 6GW capacity is already granted at Bikaner-V PS. Beyond that about 3 GW connectivity applications are already received/granted for connectivity at Bikaner-V PS. Considering application received at Bikaner-V PS, transmission scheme is evolved for as part of Rajasthan REZ Ph-IV (Part-6 : 6 GW) (Bikaner Complex).

Earlier, a HVDC system was planned from Bikaner-V PS to Begunia (Odisha in ER) to meet the demand of Green Hydrogen (GH) in Paradeep and Gopalpur areas. However, due to non-receipt of adequate applications from Green Hydrogen developers in Odisha as well as upcoming thermal generations in ER, power transfer requirement from RE pockets of Rajasthan to Odisha in ER is presently not envisaged in 2028-29 timeframe.

In the CEA meeting held on 19.12.24 under the Chairmanship of Chairperson, CEA to discuss the planning of transmission system for RE potential zones in Rajasthan, it was stated that that power from RE generators can now be evacuated only through HVDC System as power has to be brought outside Rajasthan for consumption in other States and the distance of RE potential zones in Rajasthan to the border of neighbouring states is more than 600-700 km. In the meeting Chairperson, CEA, stated some RE capacity which could be evacuated through AC system, needs to be explored as EHVAC system could be completed in 2-3 years, whereas HVDC system would take 5-6 years.

Further, in 30th CMETS-NR meeting held on 18.06.24 issue of critical loading and higher angular separation (>20 degree) under N-1/N-1-1 contingency of 765kV Bikaner-Moga D/c line was deliberated. In the meeting it was discussed that to resolve the issue of higher angular separation (>20 degree) under N-1/N-1-1 contingency of 765kV Bikaner-Moga D/c line, suitable strengthening scheme is already under planning. As part of above scheme LILO of 765kV Bikaner -Moga line at Pallu S/s is envisaged which will reduce the angular separation (<30 degree).

Further agenda for N-1 Contingency violation in 765/400KV 1500MVA ICT at Moga Substation was deliberated in 230th OCC meeting held on 17.04.25 and it was decided to take up the matter of additional ICT at 765/400kV Moga(PG) Substation in the next CMETS meeting.

NRLDC vide mail 13.06.25 highlighted the issue of high loading in 765kV Aligarh-Greater Noida which is observed to be reaching 2700 MW (approx.) in peak solar hours during high demand of the Northern region. NRLDC stated that with commissioning of Teshri PSP units and commissioning of 765kV Bhadla-2-Sikar-2 D/c line loading of above line will further increase. NRLDC also highlighted that with multiple events of outage of all poles of HVDC Champa Kurukshetra, loading on this line takes a sharp increase.

PSTCL vide letter dated 29.10.24 stated that Punjab is experiencing significant load increase particularly in Mohali region driven by increasing industrial/commercial demand. The power deficit expected to worsen in the future which will put additional strain on Punjab transmission network. To address above issue. It is essential to establish another ISTS injection point in the Mohali region in the form of new 400kv substation. This will also improve ATC/TTC limits of Punjab.

Considering all above aspect, an EHVAC system evolved from Bikaner-V PS to various load centres in NR. The broad feature of scheme is as under:

1) For evacuation of 6GW RE power from Bikaner V PS on EHVAC system which will be take lesser implementation time than HVDC system
2) Resolve the issue of critical loading of 765kV Bikaner-Moga D/c line as well as issue of higher angular separation (>20 degree) under N-1/N-1-1 contingency

3) Resolve the issue of critical loading of 765kV Aligarh-G. Noida line
4) Feed the RE power to new load centres of Punjab, Delhi and UP to cater the future load demand

The scheme comprises EHVAC system with establishment of Bikaner-V PS along with LILO of one double ckt of 400kV Bikaner II PS- Khetri (Twin HTLS) 2xD/c line at Bikaner-V PS. For dispersal of power establishment of Pallu S/s & Panipat S/s,765 kV Bikaner-V PS – Pallu-Panipat 2xD/c line, 400 kV Pallu – Hanumangarh (RVPN) D/c line & LILO of both ckts of 765kV Bikaner – Moga D/c line at Pallu S/s is proposed. Further for onwards evacuation of power in Punjab establishment of 400kV Mohali S/s along with Lilo of one circuit of 400kV Patiala-Panchkula D/c line at Mohali & 400 kV Panipat S/s – Mohali D/c line is proposed. Further, 400 kV Panipat S/s – Mandola D/c line is proposed to meet the demand of Delhi. For onwards evacuation of power in Uttar Pradesh, establishment of 765kV Bulandshahr S/s, 765kV Lucknow-II S/s & asana S/s along with 765KV Bulandshahr – Lucknow-II – Asana D/c line & LILO of 765kV Aligarh – Gr. Noida line at Bulandshahr S/s, 765kV Bulandshahr - Noida sec-148, 400 kV Lucknow-II – Gonda D/c line, LILO of both ckts of 400kV Varanasi – Biharsharif D/c line at Asana S/s & LILO of both ckts of 400kV Balia – Patna D/c line is proposed. As part of scheme , STATCOM is also proposed at Bikaner-V PS and space for SynCon/STATCOMs shall be kept a spart of future scope on various intermediate substations.

Studies were carried out in 2029-30 time frame in various scenarios (solar maximized, evening peak and night off peak scenarios). Study files were circulated on 29.07.25. In the studies comprehensive intra-state transmission system for evacuation of 13255 MW of RE and 2400 MW power from thermal power plants in Kawai-Kalisindh-Chhabra Generation Complex in Rajasthan is considered. Further comprehensive transmission system for 4GW evacuation as part of GEC-III in UP is also considered.

To deliberate on above proposal, joint study meeting was held on 18.08.25 with all stakeholders. Grid-India vide their mail 11.08.25 provided their observations on studies as well as on transmission scheme (attached in **Annexure-A5**). Major observations of Grid-India is as under:

- Higher load considered in study files in Rajasthan and SR
- Severe low voltage issue in NR Grid in Solar maximized scenarios
- Overloading of some of the 400/220kv ICTs and 220kv lines (breaching thermal limit in N-1 scenarios)
- Lower Thermal generation (below technical minimum), higher thermal dispatch (>80%) and zero dispatch in some of plants
- Higher angular separation in 400kv Kishenpur -Moga D/c line in N-1 contingency
- Planning of dynamic compensation as part of scheme.
- High fault level on Various substation in Rajasthan
- Requirement of dynamic studies

Regarding low voltage issue & high fault level in NR, it was informed that Separate network studies to be carried out by CTU in consultation with CEA and Grid India. Regarding Higher angular separation in 400kV Kishenpur -Moga D/c line in N-1 contingency, Feasibility of upgradation of 400kV Kishenpur Moga at 765kv level is being carried out in future planning studies with envisaged hydro generation in J&K and solar injection at Moga.

Detailed reply of Grid-India observations are attached in **Annexure -A6.** Revised study files circulated subsequent to agenda. Result of system studies are enclosed in **Exhibit-II.**

In the meeting, CTU stated that Grid-India vide mail dated 27.08.25 highlighted the issue regarding high loading on 400kV Agra (PG)-Agra (UPPTCL) line. CTU stated that based on loading data, reconductoring proposal for 400kV Agra (PG)-Agra (UPPTCL) line will be taken up in upcoming CMETS-NR meeting.

In the meeting Grid-India stated that they are encountering N-1 violation issues pertaining to Intra State lines/ICTs (STU network) in NR and appraise the STUs to check the ICT and line loadings highlighted in the agenda. CTU stated that STUs may take remedial measures for identified STU lines/ICTs which are under N-1 violation. Further Grid-India stated that 400kV Noida Sec-148-Noida sec-123 line loading is above thermal limit in base case. CTUIL further added that UPPTCL may check real time loading for the above line & reconductoring proposal for 400kV Noida Sec-148-Noida sec-123 line may be studied in planning file and revert for the same. UPPTCL agreed for the same.

In the meeting Grid-India further stated that line loading of 400kV Bikaner-Sikar D/c line is also on higher side in planning files. RVPN stated that line is planned for evacuation of intra state RE power and at present one ckt of line is kept open to control the loading of 400kV Bhadla (RVPN)- Bikaner(RVPN) D/c line. CTU enquired RVPN for space availability of 400kV bay at Bikaner (RVPN) S/s to assess feasibility of additional 400kV D/c corridor from Bikaner (RVPN) S/s. RVPN stated that only 1 no. 400kV bay is available at Bikaner (RVPN) S/s, however Bikaner (Pugal) S/s which is recently approved by CEA have sufficient 400kV bays for any future interconnection. RVPN also stated that at present line loading are within limit on 400kV Bikaner-Sikar D/c line. CTU stated that with load growth and high RE injection, loading of above line will increase progressively and may breach to thermal limit by 2030 as depicted in planning files. RVPN suggested that to control loading of above line through diversion of load from Sikar S/s, possibility of interconnection of Sikar (PG) S/s to Sikar-II S/s or shifting of 400kV Bassi (PG) – Sikar (PG) D/c line to 400kV Sikar-II S/s may be explored. CTU stated that proposal will be examined with all possible alternatives and will be deliberated in discussion with CEA, Grid-India and RVPN.

Grid-India also highlighted N-1 noncompliance issues at Kankroli, Bhinmal and Chittorgarh S/s. RVPN stated that at Kankroli and Bhinmal S/s, high loading is observed due to nearby PSP generators for which system is yet to be planned. RVPN also stated at Chittorgarh (PG) S/s (3x315MVA), replacement of one no. 315MVA ICT with 500MVA is recently approved. Additionally, RVPN also planned 400kV Banswara S/s with 1000MVA transformation capacity which will ultimately share the load of Kankroli and Chittorgarh area. CTU suggested that RVPN may study the ICT loading of Chittorgarh (PG) S/s with their proposed Banswara S/s and accordingly decision may be taken up for replacement of other 2 nos. of 400/220kV ICTs at Chittorgarh S/s. RVPN agreed for the same.

Grid-India stated that there is voltage stability issue on opening of 400kV Jodhpur (Surpura) – Kankroli Line. CTUIL stated that voltage stability issue arises due to PSP generation lumped in nearby buses and voltage dipping occurs due to drawl of huge power from Kankroli S/s. CTU informed that they will examine the issue. Further, CTU carried out the studies and it is envisaged that voltage stability issue arises due to envisaged PSP generation in Kankroli/banswara complex for which intra state transmission system is to be planned by RVPN.

Grid-India also highlighted N-1 non-compliance of Ramgarh 765/400kV ICTs , 400kV Bhiwani (PG) – Bhiwani line (On opening of Bhiwani-Moga line) and high loading of 400/220kV Saharanpur ICT. CTU stated that ICT augmentation at Ramgarh S/s is taken up in ensuing CMETS-NR meeting whereas ICT augmentation at Saharanpur S/s shall be taken up after reviewing the real time loading data and approval of Leh RE park scheme (5GW). Regarding 400kV Bhiwani (PG) – Bhiwani line, CTU will examine the loading and take up the suitable measures. Grid-India stated that any other comment in addition to N-1 non-compliance issues highlighted today and in joint study meeting will be provided.

CTU enquired about space availability of 220kV scope (220kV bays and 400/220kV ICTs) as part of future provision on proposed substations i.e. Pallu, Mohali, Bulandshehr, Lucknow-II and Asna S/s. RVPN and UPPTCL stated considering future drawl requirement, space may be kept on above substations to meet the future demand in nearby area.

CTU stated that as part of the scheme 765kV Bulandshahr - Noida sec-148 (UPPTCL) D/c line is planned. At present 400/220kV Noida sec-148 is existing substation of UPPTCL. UPPTCL informed that they are planning to upgrade above substation at 765kV level and land is available for above works. Considering above CTU requested that UPPTCL may take up the work for upgradation of 400/220kV Noida sec-148 S/s at 765kV level along with 765/400kV transformation capacity in matching timeframe of above transmission scheme i.e. Rajasthan REZ Ph-IV (Part-6: 6 GW) (Bikaner Complex). UPPTCL agreed for the same.

It was stated that PSTCL are also planning 220kV downstream network at proposed Mohali S/s to feed the envisaged demand of Mohali complex as well as to relieve the loading of nearby 220kV and 400kV network. CTUIL requested that PSTCL may provide the details of 220kv downstream network, requirement of 220kv bays in ISTS at Mohali S/s. PSTCL informed that presently they have identified 6 ckts for drawl of power as part of present scope and 2 ckts as part of future scope. PSTCL stated that they will drawl about 1050MW power through these 6 ckts and additional power will be drawn from 2 ckts in future. On the query of tentative location of Mohali S/s, PSTCL stated that land for proposed Mohali substation need to identified near Lalru to Dera Bassi belt as it will be easier to establish connectivity to nearby 400kV and 220kV lines to Mohali S/s. CTU requested to provide details of proposed 6 ckts at Mohali S/s and PSTCL also requested to take up the implementation of 220kV transmission works in matching with subject comprehensive scheme. PSTCL agreed for the same. On the query of PSTCL about implementation timeframe of above comprehensive scheme, CTU stated that implementation timeframe of Mar'28 (tentative) may be considered for proposed scheme to align the intra state system. UPPTCL and PSTCL noted the same.

Grid-India stated that reactive compensation on Bikaner-V- Khetri D/c line section and 765 kV Panipat- Bulandshahr 2xD/c line on higher side. CTU stated that they will review the % reactive compensation on above lines. Accordingly, reactive compensation of above lines was modified and included in revised scope. Grid-India and CEA agreed on the proposal. No other comments received from stakeholders in the meeting.

Considering deliberation in Joint study meeting as well as in CMETS-NR meeting, following Transmission system is agreed in the meeting for evacuation of power from Rajasthan REZ Ph-IV (Part-6: 6 GW) (Bikaner Complex) :

Sl. No.	**Description of Transmission Element**	**Scope of work** **(Type of Substation/Conductor capacity/km/no. of bays etc.)**
1	Establishment of 765/400 kV, 6x1500 MVA & 400/220 kV, 8x500 MVA Bikaner-V Pooling Station along with 2x240 MVAr (765kV) & 2x125 MVAr (420kV) Bus Reactors at a suitable location near Bikaner **<u>Future provisions (excl. scope of present scheme):</u>** ➢ 765 kV line bays along with switchable line reactor –4 nos. ➢ 400 kV line bays along with switchable line reactor –4 nos. ➢ 400 kV line bays –4 Nos. ➢ 765 kV Bus Reactor along with bays: 1 No ➢ 400 kV Bus Reactor along with bays: 1 No.	Bikaner-V PS - AIS • 765/400 kV 1500 MVA ICTs- 6 Nos. (19x500 MVA including one spare unit) • 400/220 kV 500 MVA ICTs- 8 Nos. • 765kV line bays – 4 nos. (for 765kV interconnection with Pallu S/s) • 400kV line bays – 4 nos. (for 400kV interconnection with LILO of one D/c of 400kV Bikaner II PS- Khetri 2xD/c line) • 765kV ICT bays – 6 nos. • 400 kV ICT bays- 14 Nos.

Sl. No.	Description of Transmission Element	Scope of work (Type of Substation/Conductor capacity/km/no. of bays etc.)
	➢ 400/220 kV ICT along with bays-2 Nos. ➢ 400 kV Sectionalization bays: 1 set ➢ 220 kV line bays for connectivity RE Applications -4 Nos. ➢ 220kV Sectionalization bay: 2 sets ➢ 220 kV BC (2 Nos.) & TBC (2 Nos.) ➢ 1 No. of Syncon units* at 400kV level along with 1 nos. of 400kV bay ➢ 1 No. of Syncon units* at 220kV level along with 1 nos. of 220kV bay *1 No. of SynCon unit comprises dynamic support of +300MVAr/-200MVAr (Minimum) & Short circuit contribution at PCC of 1200MVA (Minimum)) (Value of inertia (MW-secs) shall be provided in RfP document)	• 220 kV ICT bays - 8 Nos. • 240 MVAr Bus Reactor-2 Nos. (7x80 MVAr, including one spare unit) • 765 kV Bus reactor bays-2 Nos. • 125 MVAr Bus Reactor-2 Nos. • 400 kV Bus reactor bays- 2 Nos. • 400kv line bays– 3 Nos. (for RE interconnection) • 220KV line bays – 10 Nos. (for RE interconnection) • 220kV Sectionalization bay: 1 set • 220 kV BC (2 Nos.) & TBC (2 Nos.) • 400kV sectionaliser bay- 1 Set
2	STATCOM (2x±300MVAr) along with MSC (4x125 MVAr) & MSR (2x125 MVAr) at Bikaner-V PS	• STATCOM (2x+300MVAr) along with MSC (4x125 MVAr) & MSR (2x125 MVAr) • 400 kV bays: 2 Nos. (for STATCOM)
3	LILO of one double ckt of 400kV Bikaner II PS- Khetri (Twin HTLS) 2xD/c line at Bikaner-V PS along with 50 MVAr switchable line reactor for each circuit at Bikaner-V PS end	Length-45km (Quad) (LILO length) • 420 kV, 50 MVAr switchable line reactors at Bikaner-V PS end– 2 Nos. • Switching equipment for 420kV, 50MVAr switchable line reactors at Bikaner-V PS end – 2 Nos.
4	Establishment of 765/400 kV, 2x1500 MVA S/s at suitable location near Pallu (Distt. Hanumangarh) along with 2x240 MVAr (765kV) & 2x125 MVAr (420kV) Bus Reactors **Future provisions (excl. scope of present scheme):** ➢ 765 kV line bays along with switchable line reactor –2 nos. ➢ 765/400 kV 1500 MVA ICTs- 2 Nos. ➢ 400 kV line bays along with switchable line reactor –4 nos. ➢ 400 kV line bays –4 Nos. ➢ 765 kV Bus Reactor along with bays: 1 No ➢ 400 kV Bus Reactor along with bays: 1 No.	Pallu S/s - AIS • 765/400 kV 1500 MVA ICTs- 2 Nos. (7x500 MVA including one spare unit) • 765kV line bays – 12 nos. (for 765kV 2xD/c interconnection each with Bikaner-IV PS, Panipat S/s and LILO of both ckts of 765kV Bikaner – Moga D/c line) • 400kV line bays – 2 nos. (for 400kV interconnection with Hanumangarh S/s) • 765kV ICT bays – 2 nos. • 400 kV ICT bays- 2 Nos.

Sl. No.	Description of Transmission Element	Scope of work (Type of Substation/Conductor capacity/km/no. of bays etc.)
	➢ 400 kV Sectionalization bays: 1 set ➢ 400/220 kV ICT along with bays-5 Nos. ➢ 220 kV line bays -8 Nos. ➢ 220kV Sectionalization bay: 1 set ➢ 220 kV BC (2 Nos.) & TBC (2 Nos.) ➢ STATCOM (2x±300MVAr) along with MSC (4x125 MVAr) & MSR (2x125 MVAr) along with 400kv bays (2nos.) ➢ 2 No. of Syncon units* at 220kV level along with 2 nos. of 220kV bay *1 No. of SynCon unit comprises dynamic support of +300MVAr/-200MVAr (Minimum) & Short circuit contribution at PCC of 1200MVA (Minimum)) (Value of inertia (MW-secs) shall be provided in RfP document)	• 240 MVAr Bus Reactor-2 Nos. (7x80 MVAr, including one spare unit) • 765 kV Bus reactor bays-2 Nos. • 125 MVAr Bus Reactor-2 Nos. • 400 kV Bus reactor bays- 2 Nos.
5	765 kV Bikaner-V PS – Pallu 2xD/c line	Line Length -120 km
6	LILO of both ckts of 765kV Bikaner – Moga D/c line at Pallu S/s along with 240MVAr switchable line reactor for each circuit at Pallu S/s end of 765kV Pallu-Moga D/c line	Length-50km (LILO length) • 765 kV, 240 MVAr switchable line reactors at Pallu S/s end– 2 Nos. • Switching equipment for 765kV, 240MVAr switchable line reactors at Pallu S/s end – 2 Nos.
7	400 kV Pallu – Hanumangarh (RVPN) D/c (Quad) line	Line Length -80 km • 400kV line bays – 2 nos. (at Hanumangarh (RVPN) S/s)
8	Establishment of 765/400 kV, 3x1500 MVA S/s at suitable location near Panipat (Distt. Panipat) along with 2x240 MVAr (765kV) & 2x125 MVAr (420kV) Bus Reactors **Future provisions (excl. scope of present scheme):** ➢ 765 kV line bays along with switchable line reactor –4 nos. ➢ 765/400 kV 1500 MVA ICTs- 3 Nos.	Panipat S/s - AIS • 765/400 kV 1500 MVA ICTs- 3 Nos. (10x500 MVA including one spare unit) • 765kV line bays –8 nos. (for 765kV 2xD/c interconnection each with Pallu S/s and Bulandshahr S/s)

Sl. No.	Description of Transmission Element	Scope of work (Type of Substation/Conductor capacity/km/no. of bays etc.)
	➢ 400 kV line bays along with switchable line reactor –4 nos. ➢ 400 kV line bays –4 Nos. ➢ 765 kV Bus Reactor along with bays: 1 No ➢ 400 kV Bus Reactor along with bays: 1 No. ➢ 400 kV Sectionalization bays: 1 set ➢ 400/220 kV ICT along with bays-5 Nos. ➢ 220 kV line bays -8 Nos. ➢ 220kV Sectionalization bay: 1 set ➢ 220 kV BC (2 Nos.) & TBC (2 nos.) ➢ STATCOM (2x±300MVAr) along with MSC (4x125 MVAr) & MSR (2x125 MVAr) along with 400kv bays (2nos.) ➢ 2 No. of Syncon units* at 400kV level along with 2 nos. of 400kV bays *1 No. of SynCon unit comprises dynamic support of +300MVAr/-200MVAr (Minimum) & Short circuit contribution at PCC of 1200MVA (Minimum)) (Value of inertia (MW-secs) shall be provided in RfP document)	• 400kV line bays – 4 nos. (for 400kV interconnection with Mohali and Mandola S/s) • 765kV ICT bays – 3 nos. • 400 kV ICT bays- 3 Nos. • 240 MVAr Bus Reactor-2 Nos. (7x80 MVAr, including one spare unit) • 765 kV Bus reactor bays-2 Nos. • 125 MVAr Bus Reactor-2 Nos. • 400 kV Bus reactor bays- 2 Nos.
9	765 kV Pallu-Panipat 2xD/c line along with 240 MVAr switchable line reactor for each circuit at each end	Length-280km • 765 kV, 240 MVAr switchable line reactors at Pallu S/s end– 2 Nos. • 765 kV, 240 MVAr switchable line reactors at Panipat S/s end– 2 Nos. • Switching equipment for 765kV, 240MVAr switchable line reactors at Pallu S/s end – 2 Nos. • Switching equipment for 765kV, 240MVAr switchable line reactors at Panipat S/s end – 2 Nos.
10	Establishment of 400/220kV, 3x500 MVA S/s at suitable location near Mohali (Distt. Mohali district) along with 2x125 MVAr (420kV) Bus Reactors	• 400kV line bays – 4 nos. (for 400kV interconnection with Panipat S/s & LILO of one circuit of 400kV Patiala-Panchkula D/c line) • 400kV ICT bays – 3 nos. • 220 kV ICT bays- 3 Nos.

Sl. No.	Description of Transmission Element	Scope of work (Type of Substation/Conductor capacity/km/no. of bays etc.)
	Future provisions (excl. scope of present scheme): ➢ 400 kV line bays along with switchable line reactor –4 nos. ➢ 400 kV line bays –2 Nos. ➢ 400 kV Bus Reactor along with bays: 1 No. ➢ 400/220 kV ICT along with bays-3 Nos. ➢ 400 kV Sectionalization bays: 1 set ➢ 220 kV line bays -4 Nos. ➢ 220kV Sectionalization bay: 1 set ➢ 220 kV BC (2 Nos.) & TBC (2 Nos.) ➢ 2 No. of Syncon units* at 400kV level along with 2 nos. of 400kV bays *1 No. of SynCon unit comprises dynamic support of +300MVAr/-200MVAr (Minimum) & Short circuit contribution at PCC of 1200MVA (Minimum)) (Value of inertia (MW-secs) shall be provided in RfP document)	• 125 MVAr Bus Reactor-2 Nos. • 400 kV Bus reactor bays- 2 Nos. • 220 kV line bays -6 Nos. (as informed by PSTCL in meeting)
11	LILO of one circuit of 400kV Patiala-Panchkula D/c line at Mohali	Length-30km (LILO length)
12	400 kV Panipat S/s – Mohali D/c (Quad Moose) line along with 80 MVAr (420kV) switchable line reactor for each circuit at Mohali end (155km)	Line Length-155km (Quad) • 420 kV, 80 MVAr switchable line reactors at Mohali S/s end– 2 Nos. • Switching equipment for 420kV, 80MVAr switchable line reactors at Mohali S/s end – 2 Nos.
13	400 kV Panipat S/s – Mandola D/c (Quad) line	Line Length-75km (Quad) • 400kV line bays at Mandola S/s – 2 nos.
14	Establishment of 765 kV S/s at suitable location near Bulandshahr (Distt. Bulandshahr) along with 2x330 MVAr (765kV) Bus Reactors **Future provisions (excl. scope of present scheme):** ➢ 765 kV line bays along with switchable line reactor –4 nos.	Bulandshahr S/s – AIS • 765kV line bays –10 nos. (for 765kV 2xD/c interconnection with Panipat S/s, 765kV D/c interconnection with Lucknow-II S/s & Noida sec-148 (UPPTCL) S/s and LILO of 765kV Aligarh – Gr. Noida line)

Sl. No.	Description of Transmission Element	Scope of work (Type of Substation/Conductor capacity/km/no. of bays etc.)
	➢ 765/400 kV 1500 MVA ICTs- 4 Nos. ➢ 400 kV line bays along with switchable line reactor –4 nos. ➢ 400 kV line bays –4 Nos. ➢ 765 kV Bus Reactor along with bays: 1 No ➢ 400 kV Bus Reactor along with bays: 1 No. ➢ 400 kV Sectionalization bays: 1 set ➢ 400/220 kV ICT along with bays-5 Nos. ➢ 220 kV line bays -8 Nos. ➢ 220kV Sectionalization bay: 1 set ➢ 220 kV BC (2 Nos.) & TBC (2 nos.) ➢ 2 No. of Syncon units* at 400kV level along with 2 nos. of 400kV bays *1 No. of SynCon unit comprises dynamic support of +300MVAr/-200MVAr (Minimum) & Short circuit contribution at PCC of 1200MVA (Minimum)) (Value of inertia (MW-secs) shall be provided in RfP document)	• 330 MVAr Bus Reactor-2 Nos. (7x110 MVAr, including one spare unit) • 765 kV Bus reactor bays-2 Nos.
15	765 kV Panipat- Bulandshahr 2xD/c line along with 240 MVAr switchable line reactor for each circuit at Bulandshahr end	Line Length-150km • 765 kV, 240 MVAr switchable line reactors at Bulandshahr S/s end– 4 Nos. • Switching equipment for 765kV, 240MVAr switchable line reactors at Bulandshahr S/s end – 4 Nos. • 1x80 MVAr, 765kv reactor spare unit
16	LILO of 765kV Aligarh – Gr. Noida line at Bulandshahr S/s (Lilo length-30km)	Length-30km (LILO length)
17	765 kV Bulandshahr - Noida sec-148 (UPPTCL) D/c line	Line Length- 50km • 765kV line bays at Noida sec-148 S/s(UPPTCL) – 2 nos.

Sl. No.	Description of Transmission Element	Scope of work (Type of Substation/Conductor capacity/km/no. of bays etc.)
18	Establishment of 765/400 kV, 2x1500 MVA Lucknow-II S/s at suitable location near Lucknow along with 2x330 MVAr (765kV) & 2x125 MVAr (420kV) Bus Reactors **Future provisions (excl. scope of present scheme):** ➢ 765 kV line bays along with switchable line reactor –8 nos. ➢ 765/400 kV 1500 MVA ICTs- 4 Nos. ➢ 400 kV line bays along with switchable line reactor –4 nos. ➢ 400 kV line bays –4 Nos. ➢ 765 kV Bus Reactor along with bays: 1 No ➢ 400 kV Bus Reactor along with bays: 1 No. ➢ 400 kV Sectionalization bays: 1 set ➢ 400/220 kV ICT along with bays-5 Nos. ➢ 220 kV line bays -8 Nos. ➢ 220kV Sectionalization bay: 1 set ➢ 220 kV BC (2 Nos.) & TBC (2 nos.) ➢ 2 No. of Syncon units* at 400kV level along with 2 nos. of 400kV bays *1 No. of SynCon unit comprises dynamic support of +300MVAr/-200MVAr (Minimum) & Short circuit contribution at PCC of 1200MVA (Minimum)) (Value of inertia (MW-secs) shall be provided in RfP document)	Lucknow-II S/s – AIS • 765/400 kV 1500 MVA ICTs- 2 Nos. (7x500 MVA including one spare unit) • 765kV line bays –4 nos. (for 765kV D/c interconnection each with Asana & Bulandshahr S/s) • 400kV line bays – 2 nos. (for 400kV interconnection with Gonda (UPPTCL) S/s) • 765kV ICT bays – 2 nos. • 400 kV ICT bays- 2 Nos. • 330 MVAr Bus Reactor-2 Nos. (7x110 MVAr, including one spare unit) • 765 kV Bus reactor bays-2 Nos. • 125 MVAr Bus Reactor-2 Nos. • 400 kV Bus reactor bays- 2 Nos.
19	765 kV Bulandshahr – Lucknow-II D/c line along with 330 MVAr switchable line reactor for each circuit at each end	Line Length- 350km • 765 kV, 330 MVAr switchable line reactors at Bulandshahr S/s end– 2 Nos. • Switching equipment for 765kV, 330MVAr switchable line reactors at Bulandshahr S/s end – 2 Nos. • 765 kV, 330 MVAr switchable line reactors at Lucknow-II S/s end– 2 Nos. • Switching equipment for 765kV, 330MVAr switchable line reactors at Lucknow-II S/s end – 2 Nos.

Sl. No.	Description of Transmission Element	Scope of work (Type of Substation/Conductor capacity/km/no. of bays etc.)
20	400 kV Lucknow-II – Gonda D/c (Quad Moose) line	Line Length- 160km • 400kV line bays at Gonda S/s(UPPTCL) – 2 nos.
21	Establishment of 765/400 kV, 2x1500 MVA S/s at suitable location near Asana Village (Chandauli District) along with 2x330 MVAr (765kV) & 2x125 MVAr (420kV) Bus Reactors **Future provisions (excl. scope of present scheme):** ➢ 765 kV line bays along with switchable line reactor –8 nos. ➢ 765/400 kV 1500 MVA ICTs- 4 Nos. ➢ 400 kV line bays along with switchable line reactor –4 nos. ➢ 400 kV line bays –4 Nos. ➢ 765 kV Bus Reactor along with bays: 1 No ➢ 400 kV Bus Reactor along with bays: 1 No. ➢ 400 kV Sectionalization bays: 1 set ➢ 400/220 kV ICT along with bays-5 Nos. ➢ 220 kV line bays -8 Nos. ➢ 220kV Sectionalization bay: 1 set ➢ 220 kV BC (2 Nos.) & TBC (2 nos.) ➢ 2 No. of Syncon units* at 400kV level along with 2 nos. of 400kV bays ➢ STATCOM (2x±300MVAr) along with MSC (4x125 MVAr) & MSR (2x125 MVAr) along with 400kv bays (2nos.) *1 No. of SynCon unit comprises dynamic support of +300MVAr/-200MVAr (Minimum) & Short circuit contribution at PCC of 1200MVA (Minimum)) (Value of inertia (MW-secs) shall be provided in RfP document)	Asna (Chandauli) S/s – AIS • 765/400 kV 1500 MVA ICTs- 2 Nos. (7x500 MVA including one spare unit) • 765kV line bays –2 nos. (for 765kV D/c interconnection each with Lucknow-II S/s) • 400kV line bays – 8 nos. (for LILO of both ckts of 400kV Varanasi – Biharsharif D/c line & LILO of both ckts of 400kV Balia – Patna D/c line) • 765kV ICT bays – 2 nos. • 400 kV ICT bays- 2 Nos. • 330 MVAr Bus Reactor-2 Nos. (7x110 MVAr, including one spare unit) • 765 kV Bus reactor bays-2 Nos. • 125 MVAr Bus Reactor-2 Nos. • 400 kV Bus reactor bays- 2 Nos.
22	765 kV Lucknow-II-Asana D/c line along with 330 MVAr switchable line reactor for each circuit at each end	Line Length- 350km • 765 kV, 330 MVAr switchable line reactors at Asana S/s end– 2 Nos.

Sl. No.	Description of Transmission Element	Scope of work (Type of Substation/Conductor capacity/km/no. of bays etc.)
		• Switching equipment for 765kV, 330MVAr switchable line reactors at Asana S/s end – 2 Nos. • 765 kV, 330 MVAr switchable line reactors at Lucknow-II S/s end– 2 Nos. • Switching equipment for 765kV, 330MVAr switchable line reactors at Lucknow-II S/s end – 2 Nos.
23	LILO of both ckts of 400kV Varanasi – Biharsharif D/c line at Asana S/s along with 80 MVAr switchable line reactor for each circuit at Asana end of 400kV Asana- Biharsharif section	Length-25km (LILO length) • 420 kV, 80 MVAr switchable line reactors at Asana S/s end– 2 Nos. • Switching equipment for 420kV, 80MVAr switchable line reactors at Asana S/s end – 2 Nos.
24	LILO of both ckts of 400kV Balia – Patna D/c line at Asana S/s along with 80 MVAr switchable line reactor for each circuit at Asana end of 400kV Patna-Asana D/c line	Length-100km (LILO length) • 420 kV, 80 MVAr switchable line reactors at Asana S/s end– 2 Nos. • Switching equipment for 420kV, 80MVAr switchable line reactors at Asana S/s end – 2 Nos.

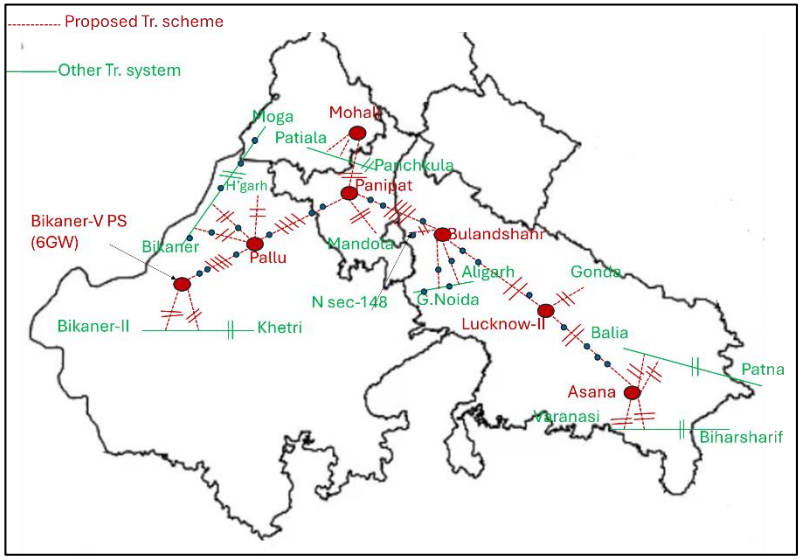


Fig: Transmission scheme for evacuation of power as part of Rajasthan REZ Ph-IV (Part-6 : 6GW) (Bikaner Complex) (Bikaner V: 6GW

List of Participants of 40th Consultation meeting for Evolving Transmission Schemes in NR held on 12.09.2025

CEA

Smt. Kavita Jha	Director

SECI

Shri R. K. Agarwal	Consultant
Shri Vineet Kumar	DGM

Grid India

Shri Gaurav Malviya	Ch. Manager
Shri Gaurav Singh	Ch. Manager
Shri Prabhankar Porwal	Manager

CTUIL

Shri Partha Sarathi Das	Sr. GM (CTUIL)
Shri Sandeep Kumawat	DGM (CTUIL)
Shri Narendra Sathvik Ranganath	Ch. Manager (CTUIL)
Shri Yatin Sharma	Manager (CTUIL)
Shri Madhusudan Meena	Engineer (CTUIL)
Shri Rishabh Bansal	ET (CTUIL)
Shri Kumar Anjul	ET (CTUIL)
Shri Jayesh Raikwar	ET (CTUIL)

RVPNL

Shri Dr. Om Prakash Mahela	XEN (PP&D)
Smt. Sona Shishodia	SE (P&P)

HPPTCL

Shri Manoj Kumar	GM (C&D)
Shri Virender Sharma	DGM
Shri Harmanjeet Singh	AE

HVPN

Shri Ramesh Chand	XEN (System Study)

PSTCL

Shri Nitin Kumar	Asst. XEN

PTCUL

Shri G.S. Budiyal	Director (Operations)
Shri Lalit Kumar	SE(Engg.)
Shri Ashok Kumar	XEN

UPPTCL

Shri Satyendra Kumar	SE

JKPTCL

Shri Ehtisham Andrabi	XEN

BBMB

Smt Richa Gupta	DD SS&P

Connectivity/GNA Applicants

Shri Ajay Kumar Pradhan	ACME Greentech Urja Private Limited, ACME Heergarh Powertech Private Limited
Shri Yogesh Sanklecha	ACME Greentech Urja Private Limited, ACME Heergarh Powertech Private Limited
Shri Tushar Goyal	ACME Greentech Urja Private Limited, ACME Heergarh Powertech Private Limited
Shri Varun Bhatnagar	Ashoka Renewable Energy 1 Private Limited, Unique Hybrid Renewable Energy 3 Private Limited
Shri Rahul Tyagi	BN Dispatchable-5 Private Limited
Shri Manish Tak	Juniper Green Cosmic Private Limited, Juniper Green Stellar Private Limited
Shri M. P. Dinkar	NHPC Limited
Shri Dipak Kumar	NHPC Limited
Shri Mahendra Singh	NHPC Limited
Shri Anjani Kumar	Panipat Green Hydrogen Private Limited
Shri Prateek Mohan Rai	Purvah Green Power Private Limited
Shri Akash Kumar	Purvah Green Power Private Limited

Shri Umang Prasad	Purvah Green Power Private Limited
Shri Vikas Tiwary	Rays Power Infra Limited
Smt Ritu Kaira	ReNew Solar Power Private Limited
Shri Mohit Jain	ReNew Solar Power Private Limited
Shri Deepak Chaudhary	STT Global Data Centres India Private Limited
Shri Akhil Agarwal	STT Global Data Centres India Private Limited
Shri Abhishek Kulkarni	Tata Power Renewable Energy Limited
Shri Santosh P Narayan	Tata Power Renewable Energy Limited
Shri Udit Tewari	THDC India Limited
Shri R.M. Dubey	THDC India Limited

Annexure A1

pstcl

PUNJAB STATE TRANSMISSION CORPORATION LIMITED,
Regd Office: PSEB Head Office, The Mall, Patiala.147001.
O/o Chief Engineer/TS, PSTCL, Patiala
***Tele-0175-2205502,* email:** ce-tl@pstcl.org
CIN - U40109PB2010SGCO33814

To

Chief Operating Officer/CTU,
Power Grid Corporation of India Ltd.
Saudamini, Plot No. 2, Sector 29, Near IFFCO Chowk,
Gurugram, Haryana 122001

Memo No.: 291/PI-381 **Dated:** 20.05.2025

Subject: **Inclusion of agenda item in the upcoming CMETS meeting:**

Agenda Item: Regarding revision *in* scope of work for 400kV Wadala Granthian

Originally, 400kV Wadala Granthian substation was proposed to be planned with 2 Nos. 500 MVA, 400/220 kV ICTs along with LILO of one circuit of 400kV Moga–Kishenpur line in Stage 1 and 1 No. 500 MVA 400/220 kV ICT along with LILO of 2nd circuit of 400kV Moga–Kishenpur line in Stage-2. Moga-Kishenpur is a 765kV line which is charged at 400kV. However, it was learned from CTU that the Moga-Kishenpur line would eventually be charged at 765 kV level due to the evacuation of some upcoming hydro generation in the J&K area.

In accordance with the above, alternative proposals for 400 kV connectivity to Wadala Granthian were explored, including the LILO of the 400 kV Samba–Jalandhar D/C line and the 400 kV Amritsar–Parbati line.

According to the minutes of the 28th CMETS meeting, and following the implementation of the Rattle HEP evacuation scheme approved therein, the single circuit 400kV Jalandhar–Samba (Quad) line and the single circuit 400kV Nakodar–Samba (Quad) line remains available for LILO in 2026-27 timeframe, at the 400kV Wadala Granthian substation.

Therefore, the load flow study was carried out considering both the 400kV Samba-Jalandhar and 400kV Samba-Nakodar lines, and the results are feasible. The load flow sheets are enclosed as **Annexure-A**.

Accordingly, the feeding arrangement will involve the LILO of either the 400 kV S/C Jalandhar–Samba line (Quad) **OR** the 400 kV S/C Samba–Nakodar line (Quad) depending upon the alignment of 400 kV Wadala Granthian w.r.t these lines. Upon completion of the

proposed 400 kV Samba–Jalandhar and 400 kV Samba–Nakodar circuits by CTU under the Ratle HEP evacuation scheme, the specific line to be LILOed at 400 kV Wadala Granthian (either 400 kV S/C Jalandhar–Samba line (Quad) or 400 kV S/C Samba–Nakodar line (Quad)) will be finalized based on the orientation of 400kV Wadala Granthian.

Further, as per these studies, while single circuit LILO of 400kV line is sufficient to meet with loads at 400kV Wadala Granthian, however, in case in future, if single circuit LILO has some reliability issues due to further load growth and ATC/TTC enhancements in coming 4-5 years down the lane, the same will be considered at that time. At that stage, Stage-2 can be planned, which shall include the installation of 2nd 500 MVA, 400/220kV ICT and LILO of 400kV Amritsar-Parbati line or any other suitable line, depending on the prevalent conditions at that time.

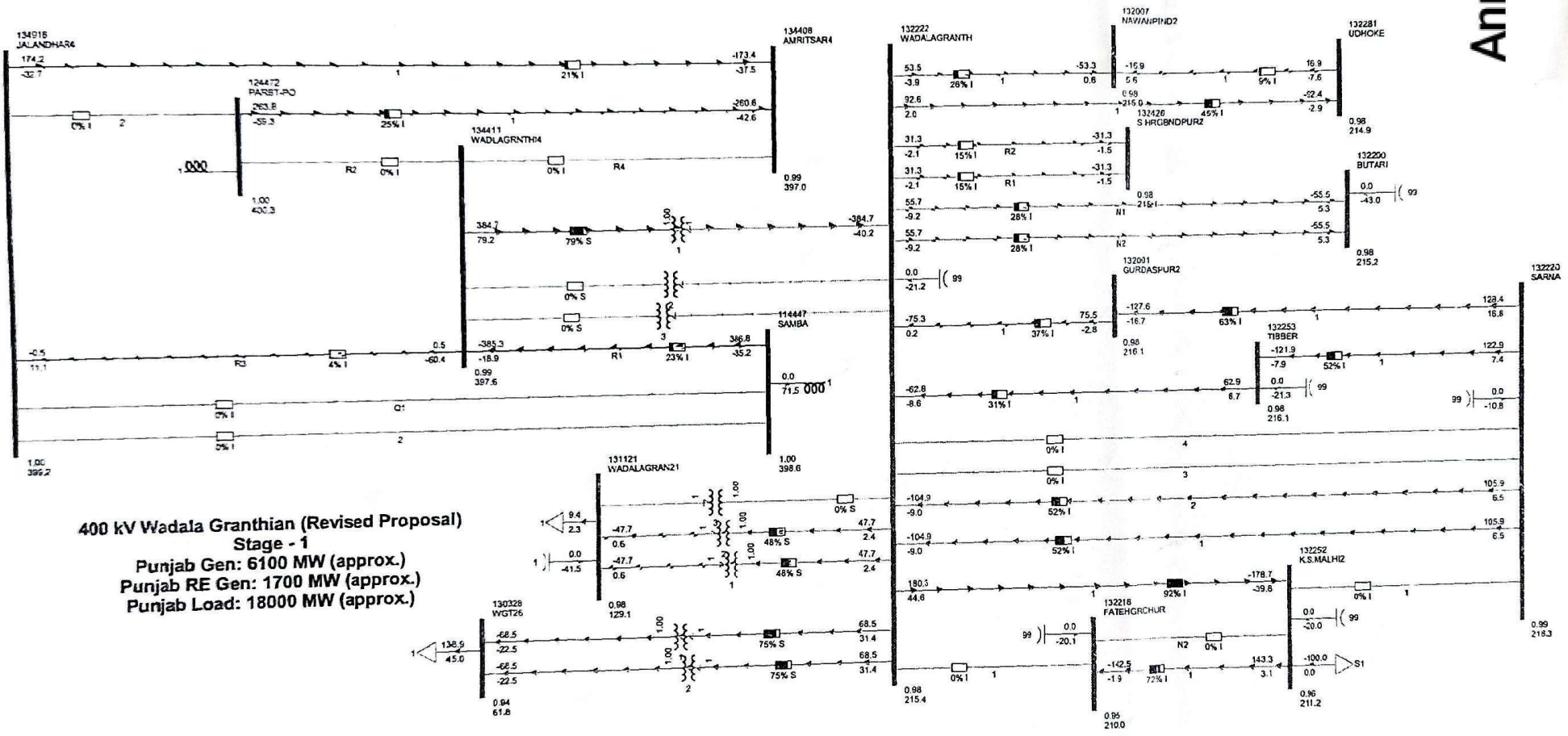
In view of the above, it is requested that the proposal of 400kV Wadala Granthian with 1x500MVA, 400/220kV ICT and LILO of 400kV Samba-Jalandhar line (Quad moose) or LILO of 400kV Samba-Nakodar line (Quad moose) may be approved.

Submitted for consideration in the upcoming CMETS meeting.

DA: As Above

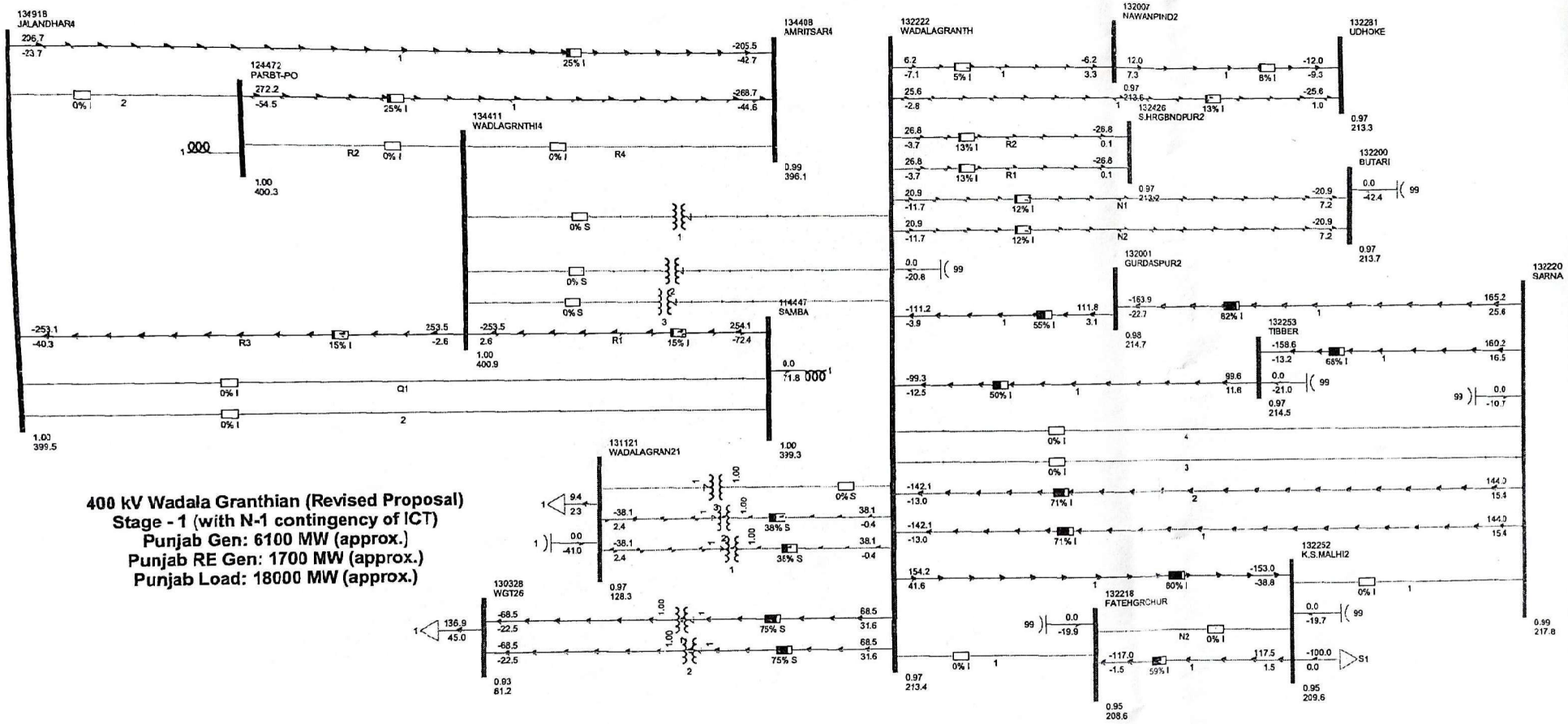
Engineer-in-Chief/TS,
PSTCL, Patiala.

Annexure-A



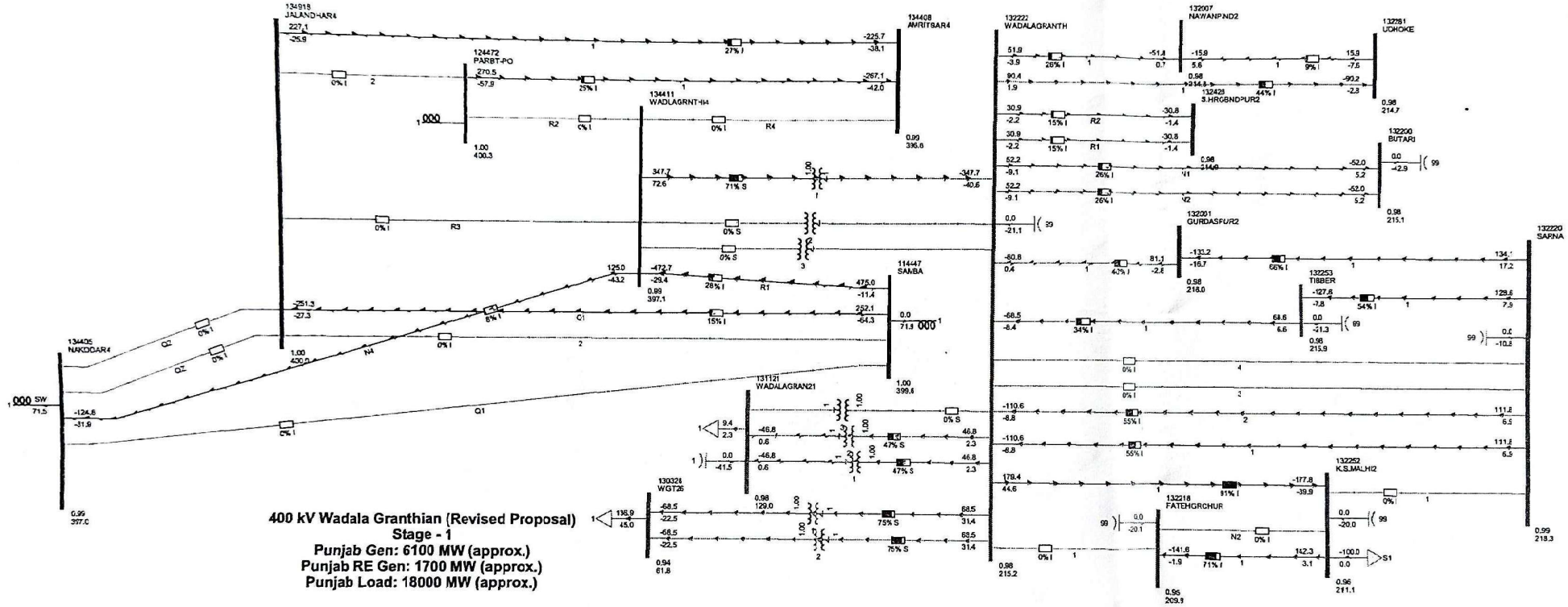
400 kV Wadala Granthian (Revised Proposal)
Stage - 1
Punjab Gen: 6100 MW (approx.)
Punjab RE Gen: 1700 MW (approx.)
Punjab Load: 18000 MW (approx.)

LILO of 400KV Jalandhar – Samba line

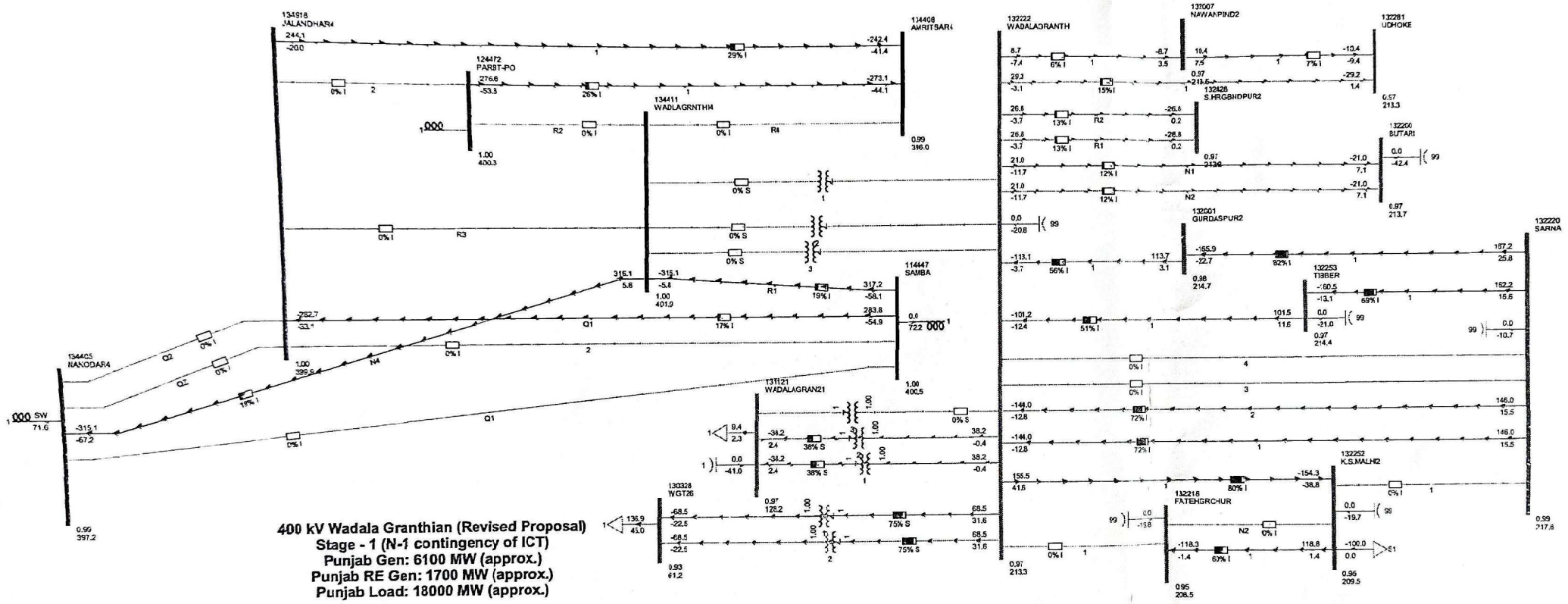


400 kV Wadala Granthian (Revised Proposal)
Stage - 1 (with N-1 contingency of ICT)
Punjab Gen: 6100 MW (approx.)
Punjab RE Gen: 1700 MW (approx.)
Punjab Load: 18000 MW (approx.)

LILO of 400kV Jalandhar – Samba line



LILO of 400 KV Nakodar – Samba line



400 kV Wadala Granthian (Revised Proposal)
Stage - 1 (N-1 contingency of ICT)
Punjab Gen: 6100 MW (approx.)
Punjab RE Gen: 1700 MW (approx.)
Punjab Load: 18000 MW (approx.)

LILO of 400kV Nakodar – Samba Line

-11-

Annexure A2

pstcl

PUNJAB STATE TRANSMISSION CORPORATION LIMITED,
Regd. Office: PSEB Head Office, The Mall, Patiala.147001.
O/o Chief Engineer/TS, PSTCL, Patiala
***Tele-0175-2205502*, email:** ce-tl@pstcl.org
CIN - U40109PB2010SGCO33814

To

Chief Operating Officer/CTU,
Power Grid Corporation of India Ltd.
Saudamini, Plot No. 2, Sector 29, Near IFFCO Chowk,
Gurugram, Haryana 122001

Memo No. 138/PI-438 **Dated:** 20.02.2025

Subject: **Regarding assessment of the requirement for appropriate reactors in view of the high bus voltages observed at various 400kV substations of PSTCL**

Due to high bus voltages observed at various 400kV substations in Punjab, it is necessary to assess the optimal requirement for suitable reactors to maintain voltage profile. It is pertinent to mention that during the 8th CMETS meeting held on 30.06.2022, four 400 kV substations in Punjab were identified for reactor installation. However, considering the current loading conditions and operational scenario, it is requested to conduct necessary system studies to again evaluate the optimal requirements of the reactors to mitigate the overvoltage being observed at the 400kV substations of PSTCL. To facilitate this assessment, the requisite data regarding installed reactors and space availability for installation of reactors is as below:

Name of the 400kV Sub-station	**Rating of the reactor(s) installed/operational at 400kV Bus**	**Rating of the reactor(s) installed/operational at 220kV Bus**	**Space availability for installation of a Bus reactor(s)**
400/220kV S/S Nakodar	Yes, 1 No. of 80MVAr rating.	Yes, 1 No. of 25MVAr rating.	**400kV:** 1 no. bay available for 400kV Reactor. (After considering space for 4 Nos. ICTs) **220kV:** No 220kV bay available for 220kV Reactor.
400/220kV S/S Ropar	Nil	Nil	**400kV:** 1 no. bay available for 400kV Reactor. (After considering space for 4 Nos. ICTs)

			220kV: No 220kV bay available for 220kV Reactor (After considering space for 10 Nos. 220kV Line Bays at Sub-station).
400/220kV S/S Behman Jassa Singh	Nil	Nil	**400kV:** 1 no. bay available for 400kV Reactor. (After considering space for 4 Nos. ICTs) No 220kV bay available for 220kV Reactor (After considering space for 10 Nos. 220kV Line Bays).
400/220kV S/S Muktsar	Yes, 1 No. of 80MVAr rating.	Nil	**400kV:** 1 no. bay available for 400kV Reactor. (After considering space for 4 Nos. ICTs) **220kV:** No 220kV bay available for 220kV Reactor.
400/220kV S/S Rajpura	Nil	Nil	**400kV:** 1 no. bay available for 400kV Reactor. (After considering space for 4 Nos. ICTs) **220kV:** No 220kV bay available for 220kV Reactor.
400/220/66 kV S/S Dhanansu	Nil	Nil	**400kV:** 1 no. bay available for 400kV Reactor. (After considering space for 4 Nos. ICTs) **220kV:** No 220kV Bay available for 220kV Reactor.
400/220kV S/S Makhu	Yes, 1 No. of 80MVAr rating.	Nil	**400kV:** 1 no. bay available for 400kV Reactor. (After considering space for 4 Nos. ICTs) **220kV:** 6 Nos. Line Bay already constructed and space available for addl. 6 nos. line bays. As such, bay for 1 No. 220kV reactor is available. However, space for only addl. 5 no. 220kV line bays shall remain for future. So, total of 11 nos. 220kV line bays will be available at the substation.
400/220kV S/S Dhuri (Bhalwan)	Yes, 1 No. of 125MVAr rating.	Yes, 1 No. of 25MVAr rating.	**400kV:** 1 no. bay available for 400kV Reactor. (After considering space for 4 Nos. ICTs).

			220kV: 10 Nos. Line Bays already constructed and space for addl. 2 nos. line bays is available. As such, bay for 1 No. 220kV reactor is available. However, space for only addl. 1 no. 220kV line bay shall remain for future. So, total of 11 nos. 220kV line bays will be available at the substation.

In view of above, it is requested to take up the matter for discussion in upcoming CMETS meeting.

Engineer-in-Chief/TS
PSTCL, Patiala

Annexure A3

भारत सरकार
Government of India
विद्युत मंत्रालय
Ministry of Power
केन्द्रीय विद्युत प्राधिकरण
Central Electricity Authority
विद्युत प्रणाली योजना एवं मूल्यांकन-I प्रभाग
Power System Planning & Appraisal-I Division

सेवा में / To,

1. COO (CTUIL), Plot No. 16, IRCON International Tower, Institutional Area, Sector 32, Gurugram, Haryana - 122001
2. Director (System Operation), Grid- India, B-9, Qutab Institutional Area, Katwaria Sarai, New Delhi- 110010
3. Managing Director, Rajasthan Rajya Vidyut Prasaran Nigam Limited, Vidyut Bhawan, Jan Path, Jyoti Nagar, Jaipur – 302005

Subject: Minutes of the meeting held on 18.06.2025 to discuss the transmission system proposed by RVPN for evacuation of 13255 MW of RE and 2400 MW power from thermal power plants in Kawai-Kalisindh-Chhabra Generation Complex (Chhabra TPS U7 & U8: 2x800 MW, Kalisindh TPS U3: 1x800 MW)

विषय: 13255 मेगावाट नवीकरणीय ऊर्जा की निकासी और कवाई-कालीसिंध-छाबड़ा उत्पादन परिसर में थर्मल पावर प्लांटों से 2400 मेगावाट बिजली (छाबड़ा टीपीएस यू7 और यू8: 2x800 मेगावाट, कालीसिंध टीपीएस यू3: 1x800 मेगावाट) की निकासी के लिए आरवीपीएन द्वारा प्रस्तावित ट्रांसमिशन सिस्टम पर चर्चा के लिए 18.06.2025 को आयोजित बैठक का कार्यवृत्त

महोदय/ Sir,

Please find enclosed the minutes of the meeting held on 18.06.2025 to discuss the transmission system proposed by RVPN for evacuation of 13255 MW of RE power and 2400 MW power from thermal power plants in Kawai-Kalisindh-Chhabra Generation Complex (Chhabra TPS U7 & U8: 2x800 MW, Kalisindh TPS U3: 1x800 MW).

भवदीय / Yours faithfully,

Signed by Kanhaiya Singh Kushwaha
Date: 03-07-2025 18:12:28

(कन्हैया सिंह कुशवाहा/ Kanhaiya Singh Kushwaha)

उप निदेशक / Deputy Director

Minutes of the meeting held on 18.06.2025 to discuss the transmission system proposed by RVPN for evacuation of 13255 MW of RE power and 2400 MW power from themal power plants in Kawai-Kalisindh-Chhabra Generation Complex (Chhabra TPS U7 & U8: 2x800 MW, Kalisindh TPS U3: 1x800 MW)

List of participants is enclosed as **Annexure-I.**

Background:

1) RVPN had submitted the proposal for transmission system for evacuation of 2120 MW power from new thermal units in Kawai-Kalisindh-Chhabra Generation Complex (Chhabra TPS U7 & U8: 2x660 MW, Kalisindh TPS U3: 1x800 MW) by 2032 which was deliberated in a meeting held on 25.10.2024 amongst CEA, CTUIL, Grid-India and RVPN. The proposal included the establishment of 765 kV substations at Anta-II, Hindaun (upgradation from 400 kV to 765 kV) & Ajarka (Alwar) and 400 kV substations at Kuskhera (Bhiwadi) & Kumher along with associated transmission lines. In the meeting, proposal for establishment of 400 kV Kumher substation along with associated transmission lines was agreed which was primarily meant to provide reliable power supply in Bharatpur area as well as to address the issue of low voltage in the Hindaun- Alwar and Bharatpur area and RVPN was requested to review the remaining transmission system as power flow on the some of the lines was very low.
2) Subsequently, RVPN submitted that capacity of the proposed Chhabra TPS (U7 & U8) has increased from 2x660 MW to 2x800 MW, with which, total generation becomes 2400 MW and in addition to this, additional thermal plants with capacity of 2400 MW are envisaged in future (2x800 MW U9 & U10 at Chhabra and 1x800 MW U4 at Kalisindh). With this, power flow on the proposed lines would further increase.
3) In addition to above, RVPN submitted the proposal of transmission system for evacuation of 16255 MW RE power (Solar: 15255 MW; Wind: 1000 MW) by 2032 which is also interconnected with the transmission system proposed for evacuation of 2400 MW power from Kawai-Kalisindh-Chhabra Generation Complex.
4) For deliberation on the above proposals for evacuation of 16255 MW of RE power and 2400 MW power from thermal power plants in Kawai-Kalisindh-Chhabra Generation Complex, a meeting was held on 16.05.2025, wherein CTUIL highlighted that with integration of so much power, there would be surplus generation under Intra-State in Rajasthan in 2032 during solar hours which would eventually increase the loading on ISTS corridors and the same is being observed in the load flow study files. RVPN needs to plan BESS and PSPs to store the surplus power during the solar hours and may also identify bulk loads envisaged by 2032, if any.
5) CEA and CTUIL also prepared LGB with envisaged RE and thermal generation and circulated it for further deliberation in next meeting.
6) RVPN submitted that they have reassessed the RE potential and RE potential to be integrated by 2032 has been reduced to 13255 MW (Solar: 12255 MW, Wind: 1000 MW) instead of earlier proposed 16255 MW.
7) RVPN further submitted that PSPs with capacity of 4.43 GW are expected under Intra-State by 2032 (details given in **Annexure-II**). In addition to this, RVPN will plan the integration of 6 GW BESS by 2032 (substation wise details given in **Annexure-III**). Also, 6.3 GW additional load is expected in the Pali and Khushkhera-Bhiwadi- Neemrana Industrial Area (KBNIA) by 2032 over and above the load projected in the 20th EPS (Details given in **Annexure-IV**).
8) The above submissions made by RVPN were deliberated in a meeting held amongst CEA, CTUIL, Grid-India and RVPN on 23.05.2025 and LGBR of Rajasthan by 2032

for afternoon scenario of winter and summer seasons was finalized. The same is attached as **Annexure- V**.

9) Load flow study files were updated accordingly and circulated to all the members.

Deliberations in the meeting:

1) Grid-India highlighted that as per the load flow study files, many substations are having low voltage (less than 0.97 pu) even in 'N-0' cases and the situation gets worse under 'N-1' contingency. Therefore, there is requirement for planning of suitable reactive power compensation devices such as capacitor banks. Grid-India further stated that suitable dynamic compensation devices such as STATCOMs/ synchronous condensers may be planned for reactive power management during day/night time as well as for improvement of Short Circuit Ratio (SCR) of intrastate RE pooling stations having SCR below the CEA standards.
2) RVPN stated that +/-300 MVAR statcoms have been proposed at each of the proposed new substations at Jaisalmer (Teliwara), Bhadla (Sultan Nagar) and Bikaner (Pugal).
3) CTUIL suggested that in view of the low SCR, +300/-200 MVAR, 400 kV synchronous condenser may be planned by RVPN at Bikaner (Pugal). Same would also provide the inertia as well as reactive power support. Also, +/- 300 MVAR Statcom may be planned at Dechu. RVPN agreed for the same.
4) RVPN further stated that in order to improve the voltage profile, they have already implemented capacitors banks at 33 kV voltage level at various substations with total capacity of 4693.301 MVAR and capacitor banks with capacity of 814.5 MVAR are under implementation and would be commissioned within a year. In addition, RVPN has planned 5.43 MVAR, 33 kV capacitor banks at each of the newly planned substation. These capacitors would further improve the voltage profile in the state. Also, implementation of capacitors takes less than a year, therefore, new capacitors may be implemented, as and when required. CEA suggested RVPN to keep the space for 2 Nos. additional capacitor banks at all the newly planned substations. RVPN further submitted that approximately 10,000 MVAR additional capacitor banks are envisaged to be added by RVPN/ Discoms in Rajasthan by 2032. RVPN was requested to submit yearly node-wise/station-wise progress regarding the same to CEA with information to CTUIL/Grid-India for review of progress. RVPN agreed for the same.
5) CEA highlighted that most of the PSPs to be connected under Intra-State are having the capacity around 1000 MW and RVPN has connected the same at the 220 kV substation in the load flow study files, due to which low voltage at the substations and high loading in the associated transmission lines is being observed. RVPN clarified that connectivity shown for PSPs in the study files is tentative only as connectivity system for PSPs has not been finalized till date. CEA suggested that connectivity of PSPs with around 500-600 MW or above capacity at 220 kV level may not suffice and RVPN may plan 400 kV substations for the same, which would also provide support to nearby 220 kV substations and improve the voltage profile. It was discussed that transmission system planning of envisaged PSPs should be such that there are no transmission constraints and low voltage issues both during pumping and generation mode. RVPN agreed for the same.
6) CEA further highlighted that in order to feed the 6 GW additional load expected in the Khushkhera-Bhiwadi-Neemrana Industrial Area (KBNIA), RVPN would need to plan additional 400 kV substations in the area. RVPN stated that they would plan the same as per the load growth.

7) GRID-INDIA suggested that based on load growth, corresponding reactive power support also to be planned in underlying transmission and distribution network of KBNIA corridor. Further, requirement of dynamic reactive compensation near this upcoming bulk load centres also to be explored by RVPN. RVPN agreed for the same.

8) Grid-India stated that RVPN needs to ensure that PSPs and BESS are implemented commensurate to the RE integration in the matching time frame so that ISTS corridors are not overloaded. CTUIL suggested for yearly review by CEA, CTUIL, Grid-India and RVPN of the progress of the proposed RE and associated transmission system, BESS & PSP implementation and the transmission planning for bulk load under Intra-state.

9) CTUIL enquired about the storage capacity of the BESS proposed by RVPN. RVPN intimated that they have planned 6 GW BESS with 2 hours of storage capacity. CTUIL suggested that keeping in view the solar hours, BESS should be planned for at least 4 hours storage capacity. RVPN agreed for the same.

10) GRID-INDIA stated that in basecase files shared, intrastate thermal machines have been backed down to 45% level of their MCR capacity. However, presently, it is observed that only supercritical intrastate units in Rajasthan are backing down to TML (Technical Minimum Level) of 55% whereas lower capacity thermal units are backing down to TML level of 72%. Out of 10711 MW installed capacity, capacity of 5421 MW cannot achieve TML of 55%. In case the assumption of TML of 45% is not being implemented for all intrastate thermal machines, RVPN to further review the modifications required in transmission system including any additional BESS requirement. RVPN agreed for the same.

11) CTUIL stated that power flow on the Nagaur (New) - Merta II (ISTS) 765 kV D/c line is very less and the line may be planned at 400 kV level. RVPN clarified that the said line has been proposed for anchoring and stability purposes, however, as Nagaur (New) substation is getting connected at other substations of RVPN, the said line may be dropped. CTUIL opined that interconnection of ISTS system with Intra-state system would also provide support and stability to the ISTS system, therefore, the proposed line at 400 kV level may by planned under ISTS and requested RVPN to provide 2 Nos. 400 kV bays at Nagaur (New) substation. RVPN agreed for the same.

12) Grid-India suggested RVPN to ensure that all existing and upcoming transmission lines have terminal equipment of commensurate ratings as per the conductor capacity of transmission line.

13) Following suggestions given by Grid-India were also agreed:

(a) Although provision of synchronous condenser is being kept at Bikaner (Pugal) substation for improvement of SCR in present scope, additional connectivity of the substation needs to be further explored both with intrastate and ISTS network by CTUIL and RVPN.

(b) Measures to be taken by CTUIL and RVPN to control the high fault levels at different substations where fault levels are exceeding the design capacity. List is attached as **Annexure-VI**.

(c) RVPN and CTUIL may explore possibility of keeping names of RE pooling stations as per local name for easy differentiation in real-time grid operations.

(d) RVPN to update the proposed capacitors in future study files of CTUIL with requirement at transmission system of >=132kV to be explicitly modelled and below voltage level (DISCOM level) capacitor banks compensation to be adjusted in node-wise load P,Q values.

14) After deliberations, the transmission system proposed by RVPN for evacuation of 13255 MW of RE and 2400 MW power from thermal power plants in Kawai-Kalisindh-Chhabra Generation Complex was agreed subject to following:

(a) RVPN to follow the 'N-1' criteria for the ICTs at the substations with more than 1000 MW RE integration (including for BESS capacity) as recommended in the Manual on Transmission Planning Criteria

(b) RVPN to keep the provision of NGR bypass arrangement for all the proposed switchable line reactors

(c) RVPN to plan and implement adequate capacitor banks to improve the voltage profile and also keep space for at least 2 Nos. additional 5.43 MVAR capacitor banks at all the newly planned 220/132/33 kV substations

(d) RVPN to plan additional corridor for thermal generators in Kawai-Kalisindh-Chhabra Generation Complex in 2nd phase i.e. (2x800 MW U9 & U10 at Chhabra and 1x800 MW U4 at Kalisindh)

(e) RVPN to implement the OPGW on all the proposed lines in line with the "*CEA (Technical Standards for construction of Electric Plants and Electric Lines) Regulations, 2022*". In case of any doubt pertaining to routing of OPGW Fibers in cases of LILO, CEA's "*Comprehensive guidelines for the usage and sharing of fiber cores of Optical Ground Wire (OPGW)/ Under Ground Fiber Optic (UGFO) Cable for power system applications*" is to be referred.

(f) RVPN to plan the BESS with at least 4 hours of storage capacity

(g) RVPN to ensure that PSPs and BESS are implemented commensurate to the envisaged RE integration in the matching time frame in phased manner so that ISTS corridors are not overloaded.

(h) RVPN to plan additional system for the load of 6 GW in KBNIA in the matching timeframe of GEC scheme along with adequate reactive power support as well as dynamic reactive compensation.

(i) RVPN to implement the STATCOMs in two sections at each substation i.e. +/- 2x150 MVAR STATCOM capacity is to be preferred over +/- 1x300 MVAR from redundancy point of view. Similarly, for BESS, total capacity may be split into two sections for reliability and redundancy purpose.

(j) CTUIL to plan Nagaur (New) - Merta II (ISTS) 400 kV D/c line under ISTS. RVPN to provide space for 2 Nos 400 kV line bays at Nagaur (New) end.

I. <u>Transmission scheme for evacuation of 13255 MW RE power (Solar: 12255 MW, Wind: 1000 MW)</u>

(A) Jaisalmer:
Solar: 1800 MW, Wind: 1000 MW, BESS: 1000 MW

(i) Upgradation of 400 kV Kankani S/s to 765 kV level along with associated lines:

a) Upgradation of 400 kV Kankani S/s to 765 kV level with 2x1500 MVA 765/400 kV ICTs, 1x330 MVAR 765 kV bus reactor

b) Phagi- Kankani 765 kV D/c line (Hex Zebra equivalent AL-59 conductor) (300 km) with 330 MVAR switchable line reactors on each circuit at Kankani end and 240 MVAR switchable line reactors on each circuit at Phagi end

c) Construction of 02 Nos. 765 kV bays at Phagi for Phagi-Kankani 765 kV D/c line (Hex Zebra equivalent AL-59 conductor)

(ii) 765/400 kV Jaisalmer (Teliwara) S/s along with associated lines:

a) Jaisalmer (Teliwara) S/s with 3x1500 MVA 765/400 kV ICTs, 1x240 MVAR 765 kV bus reactor and 125 MVAR 420 kV bus reactor

b) Jaisalmer 2- Jaisalmer (Teliwara) 400 kV D/c line (Quad Moose) (70 km)

c) LILO of both circuits of Ramgarh-Akal 400 kV D/c line (Twin Moose) at Jaisalmer (Teliwara) [LILO length: 25 km]

d) Kankani- Jaisalmer (Teliwara) 765 kV D/c line (225 km) (Hex Zebra equivalent Al 59 conductor) with 240 MVAR switchable line reactors in each circuit at both Kankani end and Jaisalmer (Teliwara) end.

e) +/- 2x150 MVAR, 400 kV STATCOM at Jaisalmer (Teliwara)

f) Construction of 02 Nos. 765 kV bays at Kankani for Kankani-Jaisalmer (Teliwara) 765 kV D/c line (225 km) (Hex Zebra equivalent Al 59 conductor)

g) Construction of 02 Nos. 400 kV bays at Jaisalmer-2 for Jaisalmer 2- Jaisalmer (Teliwara) 400 kV D/c line (Quad Moose)

h) 5 Nos. 400 kV feeder bays for RE developers at Jaisalmer (Teliwara)

i) Future space provision at Jaisalmer (Teliwara) S/s for 3x1500 MVA 765/400 kV ICTs, 4 Nos 765 kV line bays, 6 Nos 400 kV line bays, 1 No 240 MVAR 765 kV Bus reactor, 1 No.+/- 300 MVAR, 400 kV STATCOM

(B) Bhadla:
Solar: 3000 MW, BESS: 1000 MW

(i) 765/400 kV Bhadla (Sultan Nagar)

a) Bhadla (Sultan Nagar) S/s with 3x1500 MVA 765/400 kV ICTs, 2x500 MVA 400/220 kV ICTs, 240 MVAR 765 kV bus reactor and 125 MVAR 420 kV bus reactor

b) Bhadla (Sultan Nagar) – Bikaner (Pugal) 765 kV D/c line (180 km) (Hex Zebra equivalent AL 59 conductor) with 240 MVAR switchable line reactors in each circuit at both Bhadla (Sultan Nagar) end and Bikaner (Pugal) end

c) LILO of Bhadla - Merta 400 kV S/c line (Twin Moose) at Bhadla (Sultan Nagar) with 1x50 MVAR, 420 kV switchable line reactor (existing line reactor to be shifted from Bhadla end of Bhadla - Merta 400 kV S/c line) at Bhadla (Sultan Nagar) end for Bhadla (Sultan Nagar) - Merta 400 kV S/c line (LILO length: 6 km)

d) LILO of Bhadla - Surpura (Jodhpur) 400 kV S/c line (Twin Moose) at Bhadla (Sultan Nagar) with 1x50 MVAR, 420 kV switchable line reactor (existing line reactor to be shifted from

Bhadla end of Bhadla - Surpura (Jodhpur) 400 kV S/c line) at Bhadla (Sultan Nagar) end for Bhadla (Sultan Nagar) - Surpura (Jodhpur) 400 kV S/c line (LILO length: 6 km)

j) 5 Nos. 400 kV feeder bays for RE developers at Bhadla (Sultan Nagar)

k) +/- 2x150 MVAR, 400 kV STATCOM at Bhadla (Sultan Nagar)

l) LILO of Bap-BLTPS line 220 kV S/c line (HTLS) at Bhadla (Sultan Nagar) (LILO length: 20 km)

m) Construction of 02 Nos. 765 kV bays at Bikaner (Pugal) for termination of Bhadla (Sultan Nagar)-Bikaner (Pugal) 765 kV D/c line (Hex Zebra equivalent AL 59 conductor)

n) Future space provision at Bhadla (Sultan Nagar) S/s for 3x1500 MVA 765/400 kV ICTs, 4x500 MVA 400/220 kV ICTs, 4 Nos 765 kV line bays, 6 Nos. 400 kV line bays, 08 Nos. 220 kV line bays, 1 No. 240 MVAR 765 kV bus reactor, 1 No.+/-300 MVAR 400 kV STATCOM

(ii) 765/400 kV Nagaur (New) S/s alongwith associated lines:

a) Nagaur (New) S/s with 2x1500 MVA 765/400 kV ICTs, 2x500 MVA 400/220 kV ICTs, 330 MVAR 765 kV bus reactor & 125 MVAR 420 kV bus reactor

b) Nagaur (New) - Bhadla (Sultan Nagar) 765 kV D/c line (175 km) (Hex Zebra) along with 330 MVAR, 765 kV switchable line reactor on each circuit at Nagaur end.

c) Nagaur (New) -Merta (RVPN) 400 kV S/c line (Quad Moose) (115 km) along with 50 MVAR switchable line reactor at Nagaur (New) end

d) Nagaur (New) - Deedwana (PPP) 400 kV D/c line (Twin Moose) (130 km) along with 50 MVAR, 420 kV switchable line reactor on each circuit at Nagaur (New) end

e) Birloka - Nagaur (New) 220 kV D/c line with HTLS conductor (25 km)

f) LILO of Nokha- Nagaur (220 kV GSS) 220 kV S/c line at Nagaur (New) (LILO length: 50 km)

g) Construction of 02 Nos. 765 kV bays at Bhadla (Sultan Nagar) for termination of Nagaur (New) - Bhadla (Sultan Nagar) 765 kV D/c line (175 km) (Hex Zebra)

h) Construction of 01 No. 400 kV bay at Merta (RVPN) for termination of Nagaur (New) -Merta (RVPN) 400 kV S/c line (Quad Moose)

i) Construction of 02 Nos. 400 kV bays at Deedwana (PPP) for termination of Nagaur (New) - Deedwana (PPP) 400 kV D/c line (Twin Moose)

j) Construction of 02 Nos. 220 kV bays at Birloka for termination of Birloka - Nagaur (New) 220 kV D/c line with HTLS conductor

k) Future space provision at Nagaur (New) S/s for 2x1500 MVA 765/400 kV ICTs, 3x500 MVA 400/220 kV ICTs, 4 Nos. 765 kV line bays, 6 Nos. 400 kV line bays, 08 Nos. 220 kV line bays, 1 No.+/-300 MVAR, 400 kV STATCOM

(C) Bikaner:

Solar: 5755 MW, BESS: 1500 MW

(i) 765/400 kV Bikaner (Pugal)

a) Bikaner (Pugal) S/s with 3x1500 MVA 765/400 kV ICTs, 2x500 MVA 400/220 kV ICTs, 330 MVAR 765 kV bus reactor, 125 MVAR 420 kV bus reactor

b) 1 No.+300/-200 MVAR, 400 kV Synchronous Condenser at Bikaner (Pugal) (with minimum SC MVA of 1200 MVA)

c) Babai (New) -Bikaner (Pugal) 765 kV D/c line (Hex Zebra AL-59) with 330 MVAR, 765 kV switchable line reactor on each circuit at each end (320 km)

d) Bikaner (Pugal) - Hanumangarh 400 kV D/c line (Twin Moose) along with 50 MVAR, 420 kV switchable line reactor on each circuit at Bikaner (Pugal) end (165 km)

e) LILO of both circuits of Suratgarh SCTPS- Bikaner 400 kV D/c line (Twin Moose) at Bikaner (Pugal) (LILO length: 48 km)

f) 5 Nos. 400 kV feeder bays for RE developers at Bikaner (Pugal)

g) Construction of 02 Nos. 765 kV bays at Babai (New) for termination of Babai (New) -Bikaner (Pugal) 765 kV D/c line (Hex Zebra AL-59)

h) Construction of 02 Nos. 400 kV bays at Hanumangarh for termination of Bikaner (Pugal) - Hanumangarh 400 kV D/c line (Twin Moose)

i) Future space provision at Bikaner (Pugal) S/s for 3x1500 MVA 765/400 kV ICTs, 4x500 MVA 400/220 kV ICTs, 4 Nos. 765 kV line bays, 6 Nos. 400 kV line bays, 8 Nos. 220 kV line bays, 1 No 330 MVAR 765 kV bus reactor, 1 No.+/-300 MVAR, 400 kV STATCOM

(ii) 765/400 kV Babai (New) S/s alongwith associated Lines:

a) Babai (New) S/s with 2x1500 MVA 765/400 kV ICTs, 2x500 MVA 400/220 kV ICTs, 330 MVAR 765 kV bus reactor, 125 MVAR 420 kV bus reactor

b) Babai (New) -Ajarka 765 kV D/c line (Hexa Zebra) (115 km) along with 240 MVAR, 765 kV switchable line reactor on each circuit at 765 Babai (New) end

c) Babai (New) - Babai (RVPN) 400 kV D/c line (10 km) (Quad Moose)

d) Babai (New) - Amber line 400 kV D/c line (Twin Moose) (120 km) along with 50 MVAR 420 kV switchable line reactor on each circuit at Amber end

e) Babai (New) -Beri Bhajangarh 220 kV D/c line (70 km)

f) LILO of Chirawa- Khetri 220 kV S/c line at Babai (New) (LILO length: 45 km)
g) Construction of 02 Nos. 765 kV bays at Ajarka for termination of Babai (New) -Ajarka 765 kV D/c line (Hexa Zebra)
h) Construction of 02 Nos. 400 kV bays at Babai (RVPN) for termination of Babai (New) - Babai (RVPN) 400 kV D/c line (Quad Moose)
i) Construction of 02 Nos. 400 kV bays at Amber (Jaipur-North) (RVPN) for termination of Babai (New) - Amber line 400 kV D/c line (Twin Moose)
j) Construction of 02 Nos. 220 kV bays at Beri Bhajangarh for termination of Babai (New) -Beri Bhajangarh 220 kV D/c line
l) Future space provision at Babai (New) S/s for 2x1500 MVA 765/400 kV ICTs, 4x500 MVA ICTs, 4 Nos. 765 kV line bay, 6 Nos. 400 kV line bays, 8 Nos. 220 kV line bays, 1 No.+/-300 MVAR 400 kV STATCOM

(iii) 400/220 kV Amber (Jaipur North) S/s along with associated lines:

a) Amber (Jaipur North) S/s with 2x500 MVA, 400/220 kV ICTs
b) LILO of circuit-I of Sikar (PG)-Bassi (PG) 400 kV D/c line at Amber (Twin Moose) (LILO length: 1 km)
c) LILO of circuit-II of Sikar (PG)-Bassi (PG) 400 kV D/c line at Amber (Twin Moose) (LILO length: 1 km)
d) LILO of Manoharpur-VKIA 220 kV S/c line at Amber (LILO Length: 0.5 km)
e) LILO of Manoharpur-Kukas 220 kV S/c line at Amber (LILO length: 0.5 km)
f) Future space provision at Amber (Jaipur North) S/s for 3x500 MVA 400/220 kV ICTs, 6 Nos. 400 kV line bays, 8 Nos. 220 kV line bays, 125 MVAR 420 kV bus reactor

(D) Dechu
Solar: 1000 MW, BESS: 500 MW

(i) 400/220 kV Dechu S/s along with associated lines:

a) Dechu S/s with 2x500 MVA 400/220 ICTs and 125 MVAR 420 kV bus reactor
b) +/-2x150 MVAR, 400 kV STATCOM at Dechu
c) LILO of Jodhpur- Akal 400 kV S/c line at Dechu (Twin Moose) (LILO length: 6 km)
d) Dechu- Kankani 400 kV D/c line (Quad Moose) (140 km) with 80 MVAR, 420 kV switchable line reactor on each circuit at Dechu end
e) LILO of Dechu- Amarsagar 220 kV S/c line at Dechu (LILO length: 6 km)
f) LILO of Dechu- Chandan 220 kV S/c line at Dechu (LILO length: 6 km)

g) Construction of 02 Nos. 400 kV bays at Kankani for termination of Dechu- Kankani 400 kV D/c line (Quad Moose)

h) Future space provision at Dechu S/s for 3x500 MVA 400/220 kV ICTs, 6 Nos. 400 kV line bays, 8 Nos. 220 kV line bays

(E) Karnu and Nokhra:
Solar: 300 MW, BESS: 100 MW (Nokhra)

(i) 220/132 kV Karnu S/s (Dist:- Nagaur) along with associated lines:

a) Karnu S/s with 1x160 MVA, 220/132 kV ICT and 1x50 MVA, 132/33 kV ICT

b) Karnu - Nokhra 220 kV D/c line (Zebra equivalent AL-59 conductor) (80 km)

c) Karnu - Khinvsar 220 kV D/c line (Zebra equivalent AL-59 conductor) (40 km)

d) Karnu - Datina 132 kV D/c line (15 km)

e) 01 No. of 33 kV, 5.43 MVAR Capacitor Bank at 220 Karnu S/s

f) Construction of 02 Nos. 220 kV bays at Nokhra for termination of Karnu - Nokhra 220 kV D/c line (Zebra equivalent AL-59 conductor)

g) Construction of 02 Nos. 220 kV bays at Khinvsar for termination of Karnu - Khinvsar 220 kV D/c line (Zebra equivalent AL-59 conductor)

h) Construction of 02 Nos. 132 kV bays at Datina for termination of Karnu-Datina 132 kV D/c line

i) Future space provision at Karnu S/s for 1x160 MVA 220/132 kV ICT, 1x50 MVA 132/33 kV ICT, 4 Nos. 220 kV line bays, 4 Nos. 132 kV line bays, 4 Nos. 33 kV line bays, 2 Nos 5.43 MVAR capacitor banks

(ii) 220/132 kV Nokhra S/s [Distt.- Bikaner] along with associated lines:

a) Nokhra S/s with 1x200 MVA, 220/132 kV ICT & 1x50 MVA, 132/33 kV ICT

b) LILO of circuit-I of Bikampur – Kolayat 220 kV D/c line (LILO length: 25 km)

c) LILO of circuit-II of Bikampur – Kolayat 220 kV D/c line (LILO length: 25 km)

d) Mandal -Nokhra 132 kV D/c line (17 km)

e) 01 No. of 33 kV, 5.43 MVAR Capacitor Bank at 220 kV Nokhra S/s

f) Construction of 02 Nos. 132 kV bays at Mandal for termination of Mandal -Nokhra 132 kV D/c line

j) Future space provision at Nokhra S/s for 1x160 MVA 220/132 kV ICT, 1x50 MVA 132/33 kV ICT, 4 Nos. 220 kV line bays, 4 Nos. 132 kV line bays, 4 Nos. 33 kV line bays, 2 Nos 5.43 MVAR capacitor banks

(F) Bhopa:
Solar: 200 MW, BESS: 200 MW

(i) **220/132 kV S/s at Bhopa (Distt.- Jaisalmer) along with associated lines:**

a) Bhopa S/s with 1x160 MVA, 220/132 kV ICT and 1x50 MVA, 132/33 kV ICT
b) Akal - Bhopa 220 kV D/c line (Total line length is 35 km out of which 5 km D/c approach section is already constructed at 400 kV Akal S/s and remaining 30 km line is to be constructed)
c) LILO of Jaisalmer- Sangarh 132 kV S/c line at Bhopa (LILO length: 25 km)
d) Bhopa-Pithla Fanta 132 kV D/c line (20 km)
e) 01 No. of 33 kV, 5.43 MVAR Capacitor Bank at Bhopa S/s
f) Construction of 02 Nos. 132 kV bays at Pithla Fanta for termination of Bhopa-Pithla Fanta 132 kV D/c line
k) Future space provision at Bhopa S/s for 1x160 MVA 220/132 kV ICT, 1x50 MVA 132/33 kV ICT, 4 Nos. 220 kV line bays, 6 Nos. 132 kV line bays, 4 Nos. 33 kV line bays, 2 Nos 5.43 MVAR capacitor banks

(G) Betina:
Solar: 200 MW, BESS: 100 MW

(i) 220/132 kV Betina S/s (Distt. Jaisalmer) along with associated lines:

a) Betina S/s with 1x160 MVA, 220/132 kV ICT and 1x50 MVA, 132/33 kV ICT
b) LILO of ckt-1 of Akal - Jaisalmer-II 220 kV D/c line at Betina (LILO length: 15 km)
c) LILO of ckt-2 of Akal - Jaisalmer-II 220 kV D/c line at Betina (LILO length: 15 km)
d) LILO of Sankra - Dangri 132 kV S/c line at Betina (LILO length: 9 km)
e) 01 No. 5.43 MVAR, 33 kV Capacitor Bank at Betina S/s
l) Future space provision at Betina S/s for 1x160 MVA 220/132 kV ICT, 1x50 MVA 132/33 kV ICT, 4 Nos. 220 kV line bays, 6 Nos. 132 kV line bays, 4 Nos. 33 kV line bays, 2 Nos 5.43 MVAR capacitor banks

II. <u>Transmission scheme for evacuation of 2400 MW power from thermal power plants in Kawai-Kalisindh-Chhabra Generation Complex</u> <u>(Chhabra TPS U7 & U8: 2x800 MW, Kalisindh TPS U3: 1x800 MW) (Transmission system to be implemented in the matching time frame of Thermal generators)</u>

(i) 765 /400 kV Anta-II S/s along with associated transmission lines:

a) Anta-II S/s with 3x1500 MVA 765/400 kV ICTs, 240 MVAR 765 kV bus reactor and 125 MVAR 420 kV bus reactor.

b) Anta-II-Hindaun 765 kV D/c line (Hex Zebra AL-59 conductor) (270 km) along with 240 MVAR, 765 kV switchable line reactor in each circuit at Anta end

c) Anta II-Anta (Existing) 765 kV D/c line (25 km) (Hex Zebra AL-59 conductor)

d) Supercritical Chhabra TPP (Unit#7&8) - Anta-II 400 kV D/c line using (Quad Moose) (79 km)

e) Kalisindh TPP (Unit#3) - Anta-II 400 kV D/c line (Quad Moose) (84 km)

f) Construction of 02 Nos. 765 kV bays at Anta (Existing) for termination of Anta II-Anta (Existing) 765 kV D/c line (Hexa Zebra AL-59)

g) Future space provision at Anta-II S/s for 3x1500 MVA 765/400 kV ICTs, 4 Nos. 765 kV line bays, 10 Nos. 400 kV line bays

h) **Scope of Work at Generator/RVUN's end:-**

- Construction of 02 Nos. 400 kV bays at switchyard of Chhabra Ultra SC TPP (Unit # 7&8) for Chhabra Ultra supercritical TPP (Unit#7&8)-Anta II 400 kV D/c line.
- Construction of 02 Nos. 400 kV bays at switchyard of Kalisindh Ultra SC TPP (Unit#3) for 400 kV D/C Kalisindh Ultra SC TPP (Unit#3) - Anta II 400 kV D/c line .
- 125 MVAR, 420 kV bus reactor at 400 kV switchyard of Chhabra Ultra SC TPP (Unit # 7&8)
- 125 MVAR, 420 kV bus reactor at 400 kV switchyard of Kalisindh Ultra SC TPP (Unit # 3)
- Chhabra SCTPS-Chhabra USC TPP (Unit # 7 & 8) 400 kV D/c interconnecting line (Quad Moose) (2 km)
- Kalisindh SCTPS-Kalisindh USC TPP (Unit # 3) 400 kV D/c interconnecting line (Quad Moose) (2 km)

(ii) 765/400 kV Hindaun S/s (Upgradation) along with associated transmission lines:

a) Upgradation of existing 400 kV Hindaun S/s to 765 kV GIS with 2x1500 MVA, 765/400 kV ICTs and 240 MVAR, 765 kV bus reactor

b) Construction of 02 Nos. 765 kV bays (GIS) including 2x240 MVAR, switchable line reactors at Hindaun end for termination of 765 kV D/C Anta-2-Hindaun line (Hexa Zebra AL-59).

c) Construction of 02 Nos. 765 kV bays (GIS) at Hindaun for termination of Ajarka (Alwar)-Hindaun 765 kV D/c line (Hexa Zebra)

(iii) 765/400 kV Ajarka (Alwar) S/s along with associated transmission lines:

a) Ajarka (Alwar) S/s with 3x1500 MVA 765/400 kV ICTs, 2x500 MVA 400/220 kV ICTs, 240 MVAR 765 kV bus reactor and 125 MVAR 420 kV bus reactor
b) Ajarka (Alwar) - Hindaun 765 kV D/c line (160 km) (Hex Zebra) with 2x240 MVAR 765 kV switchable line reactors at Ajarka end of line.
c) LILO of one circuit of Sikar-Aligarh 765 kV D/c line (Hex Zebra AL-59) at Ajarka (Alwar) (LILO length: 18 km)
d) Ajarka (Alwar) - Alwar (PPP) 400 kV D/c line (Twin Moose) (100 km)
e) LILO of Neemrana - Kotputli 220 kV S/c line at 765 kV Ajarka (Alwar) (LILO length: 20 km)
f) LILO of Neemrana-Behror 220 kV S/c line at 765 kV Ajarka (Alwar) (LILO length: 20 km)
g) Construction of 02 Nos. 400 kV bays at 400 kV Alwar (PPP) S/s for termination of Ajarka (Alwar) - Alwar (PPP) 400 kV D/c line (Twin Moose)
h) Future space provisions at Ajarka (Alwar) S/s for 3x1500 MVA 765/400 kV ICTs, 3x500 MVA 400/220 kV ICTs, 4 Nos. 765 kV line bays, 6 Nos. 400 kV line bays, +/-300 MVAR 400 kV Statcom, 8 Nos 220 kV line bays

(iv) 400/220 kV Kushkhera/Bhiwadi S/s along with associated transmission lines:

a) Kushkhera/Bhiwadi S/s with 2x500 MVA, 400/220 kV ICTs and 125 MVAR, 420 kV bus reactor
b) Ajarka - Kushkhera/Bhiwadi 400 kV D/c line (Quad Moose) (34 km)
c) LILO of both circuits of Neemrana (PG) - Bhiwadi (PG) 400 kV D/c line at Kushkhera/Bhiwadi (Twin Moose) (LILO length: 6 km)
d) LILO of Alwar-Karoli 220 kV S/c line at Kushkhera/Bhiwadi (LILO length: 5 km)
e) LILO of KG Bas-Kushkhera 220 kV S/c line at Kushkhera/Bhiwadi (LILO length: 5 km)
f) Construction of 02 Nos. 400 kV bays at Ajarka for termination of Ajarka - Kushkhera/Bhiwadi 400 kV D/c line (Quad Moose)
g) Future space provision at Kushkhera/Bhiwadi S/s for 3x500 MVA 400/220 kV ICTs, 4 Nos. 400 kV line bays, 8 Nos. 220 kV line bays

(v) 220/132 kV Chiruni/Mundawar S/s along with associated transmission lines:

a) Chiruni/ Mundawar S/s with 1x160 MVA, 220/132 kV ICT and 40/50 MVA, 132/33 kV ICT
b) Ajarka (765 kV) - Chiruni/Mundawar 220 kV D/c line (20 km)

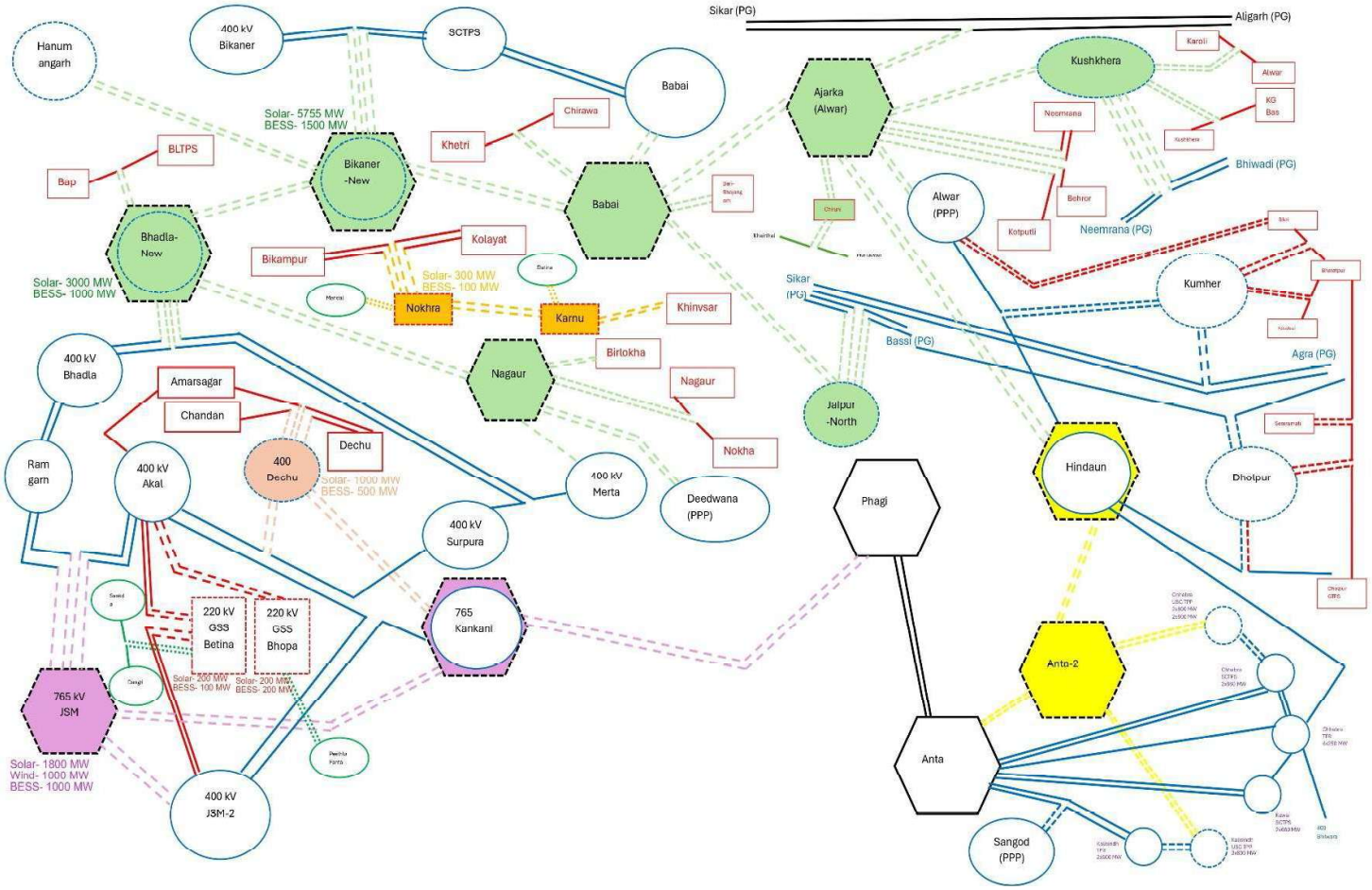
c) LILO of Khairthal - Mundawar 132 kV S/c line at Chiruni/Mundawar (LILO length: 16 km).

d) 01 No. 5.43 MVAR, 33 kV Capacitor Bank at Chiruni/Mundawar S/s

e) Construction of 02 Nos. 220 kV bays at Ajarka for termination of Ajarka (765 kV) - Chiruni/Mundawar 220 kV D/c line

f) Space provision at Chiruni/ Mundawar S/s for 1x160 MVA 220/132 kV ICT, 1x50 MVA 132/33 kV ICT, 4 Nos. 220 kV line bays, 6 Nos. 132 kV line bays, 10 Nos. 33 kV line bays, 2 Nos 5.43 MVAR capacitor banks

Schematic showing the above proposed transmission system is given below:



Meeting ended with thanks to the chair.

Annexure I

List of participants:

S.No.	Name (Smt/Shri/Ms)	Designation
CEA		
1	Ishan Sharan	Chief Engineer
2	Kavita Jha	Director
3	Nitin Deswal	Deputy Director
4	Kanhaiya Singh Kushwaha	Deputy Director
5	Komal Dupare	Deputy Director
CTUIL		
6	Sandeep Kumawat	DGM
7	Madhusudan Meena	Engineer
Grid - India		
8	Bikas Kumar Jha	DGM, NRLDC
9	Gaurav Malviya	Chief Manager, NRLDC
10	Ibtesam Asif	Deputy Manager, NRLDC
11	Prabhankar Porwal	Manager, NLDC
RVPN		
12	S.C. Meena	CE
13	Sona Shishodia	SE
14	Om Prakash Mahela	XEN
15	Lavkesh Jaga	AE
16	Upendra Nagar	AE

Annexure II

PSPs Projected in Rajasthan by 2032		
Sl. No.	**PSP Project Location**	**Capacity (MW)**
1	Pahad Kalan (Sirohi)	1000
2	Singli (Banswara)	1000
3	Rampura (Tonk)	800
4	Ghaghri (Pratapgarh)	580
5	Changla (Udaipur)	1050
	Total	**4430**

Annexure III

BESS planned by RVPN to be implemented by 2032		
Sl. No.	**Name of Substation**	**BESS (MW)**
1	400 kV GSS Surpura	125
2	400 kV GSS Heerapura (Jaipur)	125
3	220 kV GSS Sakatpura (Kota)	125
4	SCTPS (Suratgarh Super Critical TPS)	125
5	Giral LTPS	250
6	Ramgarh TPS	250
7	765 kV GSS Bikaner-New	1500
8	765 kV GSS Bhadla-New	1000
9	400 kV GSS Dechu	500
10	765 kV GSS Jaisalmer	1000
11	220 kV GSS Nokhra	100
12	220 kV GSS Bhikampur	200
13	220 kV GSS Kolayat	100
14	220 kV GSS Bhopa	200
15	220 kV GSS Betina	100
16	400 kV GSS Ramgarh	300
	Total (MW)	**6000**

Annexure IV

Additional load envisaged in Rajasthan			
S.No.	**Name of additional Load Pockets**	**Total Projected Load (MW)**	**Expected Load by 2032 (MW)**
1	Railway Data Center at Pali	30	30
2	JPMIA industrial at Pali	294	294
3	SEZ Kaparda	20	20
4	IOCL at Rohat	3.5	3.5
5	KBNIR	11856	5928
Total		**12203.5**	**6275.5**

Annexure V

LGBR of Rajasthan for the year 2032							
Source	**Installed capacity as on 31.03.2025 (GW)**	**Capacity addition during 2025-2032 (GW)**	**Total capacity by 2032 (GW)**	**% dispatch in winter**	**LGB in Winter (Jan-Feb) season**	**% dispatch in Monsoon**	**LGB in Monsoon (Jul-Aug) season**
Thermal	15	2.4	17.4	0.45	7.83	0.45	7.83
Nuclear	0.5		0.5	0.8	0.4	0.8	0.4
Hydro*	2		2	0.3	0.5	1	1.5
Wind	4.2	1.8	6	0.1	0.6	0.5	3.0
Solar#	6.2	21	27.2		26.0		26.0
ISGS allocation by 2025-32		1.25			0.8		1.0
				Total Generation (GW)	**36**		**39.7**
				Kusum [50% implementation]	**3.7**		**3.7**
				Total Generation (GW)	**39.7**		**43.4**
				Peak demand as per EPS (GW)	**28.0**		**26.0**
				Surplus	**11.7**		**17.4**
				BESS RVUN Bidded	1.0		1.0
				BESS SPP Policy	1.2		1.2
				PSP Resource adequacy	4.4		4.4
				BESS at Generation (Transmission Element) [20% (25%-5%)]	3.8		3.8
				Additional load	6.3		6.3
				Total BESS +PSP	**16.7**		**16.7**
				Net Surplus	**-5.0**		**0.7**

* 2 GW hydro capacity includes 0.5 GW hydro capacity under Intra-State in Rajasthan and 1.5 GW capacity tied-up from Central Sector generation plants. Dispatch factor has been applied only on capacity from Central Sector generation plants. Dispatch from hydro plants under Intra-State has been considered as 0 during solar hours as intimated by RVPN

In case of already commissioned solar plants of 6.2 GW capacity under Intra- State, dispatch has been considered at 80% and for 21 GW new solar plants to be added by 2032, dispatch has been considered at 100%.

Annexure VI

Stations having Fault current > 40kA in scenario-4 (i.e. June Solar Peak case)

S. No.	Bus Number	Bus Name	Voltage Level (kV)	Fault Level(MVA)	Fault Level(A)
1	164505	BIKANER-3	400	64014	92396
2	162495	BIKANER-2	220	28238	74106
3	164000	BIKANER-IV	400	49969	72124
4	164458	BIKANER-NW	400	49635	71642
5	164495	BIKANER-II	400	49538	71502
6	164256	RAMPURA TONK	400	48985	70704
7	164451	JAIPUR_RS	400	48985	70704
8	164431	BASSI	400	47403	68420
9	164445	NEEMR-PG	400	47057	67920
10	164921	BHIWADI	400	46858	67634
11	164481	FATEHG-3	400	45962	66341
12	164883	BARMER1_4	400	45487	65655
13	164459	BHADLA PG	400	44857	64746
14	162883	BARMER-I	220	24646	64680
15	164498	BHADLA-2	400	44761	64608
16	162211	HEERAPURA2	220	24284	63729
17	162484	BHADLA-3	220	23959	62877
18	163484	BHADLA3-SPL	220	23959	62877
19	167773	JAIPUR	765	81505	61512
20	164484	BHADLA-3	400	42412	61216
21	162330	BHIWADI	220	22951	60231
22	164404	BHADLA	400	41347	59679
23	164494	BHADLA-3 HVD	400	41144	59386
24	164885	BARMER-II HV	400	40863	58981
25	164480	FATEHG-2	400	40563	58547
26	162001	BIKANER-IV	220	22104	58007
27	167497	SIKAR NEW	765	76611	57819
28	167502	BEAWAR	765	76485	57723
29	164486	FATH4 SPL	400	39971	57694
30	164774	KHETRI	400	39931	57636
31	164080	NEEMR (NEW)	400	39914	57611
32	163482	FATEHG4-SPL	220	21734	57038
33	167999	DAUSA	765	75458	56949
34	167774	KHETRI	765	73587	55537
35	162505	BIKANER-3	220	21156	55520
36	164446	SIKAR	400	38205	55144
37	164888	ALWAR74	400	38175	55101
38	164427	BABAI	400	37968	54802
39	164003	BABAI74	400	37768	54514
40	164463	ANTA-4	400	36508	52695
41	164004	BHADLA-IV	400	35524	51274

42	164429	CHIT-NEW	400	35155	50741
43	162359	BHADLA-PG	220	19273	50578
44	167498	BHADLA-2	765	66626	50283
45	162307	MANSAROV	220	18991	49839
46	162498	BHADLA-2	220	18962	49762
47	162283	BASSI	220	18829	49412
48	162002	BIKANER-V	220	18700	49074
49	164489	BIKANR NEW S	400	33966	49026
50	162285	BHADLA-S	220	18668	48991
51	164001	BIKANER-V	400	33781	48759
52	164473	JAIPUR_PG	400	33676	48607
53	167417	AJMER-NW	765	64046	48336
54	162261	KTPS	220	18383	48243
55	162480	FATEH-2	220	18382	48240
56	164678	BHADLA-II ST	400	33331	48109
57	164406	HERAPU-4	400	33160	47862
58	162885	BARMER-II HV	220	18166	47675
59	162280	AKAL-2	220	18162	47663
60	163480	FATEH-SPL 2	220	18066	47410
61	162004	BHADLA-IV	220	17985	47199
62	162221	SAKATPUR	220	17956	47122
63	162208	RATANGAR	220	17871	46898
64	167494	RISHABDEO	765	61720	46581
65	167458	BIKANER-NW	765	61362	46311
66	164502	BEAWAR	400	32083	46307
67	162919	KOTA	220	17531	46007
68	164889	KHUSKHERA4	400	31811	45916
69	162110	JAISALMER220	220	17380	45610
70	164110	JAISALMER-2	400	31432	45368
71	162924	NEEMR-PG	220	17284	45358
72	167429	CHIT-NEW	765	59895	45203
73	164899	JAISALMR NEW	400	31232	45079
74	162316	RATANGAR	220	17124	44938
75	162481	FATEHG-3	220	17070	44797
76	164002	AMBER4	400	30920	44630
77	164999	DAUSA	400	30660	44254
78	164434	JODH KANKANI	400	30136	43497
79	167888	ALWAR7	765	56886	42933
80	164428	CHITTOR4	400	29215	42169
81	162986	KAROLI2	220	15826	41533
82	162229	KUSHKHER	220	15791	41440
83	162234	SANGANER	220	15741	41308
84	167505	BIKANER-3	765	54731	41306
85	164456	BIKANE-4	400	28277	40814
86	164419	RAPS_C4	400	28256	40784
87	162762	KHUSKHERA2	220	15520	40730
88	164401	AKAL-4	400	28124	40593

89	162522	AMBER42	220	15323	40214
90	167482	FATEHG-4	765	53143	40107

HPPTCL-PLG-009/1/2023-Planning Cell (Part-4) 2053-54

Annexure A4

H.P. POWER TRANSMISSION CORPORATION LIMITED
(A State Government Undertaking)
HIMFED Bhawan, Panjari, New ISBT Road
SHIMLA – 171005
CIN: U40101HP2008SGC030950

Dated: 26/05/2025

To

General Manager,
CTUIL,
16, Institutional Area,
Sector 32, Gurugram, Haryana 122001

Sub: Agenda for Approval of incidental ISTS system to allow strengthening of Transmission system in Baddi- Barotiwala-Nalagarh (BBN) Industrial area in Distt Solan of Himachal Pradesh in 38th Meeting of CMETS.

Sir,

The 38th CMETS meeting is scheduled to be held on 28.05.2025. HPPTCL agenda on subject cited above is enclosed alongwith with a request to include the agenda in 38th Meeting of CMETS for deliberations and approval please.

Yours faithfully,

Er. Manoj Kumar
GM (C&D)
HPPTCL, Shimla-05

Copy to-

1. Managing Director, HPPTCL, Shimla-05 (For information please).

GM (C&D)
HPPTCL, Shimla.

SUBJECT: Approval of incidental ISTS system to allow strengthening of Transmission system in Baddi- Barotiwala-Nalagarh (BBN) Industrial area in Distt Solan of Himachal Pradesh.

BACKGROUND:

The power supply in Baddi, Barotiwla and Nalagarh (BBN) industrial area is being catered through following system-

1. 400/220 kV,3X315 MVA Reru (Nalagarh) Substation of PGCIL. (Additonal 500 MVA Trasnformer Bank already under augmentation). Thus total Transformation capacity shall be 1445 MVA.
2. 220 kV D/C (Twin Zebra) line from Reru (Nalagarh) to 220/66 kV upperla Nagal Substation of HPSEBL.
3. 220 kV D/C (Twin Zebra) line from Upperla Nangal to Baddi /Mandhala

In addition, a 400 kV D/C line has been constructed by HPSEBL from Reru to Kunihar substation and is yet to be put to use. HPPTCL after consulation with HPSEBL and GoHP has decided to terimate this line at 220 kV level in both 400/220 kV Reru Substation and 220/132 kV Kunihar Substation. This shall ensure a ring of 220 kV Starting from 400/220 kV Reru Substation then connecting Kunihar, Baddi, Upperla Nangal and back to 400/220 kV Reru Substation. It will result in improvement in contingency and reliablility of entire system in the area. In order to terminate this line HPPTCL requires 2 No. of 220 kV bays at 400/220 kV Reru Substation under ISTS with CTs capable of handling current for ACSR Twin Moose Conductor.

Another important development in the area is upcoming Medical Devices Park

3. Upon confirmation of approval, HPPTCL shall convey timelines for construction of 4 No. 220 kV line bays and Uprating of 2 No. existing 220 kV line bays to CTUIL separately to ensure matching of upstream Interstate and downstream Intrastate system.

NLDC Observations on Transmission scheme for evacuation of power as part of Rajasthan REZ Ph-IV (Part-6 6GW) (Bikaner –V)- Scenario 7

1. Details of Proposed Scheme

Transmission system for evacuation of power from Rajasthan REZ Ph-IV (Part-6: 6 GW) (Bikaner Complex):

1. Establishment of 765/400 kV, 6x1500 MVA & 400/220 kV, 8x500 MVA Bikaner-V Pooling Station along with 2x240 MVAr (765kV) & 2x125 MVAr (420kV) Bus Reactors at a suitable location near Bikaner
2. LILO of one double ckt of 400kV Bikaner II PS- Khetri (Twin HTLS) 2xD/c line at Bikaner-V PS along with 80 MVAr switchable line reactor for each circuit at Bikaner-V PS end of 400KV Bikaner-V PS-Khetri D/c line (LILO length-45km) {400kV Bikaner-V-Bikaner-II section 44kM & 400kV Bikaner-V-Khetri section 272kM}
3. Establishment of 765/400 kV, 2x1500 MVA S/s at suitable location near Pallu (Distt. Hanumangarh) along with 2x240 MVAr (765kV) & 2x125 MVAr (420kV) Bus Reactors
4. 765 kV Bikaner-V PS – Pallu 2xD/c line (120 km)
5. LILO of both ckts of 765kV Bikaner – Moga D/c line at Pallu S/s along with 240MVAr switchable line reactor for each circuit at Pallu S/s end of 765kV Pallu-Moga D/c line (LILO length-50km) {765kV Pallu-Bikaner-V section 140kM & 765kV Pallu-Moga section 307kM}
6. 400 kV Pallu – Hanumangarh (RVPN) D/c (Quad Moose) line (80km)
7. Establishment of 765/400 kV, 3x1500 MVA S/s at suitable location near Panipat (Distt. Panipat) along with 2x240 MVAr (765kV) & 2x125 MVAr (420kV) Bus Reactors
8. 765 kV Pallu-Panipat 2xD/c line along with 240 MVAr switchable line reactor for each circuit at each end (280km)
9. Establishment of 400/220kV, 3x500 MVA S/s at suitable location near Mohali (Distt. Mohali district) along with 2x125 MVAr (420kV) Bus Reactors *
10. LILO of one circuit of 400kV Patiala-Panchkula D/c line at Mohali (LILO length-30km) {400kV Mohali-Patiala section 65kM & 400kV Mohali-Panchkula section 60kM}
11. 400 kV Panipat S/s – Mohali D/c (Quad Moose) line along with 80 MVAr (420kV) switchable line reactor for each circuit at Mohali end (155km)
12. 400 kV Panipat S/s – Mandola D/c (Quad Moose) line (75km)
13. Establishment of 765 kV S/s at suitable location near Bulandshahr (Distt. Bulandshahr) along with 2x330 MVAr (765kV) Bus Reactors
14. 765 kV Panipat- Bulandshahr 2xD/c line along with 330 MVAr switchable line reactor for each circuit at Bulandshahr end (150km)
15. LILO of 765kV Aligarh – Gr. Noida line at Bulandshahr S/s (LILO length-30km) {765kV Bulandshahr -Aligarh section 80kM & 765kV Bulandshahr – Gr. Noida section 51kM}
16. 765 kV Bulandshahr - Noida sec-148 (UPPTCL) D/c line (50km)
17. Establishment of 765/400 kV, 2x1500 MVA Lucknow-II S/s at suitable location near Lucknow along with 2x330 MVAr (765kV) & 2x125 MVAr (420kV) Bus Reactors
18. 765 kV Bulandshahr – Lucknow-II D/c line along with 330 MVAr switchable line reactor for each circuit at each end (350km)
19. 400 kV Lucknow-II – Gonda D/c (Quad Moose) line (160km)
20. Establishment of 765/400 kV, 2x1500 MVA S/s at suitable location near Asana Village (Chandauli District) along with 2x330 MVAr (765kV) & 2x125 MVAr (420kV) Bus Reactors

NLDC Observations on Transmission scheme for evacuation of power as part of Rajasthan REZ Ph-IV (Part-6 6GW) (Bikaner –V)- Scenario 7

21. 765 kV Lucknow-II-Asana D/c line along with 330 MVAr switchable line reactor for each circuit at each end (350km)
22. LILO of both ckts of 400kV Varanasi – Biharsharif D/c line at Asana S/s along with 80 MVAr switchable line reactor for each circuit at Asana end of 400kV Asana- Biharsharif section (LILO length-25km) {400kV Asana- Varanasi section 115kM & 400kV Asana- Biharsharif section 266 kM}
23. LILO of both ckts of 400kV Balia – Patna D/c line at Asana S/s along with 80 MVAr switchable line reactor for each circuit at Asana end of 400kV Patna-Asana D/c line (LILO length-100km) {400kV Asana-Balia section 145km & 400kV Asana-Patna section 250 km}

Proposed Intra state Transmission scheme implemented by UPPTCL

1. Upgradation of 400kV Noida sec-148 (UPPTCL) S/s at 765kV level by 765/400 kV, 2x1500 MVA ICTs & 1x240MVAr Bus reactor

2. Load Generation Balance

Scenario-7 (Feb Solar Peak)

- The comparison of LGB considered vis-a-vis 20th EPS report & region wise demand met is given below

S. No.	Region	Load	Gen.	IR Exchange (Import: +ve)	As per 20th EPS Peak Load in 2029-30 (MW)	Average Demand Met in Solar Hours in Feb 2025 (MW)	Peak Demand met during Solar Hours Feb 2025 (MW)
		(MW)	(MW)	(MW)			
1	NR	121294	177056	55762	116745	56675	69254
2	WR	114256	138319	24063	107050	73086	79999
3	SR	105890	90900	-14990	97440	61680	68568
4	ER	35840	16631	-19209	45752	20727	23451
5	NER	2957	2025	-932	5835	2142	2843
6	All India	382315	428024	-	334811	214318	238074
7	Rajasthan	44934	128593	83659	24520	16909	19352

- As per the 20th EPS, the projected demand for Rajasthan is around 25 GW. In the study file, ~45 GW has been considered. Rajasthan has met the peak demand of **~19 GW** in Feb 2025 during solar hrs. Therefore, the Rajasthan demand considered in the study file **(~45 GW)** should be reviewed and revised.
- Similarly, for the SR, the demand considered in the study is approximately 105 GW, whereas the actual peak demand met during solar hours in Feb 2025 was around 68 GW. It is therefore recommended that the demand for SR be reviewed and revised accordingly in the study file.

NLDC Observations on Transmission scheme for evacuation of power as part of Rajasthan REZ Ph-IV (Part-6 6GW) (Bikaner –V)- Scenario 7

- The NER demand has been considered as ~2.9 GW. However, the Peak demand met during the month of Feb 2025 was ~2.8 GW. As per 20th EPS, the projected peak demand for NER for the 2029-30-time frame is ~6 GW. This can be adjusted in the study file.
- A bulk load of 6.5 GW each has been considered at 400 kV Ramgarh-II and Bhadla-IV, presumably to account for future HVDC evacuations from these stations. However, as the HVDC systems from these locations are planned for implementation in 2030–31, while the current study pertains to the 2029–30 timeframe, it is suggested that the same may appropriately revised.
- Power factor of load to be revised according to practical values to get correct picture of any low voltage scenario.

State		Scen7	Scen7 p.f.
Punjab	P	18188	0.95
	Q	5307	
Rajasthan	P	29210	0.96
	Q	8237	
Haryana	P	17366	0.95
	Q	5048	
Uttar Pradesh	P	26535	0.95
	Q	9140	
Himachal Pradesh	P	1834	0.95
	Q	535	
Delhi	P	9496	0.96
	Q	2918	

As per Manual on Transmission planning criteria, 2023 clause 3.4.2.2 states that

Quote

"For developing an optimal ISTS, the STUs must clearly spell out the substation-wise maximum and minimum demand in MW and MVAr on seasonal basis. In the absence of MVAR data, the load power factor shall be taken as per Central Electricity Authority (Technical Standards for Connectivity to the Grid) Regulations, 2007 and its amendments or re- enactment thereof. The STUs shall provide adequate reactive compensation to bring power factor as close to unity at 132 kV and 220 kV voltage levels"

Unquote

Therefore, planning studies may be carried out as per CEA standards and should be considered on seasonal basis.

It is observed that the average load power factor is around 0.96. However, a standard value of 0.95 may be adopted uniformly**. At certain nodes, overly pessimistic power**

factor values have been used, which do not represent the actual voltage conditions and may lead to incorrect planning inferences.

3. Dispatch of Thermal Plants:

- The thermal generation of some of the plants has been backed down to very low levels or kept off during solar hours. The tech minimum level considered in the case may be mentioned, and the generators' dispatch should be considered per merit order.
- Swing bus generation may also be brought within limit though scaling of LGB.

Bus Number	Bus Name	Id	PGen (MW)	PMax (MW)	Despatch
444019	FARAKKA 400.00	T4	-322	500	-64%
444019	FARAKKA 400.00	T5	-322	500	-64%
444019	FARAKKA 400.00	T6	-322	500	-64%
444019	FARAKKA 400.00	T1	-129	200	-64%
444019	FARAKKA 400.00	T2	-129	200	-64%
444019	FARAKKA 400.00	T3	-129	200	-64%
162257	SURATGARH-42 220.00	T1	0	250	0%
162257	SURATGARH-42 220.00	T2	0	250	0%
412001	KANTI 220.00	T3	34	195	17%
412001	KANTI 220.00	T4	34	195	17%
362013	AMARKANTAK-2 220.00	T3	77	210	37%
362014	BIRSINGPUR42 220.00	T1	77	210	37%
362014	BIRSINGPUR42 220.00	T2	77	210	37%
362014	BIRSINGPUR42 220.00	T3	77	210	37%
362014	BIRSINGPUR42 220.00	T4	77	210	37%
421159	TUSURA 132.00	T1	15	40	38%
422020	IBTPS2 220.00	T1	81	210	38%
422020	IBTPS2 220.00	T2	81	210	38%
442023	BAKRESWAR 220.00	T3	81	210	38%
442023	BAKRESWAR 220.00	T4	81	210	38%
442023	BAKRESWAR 220.00	T5	81	210	38%
444023	BAKRASWR 400.00	T1	81	210	38%
444023	BAKRASWR 400.00	T2	81	210	38%
214051	BTPS-NTPC 400.00	T1	96	250	38%
214051	BTPS-NTPC 400.00	T2	96	250	38%
214051	BTPS-NTPC 400.00	T3	96	250	38%
414010	KAHALGAON-B 400.00	T1	192	500	38%
414010	KAHALGAON-B 400.00	T2	192	500	38%
414010	KAHALGAON-B 400.00	T3	192	500	38%
414020	NABINAGAR-I 400.00	T1	96	250	38%
414020	NABINAGAR-I 400.00	T2	96	250	38%
414020	NABINAGAR-I 400.00	T3	96	250	38%
414020	NABINAGAR-I 400.00	T4	96	250	38%
454001	DURGAPUR TPS 400.00	T1	192	500	38%
454001	DURGAPUR TPS 400.00	T2	192	500	38%
482003	CHNDRP TPS-B 220.00	T7	96	250	38%
482003	CHNDRP TPS-B 220.00	T8	96	250	38%
484002	BOKARO-A 400.00	T1	192	500	38%
428002	TALABIRA-NLC 765.00	T1	307	800	38%
428002	TALABIRA-NLC 765.00	T2	307	800	38%
428002	TALABIRA-NLC 765.00	T3	307	800	38%

NLDC Observations on Transmission scheme for evacuation of power as part of Rajasthan REZ Ph-IV (Part-6 6GW) (Bikaner –V)- Scenario 7

Bus Number	Bus Name	Id	PGen (MW)	PMax (MW)	Despatch
428072	DARLIPALLI 765.00	T1	307	800	38%
428072	DARLIPALLI 765.00	T2	307	800	38%
454012	WARIA-400 400.00	T1	307	800	38%
474051	PVUNL 400.00	T1	307	800	38%
474051	PVUNL 400.00	T2	307	800	38%
474051	PVUNL 400.00	T3	307	800	38%
414031	NABINAGAR-II 400.00	T1	253	660	38%
414031	NABINAGAR-II 400.00	T2	253	660	38%
414031	NABINAGAR-II 400.00	T3	253	660	38%
424027	VEDANTA 400.00	T4	230	600	38%
424200	OPGC-OD 400.00	T3	253	660	38%
444010	SAGARDIGHI_4 400.00	T5	253	660	38%
474050	NORTHKARNPRA 400.00	T1	253	660	38%
474050	NORTHKARNPRA 400.00	T2	253	660	38%
474050	NORTHKARNPRA 400.00	T3	253	660	38%
424029	GMR 400.00	T1	134	350	38%
424029	GMR 400.00	T2	134	350	38%
424035	IND-BHARATH 400.00	T1	134	350	38%
424035	IND-BHARATH 400.00	T2	134	350	38%
424205	GMR-OD 400.00	T3	134	350	38%
424027	VEDANTA 400.00	T1	0	0	0
424027	VEDANTA 400.00	T2	0	0	0
424027	VEDANTA 400.00	T3	0	0	0

Farakka is considered as slack bus.

- Some of the units are also kept in service with zero despatch. Only for reactive power support.
- The dispatch levels of certain thermal generators have been considered above 80% during solar hours. The list is provided below.

Bus Number	Bus Name	Id	PGen (MW)	PMax (MW)	Despatch
428000	ODISHA UMPP8 765.00	T1	765	800	96%
428000	ODISHA UMPP8 765.00	T2	765	800	96%
428000	ODISHA UMPP8 765.00	T3	765	800	96%
428001	OD-UMPP-SPLT 765.00	T4	765	800	96%
428001	OD-UMPP-SPLT 765.00	T5	765	800	96%
414095	PIRPAINTI 400.00	T1	600	660	91%
414095	PIRPAINTI 400.00	T2	600	660	91%
424028	LANCOBDN 400.00	T2	563	660	85%
424203	LANCO-OD 400.00	T1	563	660	85%
424026	MONNET 400.00	T1	446	525	85%
424026	MONNET 400.00	T2	446	525	85%
174468	ANPARA4 400.00	T4	425	500	85%
174468	ANPARA4 400.00	T5	425	500	85%
177405	ANPARAC 765.00	T1	510	600	85%
177405	ANPARAC 765.00	T2	510	600	85%
177406	ANPARA-D 765.00	T1	425	500	85%
177406	ANPARA-D 765.00	T2	425	500	85%
174468	ANPARA4 400.00	T1	178	210	85%
174468	ANPARA4 400.00	T2	178	210	85%
424129	NSL-ODISHA 400.00	T1	550	660	83%
424129	NSL-ODISHA 400.00	T2	550	660	83%

NLDC Observations on Transmission scheme for evacuation of power as part of Rajasthan REZ Ph-IV (Part-6 6GW) (Bikaner –V)- Scenario 7

As per NEP (Vol-2) Transmission, Despatch considered for Feb Afternoon peak scenario is as below

Regions	Coal	Gas	Nuclear	Hydro	PSP	Solar	Wind	Small Hydro	BESS
Northern	64%	0%	80%	30%	-110%	90%	10%	30%	-100%
Western	64%	0%	80%	20%	-110%	80%	5%	20%	-100%
Southern	64%	0%	80%	20%	-110%	80%	10%	20%	-100%
Eastern	64%	0%	80%	30%	-110%	80%	0%	30%	-100%
North Eastern	64%	0%	80%	30%	-110%	80%	0%	30%	-100%

➢ **Despatch of PSP considered in the study case**

- Low Despatch considered for PSPs in study case. The same may be revised

Bus Number	Bus Name	Id	PGen (MW)	PMax (MW)	% Despatch
354011	SSP4 400.00	P1	-1200	1450	-83%
194499	TEHRI4 400.00	P1	-150	250	-60%
194499	TEHRI4 400.00	P2	-150	250	-60%
194499	TEHRI4 400.00	P3	-150	250	-60%
194499	TEHRI4 400.00	P4	-150	250	-60%
1999	BHIRA-PSS 11.000	P1	-66	150	-44%
352038	KADANA HPS 220.00	P1	-27	60	-44%
352038	KADANA HPS 220.00	P2	-27	60	-44%
352038	KADANA HPS 220.00	P3	-27	60	-44%
352038	KADANA HPS 220.00	P4	-27	60	-44%
89	GHATGR-PSS 11.000	P1	-55	125	-44%
89	GHATGR-PSS 11.000	P2	-55	125	-44%
374899	MURBAD400 400.00	P1	-1150	4500	-26%

Ideally, the LGB shall be worked out through production cost modelling studies for the planning time-frame.

4. Angular separation, line/elements loading & Voltage issues

- Severe low voltage has been observed in study case. Low voltage nodes in Rajasthan (less than 0.9 pu) are listed in **Annexure – I.**
- Voltages at many important stations are on the lower side in steady state. The voltages will reduce further in case of N-1 contingency. Suitable reactive power compensation may be planned to keep the voltages within permissible limits in the steady state.
- In the study, certain elements are observed to be loaded beyond 100 % of its thermal limit. The list of such elements in Rajasthan is provided in **Annexure-II.**
- In the study, certain elements are observed to be loaded beyond N-1 safe limit. The list of such elements in Rajasthan is provided in **Annexure-III.** The thermal ratings for some transmission lines are not available in the study case and need to be incorporated for accurate analysis.

NLDC Observations on Transmission scheme for evacuation of power as part of Rajasthan REZ Ph-IV (Part-6 6GW) (Bikaner –V)- Scenario 7

- The angular separation between 400 kV Moga & Kishenpur exceeding 30 deg under N-0 and ~40 deg under N-1 contingency.
- The angular separation between 765 kV Fatehpur & Varanasi buses exceeding 20 deg under N-1 contingency.
- The angular separation between 400 kV Singrauli and 400 kV Lucknow exceeding 20 deg under N-0. Singrauli is a generating node.
- Angular separation and line loading between 765 kV Bikaner & 765 kV Khetri buses under contingency of 765 kV Bikaner-Khetri-D/c are (line length= 240 kM)

N-0	N-1	N-1-1
15 deg. 2350 MW	18 deg. 2900MW	23.2 deg. 0 MW

- Angular separation and line loading between 765 kV Pallu & 765 kV Moga buses under contingency of 765 kV Pallu-Moga-D/c are (line length= 307 kM)

N-0	N-1	N-1-1
13 deg. 1700 MW	18 deg. 2250 MW	28 deg. 0 MW

- Angular separation and line loading between 765 kV Pallu & 765 kV Panipat buses under contingency of 765 kV Pallu-Panipat-Q/c are (line length= 280 kM)

N-0	N-1	N-1-1
13 deg. 1800 MW	15 deg. 2150 MW	29 deg. 2650 MW

- The Manual on Transmission planning criteria 2023 clause no. 3.14.12 states that

  Quote

  " .... the lines for which the angular difference between its terminal buses is more than 20 degrees after contingency of one circuit may be selected for performing stability studies"

  Unquote

  Therefore, transient stability analysis may be carried out to ascertain the stability of the system.

NLDC Observations on Transmission scheme for evacuation of power as part of Rajasthan REZ Ph-IV (Part-6 6GW) (Bikaner –V)- Scenario 7

5. SCR of Pooling station

- In the base case shared, the SCR of a number of pooling stations have been observed less than 5 (Marked as Red)

Pooling Station	Total RE Injection in the Region (MW)	Direct RE Injection at POI (MW)	Voltage Level of POI (kV)	POI Fault MVA	SCR
Bikaner-V	6000	3500	220	16400	4.68
		2500	400	33800	5.63

- The fault current contribution from the incoming capacity has not been considered while evaluating the fault level of above pooling stations.
- The possibility of planning synchronous condensers and additional interconnections at these stations to improve the fault level needs to be explored.

6. Fault level of Bus

- Several stations are seen to have very high fault levels in the solar peak scenario case.
- Necessary network/bus arrangements need to be planned to limit the fault current in coming future.
- The list of those stations in Rajasthan is given below

Stations	Base kV	SC Current (in kA)
BIKANER-IV	400	72
RAMPURA TONK	400	71
Bassi	400	69
NEEMR-PG	400	69
JAIPUR_RS	400	71
BIKANER-NW	400	72
BHADLA PG	400	66
FATEHG-3	400	66
BIKANER-II	400	71
BHADLA-2	400	66
BIKANER-3	400	91
BARMER1_4	400	64
KHUSKHERA4	400	70
BHIWADI	400	70
BIKANER-NW	765	51
SIKAR NEW	765	58
BHADLA-2	765	52
BEAWAR	765	58
JAIPUR	765	62
DAUSA	765	57

NLDC Observations on Transmission scheme for evacuation of power as part of Rajasthan REZ Ph-IV (Part-6 6GW) (Bikaner –V)- Scenario 7

7. Dynamic Simulation Studies and Studies for Other Planning Scenarios

- Base case for only one scenario has been shared. For comprehensive planning the study needs to be conducted for all the 9 identified scenarios of planning.
    a. August Solar Max (Scenario-1)
    b. August Evening Peak (Scenario-2)
    c. August Night Off-peak (Scenario3)
    d. June Solar Max (Scenario-4)
    e. June Evening Peak (Scenario-5)
    f. June Night Off-peak (Scenario6)
    g. February Solar Max (Scenario-7)
    h. February Evening Peak (Scenario-8)
    i. February Night Off-peak (Scenario-9)
- Significant RE penetration is anticipated in the near future. The generation is also getting evacuated through large EHV lines. Therefore, dynamic simulation studies may be carried out to assess the stability of the planned system.
- Dynamic reactive compensation devices may also be planned at suitable locations to provide necessary reactive power support.

8. Other Major Comments

- STATCOMs mentioned in the planning note have not been modelled in the base case. The rating of all the STATCOMs needs to be confirmed.
- It is requested to assign unique name for envisaged RE pooling stations. As several pooling substations with identical names but different numerical suffixes have been planned in the same district along with multiple interconnections, there is a chance of miscommunication during real-time operation among multiple constituents. For clarity of operation and ensuring that names of different substations are easily distinguished from each other, it is suggested that after finalization of the exact location, the ISTS substations are uniquely named as per the geographical name of the nearest location like village or taluk.

  The issue has been highlighted in NCT meetings and several communications from GRID-INDIA to CEA/CTUIL.
- The following high-capacity HVDC links have been considered in service,
    - 6000 MW Bhadla – III – Fatehpur LCC HVDC
    - 6000 MW Barmer – II – Murbad LCC HVDC
    - 6000 MW KPS -II – Nagpur LCC HVDC
    - 2500 MW KPS-III – South Olpad VSC HVDC

CTUIL is requested to confirm the visibility and commissioning timeline of the above HVDC links to facilitate accurate planning of the proposed GEC-III transmission network.

NLDC Observations on Transmission scheme for evacuation of power as part of Rajasthan REZ Ph-IV (Part-6 6GW) (Bikaner –V)- Scenario 7

Annexure – 1

Bus Number	Bus Name	Base kV	V(PU)	V (kV)
161822	GHATOL	132	0.77	101
161327	KOTRA	132	0.77	101
161001	ABUROAD 1	132	0.77	102
161886	KUSHALGARH	132	0.77	102
161198	RIICO ABU RD	132	0.77	102
161933	SWAROPGANJ	132	0.78	103
161744	PALODA	132	0.78	103
161023	BAGIDRA	132	0.79	104
161907	CHORDI	132	0.79	104
161296	NEGADIYA	132	0.79	104
161934	SORDA	132	0.79	104
161930	POSALIYA	132	0.79	105
161790	REODAR	132	0.79	105
161145	PINDWARA	132	0.79	105
161131	SIROHI1	132	0.79	105
161779	RAMSEEN	132	0.79	105
161017	BADAGAON	132	0.80	105
161685	MAHI-II	132	0.80	105
161328	SANDERAO	132	0.80	105
161908	PEEPALWA	132	0.80	105
161873	UMAIDPUR	132	0.80	105
161326	JAWAL	132	0.80	106
161161	BANSWAR1	132	0.80	106
161160	MAHI-I	132	0.80	106
161085	DALOT	132	0.80	106
161853	SUMERPUR	132	0.80	106
161941	REODAR1	132	0.80	106
161932	DESURI	132	0.81	107
161931	BERA	132	0.81	107
161747	PARTAPUR	132	0.81	107
161166	BALI1	132	0.81	108
161178	FALNA	132	0.82	108
161781	RANI	132	0.82	108
161208	SUHAGPURA	132	0.82	108
161295	ARNOD	132	0.82	108
161605	JADOL1	132	0.82	108
161026	BAGRA1	132	0.82	109
161322	JASWANTPURA	132	0.83	109
161909	MOKHAMPURA	132	0.83	109
161188	GOGUNDA1	132	0.83	110
161905	CHITRI	132	0.84	111
161760	PRATAPGA	132	0.84	112
161798	SAGWARA1	132	0.84	112
161294	BARAWARDA	132	0.85	112
161906	SEEMALWARA	132	0.85	112
161929	AHORE	132	0.85	113
161611	JALORE1	132	0.85	113
161144	JALOR-21	132	0.86	113
161104	DHURIYAWA	132	0.86	113
161858	TAGOREN	132	0.86	113
161741	PADROO1	132	0.86	114
161082	CHOTISADAR	132	0.86	114

NLDC Observations on Transmission scheme for evacuation of power as part of Rajasthan REZ Ph-IV (Part-6 6GW) (Bikaner –V)- Scenario 7

Bus Number	Bus Name	Base kV	V(PU)	V (kV)
161168	DUNGRPR	132	0.86	114
161793	RISHDEO	132	0.86	114
161857	KHERWARA	132	0.86	114
161897	BICHIWARA	132	0.86	114
161305	DUNGARPUR21	132	0.87	115
161624	JUNAMEET	132	0.87	115
161914	KANERA	132	0.87	115
161324	BAKRA	132	0.87	115
161315	BAMBORI21	132	0.87	115
161887	BIJAIPUR	132	0.88	116
161019	BADISADAR	132	0.88	116
161694	MANDAWAL	132	0.88	116
161743	PALI1	132	0.88	116
161913	BAMBORA	132	0.88	116
161881	Z_MINES	132	0.88	116
161802	SAMDARI1	132	0.88	116
161014	ASPUR-21	132	0.88	116
161910	DHORIA	132	0.88	116
161915	RASOOLPUR	132	0.88	116
161758	POONSA	132	0.88	117
161924	JERAN	132	0.88	117
161306	SARADA	132	0.88	117
161714	MOKHMPUR	132	0.88	117
161127	NIMBHER1	132	0.88	117
161103	BHINMAL1	132	0.88	117
161782	RANIWARA	132	0.88	117
161055	BHADROONA	132	0.88	117
161475	SAILA	132	0.88	117
161633	KANKROL1	132	0.88	117
161207	KELWARA_U	132	0.89	117
161835	SISARMA1	132	0.89	117
161882	BAMANTUKDA	132	0.89	117
161833	SINDRA1	132	0.89	117
161811	SAPOL	132	0.89	117
161727	NATHDWAR	132	0.89	117
161089	DASPAN	132	0.89	117
161018	BADESAR1	132	0.89	117
161903	GHUMATI	132	0.89	117
161024	BAGORA1	132	0.89	117
161697	MANGLWAR	132	0.89	118
161838	SIWANA	132	0.89	118
161165	KANKR-21	132	0.89	118
161635	KAPASN	132	0.89	118
161005	AMET 1	32	0.89	118
161808	SANKAD1	132	0.89	118
161911	BALICHA	132	0.89	118
161801	SALUMBR1	132	0.89	118
161916	BHOPLSGR	132	0.89	118
161474	PPACHPADRA	132	0.89	118
161325	KHOKHA	132	0.89	118
161137	PALI-21	132	0.90	118
161410	KARWADA21	132	0.90	118
161321	LAKHNI21	132	0.90	118

NLDC Observations on Transmission scheme for evacuation of power as part of Rajasthan REZ Ph-IV (Part-6 6GW) (Bikaner –V)- Scenario 7

Bus Number	Bus Name	Base kV	V(PU)	V (kV)
161293	JHOOJHPURA	132	0.90	118
161320	LOONWAJAGIR	132	0.90	118
161647	KHARCHI	132	0.90	118
161616	JEEWANA	132	0.90	119
161329	VOPARI	132	0.90	119
161323	SAYLA1	132	0.90	119
161297	KARSANA21	132	0.90	119
161370	SALUMBER21	132	0.90	119
162341	REODAR2	220	0.81	179
162230	SIROHI	220	0.82	180
162880	DALOT	220	0.82	180
162899	SUMERPUR	220	0.82	181
162266	BALI	220	0.84	184
162245	PINDWARA	220	0.84	185
162799	PAHAD SIROHI	220	0.84	185
162907	SAGWARA2	220	0.85	187
162760	PRATAPGARH-W	220	0.86	188
162789	SINGLI_BANSW	220	0.86	189
162260	BANSWARA-W	220	0.86	189
162891	NATHDWARA2	220	0.86	190
162244	JALORE	220	0.86	190
162325	BAMANTUKDA	220	0.88	193
162896	BAMBORI2	220	0.88	194
162892	DUNGARPUR	220	0.89	195
162281	ASPUR	220	0.89	196
162798	HZL	220	0.89	197
162918	DARIBA2	220	0.90	197
162265	KANKR-RS	220	0.90	197
162819	SAYLA	220	0.90	197
162206	KANKR-PG	220	0.90	198

NLDC Observations on Transmission scheme for evacuation of power as part of Rajasthan REZ Ph-IV (Part-6 6GW) (Bikaner –V)- Scenario 7

Annexure-II

From Bus			To bus			Ckt ID	LOADING (in MW)	Thermal Limit (in MVA)	PERCENT Loading
162230	SIROHI	220	162244	JALORE	220.00*	1	642	229	280
162260	BANSWARA-W	220	162281	ASPUR	220.00*	1	534	229	233
162359	BHADLA-PG	220	162399	ESSEL	220.00*	1	376	220	171
162359	BHADLA-PG	220	162399	ESSEL	220.00*	2	376	220	171
162235	PALI	220	162334	JODHPURN-42	220	1	377	229	165
162262	BADISID-S	220	162285	BHADLA-S	220.00*	1	318	200	159
162242	BARSINGS	220	162256	BIKANE-2	220	1	355	229	155
162227	NIMBHERA	220	162318	SAWA	220	1	348	229	152
162228	CHITTOR-42	220	164428	CHITTOR4	400.00*	1	470	315	149
162228	CHITTOR-42	220	164428	CHITTOR4	400.00*	2	470	315	149
162206	KANKR-PG	220	164418	KANKROLI	400.00*	1	456	315	145
162206	KANKR-PG	220	164418	KANKROLI	400.00*	2	456	315	145
162206	KANKR-PG	220	164418	KANKROLI	400.00*	3	456	315	145
162206	KANKR-PG	220	164418	KANKROLI	400.00*	4	456	315	145
162245	PINDWARA	220	162266	BALI	220.00*	1	330	229	144
162250	KISHANGA	220	162329	AJMER42	220	H1	325	229	142
162282	BAP_2	220	162285	BHADLA-S	220.00*	2	311	229	136
162253	BIKANE-4	220	162254	SRIDUNGA	220	1	310	229	135
162914	BHINM-PG	220	164405	BHINMAL	400.00*	1	425	315	135
162914	BHINM-PG	220	164405	BHINMAL	400.00*	2	425	315	135
162914	BHINM-PG	220	164405	BHINMAL	400.00*	3	425	315	135
162264	BILARA	220	162299	JODHPU-4	220	H1	307	229	134
162228	CHITTOR-42	220	162760	PRATAPGARH-W	220.00*	1	259	200	129
161028	BHIKAMPUR	132	162028	BHIKAMPUR 2	20.00*	1	200	160	125
162231	BALOTRA	220	162244	JALORE	220.00*	1	285	229	125
162314	RAMGARH	220	162403	RAMGARH_RE	220	2	266	220	121
162220	DHOLPU GAS	220	162268	DHOLPU-2	220.00*	1	276	229	121
161047	BHADLA	132	162285	BHADLA-S	220.00*	1	190	160	119
162221	SAKATPUR	220	162261	KTPS	220	1	269	229	117
162221	SAKATPUR	220	162261	KTPS	220	2	269	229	117
162221	SAKATPUR	220	162261	KTPS	220	3	269	229	117
162221	SAKATPUR	220	162261	KTPS	220	4	269	229	117
162200	MERTA-42	220	162336	JETHANA	220	1	252	220	115
162227	NIMBHERA	220	162228	CHITTOR-42	220	1	252	220	115
162359	BHADLA-PG	220	162398	SOURYA	220.00*	1	252	220	114
162359	BHADLA-PG	220	162398	SOURYA	220.00*	2	252	220	114
162227	NIMBHERA	220	162760	PRATAPGARH-W	220.00*	1	227	200	114
162244	JALORE	220	162819	SAYLA	220	1	250	220	114
162300	KALISIND	220	164412	KALISI-4	400.00*	2	564	500	113
161941	REODAR1	132	162341	REODAR2	220.00*	1	180	160	112
161159	HANUMANG	132	162259	HANUMANG	220.00*	1	291	260	112
162259	HANUMANG	220	162990	HANUMAN	220	1	255	229	111
162240	BHOPALGA	220	162241	KHINVSAR	220.00*	1	248	229	108
162007	DAUSA	220	162283	BASSI	220.00*	1	245	233	105
162007	DAUSA	220	162283	BASSI	220.00*	2	245	233	105
162208	RATANGAR	220	162324	BADNU	220.00*	1	241	229	105
164256	RAMPURA TO	400	164451	JAIPUR_RS	400.00*	1	887	850	104
162232	MODAK	220	162249	JHALAWAR	220	1	238	229	104
162206	KANKR-PG	220	162265	KANKR-RS	220	1	237	229	103
162206	KANKR-PG	220	162265	KANKR-RS	220	2	237	229	103
162255	SIKAR-RS	220	162344	SIKAR-PG	220	1	235	229	103
162255	SIKAR-RS	220	162344	SIKAR-PG	220	2	235	229	103

NLDC Observations on Transmission scheme for evacuation of power as part of Rajasthan REZ Ph-IV (Part-6 6GW) (Bikaner –V)- Scenario 7

Annexure-III

From Bus			To bus			Ckt ID	LOADING (in MW)	Thermal Limit (in MVA)	PERCENT Loading
162093	DEEDWANA-42	220	164415	DEEDWANA	400	1	255.3	315	81
162093	DEEDWANA-42	220	164415	DEEDWANA	400	2	255.3	315	81
162359	BHADLA-PG	220	164459	BHADLA PG	400	1	470.3	500	94.1
162359	BHADLA-PG	220	164459	BHADLA PG	400	2	470.3	500	94.1
162359	BHADLA-PG	220	164459	BHADLA PG	400	3	470.3	500	94.1
162359	BHADLA-PG	220	164459	BHADLA PG	400	4	470.3	500	94.1
162359	BHADLA-PG	220	164459	BHADLA PG	400	5	470.3	500	94.1
162359	BHADLA-PG	220	164459	BHADLA PG	400	6	470.3	500	94.1
162485	SANGOD42 2	220	164485	SANGOD	400	1	351.5	500	70.3
162485	SANGOD42	220	164485	SANGOD	400	2	351.5	500	70.3
162919	KOTA	220	164420	KOTA	400	1	287.7	315	91.3
162919	KOTA	220	164420	KOTA	400	2	287.7	315	91.3
162990	HANUMAN	220	164511	HANUMAN	400	1	337.5	500	67.5
162990	HANUMAN	220	164511	HANUMAN	400	2	337.5	500	67.5
164404	BHADLA	400	164678	BHADLA-SU	400	T1	692.9	850	81.5
164404	BHADLA	400	164678	BHADLA-SU	400	T2	692.9	850	81.5
164409	HINDAU-4	400	164890	KUMHER4	400	T1	771.1	857	90
164427	BABAI	400	164445	NEEMR-PG	400	T1	634.2	857	74
164428	CHITTOR4	400	164429	CHIT-NEW	400	1	1272.2	1714	74.2
164428	CHITTOR4	400	164429	CHIT-NEW	400	2	1272.2	1714	74.2
164428	CHITTOR4	400	164601	UDAIPUR4	400	T1	798.5	857	93.2

Scenario-4

Rajasthan ES devices	Dispatch
PSPs	-4430 MW (100%)
Battery	-6500 MW (100%)

N-1 Cases not converging (voltage instability)	
SING OPN LIN 460 164410-164601(T1)	400kV Bhilwara Udaipur
SING OPN LIN 499 164428-164429(1) / (2)	400kV Chittorgarh-Chittorgarh New 1/2
SING OPN LIN 501 164428-164601(T1)	400kV Chittorgarh-Udaipur

400kV and above N-1 non compliance issues			
Monitored Element	Contingency	Rate	%
174406 NOIIDA-148 400.00 174995 NOIDA-SEC123400.00 T1	parallel ckt	857	152.44
174406 NOIIDA-148 400.00 174995 NOIDA-SEC123400.00 T2	parallel ckt	857	152.44
174058 ORAI 400.00 174964 GARAUTHA 400.00 1	parallel ckt	857	151.85
174058 ORAI 400.00 174964 GARAUTHA 400.00 2	parallel ckt	857	151.85
174258 ORAI 400.00 177258 ORAI 765.00 1	parallel ICT	1000	130.31
174258 ORAI 400.00 177258 ORAI 765.00 2	parallel ICT	1000	130.31
164409 HINDAU-4 400.00 164890 KUMHER4 400.00 T1	400kV Sikar-Kumher	857	123.83
134438 MOGA SPLT4 400.00 144417 1 FATEHABAD 400.00	400kV Bhiwani - Moga	857	121.51
174402 BARELI4 400.00 174410 BAREL-PG 400.00 1	parallel ckt	857	120.4
174402 BARELI4 400.00 174410 BAREL-PG 400.00 2	parallel ckt	857	120.4
174889 ROBERTGANJ 400.00 174890 GREENKO 400.00 1	Parallel ckt	1714	119.29
174889 ROBERTGANJ 400.00 174890 GREENKO 400.00 2	Parallel ckt	1714	119.29
174474 ALLAHABA 400.00 174479 VARANASI 400.00 1	765kV Meja-II - Mirzapur-II	857	115.78
134423 MOGA4 400.00 137703 MOGA-PG 765.00 1	parallel ICT	1500	112.68
134423 MOGA4 400.00 137703 MOGA-PG 765.00 2	parallel ICT	1500	112.68
144401 KHEDAR 400.00 144403 KIRORI 400.00 1	parallel ckt	857	108.24
144401 KHEDAR 400.00 144403 KIRORI 400.00 2	parallel ckt	857	108.24
174450 INDRPRM 400.00 174995 NOIDA-SEC123400.00 1	400kV Gaziabad-	857	107.17

	Noida Sec123		
174268 GAZIABAD 400.00 174995 1 NOIDA-SEC123400.00	400kV Indirapuram-Noida Sec123	857	107.17
174438 LUCK4-PG 400.00 174451 LUCK74-P 400.00 1	Parallel ckt	1714	106.76
174438 LUCK4-PG 400.00 174451 LUCK74-P 400.00 2	Parallel ckt	1714	106.76
134925 MALERKOTLA4 400.00 144483 KURUKSHETR 400.00 2	parallel ckt	857	106.04
174002 BAGPAT 400.00 174905 MEERUT 400.00 1	parallel ckt	857	102.45
174002 BAGPAT 400.00 174905 MEERUT 400.00 2	parallel ckt	857	102.45
164404 BHADLA 400.00 164678 T1 BHADLA-SULTA400.00	parallel ckt	857	102.01
164446 SIKAR 400.00 164456 BIKANE-4 400.00 T1	parallel ckt	857	101.83
164446 SIKAR 400.00 164456 BIKANE-4 400.00 T2	parallel ckt	857	101.83
174889 ROBERTGANJ 400.00 174891 AVAADA WATER400.00 1	Parallel ckt	1714	101.67
174889 ROBERTGANJ 400.00 174891 AVAADA WATER400.00 2	Parallel ckt	1714	101.67

Contingencies causing angular spread >20 deg in adjacent nodes

Adjacent Nodes Angular difference	Contingency	Angular difference
114422 KISHENPUR 400.00 134423 MOGA4 400.00 2	parallel ckt	27.4
114422 KISHENPUR 400.00 134423 MOGA4 400.00 1	parallel ckt	27.1
162260 BANSWARA-W 220.00 162281 ASPUR 220.00 1	400kV Kankroli - RAPPC	26.5
134438 MOGA SPLT4 400.00 144469 1 BHIWANI-PG 400.00	400kV Moga - Fatehabad	26.1
174437 LUCKN_UP 400.00 174923 SINGRL4 400.00 1	400kV Singrauli-Fatehpur	24.8
164495 BIKANER-II 400.00 164774 KHETRI 400.00 H1	parallel ckt	23.7
164495 BIKANER-II 400.00 164774 KHETRI 400.00 H2	parallel ckt	23.7
134438 MOGA SPLT4 400.00 144417 1 FATEHABAD 400.00	400kV Moga - Bhiwani	23.2
177000 VARNASI8 765.00 177990 FATEHPUR 765765.00 1	parallel ckt	22.5
177000 VARNASI8 765.00 177990 FATEHPUR 765765.00 2	parallel ckt	22.5
134484 PATRAN4 400.00 144880 SIWANI 400.00 Q1	parallel ckt	22.4
134484 PATRAN4 400.00 144880 SIWANI 400.00 Q2	parallel ckt	22.4
162230 SIROHI 220.00 162244 JALORE 220.00 1	400kV Kankroli - Jodhpur Surpura	21.9
167890 BIKNAER7 PUG765.00 167891 BABAI7 765.00 1	parallel ckt	20.9
167890 BIKNAER7 PUG765.00 167891 BABAI7 765.00 2	parallel ckt	20.9
164418 KANKROLI 400.00 164433 1 JODH SURPURA400.00	400kV Jaipur - Jodh Kankani	20.5
167080 NEEMR (NEW) 765.00 177806 BAREILLY 765.00 1	parallel ckt	20.3

167080 NEEMR (NEW) 765.00 177806 BAREILLY 765.00 2	parallel ckt	20.3

400kV and above elements running above thermal rating in basecase									
From bus			To bus			ckt no	Loading	Rating	% Rating
162228	CHITTOR-42	220	164428	CHITTOR4	400.00 *	1	437.8	315	139
162228	CHITTOR-42	220	164428	CHITTOR4	400.00 *	2	437.8	315	139
162914	BHINM-PG	220	164405	BHINMAL	400.00 *	1	409	315	129.8
162914	BHINM-PG	220	164405	BHINMAL	400.00 *	2	409	315	129.8
162914	BHINM-PG	220	164405	BHINMAL	400.00 *	3	409	315	129.8
162206	KANKR-PG	220	164418	KANKROLI	400.00 *	1	393.3	315	124.9
162206	KANKR-PG	220	164418	KANKROLI	400.00 *	2	393.3	315	124.9
162206	KANKR-PG	220	164418	KANKROLI	400.00 *	3	393.3	315	124.9
162206	KANKR-PG	220	164418	KANKROLI	400.00 *	4	624.3	500	124.9
134438	MOGA SPLT4	400	144417	FATEHABAD	400.00 *	1	983.2	857	114.7
171279	MEJAROAD	132	174000	MEJA	400.00 *	2	225.2	200	112.6
164409	HINDAU-4	400	164890	KUMHER4	400.00 *	T1	921.9	857	107.6

400kV and above BUSES WITH VOLTAGE LESS THAN 0.9700 (CEA TPC 2023 : 3.10.4)			
Bus number	Bus name	V(pu)	V(kV)
167891	BABAI7 765.00	0.967	739.71
164601	UDAIPUR4 400	0.923	369.15
144958	K-B-FSC3 400.00	0.950	379.89
144457	K-B-FSC2 400	0.950	379.89
164418	KANKROLI 400.00	0.951	380.3
154428	BAMNAULI4 400	0.953	381.08
154497	DWARKA 400	0.953	381.18
154495	TUGHLAKABAD 400	0.955	381.92
134898	MOHALI 400	0.955	381.94
154708	JHATIKARASP 400.00	0.956	382.44
154426	BAWANA-G 400	0.958	383.06
154427	BAWANA 400.00	0.958	383.1

184498	TIKRI KHURD 400.00	0.958	383.21
144443	SONEP-PG 400	0.959	383.49
154928	MAHARANIBAGH 400	0.959	383.6
154496	GOPAL PUR 400.00	0.959	383.73
144429	BALB_FSC 400.00	0.959	383.76
154487	MANDOLA SPLI400.00	0.960	383.86
134484	PATRAN4 400.00	0.961	384.18
144406	DEEPALPUR 400	0.961	384.31
174427	GORAK_UP 400.00	0.961	384.34
144434	BAHADURGARH 400	0.962	384.73
164888	ALWAR74 AJAR400.00	0.962	384.88
174415	MAINFSC2 400.00	0.962	384.92
174914	MAINFSC1 400	0.962	384.92
164428	CHITTOR4 400	0.963	385.05
144450	MANESAR 400.00	0.964	385.69
144904	KAITHAL 400	0.965	385.85
144005	QADARPUR 400	0.965	385.92
154501	NARELA ISTS 400.00	0.965	385.98
144006	SONAROAD 400.00	0.965	385.99
154702	HARSH VIHAR 400	0.965	386.12
164889	KHUSKHERA4 400	0.966	386.24
144410	NUHIYANWALI 400	0.966	386.45
164410	BHILWA-4 400	0.966	386.44
144866	BALLABGARHSP400.00	0.966	386.49
144417	FATEHABAD 400.00	0.966	386.53
164445	NEEMR-PG 400.00	0.968	387.15
144421	HISSAR 400	0.968	387.19
164407	ALWAR 400.00	0.968	387.29
174454	DADR-HVD 400.00	0.968	387.31
174424	DADR-NCR 400	0.969	387.41
154435	MANDOLA 400.00	0.969	387.45
154489	MANDOLASP3 400.00	0.969	387.45
154488	MANDOLASP2 400	0.969	387.45
154455	MUNDKA 400	0.969	387.65
144441	GURGAON 400.00	0.969	387.66
144480	JINDPG 400.00	0.969	387.75
134925	MALERKOTLA4 400.00	0.970	387.84
174450	INDRPRM 400	0.970	387.85
144483	KURUKSHETR 400	0.970	387.88
144407	KABULPUR 400.00	0.970	387.92

Scenario-5

Rajasthan ES devices	Dispatch
PSPs	+3987 MW (100%)
Battery	+6507 MW (100%)

N-1 non compliance issues			
Monitored Element	Contingency	Rate	%
174400 AGRAUP4 400.00 174922 AGRA 400.00 2	400kV Agra-Agra New	857	148.26
164889 KHUSKHERA4 400.00 164921 BHIWADI 400.00 T1	parallel ckt	857	144.15
164889 KHUSKHERA4 400.00 164921 BHIWADI 400.00 T2	parallel ckt	857	144.15
164409 HINDAU-4 400.00 164890 KUMHER4 400.00 T1	400kV Agra-Kumher4	857	124.93
174406 NOIIDA-148 400.00 174995 NOIDA-SEC123400.00 T1	parallel ckt	857	120.46
174406 NOIIDA-148 400.00 174995 NOIDA-SEC123400.00 T2	parallel ckt	857	120.46
124441 BILASPUR 400.00 134322 ROPAR4 400.00 TS	400kV Koldam-Ropar	857	118.44
174258 ORAI 400.00 174964 GARAUTHA 400.00 1	parallel ckt	857	114.88
174258 ORAI 400.00 174964 GARAUTHA 400.00 2	parallel ckt	857	114.88
174889 ROBERTGANJ 400.00 174890 GREENKO 400.00 1	parallel ckt	1714	109.1
174889 ROBERTGANJ 400.00 174890 GREENKO 400.00 2	parallel ckt	1714	109.1
134406 RAJPURA_TH4 400.00 134407 RAJPURA4 400.00 1	parallel ckt	857	103.94
134406 RAJPURA_TH4 400.00 134407 RAJPURA4 400.00 2	parallel ckt	857	103.94
174414 AGRANEW 400.00 174922 AGRA 400.00 2	400kV Agra-AgraUP4	857	103.59
164431 BASSI 400.00 164473 JAIPUR_PG 400.00 1	parallel ckt	857	101.59
164431 BASSI 400.00 164473 JAIPUR_PG 400.00 2	parallel ckt	857	101.59

Contingencies causing angular spread >20 deg in adjacent nodes		
174437 LUCKN_UP 400.00 174923 SINGRL4 400.00 1	400kV Singrauli-Fatehpur	25.233
164409 HINDAU-4 400.00 164411 CHABRA-4 400.00 T1	765kV Hindaun-Anta2	22.427
114447 SAMBA 400.00 114541 KISTAWAR 400.00 Q1	400kV Kishenpur-Kishtwar	20.72
174415 MAINFSC2 400.00 174465 FATEH-PG 400.00 1	765kV Bara-MainpuriUP	20.445

400kV and above elements running above thermal rating in basecase							
From bus		To bus		ckt no	Loading	Rating	% Rating
174400	AGRAUP4 400.00	174922	AGRA 400.00*	2	1029.5	857	120.1

400kV and above BUSES WITH VOLTAGE LESS THAN 0.9700 (CEA TPC 2023 : 3.10.4)			
Bus number	**Bus name**	**V(pu)**	**V(kV)**
174404	UNNAFSC2 400	0.948	379.19
174403	UNNAFSC1 400	0.948	379.19
174427	GORAK_UP 400	0.958	383.19
154495	TUGHLAKABAD 400	0.964	385.75
154428	BAMNAULI4 400	0.966	386.52
154497	DWARKA 400	0.967	386.77
174450	INDRPRM 400	0.967	386.87
164004	BHADLA-IV 400	0.968	387.17
174446	MURADNG4 400	0.969	387.39
174268	GAZIABAD 400	0.969	387.52
174482	AZAMGAR4 400	0.970	387.98

Scenario-9

Rajasthan ES devices	Dispatch
PSPs	+3987 MW (100%)
Battery	**+2139 MW (32%)**

*Many BM plants have been considered as Battery in Scenario 9 ?

400kV and above N-1 non compliance issues			
Monitored Element	Contingency	Rate	%
164889 KHUSKHERA4 400.00 164921 BHIWADI 400.00 T1	parallel ckt	857	192.84
164889 KHUSKHERA4 400.00 164921 BHIWADI 400.00 T2	parallel ckt	857	192.84
174438 LUCK4-PG 400.00 174720 SULTANPUR RD400.00 T1	765kV Bara-Meja-II	857	148.71
144404 JHAJAR_N 400.00 144408 DHANONDA 400.00 1	parallel ckt	857	104.45
144404 JHAJAR_N 400.00 144408 DHANONDA 400.00 2	parallel ckt	857	104.45
174420 ALIGARH-PG 400.00 174491 KHURJA TPS 400.00 1	parallel ckt	857	101.94
174420 ALIGARH-PG 400.00 174491 KHURJA TPS 400.00 2	parallel ckt	857	101.94

Contingencies causing angular spread >20 deg in adjacent nodes		
174437 LUCKN_UP 400.00 174923 SINGRL4 400.00 1	400kV Singrauli-Fatehpur	20.91

400kV and above elements running above thermal rating in basecase							
From bus		To bus		ckt no	Loading	Rating	% Rating
164889	KHUSKHERA400	164921	BHIWADI400	T1	986.2	857	115.1
164889	KHUSKHERA400	164921	BHIWADI400	T2	986.2	857	115.1

General comments

Rajasthan informed, during the recently concluded 55th TCC and 80th NRPC meeting, that their existing **400 kV twin moose transmission lines are designed for a maximum conductor temperature of 75°C**. As a result, these lines **cannot reliably carry more than 660 MW** on a continuous basis. This limitation must be duly considered in all future base cases and incorporated into system studies accordingly.

NLDC Observations on Transmission scheme for evacuation of power as part of Rajasthan REZ Ph-IV (Part-6 6GW) (Bikaner –V)- Scenario 8

1. Details of Proposed Scheme

Transmission system for evacuation of power from Rajasthan REZ Ph-IV (Part-6: 6 GW) (Bikaner Complex):

1. Establishment of 765/400 kV, 6x1500 MVA & 400/220 kV, 8x500 MVA Bikaner-V Pooling Station along with 2x240 MVAr (765kV) & 2x125 MVAr (420kV) Bus Reactors at a suitable location near Bikaner
2. LILO of one double ckt of 400kV Bikaner II PS- Khetri (Twin HTLS) 2xD/c line at Bikaner-V PS along with 80 MVAr switchable line reactor for each circuit at Bikaner-V PS end of 400KV Bikaner-V PS-Khetri D/c line (LILO length-45km) {400kV Bikaner-V-Bikaner-II section 44kM & 400kV Bikaner-V-Khetri section 272kM}
3. Establishment of 765/400 kV, 2x1500 MVA S/s at suitable location near Pallu (Distt. Hanumangarh) along with 2x240 MVAr (765kV) & 2x125 MVAr (420kV) Bus Reactors
4. 765 kV Bikaner-V PS – Pallu 2xD/c line (120 km)
5. LILO of both ckts of 765kV Bikaner – Moga D/c line at Pallu S/s along with 240MVAr switchable line reactor for each circuit at Pallu S/s end of 765kV Pallu-Moga D/c line (LILO length-50km) {765kV Pallu-Bikaner-V section 140kM & 765kV Pallu-Moga section 307kM}
6. 400 kV Pallu – Hanumangarh (RVPN) D/c (Quad Moose) line (80km)
7. Establishment of 765/400 kV, 3x1500 MVA S/s at suitable location near Panipat (Distt. Panipat) along with 2x240 MVAr (765kV) & 2x125 MVAr (420kV) Bus Reactors
8. 765 kV Pallu-Panipat 2xD/c line along with 240 MVAr switchable line reactor for each circuit at each end (280km)
9. Establishment of 400/220kV, 3x500 MVA S/s at suitable location near Mohali (Distt. Mohali district) along with 2x125 MVAr (420kV) Bus Reactors *
10. LILO of one circuit of 400kV Patiala-Panchkula D/c line at Mohali (LILO length-30km) {400kV Mohali-Patiala section 65kM & 400kV Mohali-Panchkula section 60kM}
11. 400 kV Panipat S/s – Mohali D/c (Quad Moose) line along with 80 MVAr (420kV) switchable line reactor for each circuit at Mohali end (155km)
12. 400 kV Panipat S/s – Mandola D/c (Quad Moose) line (75km)
13. Establishment of 765 kV S/s at suitable location near Bulandshahr (Distt. Bulandshahr) along with 2x330 MVAr (765kV) Bus Reactors
14. 765 kV Panipat- Bulandshahr 2xD/c line along with 330 MVAr switchable line reactor for each circuit at Bulandshahr end (150km)
15. LILO of 765kV Aligarh – Gr. Noida line at Bulandshahr S/s (LILO length-30km) {765kV Bulandshahr -Aligarh section 80kM & 765kV Bulandshahr – Gr. Noida section 51kM}
16. 765 kV Bulandshahr - Noida sec-148 (UPPTCL) D/c line (50km)
17. Establishment of 765/400 kV, 2x1500 MVA Lucknow-II S/s at suitable location near Lucknow along with 2x330 MVAr (765kV) & 2x125 MVAr (420kV) Bus Reactors
18. 765 kV Bulandshahr – Lucknow-II D/c line along with 330 MVAr switchable line reactor for each circuit at each end (350km)
19. 400 kV Lucknow-II – Gonda D/c (Quad Moose) line (160km)
20. Establishment of 765/400 kV, 2x1500 MVA S/s at suitable location near Asana Village (Chandauli District) along with 2x330 MVAr (765kV) & 2x125 MVAr (420kV) Bus Reactors

NLDC Observations on Transmission scheme for evacuation of power as part of Rajasthan REZ Ph-IV (Part-6 6GW) (Bikaner –V)- Scenario 8

21. 765 kV Lucknow-II-Asana D/c line along with 330 MVAr switchable line reactor for each circuit at each end (350km)
22. LILO of both ckts of 400kV Varanasi – Biharsharif D/c line at Asana S/s along with 80 MVAr switchable line reactor for each circuit at Asana end of 400kV Asana- Biharsharif section (LILO length-25km) {400kV Asana- Varanasi section 115kM & 400kV Asana- Biharsharif section 266 kM}
23. LILO of both ckts of 400kV Balia – Patna D/c line at Asana S/s along with 80 MVAr switchable line reactor for each circuit at Asana end of 400kV Patna-Asana D/c line (LILO length-100km) {400kV Asana-Balia section 145km & 400kV Asana-Patna section 250 km}

Proposed Intra state Transmission scheme implemented by UPPTCL

1. Upgradation of 400kV Noida sec-148 (UPPTCL) S/s at 765kV level by 765/400 kV, 2x1500 MVA ICTs & 1x240MVAr Bus reactor

2. Load Generation Balance

Scenario-8 (Feb Evening Peak)

- The comparison of LGB considered vis-a-vis 20th EPS report & region wise demand met is given below

S. No.	Region	Load	Gen.	IR Exchange (Import: +ve)	As per 20th EPS Peak Load in 2029-30 (MW)	Average Demand Met in Evening Hours in Feb 2025 (MW)	Peak Demand met during Evening Hours Feb 2025 (MW)
		(MW)	(MW)	(MW)			
1	NR	101397	77198	-24199	116745	51157	61022
2	WR	101282	131188	29906	107050	64460	72133
3	SR	115410	105931	-9479	97440	48645	55503
4	ER	38289	46827	8538	45752	21315	24245
5	NER	4356	4306	-50	5835	2362	2862
6	All India	362722	372038	X	334811	188040	209077
7	Rajasthan	31680	21986	9694	24520	12897	15614

- As per the 20th EPS, the projected demand for Rajasthan is around 25 GW. In the study file, ~32 GW has been considered. Rajasthan has met the peak demand of **~15 GW** in Feb 2025 during Evening hrs. Therefore, the Rajasthan demand considered in the study file **(~32 GW)** should be reviewed and revised.
- Similarly, for the SR, the demand considered in the study is approximately 115 GW, whereas the actual peak demand met during evening hours in Feb 2025 was around 55 GW. It is therefore recommended that the demand for SR be reviewed and revised accordingly in the study file.

NLDC Observations on Transmission scheme for evacuation of power as part of Rajasthan REZ Ph-IV (Part-6 6GW) (Bikaner –V)- Scenario 8

- Power factor of load to be revised according to practical values to get correct picture of any low voltage scenario.

State		Scen7	Scen7 p.f.
Punjab	P	18188	0.98
	Q	5307	
Rajasthan	P	29210	0.97
	Q	8237	
Haryana	P	17366	0.99
	Q	5048	
Uttar Pradesh	P	26535	0.99
	Q	9140	
Himachal Pradesh	P	1834	0.96
	Q	535	
Delhi	P	9496	0.98
	Q	2918	

As per Manual on Transmission planning criteria, 2023 clause 3.4.2.2 states that

Quote

"For developing an optimal ISTS, the STUs must clearly spell out the substation-wise maximum and minimum demand in MW and MVAr on seasonal basis. In the absence of MVAR data, the load power factor shall be taken as per Central Electricity Authority (Technical Standards for Connectivity to the Grid) Regulations, 2007 and its amendments or re- enactment thereof. The STUs shall provide adequate reactive compensation to bring power factor as close to unity at 132 kV and 220 kV voltage levels"

Unquote

Therefore, planning studies may be carried out as per CEA standards and should be considered on seasonal basis.

It is observed that the average load power factor is around 0.98. However, a standard value of 0.95 may be adopted uniformly**. At certain nodes, overly pessimistic power factor values have been used, which do not represent the actual voltage conditions and may lead to incorrect planning inferences.**

3. **Dispatch of Thermal Plants:**

- The thermal generation of some of the plants has been backed down to very low levels or kept off during evening hours. The tech minimum level considered in the case may be mentioned, and the generators' dispatch should be considered per merit order.
- Swing bus generation may also be brought within limit though scaling of LGB.

NLDC Observations on Transmission scheme for evacuation of power as part of Rajasthan REZ Ph-IV (Part-6 6GW) (Bikaner –V)- Scenario 8

Bus Number	Bus Name	Id	PGen (MW)	PMax (MW)	despatch
154426	BAWANA-G 400.00	T2	0	253	0.0%
162257	SURATGARH-42 220.00	T1	0	250	0.0%
162257	SURATGARH-42 220.00	T2	0	250	0.0%
444019	FARAKKA 400.00	T1	17	200	8.5%
444019	FARAKKA 400.00	T2	17	200	8.5%
444019	FARAKKA 400.00	T3	17	200	8.5%
444019	FARAKKA 400.00	T4	42	500	8.5%
444019	FARAKKA 400.00	T5	42	500	8.5%
444019	FARAKKA 400.00	T6	42	500	8.5%
214051	BTPS-NTPC 400.00	T1	99	250	39.6%
214051	BTPS-NTPC 400.00	T2	99	250	39.6%
214051	BTPS-NTPC 400.00	T3	99	250	39.6%

As per NEP (Vol-2) Transmission, Despatch considered for Feb Evening peak scenario is as below

Regions	Coal	Gas	Nuclear	Hydro	PSP	Solar	Wind	Small Hydro	BESS
Northern	80%	40%	80%	60%	90%	0%	35%	60%	66%
Western	80%	40%	80%	40%	90%	0%	25%	40%	66%
Southern	80%	40%	80%	40%	90%	0%	30%	40%	66%
Eastern	80%	40%	80%	60%	90%	0%	0%	60%	66%
North Eastern	80%	40%	80%	60%	90%	0%	0%	60%	66%

- **Despatch of PSP considered in the study case**
  - Low Despatch considered for PSPs in study case. The same may be revised

Bus Number	Bus Name	Id	PGen (MW)	PMax (MW)	despatch
174891	AVAADA WATER 400.00	P1	450	900	50.0%
174891	AVAADA WATER 400.00	P2	260	520	50.0%
174890	GREENKO 400.00	P1	360	610	59.0%
174890	GREENKO 400.00	P2	360	610	59.0%
174890	GREENKO 400.00	P3	360	610	59.0%
174998	PIPRI 400.00	P1	480	810	59.3%
162132	CHANGLA UDAI 220.00	P1	567	945	60.0%
162789	SINGLI_BANSW 220.00	P1	540	900	60.0%
162799	PAHAD SIROHI 220.00	P1	540	900	60.0%
164256	RAMPURA TONK 400.00	P1	432	720	60.0%
162946	GHAGHRI PRTG 220.00	P1	314	522	60.2%
174730	ROBERTSGANJ 400.00	P1	1000	1350	74.1%

Ideally, the LGB shall be worked out through production cost modelling studies for the planning time-frame.

NLDC Observations on Transmission scheme for evacuation of power as part of Rajasthan REZ Ph-IV (Part-6 6GW) (Bikaner –V)- Scenario 8

4. Angular separation, line/elements loading & Voltage issues

- No severe low voltage has been observed in study case. Low voltage nodes in Rajasthan (less than 0.95 pu) are listed in **Annexure – I.**
- Suitable reactive power compensation may be planned to keep the voltages within permissible limits in the steady state.
- In the study, certain elements are observed to be loaded beyond 100 % of its thermal limit. The list of such elements in Rajasthan is provided in **Annexure-II.**
- In the study, certain elements are observed to be loaded beyond N-1 safe limit. The list of such elements in Rajasthan is provided in **Annexure-III.** The thermal ratings for some transmission lines are not available in the study case and need to be incorporated for accurate analysis.
- The angular separation between 400 kV Singrauli and 400 kV Lucknow exceeding 20 deg under N-0. Singrauli is a generating node.
- The Manual on Transmission planning criteria 2023 clause no. 3.14.12 states that

  Quote

  " .... the lines for which the angular difference between its terminal buses is more than 20 degrees after contingency of one circuit may be selected for performing stability studies"

  Unquote

  Therefore, transient stability analysis may be carried out to ascertain the stability of the system.

5. Fault level of Bus

- Several stations are seen to have very high fault levels in the Evening peak scenario case.
- Necessary network/bus arrangements need to be planned to limit the fault current in coming future.
- The list of those stations in Rajasthan is given below

Stations	Base kV	SC Current (in kA)
	400	
RAMPURA TONK	400	68
Bassi	400	66
NEEMR-PG	400	66
JAIPUR_RS	400	68
BIKANER-3	400	66
KHUSKHERA4	400	67
BHIWADI	400	67
SIKAR NEW	765	51

NLDC Observations on Transmission scheme for evacuation of power as part of Rajasthan REZ Ph-IV (Part-6 6GW) (Bikaner –V)- Scenario 8

Stations	Base kV	SC Current (in kA)
Beawar	765	51
Jaipur	765	58
Dausa	765	53

6. Dynamic Simulation Studies and Studies for Other Planning Scenarios

- Base case for only one scenario has been shared. For comprehensive planning the study needs to be conducted for all the 9 identified scenarios of planning.
    a. August Solar Max (Scenario-1)
    b. August Evening Peak (Scenario-2)
    c. August Night Off-peak (Scenario3)
    d. June Solar Max (Scenario-4)
    e. June Evening Peak (Scenario-5)
    f. June Night Off-peak (Scenario6)
    g. February Solar Max (Scenario-7)
    h. February Evening Peak (Scenario-8)
    i. February Night Off-peak (Scenario-9)

- Dynamic reactive compensation devices may also be planned at suitable locations to provide necessary reactive power support.

NLDC Observations on Transmission scheme for evacuation of power as part of Rajasthan REZ Ph-IV (Part-6 6GW) (Bikaner –V)- Scenario 8

Annexure-I

Bus Number	Bus Name	Base kV	V(PU)	V (kV)
161202	PEEPLU1	132	0.930	123
161688	MALPURA1	132	0.938	124
161639	KEKRI	132	0.941	124
161060	BHIWADI1	132	0.942	124
161080	CHOPANKI	132	0.943	125
161205	ARAIN_1	132	0.944	125
161440	SARWAR	132	0.944	125
161432	GANGDHAR	132	0.946	125
161657	SAWAR	132	0.948	125
161645	KHANDAR	132	0.948	125
161775	RAJGARH1	132	0.948	125
161101	BHIWADI-2	132	0.948	125
161832	SILORA_1	132	0.949	125
161829	SHEOPUR1	132	0.949	125
161869	TODARASI	132	0.950	125
161499	BRAMTEMP	132	0.950	125
161673	KUSHKHER	132	0.950	125

NLDC Observations on Transmission scheme for evacuation of power as part of Rajasthan REZ Ph-IV (Part-6 6GW) (Bikaner –V)- Scenario 8

Annexure-II

From Bus			To bus			Ckt ID	LOADING (in MW)	Thermal Limit (in MVA)	PERCENT Loading
161170	VKIA_21	132	161879	VKIA1	132.00*	1	110	80	138
162250	KISHANGA	220.00*	162329	AJMER42	220	H1	309	229	135
162220	DHOLPU GAS	220.00*	162268	DHOLPU-2	220	1	265	229	116
161073	CHAMPAPUR	132	161111	HEERAPURA1	132.00*	1	89	80	111
162293	DECHU	220.00*	162555	DECHU NEW 2	220	Z1	220	198	111
162293	DECHU	220.00*	162555	DECHU NEW 2	220	Z2	220	198	111
162328	CHAKSU	220.00*	162973	JAIPUR_PG	220	1	249	229	109
161162	KISHA-21	132	161653	KISHANGARH1	132.00*	2	84	80	106
161977	SHEO	132	162828	SHEO 220	220.00*	1	166	160	104
162210	BHTRATPU	220	172115	AGRA-PG	220.00*	1	210	208	101

Annexure-III

From Bus		To Bus			Ckt ID	LOADING (in MW)	Thermal Limit (in MVA)	PERCENT Loading
162257	SURATGARH-42220.00	164457	SURATG-4	400	1	301.4	315	95.7
162257	SURATGARH-42220.00	164457	SURATG-4	400	2	301.4	315	95.7
164409	HINDAU-4 400.00	164890	KUMHER4	400	T1	573.8	857	67
164889	KHUSKHERA4 400.00*	164921	BHIWADI	400	T1	797.4	857	93
164889	KHUSKHERA4 400.00*	164921	BHIWADI	400	T2	797.4	857	93

NLDC Observations on Transmission scheme for evacuation of power as part of Rajasthan REZ Ph-IV (Part-6 6GW) (Bikaner –V)- Scenario 8

Annexure-A6

Reply of Grid-India Observations on Transmission scheme for evacuation of power as part of Rajasthan REZ Ph-IV (Part-6 : 6GW) (Bikaner –V)

A) Scenario-7 (Feb Solar Peak)

1. Load Generation Balance

- The comparison of LGB considered vis-a-vis 20th EPS report & region wise demand met is given below

S. No.	Region	Load	Gen.	IR Exchange (Import: +ve)	As per 20th EPS Peak Load in 2029-30 (MW)	Average Demand Met in Solar Hours in Feb 2025 (MW)	Peak Demand met during Solar Hours Feb 2025 (MW)
		(MW)	(MW)	(MW)			
1	NR	121294	177056	55762	116745	56675	69254
2	WR	114256	138319	24063	107050	73086	79999
3	SR	105890	90900	-14990	97440	61680	68568
4	ER	35840	16631	-19209	45752	20727	23451
5	NER	2957	2025	-932	5835	2142	2843
6	All India	382315	428024	-	334811	214318	238074
7	Rajasthan	44934	128593	83659	24520	16909	19352

- As per the 20th EPS, the projected demand for Rajasthan is around 25 GW. In the study file, ~45 GW has been considered. Rajasthan has met the peak demand of **~19 GW** in Feb 2025 during solar hrs. Therefore, the Rajasthan demand considered in the study file **(~45 GW)** should be reviewed and revised.

  CTU Reply : Additional solar generation of 12GW & 13GW load at Ramgarh-II and Bhadla-IV was considered due to envisaged RE generation, however transmission scheme of Ramgarh-II & Bhadla-IV is yet to be finalized , Considering above , envisaged load and generation is removed in revised file. Further 6GW of Bulk load (mainly at KBNIR) is also considered as part of GEC-III scheme. Therefore, net load of about 26GW is considered in study file by 2028-29 in Rajasthan.

- Similarly, for the SR, the demand considered in the study is approximately 105 GW, whereas the actual peak demand met during solar hours in Feb 2025 was around 68 GW. It is therefore recommended that the demand for SR be reviewed and revised accordingly in the study file.

CTU Reply : As per 20th EPS, SR demand is considered as 97.4GW**.** Considering demand growth (~5%) and additional 23.5GW load of GH/GA, SR demand considered is in order. The 23.5GW GH/GA load is envisaged on Tuticorin, Ramyaptnm, Vizag, Kakinada & Mangalore Substations by 2029-30, out of which 5.5GW GH/GA applications are already received. A sensitivity case was also carried out considering lesser demand of SR .

- The NER demand has been considered as ~2.9 GW. However, the Peak demand met during the month of Feb 2025 was ~2.8 GW. As per 20th EPS, the projected peak demand for NER for the 2029-30-time frame is ~6 GW. This can be adjusted in the study file
  CTU Reply : Incorporated in revised file

- A bulk load of 6.5 GW each has been considered at 400 kV Ramgarh-II and Bhadla-IV, presumably to account for future HVDC evacuations from these stations. However, as the HVDC systems from these locations are planned for implementation in 2030–31, while the current study pertains to the 2029–30 timeframe, it is suggested that the same may appropriately revised.

  CTU Reply : Modified in revised file

- Power factor of load to be revised according to practical values to get correct picture of any low voltage scenario.

State		Scen7	Scen7 p.f.
Punjab	P	18188	0.95
	Q	5307	
Rajasthan	P	29210	0.96
	Q	8237	
Haryana	P	17366	0.95
	Q	5048	
Uttar Pradesh	P	26535	0.95
	Q	9140	
Himachal Pradesh	P	1834	0.95
	Q	535	
Delhi	P	9496	0.96
	Q	2918	

As per Manual on Transmission planning criteria, 2023 clause 3.4.2.2 states that

Quote

"For developing an optimal ISTS, the STUs must clearly spell out the substation-wise maximum and minimum demand in MW and MVAr on seasonal basis. In the absence of MVAR data, the load power factor shall be taken as per Central Electricity Authority

(Technical Standards for Connectivity to the Grid) Regulations, 2007 and its amendments or re- enactment thereof. The STUs shall provide adequate reactive compensation to bring power factor as close to unity at 132 kV and 220 kV voltage levels"

Unquote

Therefore, planning studies may be carried out as per CEA standards and should be considered on seasonal basis.

It is observed that the average load power factor is around 0.96. However, a standard value of 0.95 may be adopted uniformly**. At certain nodes, overly pessimistic power factor values have been used, which do not represent the actual voltage conditions and may lead to incorrect planning inferences.**

CTU Reply : 0.95 pf incorporated in all states wherever required

2. Dispatch of Thermal Plants:

- The thermal generation of some of the plants has been backed down to very low levels or kept off during solar hours. The tech minimum level considered in the case may be mentioned, and the generators' dispatch should be considered per merit order.
- Swing bus generation may also be brought within limit though scaling of LGB.

Bus Number	Bus Name	Id	PGen (MW)	PMax (MW)	Despatch
444019	FARAKKA 400.00	T4	-322	500	-64%
444019	FARAKKA 400.00	T5	-322	500	-64%
444019	FARAKKA 400.00	T6	-322	500	-64%
444019	FARAKKA 400.00	T1	-129	200	-64%
444019	FARAKKA 400.00	T2	-129	200	-64%
444019	FARAKKA 400.00	T3	-129	200	-64%
162257	SURATGARH-42 220.00	T1	0	250	0%
162257	SURATGARH-42 220.00	T2	0	250	0%
412001	KANTI 220.00	T3	34	195	17%
412001	KANTI 220.00	T4	34	195	17%
362013	AMARKANTAK-2 220.00	T3	77	210	37%
362014	BIRSINGPUR42 220.00	T1	77	210	37%
362014	BIRSINGPUR42 220.00	T2	77	210	37%
362014	BIRSINGPUR42 220.00	T3	77	210	37%
362014	BIRSINGPUR42 220.00	T4	77	210	37%
421159	TUSURA 132.00	T1	15	40	38%
422020	IBTPS2 220.00	T1	81	210	38%
422020	IBTPS2 220.00	T2	81	210	38%
442023	BAKRESWAR 220.00	T3	81	210	38%
442023	BAKRESWAR 220.00	T4	81	210	38%
442023	BAKRESWAR 220.00	T5	81	210	38%
444023	BAKRASWR 400.00	T1	81	210	38%
444023	BAKRASWR 400.00	T2	81	210	38%
214051	BTPS-NTPC 400.00	T1	96	250	38%
214051	BTPS-NTPC 400.00	T2	96	250	38%
214051	BTPS-NTPC 400.00	T3	96	250	38%
414010	KAHALGAON-B 400.00	T1	192	500	38%
414010	KAHALGAON-B 400.00	T2	192	500	38%

Bus Number	Bus Name	Id	PGen (MW)	PMax (MW)	Despatch
414010	KAHALGAON-B 400.00	T3	192	500	38%
414020	NABINAGAR-I 400.00	T1	96	250	38%
414020	NABINAGAR-I 400.00	T2	96	250	38%
414020	NABINAGAR-I 400.00	T3	96	250	38%
414020	NABINAGAR-I 400.00	T4	96	250	38%
454001	DURGAPUR TPS 400.00	T1	192	500	38%
454001	DURGAPUR TPS 400.00	T2	192	500	38%
482003	CHNDRP TPS-B 220.00	T7	96	250	38%
482003	CHNDRP TPS-B 220.00	T8	96	250	38%
484002	BOKARO-A 400.00	T1	192	500	38%
428002	TALABIRA-NLC 765.00	T1	307	800	38%
428002	TALABIRA-NLC 765.00	T2	307	800	38%
428002	TALABIRA-NLC 765.00	T3	307	800	38%
428072	DARLIPALLI 765.00	T1	307	800	38%
428072	DARLIPALLI 765.00	T2	307	800	38%
454012	WARIA-400 400.00	T1	307	800	38%
474051	PVUNL 400.00	T1	307	800	38%
474051	PVUNL 400.00	T2	307	800	38%
474051	PVUNL 400.00	T3	307	800	38%
414031	NABINAGAR-II 400.00	T1	253	660	38%
414031	NABINAGAR-II 400.00	T2	253	660	38%
414031	NABINAGAR-II 400.00	T3	253	660	38%
424027	VEDANTA 400.00	T4	230	600	38%
424200	OPGC-OD 400.00	T3	253	660	38%
444010	SAGARDIGHI_4 400.00	T5	253	660	38%
474050	NORTHKARNPRA 400.00	T1	253	660	38%
474050	NORTHKARNPRA 400.00	T2	253	660	38%
474050	NORTHKARNPRA 400.00	T3	253	660	38%
424029	GMR 400.00	T1	134	350	38%
424029	GMR 400.00	T2	134	350	38%
424035	IND-BHARATH 400.00	T1	134	350	38%
424035	IND-BHARATH 400.00	T2	134	350	38%
424205	GMR-OD 400.00	T3	134	350	38%
424027	VEDANTA 400.00	T1	0	0	0
424027	VEDANTA 400.00	T2	0	0	0
424027	VEDANTA 400.00	T3	0	0	0

Farakka is considered as slack bus.

CTU Reply : Dispatches were modified incl. for Farakka bus (swing) and incorporated in revised file

- Some of the units are also kept in service with zero despatch. Only for reactive power support.

  CTU Reply : any such units kept off in revised file

- The dispatch levels of certain thermal generators have been considered above 80% during solar hours. The list is provided below.

Bus Number	Bus Name	Id	PGen (MW)	PMax (MW)	Despatch
428000	ODISHA UMPP8 765.00	T1	765	800	96%

428000	ODISHA UMPP8 765.00	T2	765	800	96%
428000	ODISHA UMPP8 765.00	T3	765	800	96%
428001	OD-UMPP-SPLT 765.00	T4	765	800	96%
428001	OD-UMPP-SPLT 765.00	T5	765	800	96%
414095	PIRPAINTI 400.00	T1	600	660	91%
414095	PIRPAINTI 400.00	T2	600	660	91%
424028	LANCOBDN 400.00	T2	563	660	85%
424203	LANCO-OD 400.00	T1	563	660	85%
424026	MONNET 400.00	T1	446	525	85%
424026	MONNET 400.00	T2	446	525	85%
174468	ANPARA4 400.00	T4	425	500	85%
174468	ANPARA4 400.00	T5	425	500	85%
177405	ANPARAC 765.00	T1	510	600	85%
177405	ANPARAC 765.00	T2	510	600	85%
177406	ANPARA-D 765.00	T1	425	500	85%
177406	ANPARA-D 765.00	T2	425	500	85%
174468	ANPARA4 400.00	T1	178	210	85%
174468	ANPARA4 400.00	T2	178	210	85%
424129	NSL-ODISHA 400.00	T1	550	660	83%
424129	NSL-ODISHA 400.00	T2	550	660	83%

CTU Reply : On bar units having zero dispatch is being kept off. Dispatches of other units are modified.

As per NEP (Vol-2) Transmission, Despatch considered for Feb Afternoon peak scenario is as below

Regions	Coal	Gas	Nuclear	Hydro	PSP	Solar	Wind	Small Hydro	BESS
Northern	64%	0%	80%	30%	-110%	90%	10%	30%	-100%
Western	64%	0%	80%	20%	-110%	80%	5%	20%	-100%
Southern	64%	0%	80%	20%	-110%	80%	10%	20%	-100%
Eastern	64%	0%	80%	30%	-110%	80%	0%	30%	-100%
North Eastern	64%	0%	80%	30%	-110%	80%	0%	30%	-100%

➢ **Despatch of PSP considered in the study case**

- Low Despatch considered for PSPs in study case. The same may be revised

Bus Number	Bus Name	Id	PGen (MW)	PMax (MW)	% Despatch
354011	SSP4 400.00	P1	-1200	1450	-83%
194499	TEHRI4 400.00	P1	-150	250	-60%
194499	TEHRI4 400.00	P2	-150	250	-60%
194499	TEHRI4 400.00	P3	-150	250	-60%
194499	TEHRI4 400.00	P4	-150	250	-60%
1999	BHIRA-PSS 11.000	P1	-66	150	-44%
352038	KADANA HPS 220.00	P1	-27	60	-44%
352038	KADANA HPS 220.00	P2	-27	60	-44%
352038	KADANA HPS 220.00	P3	-27	60	-44%
352038	KADANA HPS 220.00	P4	-27	60	-44%
89	GHATGR-PSS 11.000	P1	-55	125	-44%
89	GHATGR-PSS 11.000	P2	-55	125	-44%

374899	MURBAD400 400.00	P1	-1150	4500	-26%

CTU Reply : Dispatches of PSP units were modified.

3. <u>Angular separation, line/elements loading & Voltage issues</u>

- Severe low voltage has been observed in study case. Low voltage nodes in Rajasthan (less than 0.9 pu) are listed in **Annexure – I.**
- Voltages at many important stations are on the lower side in steady state. The voltages will reduce further in case of N-1 contingency. Suitable reactive power compensation may be planned to keep the voltages within permissible limits in the steady state.

  CTU Reply – Separate network studies to be carried out by CTU in consultation with CEA and Grid India for installation of SynCon at optimal location in ISTS substations. Verification of short circuit capacity and space availability at various pooling substations is undergoing.

- In the study, certain elements are observed to be loaded beyond 100 % of its thermal limit. The list of such elements in Rajasthan is provided in **Annexure-II.**

  CTU Reply – Detailing provided in Annexure-II

- In the study, certain elements are observed to be loaded beyond N-1 safe limit. The list of such elements in Rajasthan is provided in **Annexure-III.** The thermal ratings for some transmission lines are not available in the study case and need to be incorporated for accurate analysis.

  CTU Reply – Detailing provided in **Annexure-III**

- The angular separation between 400 kV Moga & Kishenpur exceeding 30 deg under N-0 and ~40 deg under N-1 contingency.

  CTU Reply : Noted. Feasibility of upgradation of 400kV Kishenpur Moga at 765kv level is being carried out in future planning studies with envisaged hydro generation in J&K and solar injection at Moga.

- The angular separation between 765 kV Fatehpur & Varanasi buses exceeding 20 deg under N-1 contingency.

  CTU Reply : measures to be taken in future planning studies. Stability studies will be carried out by CTU. Dynamic file is under preparation

- The angular separation between 400 kV Singrauli and 400 kV Lucknow exceeding 20 deg under N-0. Singrauli is a generating node.

CTU Reply : measures to be taken in future planning studies. Stability studies will be carried out by CTU. Dynamic file is under preparation

The Manual on Transmission planning criteria 2023 clause no. 3.14.12 states that

Quote

" .... the lines for which the angular difference between its terminal buses is more than 20 degrees after contingency of one circuit may be selected for performing stability studies"

Unquote

Therefore, transient stability analysis may be carried out to ascertain the stability of the system.

4. <u>SCR of Pooling station</u>

- In the base case shared, the SCR of a number of pooling stations have been observed less than 5 (Marked as Red)

Pooling Station	Total RE Injection in the Region (MW)	Direct RE Injection at POI (MW)	Voltage Level of POI (kV)	POI Fault MVA	SCR
Bikaner-V	6000	3500	220	16400	4.68
		2500	400	33800	5.63

- The fault current contribution from the incoming capacity has not been considered while evaluating the fault level of above pooling stations.
- The possibility of planning synchronous condensers and additional interconnections at these stations to improve the fault level needs to be explored.

CTU Reply – As per CTU calculation, SCR at 220kV level of Bikaner-V PS is about 4.9. with interconnection of Bhadla-IV PS to Bikaner V PS at 765kV level will further increase the SCR (>5). Further SynCons are considered at Bikaner V PS as part of future scope to improve the SCR. In case of any proposed shifting of RE connectivity from 400kV level to 220kV level, SynCon will be considered at Bikaner-V PS and connectivity will be made effective in matching timeframe of SynCons.

5. <u>Fault level of Bus</u>

- Several stations are seen to have very high fault levels in the solar peak scenario case.
- Necessary network/bus arrangements need to be planned to limit the fault current in coming future.
- The list of those stations in Rajasthan is given below

Stations	Base kV	SC Current (in kA)
BIKANER-IV	400	72
RAMPURA TONK	400	71
Bassi	400	69
NEEMR-PG	400	69
JAIPUR_RS	400	71
BIKANER-NW	400	72
BHADLA PG	400	66
FATEHG-3	400	66
BIKANER-II	400	71
BHADLA-2	400	66
BIKANER-3	400	91
BARMER1_4	400	64
KHUSKHERA4	400	70
BHIWADI	400	70
BIKANER-NW	765	51
SIKAR NEW	765	58
BHADLA-2	765	52
BEAWAR	765	58
JAIPUR	765	62
DAUSA	765	57

CTU Reply – Separate network studies to be carried out by CTU in consultation with CEA and Grid India to reduce the fault level at various RE pooling stations in NR wherever fault level exceeded the designed capacity

6. <u>Dynamic Simulation Studies and Studies for Other Planning Scenarios</u>

- Base case for only one scenario has been shared. For comprehensive planning the study needs to be conducted for all the 9 identified scenarios of planning.
    a. August Solar Max (Scenario-1)
    b. August Evening Peak (Scenario-2)
    c. August Night Off-peak (Scenario3)
    d. June Solar Max (Scenario-4)
    e. June Evening Peak (Scenario-5)
    f. June Night Off-peak (Scenario6)
    g. February Solar Max (Scenario-7)
    h. February Evening Peak (Scenario-8)
    i. February Night Off-peak (Scenario-9)

CTU Reply – At present for planning related studies in NR, 5 nos. of scenarios are considered (SC-4,5,7,8 & 9) which will cover max. export -import scenarios, low and high voltage scenario etc., however for future planning studies, same may be consulted with Grid-India in advance to consider balance scenarios also.

- Significant RE penetration is anticipated in the near future. The generation is also getting evacuated through large EHV lines. Therefore, dynamic simulation studies may be carried out to assess the stability of the planned system.
- Dynamic reactive compensation devices may also be planned at suitable locations to provide necessary reactive power support.

CTU Reply – Considering the severe convergence issues in dynamics file, CTUIL is carrying out dynamic studies to converged files on truncated network specific to RE pockets in Rajasthan and Gujarat rather than to converge the file on All India level. In this regard, CTU is also pursuing for consultation with IIT Bombay for preparation of dynamics file.

Dynamic compensation is incorporated at various nodes as part of scheme (in existing and future scope).

7. <u>Other Major Comments</u>

- STATCOMs mentioned in the planning note have not been modelled in the base case. The rating of all the STATCOMs needs to be confirmed.

  CTU reply: Noted

- It is requested to assign unique name for envisaged RE pooling stations. As several pooling substations with identical names but different numerical suffixes have been planned in the same district along with multiple interconnections, there is a chance of miscommunication during real-time operation among multiple constituents. For clarity of operation and ensuring that names of different substations are easily distinguished from each other, it is suggested that after finalization of the exact location, the ISTS substations are uniquely named as per the geographical name of the nearest location like village or taluk.

  The issue has been highlighted in NCT meetings and several communications from GRID-INDIA to CEA/CTUIL.

CTU Reply – In the 31st NCT meeting, issue was deliberated and it was decided that list of all such pooling stations will be deliberated in next NCT meeting. As decided, it is requested that Grid-India may update the list and provide it to CTU for take up the matter.

- The following high-capacity HVDC links have been considered in service,
  - 6000 MW Bhadla – III – Fatehpur LCC HVDC
  - 6000 MW Barmer – II – Murbad LCC HVDC
  - 6000 MW KPS -II – Nagpur LCC HVDC
  - 2500 MW KPS-III – South Olpad VSC HVDC

CTUIL is requested to confirm the visibility and commissioning timeline of the above HVDC links to facilitate accurate planning of the proposed GEC-III transmission network.

CTU Reply – Timelines of various HVDC link is as under :

- 6000 MW Bhadla – III – Fatehpur LCC HVDC : Under implementation (Pole-1 : Jan'29, Pole-2: Jul'29)

- 6000 MW Barmer – II – Murbad LCC HVDC : Under approval with MOP (expected Pole-1 : Sep'29, Pole-2: Mar'30)
- 6000 MW KPS -II – Nagpur LCC HVDC : Under implementation (expected Pole-1 : Nov'28, Pole-2: Apr'29)
- 2500 MW KPS-III – South Olpad VSC HVDC : Under advance stage of bidding (2029-30)

Annexure – 1

Bus Number	Bus Name	Base kV	V(PU)	V (kV)
161822	GHATOL	132	0.77	101
161327	KOTRA	132	0.77	101
161001	ABUROAD 1	132	0.77	102
161886	KUSHALGARH	132	0.77	102
161198	RIICO ABU RD	132	0.77	102
161933	SWAROPGANJ	132	0.78	103
161744	PALODA	132	0.78	103
161023	BAGIDRA	132	0.79	104
161907	CHORDI	132	0.79	104
161296	NEGADIYA	132	0.79	104
161934	SORDA	132	0.79	104
161930	POSALIYA	132	0.79	105
161790	REODAR	132	0.79	105
161145	PINDWARA	132	0.79	105
161131	SIROHI1	132	0.79	105
161779	RAMSEEN	132	0.79	105
161017	BADAGAON	132	0.80	105
161685	MAHI-II	132	0.80	105
161328	SANDERAO	132	0.80	105
161908	PEEPALWA	132	0.80	105
161873	UMAIDPUR	132	0.80	105
161326	JAWAL	132	0.80	106
161161	BANSWAR1	132	0.80	106
161160	MAHI-I	132	0.80	106
161085	DALOT	132	0.80	106
161853	SUMERPUR	132	0.80	106
161941	REODAR1	132	0.80	106
161932	DESURI	132	0.81	107
161931	BERA	132	0.81	107
161747	PARTAPUR	132	0.81	107
161166	BALI1	132	0.81	108
161178	FALNA	132	0.82	108
161781	RANI	132	0.82	108
161208	SUHAGPURA	132	0.82	108
161295	ARNOD	132	0.82	108
161605	JADOL1	132	0.82	108
161026	BAGRA1	132	0.82	109
161322	JASWANTPURA	132	0.83	109
161909	MOKHAMPURA	132	0.83	109
161188	GOGUNDA1	132	0.83	110
161905	CHITRI	132	0.84	111
161760	PRATAPGA	132	0.84	112

161798	SAGWARA1	132	0.84	112
161294	BARAWARDA	132	0.85	112
161906	SEEMALWARA	132	0.85	112
161929	AHORE	132	0.85	113
161611	JALORE1	132	0.85	113
161144	JALOR-21	132	0.86	113
161104	DHURIYAWA	132	0.86	113
161858	TAGOREN	132	0.86	113
161741	PADROO1	132	0.86	114
161082	CHOTISADAR	132	0.86	114
161168	DUNGRPR	132	0.86	114
161793	RISHDEO	132	0.86	114
161857	KHERWARA	132	0.86	114
161897	BICHIWARA	132	0.86	114
161305	DUNGARPUR21	132	0.87	115
161624	JUNAMEET	132	0.87	115
161914	KANERA	132	0.87	115
161324	BAKRA	132	0.87	115
161315	BAMBORI21	132	0.87	115
161887	BIJAIPUR	132	0.88	116
161019	BADISADAR	132	0.88	116
161694	MANDAWAL	132	0.88	116
161743	PALI1	132	0.88	116
161913	BAMBORA	132	0.88	116
161881	Z_MINES	132	0.88	116
161802	SAMDARI1	132	0.88	116
161014	ASPUR-21	132	0.88	116
161910	DHORIA	132	0.88	116
161915	RASOOLPUR	132	0.88	116
161758	POONSA	132	0.88	117
161924	JERAN	132	0.88	117
161306	SARADA	132	0.88	117
161714	MOKHMPUR	132	0.88	117
161127	NIMBHER1	132	0.88	117
161103	BHINMAL1	132	0.88	117
161782	RANIWARA	132	0.88	117
161055	BHADROONA	132	0.88	117
161475	SAILA	132	0.88	117
161633	KANKROL1	132	0.88	117
161207	KELWARA_U	132	0.89	117
161835	SISARMA1	132	0.89	117
161882	BAMANTUKDA	132	0.89	117
161833	SINDRA1	132	0.89	117
161811	SAPOL	132	0.89	117
161727	NATHDWAR	132	0.89	117
161089	DASPAN	132	0.89	117
161018	BADESAR1	132	0.89	117
161903	GHUMATI	132	0.89	117
161024	BAGORA1	132	0.89	117
161697	MANGLWAR	132	0.89	118
161838	SIWANA	132	0.89	118
161165	KANKR-21	132	0.89	118
161635	KAPASN	132	0.89	118
161005	AMET 1	32	0.89	118

161808	SANKAD1	132	0.89	118
161911	BALICHA	132	0.89	118
161801	SALUMBR1	132	0.89	118
161916	BHOPLSGR	132	0.89	118
161474	PPACHPADRA	132	0.89	118
161325	KHOKHA	132	0.89	118
161137	PALI-21	132	0.90	118
161410	KARWADA21	132	0.90	118
161321	LAKHNI21	132	0.90	118
161293	JHOOJHPURA	132	0.90	118
161320	LOONWAJAGIR	132	0.90	118
161647	KHARCHI	132	0.90	118
161616	JEEWANA	132	0.90	119
161329	VOPARI	132	0.90	119
161323	SAYLA1	132	0.90	119
161297	KARSANA21	132	0.90	119
161370	SALUMBER21	132	0.90	119
162341	REODAR2	220	0.81	179
162230	SIROHI	220	0.82	180
162880	DALOT	220	0.82	180
162899	SUMERPUR	220	0.82	181
162266	BALI	220	0.84	184
162245	PINDWARA	220	0.84	185
162799	PAHAD SIROHI	220	0.84	185
162907	SAGWARA2	220	0.85	187
162760	PRATAPGARH-W	220	0.86	188
162789	SINGLI_BANSW	220	0.86	189
162260	BANSWARA-W	220	0.86	189
162891	NATHDWARA2	220	0.86	190
162244	JALORE	220	0.86	190
162325	BAMANTUKDA	220	0.88	193
162896	BAMBORI2	220	0.88	194
162892	DUNGARPUR	220	0.89	195
162281	ASPUR	220	0.89	196
162798	HZL	220	0.89	197
162918	DARIBA2	220	0.90	197
162265	KANKR-RS	220	0.90	197
162819	SAYLA	220	0.90	197
162206	KANKR-PG	220	0.90	198

Annexure-II

From Bus			To bus			Ckt ID	LOADING (in MW)	Thermal Limit (in MVA)	% Loading	CTU Reply
162230	SIROHI	220	162244	JALORE	220.00*	1	642	229	280	Loading is higher due to 1000MW Pahad Kalan (Sirohi) PSP. RVPN may study the evacuation system
162260	BANSWARA-W	220	162281	ASPUR	220.00*	1	534	229	233	Loading is higher due to 1000MW Singli (Banswara) PSP. RVPN may study the evacuation system
162359	BHADLA-PG	220	162399	ESSEL	220.00*	1	376	220	171	Dedicated line of RE generator. Thermal rating corrected
162359	BHADLA-PG	220	162399	ESSEL	220.00*	2	376	220	171	
162235	PALI	220	162334	JODHPURN-42	220	1	377	229	165	RVPN may review the loading
162262	BADISID-S	220	162285	BHADLA-S	220.00*	1	318	200	159	RVPN may review the loading
162242	BARSINGS	220	162256	BIKANE-2	220	1	355	229	155	Loadings are higher due to 300MW solar. RVPN may review the loading
162227	NIMBHERA	220	162318	SAWA	220	1	348	229	152	Loading is higher due to 1000MW Singli (Banswara) PSP. RVPN may study the evacuation system
162228	CHITTOR-42	220	164428	CHITTOR4	400.00*	1	470	315	149	Due to Singli (Banswara) (1000MW)PSP & Ghaghri (Pratapgarh) (580MW) PSP
162228	CHITTOR-42	220	164428	CHITTOR4	400.00*	2	470	315	149	

From Bus			To bus			Ckt ID	LOADING (in MW)	Thermal Limit (in MVA)	% Loading	CTU Reply
162206	KANKR-PG	220	164418	KANKROLI	400.00*	1	456	315	145	4th ICT 500MVA correctecd & Loading is high due to Changla (Udaipur) (1050MW) PSP
162206	KANKR-PG	220	164418	KANKROLI	400.00*	2	456	315	145	
162206	KANKR-PG	220	164418	KANKROLI	400.00*	3	456	315	145	
162206	KANKR-PG	220	164418	KANKROLI	400.00*	4	456	315	145	
162245	PINDWARA	220	162266	BALI	220.00*	1	330	229	144	Due to Pahad Kalan (Sirohi) (1000MW)PSP
162250	KISHANGA	220	162329	AJMER42	220	H1	325	229	142	HTLS conductor
162282	BAP_2	220	162285	BHADLA-S	220.00*	2	311	229	136	RVPN may review the loading
162253	BIKANE-4	220	162254	SRIDUNGA	220	1	310	229	135	RVPN may review the loading
162914	BHINM-PG	220	164405	BHINMAL	400.00*	1	425	315	135	Loading is higher due to 1000MW Pahad Kalan (Sirohi) PSP. RVPN may study the evacuation system
162914	BHINM-PG	220	164405	BHINMAL	400.00*	2	425	315	135	
162914	BHINM-PG	220	164405	BHINMAL	400.00*	3	425	315	135	
162264	BILARA	220	162299	JODHPU-4	220	H1	307	229	134	Line is HTLS line. Thermal rating corrected
162228	CHITTOR-42	220	162760	PRATAPGARH-W	220.00*	1	259	200	129	Thermal Rating Corrected & Loading is higher due to 1000MW Singli (Banswara) PSP.
161028	BHIKAMPUR	132	162028	BHIKAMPUR 2	220.00*	1	200	160	125	RVPN may review the loading
162231	BALOTRA	220	162244	JALORE	220.00*	1	285	229	125	Loading is higher due to 1000MW Pahad Kalan (Sirohi) PSP. RVPN may study the evacuation system

From Bus			To bus			Ckt ID	LOADING (in MW)	Thermal Limit (in MVA)	% Loading	CTU Reply
162314	RAMGARH	220	162403	RAMGARH_RE	220	2	266	220	121	RVPN may review the loading
162220	DHOLPUGAS	220	162268	DHOLPU-2	220.00*	1	276	229	121	RVPN may review the loading
161047	BHADLA	132	162285	BHADLA-S	220.00*	1	190	160	119	RVPN may review the loading
162221	SAKATPUR	220	162261	KTPS	220	1	269	229	117	Loading are in order with revised dispatch.
162221	SAKATPUR	220	162261	KTPS	220	2	269	229	117	
162221	SAKATPUR	220	162261	KTPS	220	3	269	229	117	
162221	SAKATPUR	220	162261	KTPS	220	4	269	229	117	
162200	MERTA-42	220	162336	JETHANA	220	1	252	220	115	RVPN may review the loading
162227	NIMBHERA	220	162228	CHITTOR-42	220	1	252	220	115	RVPN may review the loading
162359	BHADLA-PG	220	162398	SOURYA	220.00*	1	252	220	114	Dedicated line of RE generator. Thermal rating corrected
162359	BHADLA-PG	220	162398	SOURYA	220.00*	2	252	220	114	
162227	NIMBHERA	220	162760	PRATAPGARH-W	220.00*	1	227	200	114	RVPN may review the loading
162244	JALORE	220	162819	SAYLA	220	1	250	220	114	Loading is higher due to 1000MW Pahad Kalan (Sirohi) PSP. RVPN may study the evacuation system
162300	KALISIND	220	164412	KALISI-4	400.00*	2	564	500	113	Only one 500MVA ICT
161941	REODAR1	132	162341	REODAR2	220.00*	1	180	160	112	RVPN may review the loading
161159	HANUMANG	132	162259	HANUMANG	220.00*	1	291	260	112	RVPN may review the loading
162259	HANUMANG	220	162990	HANUMAN	220	1	255	229	111	RVPN may review the loading
162240	BHOPALGA	220	162241	KHINVSAR	220.00*	1	248	229	108	RVPN may review the loading

From Bus			To bus			Ckt ID	LOADING (in MW)	Thermal Limit (in MVA)	% Loading	CTU Reply
162007	DAUSA	220	162283	BASSI	220.00*	1	245	233	105	RVPN may review the loading
162007	DAUSA	220	162283	BASSI	220.00*	2	245	233	105	RVPN may review the loading
162208	RATANGAR	220	162324	BADNU	220.00*	1	241	229	105	RVPN may review the loading
164256	RAMPURA TO	400	164451	JAIPUR_RS	400.00*	1	887	850	104	Loading are in order
162232	MODAK	220	162249	JHALAWAR	220	1	238	229	104	Loading are in order
162206	KANKR-PG	220	162265	KANKR-RS	220	1	237	229	103	Loading are in order
162206	KANKR-PG	220	162265	KANKR-RS	220	2	237	229	103	Loading are in order
162255	SIKAR-RS	220	162344	SIKAR-PG	220	1	235	229	103	RVPN may review the loading
162255	SIKAR-RS	220	162344	SIKAR-PG	220	2	235	229	103	RVPN may review the loading

Annexure-III

From Bus			To bus			Ckt ID	LOADING (in MW)	Thermal Limit (in MVA)	PERCENT Loading	CTU Reply
162093	DEEDWANA-42	220	164415	DEEDWANA	400	1	255.3	315	81	RVPN may review the loading
162093	DEEDWANA-42	220	164415	DEEDWANA	400	2	255.3	315	81	RVPN may review the loading
162359	BHADLA-PG	220	164459	BHADLA PG	400	1	470.3	500	94.1	400/220kv ICTs are N-1 compliant.
162359	BHADLA-PG	220	164459	BHADLA PG	400	2	470.3	500	94.1	
162359	BHADLA-PG	220	164459	BHADLA PG	400	3	470.3	500	94.1	
162359	BHADLA-PG	220	164459	BHADLA PG	400	4	470.3	500	94.1	
162359	BHADLA-PG	220	164459	BHADLA PG	400	5	470.3	500	94.1	
162359	BHADLA-PG	220	164459	BHADLA PG	400	6	470.3	500	94.1	
162485	SANGOD42 2	220	164485	SANGOD	400	1	351.5	500	70.3	RVPN may review the loading
162485	SANGOD42	220	164485	SANGOD	400	2	351.5	500	70.3	
162919	KOTA	220	164420	KOTA	400	1	287.7	315	91.3	CTU shall analyze and take up the augmentation in consultation with NRLDC
162919	KOTA	220	164420	KOTA	400	2	287.7	315	91.3	
162990	HANUMAN	220	164511	HANUMAN	400	1	337.5	500	67.5	RVPN may review the loading
162990	HANUMAN	220	164511	HANUMAN	400	2	337.5	500	67.5	
164404	BHADLA	400	164678	BHADLA-SU	400	T1	692.9	850	81.5	RVPN may review the loading
164404	BHADLA	400	164678	BHADLA-SU	400	T2	692.9	850	81.5	
164409	HINDAU-4	400	164890	KUMHER4	400	T1	771.1	857	90	Loading is high due to radial KBNIR 1000MW load. RVPN may study the evacuation system
164427	BABAI	400	164445	NEEMR-PG	400	T1	634.2	857	74	Loading are in order
164428	CHITTOR4	400	164429	CHIT-NEW	400	1	1272.2	1714	74.2	Loading is higher due to 1000MW Pahad Kalan (Sirohi) PSP. RVPN may study the evacuation system .
164428	CHITTOR4	400	164429	CHIT-NEW	400	2	1272.2	1714	74.2	
164428	CHITTOR4	400	164601	UDAIPUR4	400	T1	798.5	857	93.2	Loading is higher due to 1000MW Pahad Kalan (Sirohi) PSP. RVPN may study the evacuation system

B) Scenario-8 (Feb Evening Peak)

- The comparison of LGB considered vis-a-vis 20th EPS report & region wise demand met is given below

S. No.	Region	Load	Gen.	IR Exchange (Import: +ve)	As per 20th EPS Peak Load in 2029-30 (MW)	Average Demand Met in Evening Hours in Feb 2025 (MW)	Peak Demand met during Evening Hours Feb 2025 (MW)
		(MW)	(MW)	(MW)			
1	NR	101397	77198	-24199	116745	51157	61022
2	WR	101282	131188	29906	107050	64460	72133
3	SR	115410	105931	-9479	97440	48645	55503
4	ER	38289	46827	8538	45752	21315	24245
5	NER	4356	4306	-50	5835	2362	2862
6	All India	362722	372038	X	334811	188040	209077
7	Rajasthan	31680	21986	9694	24520	12897	15614

- As per the 20th EPS, the projected demand for Rajasthan is around 25 GW. In the study file, ~32 GW has been considered. Rajasthan has met the peak demand of **~15 GW** in Feb 2025 during Evening hrs. Therefore, the Rajasthan demand considered in the study file **(~32 GW)** should be reviewed and revised

CTU Reply : 6GW of Bulk load (mainly at KBNIR) is considered as part of GEC-III scheme. Therefore net load of about 26GW is considered in study file by 2028-29 in Rajasthan.

- Similarly, for the SR, the demand considered in the study is approximately 115 GW, whereas the actual peak demand met during evening hours in Feb 2025 was around 55 GW. It is therefore recommended that the demand for SR be reviewed and revised accordingly in the study file.

CTU Reply : As per 20th EPS, SR demand is considered as 97.4GW**.** Considering demand growth (~5%) and additional 23.5GW load of GH/GA, SR demand considered is in order. The 23.5GW GH/GA load is envisaged on Tuticorin, Ramyaptnm, Vizag, Kakinada & Mangalore Substations by 2029-30, out of which 5.5GW GH/GA applications are already received. A sensitivity case was also carried out considering lesser demand of SR .

- Power factor of load to be revised according to practical values to get correct picture of any low voltage scenario.

State		Scen7	Scen7 p.f.
Punjab	P	18188	0.98
	Q	5307	
Rajasthan	P	29210	0.97
	Q	8237	
Haryana	P	17366	0.99
	Q	5048	
Uttar Pradesh	P	26535	0.99
	Q	9140	
Himachal Pradesh	P	1834	0.96
	Q	535	
Delhi	P	9496	0.98
	Q	2918	

As per Manual on Transmission planning criteria, 2023 clause 3.4.2.2 states that

Quote

"For developing an optimal ISTS, the STUs must clearly spell out the substation-wise maximum and minimum demand in MW and MVAr on seasonal basis. In the absence of MVAR data, the load power factor shall be taken as per Central Electricity Authority (Technical Standards for Connectivity to the Grid) Regulations, 2007 and its amendments or re- enactment thereof. The STUs shall provide adequate reactive compensation to bring power factor as close to unity at 132 kV and 220 kV voltage levels"

Unquote

Therefore, planning studies may be carried out as per CEA standards and should be considered on seasonal basis.

It is observed that the average load power factor is around 0.98. However, a standard value of 0.95 may be adopted uniformly**. At certain nodes, overly pessimistic power factor values have been used, which do not represent the actual voltage conditions and may lead to incorrect planning inferences.**

CTU Reply : 0.95 pf incorporated in all states wherever required

8. **<u>Dispatch of Thermal Plants:</u>**

- The thermal generation of some of the plants has been backed down to very low levels or kept off during evening hours. The tech minimum level considered in the case may be mentioned, and the generators' dispatch should be considered per merit order.
- Swing bus generation may also be brought within limit though scaling of LGB.

Bus Number	Bus Name	Id	PGen (MW)	PMax (MW)	despatch

154426	BAWANA-G 400.00	T2	0	253	0.0%
162257	SURATGARH-42 220.00	T1	0	250	0.0%
162257	SURATGARH-42 220.00	T2	0	250	0.0%
444019	FARAKKA 400.00	T1	17	200	8.5%
444019	FARAKKA 400.00	T2	17	200	8.5%
444019	FARAKKA 400.00	T3	17	200	8.5%
444019	FARAKKA 400.00	T4	42	500	8.5%
444019	FARAKKA 400.00	T5	42	500	8.5%
444019	FARAKKA 400.00	T6	42	500	8.5%
214051	BTPS-NTPC 400.00	T1	99	250	39.6%
214051	BTPS-NTPC 400.00	T2	99	250	39.6%
214051	BTPS-NTPC 400.00	T3	99	250	39.6%

CTU Reply : Dispatches were modified and incorporated in revised file

As per NEP (Vol-2) Transmission, Despatch considered for Feb Evening peak scenario is as below

Regions	Coal	Gas	Nuclear	Hydro	PSP	Solar	Wind	Small Hydro	BESS
Northern	80%	40%	80%	60%	90%	0%	35%	60%	66%
Western	80%	40%	80%	40%	90%	0%	25%	40%	66%
Southern	80%	40%	80%	40%	90%	0%	30%	40%	66%
Eastern	80%	40%	80%	60%	90%	0%	0%	60%	66%
North Eastern	80%	40%	80%	60%	90%	0%	0%	60%	66%

- **Despatch of PSP considered in the study case**
  - Low Despatch considered for PSPs in study case. The same may be revised

Bus Number	Bus Name	Id	PGen (MW)	PMax (MW)	despatch
174891	AVAADA WATER 400.00	P1	450	900	50.0%
174891	AVAADA WATER 400.00	P2	260	520	50.0%
174890	GREENKO 400.00	P1	360	610	59.0%
174890	GREENKO 400.00	P2	360	610	59.0%
174890	GREENKO 400.00	P3	360	610	59.0%
174998	PIPRI 400.00	P1	480	810	59.3%
162132	CHANGLA UDAI 220.00	P1	567	945	60.0%
162789	SINGLI_BANSW 220.00	P1	540	900	60.0%
162799	PAHAD SIROHI 220.00	P1	540	900	60.0%
164256	RAMPURA TONK 400.00	P1	432	720	60.0%
162946	GHAGHRI PRTG 220.00	P1	314	522	60.2%
174730	ROBERTSGANJ 400.00	P1	1000	1350	74.1%

Ideally, the LGB shall be worked out through production cost modelling studies for the planning time-frame.

CTU Reply : Dispatches were modified and incorporated in revised file

9. <u>Angular separation, line/elements loading & Voltage issues</u>

- No severe low voltage has been observed in study case. Low voltage nodes in Rajasthan (less than 0.95 pu) are listed in **Annexure – I.**
- Suitable reactive power compensation may be planned to keep the voltages within permissible limits in the steady state.

  CTU Reply – Separate network studies to be carried out by CTU in consultation with CEA and Grid India for installation of SynCon at optimal location in ISTS substations. Verification of short circuit capacity and space availability at various pooling substations is undergoing.

- In the study, certain elements are observed to be loaded beyond 100 % of its thermal limit. The list of such elements in Rajasthan is provided in **Annexure-II.**

  CTU Reply – Detailing provided in Annexure-II

- In the study, certain elements are observed to be loaded beyond N-1 safe limit. The list of such elements in Rajasthan is provided in **Annexure-III.** The **thermal ratings for some transmission lines are not available** in the study case and need to be incorporated for accurate analysis.

  CTU Reply – Detailing provided in **Annexure-III**

- The angular separation between 400 kV Singrauli and 400 kV Lucknow exceeding 20 deg under N-0. Singrauli is a generating node.

  CTU Reply : measures to be taken in future planning studies. Stability studies will be carried out by CTU. Dynamic file is under preparation

- The Manual on Transmission planning criteria 2023 clause no. 3.14.12 states that

  Quote

  " .... the lines for which the angular difference between its terminal buses is more than 20 degrees after contingency of one circuit may be selected for performing stability studies"

  Unquote

Therefore, transient stability analysis may be carried out to ascertain the stability of the system.

10. <u>Fault level of Bus</u>

- Several stations are seen to have very high fault levels in the Evening peak scenario case.
- Necessary network/bus arrangements need to be planned to limit the fault current in coming future.
- The list of those stations in Rajasthan is given below

Stations	Base kV	SC Current(in kA)
	400	
RAMPURA TONK	400	68
Bassi	400	66
NEEMR-PG	400	66
JAIPUR_RS	400	68
BIKANER-3	400	66
KHUSKHERA4	400	67
BHIWADI	400	67
SIKAR NEW	765	51
Stations	**Base kV**	**SC Current(in kA)**
Beawar	765	51
Jaipur	765	58
Dausa	765	53

CTU Reply – Separate network studies to be carried out by CTU in consultation with CEA and Grid India to reduce the fault level at various RE pooling stations in NR wherever fault level exceeded the designed capacity

11. <u>Dynamic Simulation Studies and Studies for Other Planning Scenarios</u>

- Base case for only one scenario has been shared. For comprehensive planning the study needs to be conducted for all the 9 identified scenarios of planning.

a. August Solar Max (Scenario-1)
b. August Evening Peak (Scenario-2)
c. August Night Off-peak (Scenario3)
d. June Solar Max (Scenario-4)
e. June Evening Peak (Scenario-5)
f. June Night Off-peak (Scenario6)
g. February Solar Max (Scenario-7)
h. February Evening Peak (Scenario-8)
i. February Night Off-peak (Scenario-9)

CTU Reply – At present for planning related studies in NR, 5 nos. of scenarios are considered (SC-4,5,7,8 & 9) which will cover max. export -import scenarios, low and high voltage scenario etc., however for future planning studies, same may be consulted with Grid-India in advance to consider balance scenarios also.

- Dynamic reactive compensation devices may also be planned at suitable locations to provide necessary reactive power support.

CTU Reply – Dynamic compensation is incorporated at various nodes as part of scheme (in existing and future scope).

Annexure-I

Bus Number	Bus Name	Base kV	V(PU)	V (kV)
161202	PEEPLU1	132	0.930	123
161688	MALPURA1	132	0.938	124
161639	KEKRI	132	0.941	124
161060	BHIWADI1	132	0.942	124
161080	CHOPANKI	132	0.943	125
161205	ARAIN_1	132	0.944	125
161440	SARWAR	132	0.944	125
161432	GANGDHAR	132	0.946	125
161657	SAWAR	132	0.948	125
161645	KHANDAR	132	0.948	125
161775	RAJGARH1	132	0.948	125
161101	BHIWADI-2	132	0.948	125
161832	SILORA_1	132	0.949	125
161829	SHEOPUR1	132	0.949	125
161869	TODARASI	132	0.950	125
161499	BRAMTEMP	132	0.950	125
161673	KUSHKHER	132	0.950	125

Annexure-II

From Bus			To bus			Ckt ID	LOADING (in MW)	Thermal Limit (in MVA)	PERCENT Loading	CTU Reply
161170	VKIA_21	132	161879	VKIA1	132*	1	110	80	138	RVPN may review the loading
162250	KISHANGA	220*	162329	AJMER42	220	H1	309	229	135	Loading is in order (HTLS line)
162220	DHOLPU GAS	220*	162268	DHOLPU-2	220	1	265	229	116	RVPN may review the loading
161073	CHAMPAPUR	132	161111	HEERAPURA1	132*	1	89	80	111	RVPN may review the loading
162293	DECHU	220*	162555	DECHU NEW 2	220	Z1	220	198	111	RVPN may review the loading
162293	DECHU	220*	162555	DECHU NEW 2	220	Z2	220	198	111	
162328	CHAKSU	220*	162973	JAIPUR_PG	220	1	249	229	109	RVPN may review the loading
161162	KISHA-21	132	161653	KISHANGARH1	132*	2	84	80	106	Loadings are in order
161977	SHEO	132	162828	SHEO 220	220*	1	166	160	104	RVPN may review the loading
162210	BHTRATPU	220	172115	AGRA-PG	220*	1	210	208	101	RVPN may review the loading

Annexure-III

From Bus		To Bus			Ckt ID	LOADING (in MW)	Thermal Limit (in MVA)	PERCENT Loading	CTU Reply
162257	SURATGARH-42220.00	164457	SURATG-4	400	1	301.4	315	95.7	RVPN may review the loading
162257	SURATGARH-42220.00	164457	SURATG-4	400	2	301.4	315	95.7	
164409	HINDAU-4 400.00	164890	KUMHER4	400	T1	573.8	857	67	Loading is in order
164889	KHUSKHERA4 400.00*	164921	BHIWADI	400	T1	797.4	857	93	Loading is high due to KBNIR 1428MW load. RVPN may plan the system in matching time frame of envisaged load
164889	KHUSKHERA4 400.00*	164921	BHIWADI	400	T2	797.4	857	93	

C) Scenario-4

Rajasthan ES devices	Dispatch
PSPs	-4430 MW (100%)
Battery	-6500 MW (100%)

N-1 Cases not converging (voltage instability)		CTU Reply
SING OPN LIN 460 164410-164601(T1)	400kV Bhilwara Udaipur	Issue is due to Singli (Banswara) 1000MW PSP. RVPN may review and plan the system
SING OPN LIN 499 164428-164429(1) / (2)	400kV Chittorgarh-Chittorgarh New 1/2	
SING OPN LIN 501 164428-164601(T1)	400kV Chittorgarh-Udaipur	

400kV and above N-1 non compliance issues				CTU Reply
Monitored Element	Contingency	Rate	%	
174406 NOIIDA-148 400.00 174995 NOIDA-SEC123400.00 T1	parallel ckt	857	152.44	UPPTCL may review the kine loading.
174406 NOIIDA-148 400.00 174995 NOIDA-SEC123400.00 T2	parallel ckt	857	152.44	
174058 ORAI 400.00 174964 GARAUTHA 400.00 1	parallel ckt	857	151.85	Line is Quad Moose, Rating corrected
174058 ORAI 400.00 174964 GARAUTHA 400.00 2	parallel ckt	857	151.85	
174258 ORAI 400.00 177258 ORAI 765.00 1	parallel ICT	1000	130.31	CTU shall analyze and take up the augmentation in consultation with NRLDC
174258 ORAI 400.00 177258 ORAI 765.00 2	parallel ICT	1000	130.31	
164409 HINDAU-4 400.00 164890 KUMHER4 400.00 T1	400kV Sikar-Kumher	857	123.83	Loading is high due to KBNIR 1428MW load. RVPN may plan the system in matching time frame of envisaged load
134438 MOGA SPLT4 400.00 144417 FATEHABAD 400.00 1	400kV Bhiwani - Moga	857	121.51	measures to be taken in future planning studies.
174402 BARELI4 400.00 174410 BAREL-PG 400.00 1	parallel ckt	857	120.4	measures to be taken in future planning studies
174402 BARELI4 400.00 174410 BAREL-PG 400.00 2	parallel ckt	857	120.4	

174889 ROBERTGANJ 400.00 174890 GREENKO 400.00 1	Parallel ckt	1714	119.29	Dedicated line of PSP generator. Thermal rating corrected
174889 ROBERTGANJ 400.00 174890 GREENKO 400.00 2	Parallel ckt	1714	119.29	
174474 ALLAHABA 400.00 174479 VARANASI 400.00 1	765kV Meja-II - Mirzapur-II	857	115.78	Loadings are in order(with UPPTCL Revised GEC-III Proposal)
134423 MOGA4 400.00 137703 MOGA-PG 765.00 1	parallel ICT	1500	112.68	CTU shall analyze and take up the augmentation in consultation with NRLDC
134423 MOGA4 400.00 137703 MOGA-PG 765.00 2	parallel ICT	1500	112.68	
144401 KHEDAR 400.00 144403 KIRORI 400.00 1	parallel ckt	857	108.24	Loading govern by Thermal Gen at Khedar HVPNL may review
144401 KHEDAR 400.00 144403 KIRORI 400.00 2	parallel ckt	857	108.24	
174450 INDRPRM 400.00 174995 NOIDA-SEC123400.00 1	400kV Gaziabad-Noida Sec123	857	107.17	Line is Quad Moose, Rating corrected
174268 GAZIABAD 400.00 174995 NOIDA-SEC123400.00 1	400kV Indirapuram-Noida Sec123	857	107.17	Line is Quad Moose, Rating corrected
174438 LUCK4-PG 400.00 174451 LUCK74-P 400.00 1	Parallel ckt	1714	106.76	CTU shall analyze and take up the measures in consultation with Grid-India
174438 LUCK4-PG 400.00 174451 LUCK74-P 400.00 2	Parallel ckt	1714	106.76	
134925 MALERKOTLA4 400.00 144483 KURUKSHETR 400.00 2	parallel ckt	857	106.04	Line Length is corrected , Loadings are in order
174002 BAGPAT 400.00 174905 MEERUT 400.00 1	parallel ckt	857	102.45	Line is Quad Moose, Rating corrected
174002 BAGPAT 400.00 174905 MEERUT 400.00 2	parallel ckt	857	102.45	
164404 BHADLA 400.00 164678 BHADLA-SULTA400.00 T1	parallel ckt	857	102.01	RVPN may review
164446 SIKAR 400.00 164456 BIKANE-4 400.00 T1	parallel ckt	857	101.83	RVPN may review
164446 SIKAR 400.00 164456 BIKANE-4 400.00 T2	parallel ckt	857	101.83	
174889 ROBERTGANJ 400.00 174891 AVAADA WATER400.00 1	Parallel ckt	1714	101.67	Dedicated line of PSP generator. Thermal rating corrected
174889 ROBERTGANJ 400.00 174891 AVAADA WATER400.00 2	Parallel ckt	1714	101.67	

	Contingencies causing angular spread >20 deg in adjacent nodes

Adjacent Nodes Angular difference	Contingency	Angular difference	
114422 KISHENPUR 400.00 134423 MOGA4 400.00 2	parallel ckt	27.4	Reply si communicated with SC-7/8 query.
114422 KISHENPUR 400.00 134423 MOGA4 400.00 1	parallel ckt	27.1	
162260 BANSWARA-W 220.00 162281 ASPUR 220.00 1	400kV Kankroli - RAPPC	26.5	RVPN may carry out the stability studies
134438 MOGA SPLT4 400.00 144469 BHIWANI-PG 400.00 1	400kV Moga - Fatehabad	26.1	Stability studies will be carried out by CTU. Dynamic file is under preparation
174437 LUCKN_UP 400.00 174923 SINGRL4 400.00 1	400kV Singrauli-Fatehpur	24.8	
164495 BIKANER-II 400.00 164774 KHETRI 400.00 H1	parallel ckt	23.7	LILO of other 2 ckt are under planning with Bikaner-VI scheme.
164495 BIKANER-II 400.00 164774 KHETRI 400.00 H2	parallel ckt	23.7	
134438 MOGA SPLT4 400.00 144417 FATEHABAD 400.00 1	400kV Moga - Bhiwani	23.2	Stability studies will be carried out by CTU. Dynamic file is under preparation
177000 VARNASI8 765.00 177990 FATEHPUR 765765.00 1	parallel ckt	22.5	
177000 VARNASI8 765.00 177990 FATEHPUR 765765.00 2	parallel ckt	22.5	
134484 PATRAN4 400.00 144880 SIWANI 400.00 Q1	parallel ckt	22.4	
134484 PATRAN4 400.00 144880 SIWANI 400.00 Q2	parallel ckt	22.4	
162230 SIROHI 220.00 162244 JALORE 220.00 1	400kV Kankroli - Jodhpur Surpura	21.9	RVPN may carry out the stability studies
167890 BIKNAER7 PUG765.00 167891 BABAI7 765.00 1	parallel ckt	20.9	
167890 BIKNAER7 PUG765.00 167891 BABAI7 765.00 2	parallel ckt	20.9	
164418 KANKROLI 400.00 164433 JODH SURPURA400.00 1	400kV Jaipur - Jodh Kankani	20.5	
167080 NEEMR (NEW) 765.00 177806 BAREILLY 765.00 1	parallel ckt	20.3	Stability studies will be carried out by CTU. Dynamic file is under preparation
167080 NEEMR (NEW) 765.00 177806 BAREILLY 765.00 2	parallel ckt	20.3	

400kV and above elements running above thermal rating in basecase	CTU Reply

From bus			To bus			ckt no	Loading	Rating	% Rating	
162228	CHITTOR-42	220	164428	CHITTOR4	400*	1	437.8	315	139	Due to Singli (Banswara) (1000MW)PSP & Ghaghri (Pratapgarh) (580MW) PSP
162228	CHITTOR-42	220	164428	CHITTOR4	400*	2	437.8	315	139	
162914	BHINM-PG	220	164405	BHINMAL	400*	1	409	315	129.8	Loading is higher due to 1000MW Pahad Kalan (Sirohi) PSP. RVPN may study the evacuation system
162914	BHINM-PG	220	164405	BHINMAL	400*	2	409	315	129.8	
162914	BHINM-PG	220	164405	BHINMAL	400*	3	409	315	129.8	
162206	KANKR-PG	220	164418	KANKROLI	400*	1	393.3	315	124.9	Loading is high due to Changla (Udaipur) (1050MW) PSP
162206	KANKR-PG	220	164418	KANKROLI	400*	2	393.3	315	124.9	
162206	KANKR-PG	220	164418	KANKROLI	400*	3	393.3	315	124.9	
162206	KANKR-PG	220	164418	KANKROLI	400*	4	624.3	500	124.9	
134438	MOGA SPLT4	400	144417	FATEHABAD	400*	1	983.2	857	114.7	Loading will be reviewed w.r.t. real time loading and measures will be taken
171279	MEJAROAD	132	174000	MEJA	400*	2	225.2	200	112.6	No Such 200MVA ICTs exits, UPPTCL may confirm/review
164409	HINDAU-4	400	164890	KUMHER4	400*	T1	921.9	857	107.6	Loading is high due to radial KBNIR 1000MW load. RVPN may study the evacuation system

400kV and above BUSES WITH VOLTAGE LESS THAN 0.9700 (CEA TPC 2023 : 3.10.4)			
Bus number	**Bus name**	**V(pu)**	**V(kV)**
167891	BABAI7 765.00	0.967	739.71
164601	UDAIPUR4 400	0.923	369.15
144958	K-B-FSC3 400.00	0.950	379.89
144457	K-B-FSC2 400	0.950	379.89
164418	KANKROLI 400.00	0.951	380.3
154428	BAMNAULI4 400	0.953	381.08
154497	DWARKA 400	0.953	381.18
154495	TUGHLAKABAD 400	0.955	381.92
134898	MOHALI 400	0.955	381.94
154708	JHATIKARASP 400.00	0.956	382.44

154426	BAWANA-G 400	0.958	383.06
154427	BAWANA 400.00	0.958	383.1
184498	TIKRI KHURD 400.00	0.958	383.21
144443	SONEP-PG 400	0.959	383.49
154928	MAHARANIBAGH 400	0.959	383.6
154496	GOPAL PUR 400.00	0.959	383.73
144429	BALB_FSC 400.00	0.959	383.76
154487	MANDOLA SPLI400.00	0.960	383.86
134484	PATRAN4 400.00	0.961	384.18
144406	DEEPALPUR 400	0.961	384.31
174427	GORAK_UP 400.00	0.961	384.34
144434	BAHADURGARH 400	0.962	384.73
164888	ALWAR74 AJAR400.00	0.962	384.88
174415	MAINFSC2 400.00	0.962	384.92
174914	MAINFSC1 400	0.962	384.92
164428	CHITTOR4 400	0.963	385.05
144450	MANESAR 400.00	0.964	385.69
144904	KAITHAL 400	0.965	385.85
144005	QADARPUR 400	0.965	385.92
154501	NARELA ISTS 400.00	0.965	385.98
144006	SONAROAD 400.00	0.965	385.99
154702	HARSH VIHAR 400	0.965	386.12
164889	KHUSKHERA4 400	0.966	386.24
144410	NUHIYANWALI 400	0.966	386.45
164410	BHILWA-4 400	0.966	386.44
144866	BALLABGARHSP400.00	0.966	386.49
144417	FATEHABAD 400.00	0.966	386.53
164445	NEEMR-PG 400.00	0.968	387.15
144421	HISSAR 400	0.968	387.19
164407	ALWAR 400.00	0.968	387.29
174454	DADR-HVD 400.00	0.968	387.31
174424	DADR-NCR 400	0.969	387.41
154435	MANDOLA 400.00	0.969	387.45
154489	MANDOLASP3 400.00	0.969	387.45
154488	MANDOLASP2 400	0.969	387.45
154455	MUNDKA 400	0.969	387.65
144441	GURGAON 400.00	0.969	387.66
144480	JINDPG 400.00	0.969	387.75
134925	MALERKOTLA4 400.00	0.970	387.84
174450	INDRPRM 400	0.970	387.85
144483	KURUKSHETR 400	0.970	387.88
144407	KABULPUR 400.00	0.970	387.92

Scenario-5

Rajasthan ES devices	Dispatch
PSPs	+3987 MW (100%)
Battery	+6507 MW (100%)

N-1 non compliance issues				CTU Reply
Monitored Element	Contingency	Rate	%	
174400 AGRAUP4 400.00 174922 AGRA 400.00 2	400kV Agra-Agra New	857	148.26	Loading data has been received from NRLDC. Measures i.e. reconductoring of line/ load diversion will be taken. UPPTCL may also provide their views.
164889 KHUSKHERA4 400.00 164921 BHIWADI 400.00 T1	parallel ckt	857	144.15	Loading is high due to radial KBNIR 1428MW load. RVPN may study the evacuation system
164889 KHUSKHERA4 400.00 164921 BHIWADI 400.00 T2	parallel ckt	857	144.15	
164409 HINDAU-4 400.00 164890 KUMHER4 400.00 T1	400kV Agra-Kumher4	857	124.93	Loading is high due to radial KBNIR 1000MW load. RVPN may study the evacuation system
174406 NOIIDA-148 400.00 174995 NOIDA-SEC123400.00 T1	parallel ckt	857	120.46	Loading is marginally higher in N-1. UPPTCL may provide the detail of conductor configuration (45/75 or 45/85)
174406 NOIIDA-148 400.00 174995 NOIDA-SEC123400.00 T2	parallel ckt	857	120.46	
124441 BILASPUR 400.00 134322 ROPAR4 400.00 TS	400kV Koldam-Ropar	857	118.44	Rating Corrected (Triple Snowbird)
174258 ORAI 400.00 174964 GARAUTHA 400.00 1	parallel ckt	857	114.88	Rating Corrected (Quad Moose)
174258 ORAI 400.00 174964 GARAUTHA 400.00 2	parallel ckt	857	114.88	
174889 ROBERTGANJ 400.00 174890 GREENKO 400.00 1	parallel ckt	1714	109.1	Dedicated line of PSP generator. Thermal rating corrected
174889 ROBERTGANJ 400.00 174890 GREENKO 400.00 2	parallel ckt	1714	109.1	

134406 RAJPURA_TH4 400.00 134407 RAJPURA4 400.00 1	parallel ckt	857	103.94	PSTCL may review the loading
134406 RAJPURA_TH4 400.00 134407 RAJPURA4 400.00 2	parallel ckt	857	103.94	
174414 AGRANEW 400.00 174922 AGRA 400.00 2	400kV Agra-AgraUP4	857	103.59	Loadings are in order
164431 BASSI 400.00 164473 JAIPUR_PG 400.00 1	parallel ckt	857	101.59	Loadings are in order
164431 BASSI 400.00 164473 JAIPUR_PG 400.00 2	parallel ckt	857	101.59	

Contingencies causing angular spread >20 deg in adjacent nodes			CTU Reply
174437 LUCKN_UP 400.00 174923 SINGRL4 400.00 1	400kV Singrauli-Fatehpur	25.233	Reply
164409 HINDAU-4 400.00 164411 CHABRA-4 400.00 T1	765kV Hindaun-Anta2	22.427	RVPN may carry out the stability studies
114447 SAMBA 400.00 114541 KISTAWAR 400.00 Q1	400kV Kishenpur-Kishtwar	20.72	Stability studies will be carried out by CTU. Dynamic file is under preparation
174415 MAINFSC2 400.00 174465 FATEH-PG 400.00 1	765kV Bara-MainpuriUP	20.445	

400kV and above BUSES WITH VOLTAGE LESS THAN 0.9700 (CEA TPC 2023 : 3.10.4)			
Bus number	**Bus name**	**V(pu)**	**V(kV)**
174404	UNNAFSC2 400	0.948	379.19
174403	UNNAFSC1 400	0.948	379.19
174427	GORAK_UP 400	0.958	383.19
154495	TUGHLAKABAD 400	0.964	385.75
154428	BAMNAULI4 400	0.966	386.52
154497	DWARKA 400	0.967	386.77
174450	INDRPRM 400	0.967	386.87
164004	BHADLA-IV 400	0.968	387.17
174446	MURADNG4 400	0.969	387.39
174268	GAZIABAD 400	0.969	387.52
174482	AZAMGAR4 400	0.970	387.98

Scenario-9

Rajasthan ES devices	Dispatch
PSPs	+3987 MW (100%)
Battery	**+2139 MW (32%)**

400kV and above N-1 non compliance issues				CTU Reply
Monitored Element	Contingency	Rate	%	
164889 KHUSKHERA4 400.00 164921 BHIWADI 400.00 T1	parallel ckt	857	192.84	Loading is high due to radial KBNIR 1428MW load. RVPN may study the evacuation system
164889 KHUSKHERA4 400.00 164921 BHIWADI 400.00 T2	parallel ckt	857	192.84	
174438 LUCK4-PG 400.00 174720 SULTANPUR RD400.00 T1	765kV Bara-Meja-II	857	148.71	UPPTCL may review the loading
144404 JHAJAR_N 400.00 144408 DHANONDA 400.00 1	parallel ckt	857	104.45	Loading are marginally higher in N-1. NRLDC may provide real time loading data to review
144404 JHAJAR_N 400.00 144408 DHANONDA 400.00 2	parallel ckt	857	104.45	
174420 ALIGARH-PG 400.00 174491 KHURJA TPS 400.00 1	parallel ckt	857	101.94	Loading are marginally higher in N-1. NRLDC may provide real time loading data to review
174420 ALIGARH-PG 400.00 174491 KHURJA TPS 400.00 2	parallel ckt	857	101.94	

Contingencies causing angular spread >20 deg in adjacent nodes			CTU Reply
174437 LUCKN_UP 400.00 174923 SINGRL4 400.00 1	400kV Singrauli-Fatehpur	20.91	Replied in Sc-7/8.

400kV and above elements running above thermal rating in base case								CTU Reply
From bus		To bus		ckt no	Loading	Rating	% Rating	
164889	KHUSKHERA400	164921	BHIWADI400	T1	986.2	857	115.1	Loading is high due to radial KBNIR 1428MW load. RVPN may study the evacuation system
164889	KHUSKHERA400	164921	BHIWADI400	T2	986.2	857	115.1	

General comments

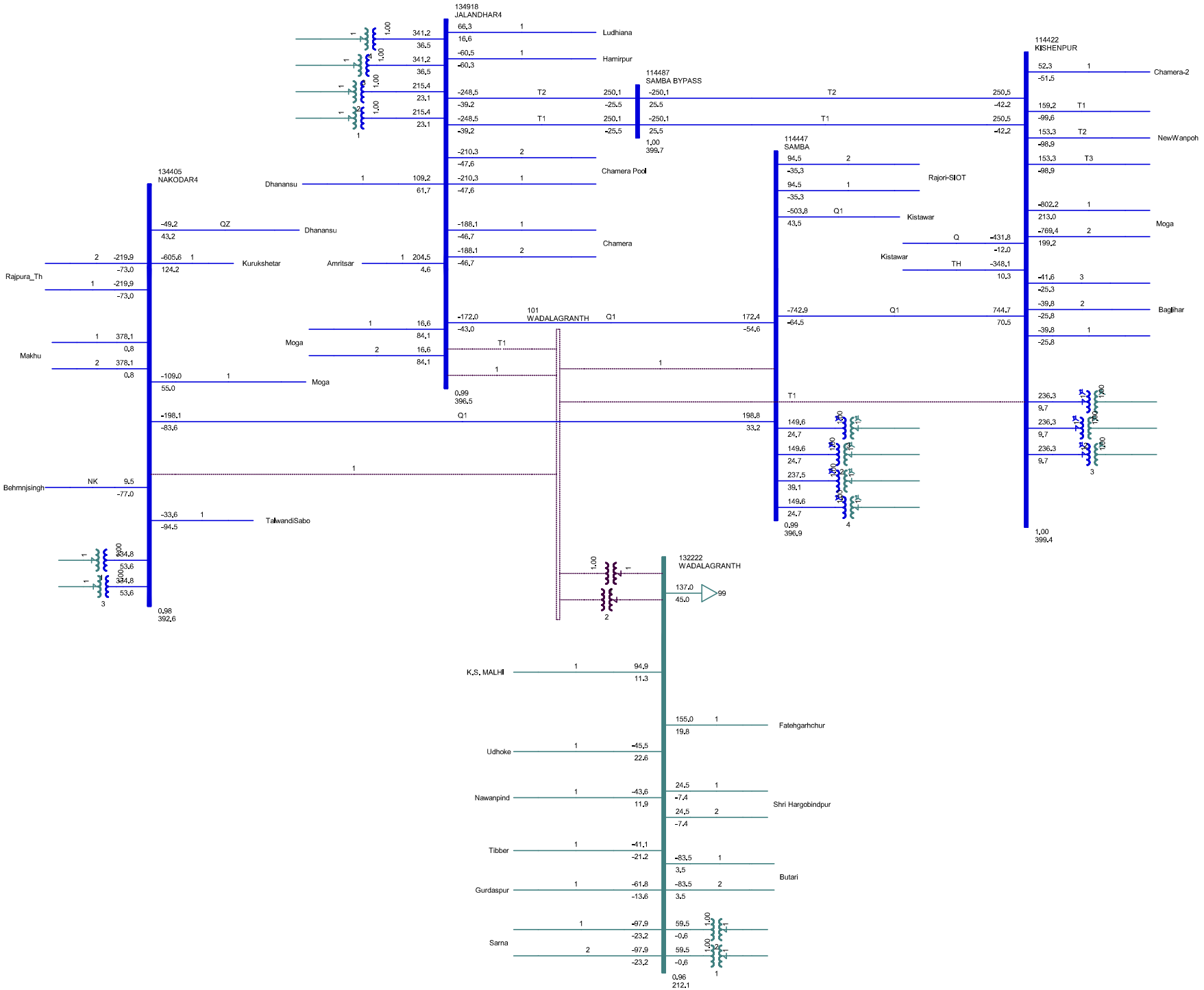
Rajasthan informed, during the recently concluded 55th TCC and 80th NRPC meeting, that their existing **400 kV twin moose transmission lines are designed for a maximum conductor temperature of 75°C**. As a result, these lines **cannot reliably carry more than 660 MW** on a continuous basis. This limitation must be duly considered in all future base cases and incorporated into system studies accordingly.

RVPN may reply

Summer Solar Max

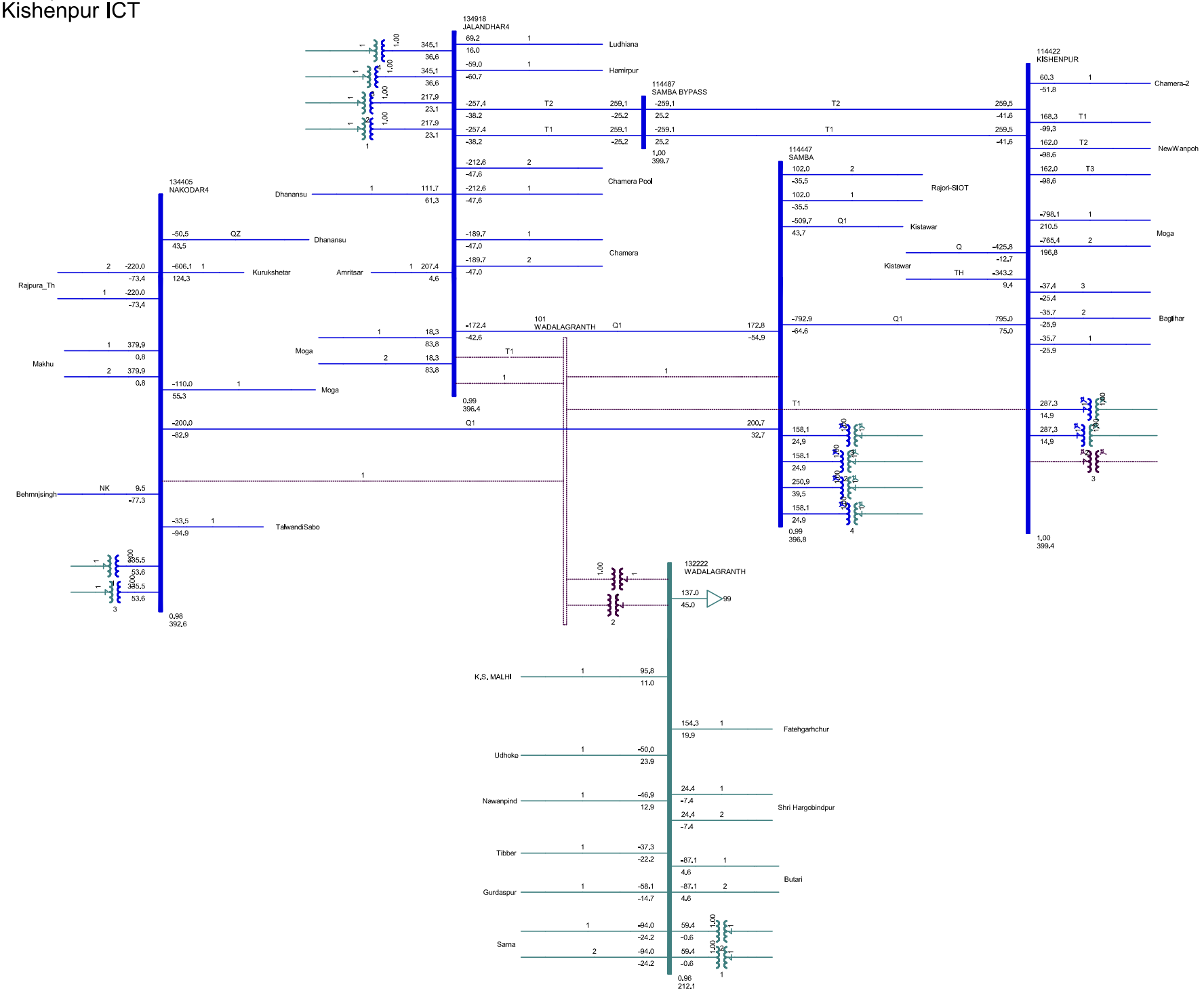
Without Proposal

Exhibit-I



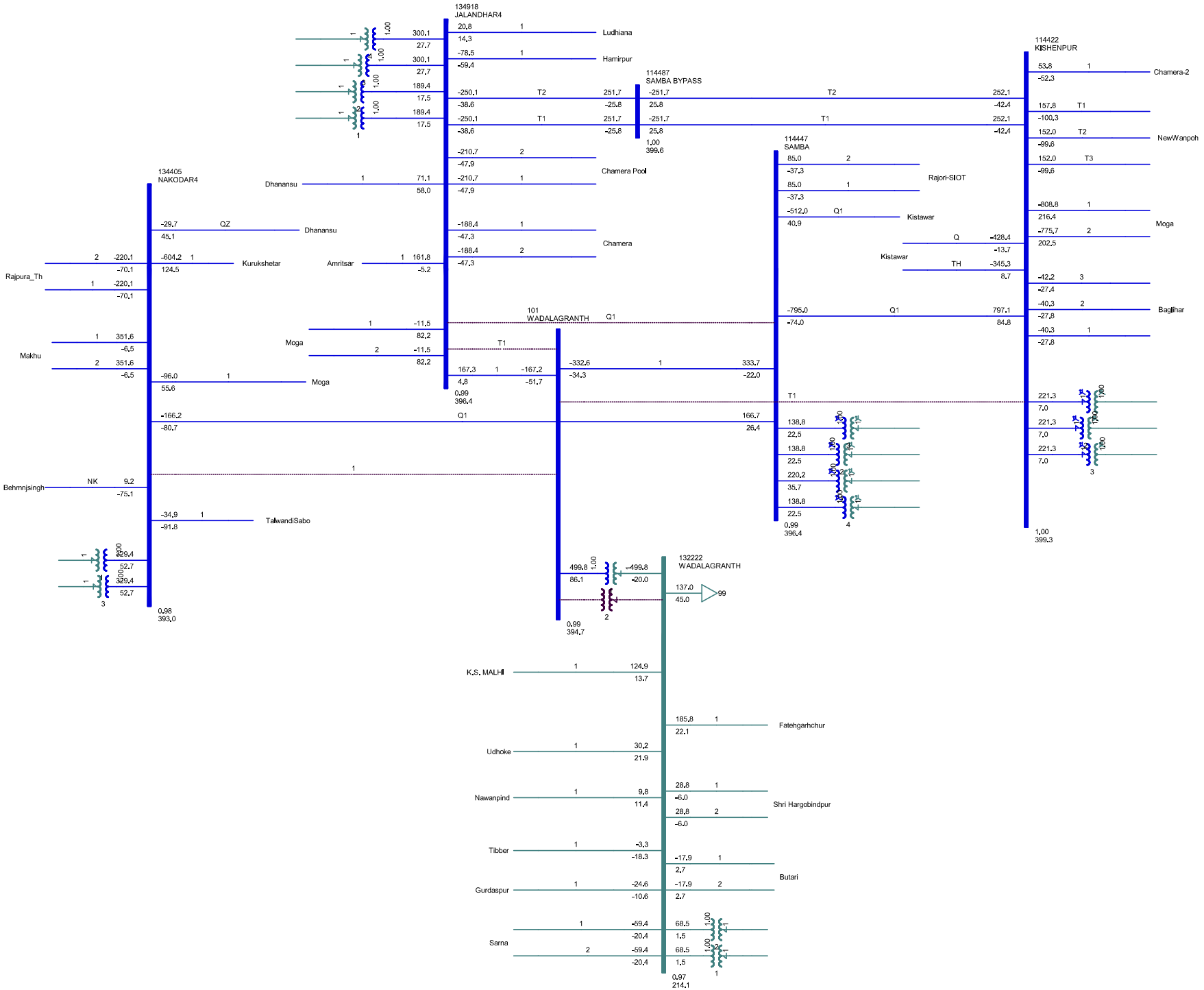
Summer Solar Max

Without Proposal
N-1 of Kishenpur ICT



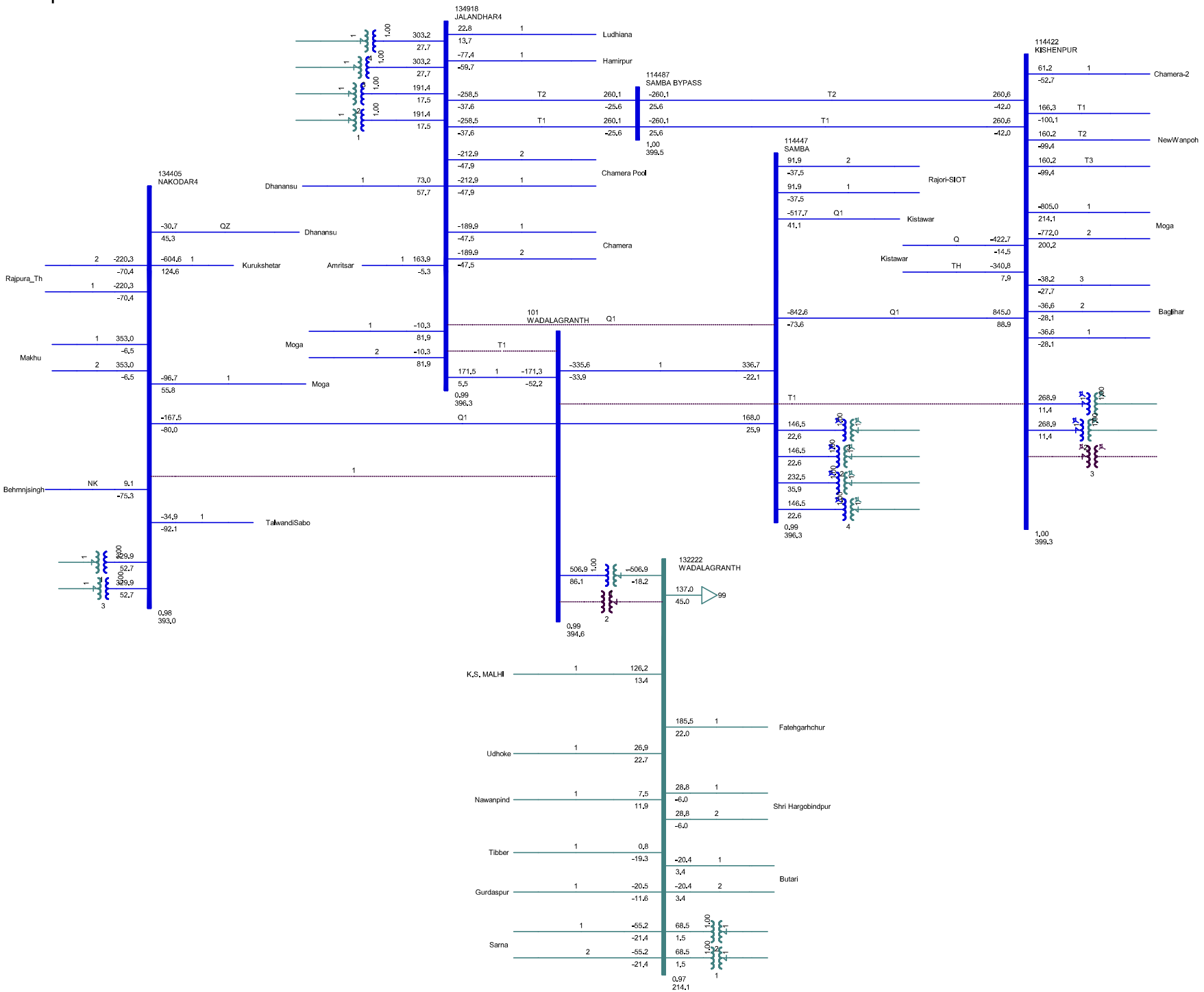
Summer Solar Max

LILO of 400 kV Samba-Jalandhar line (Quad)



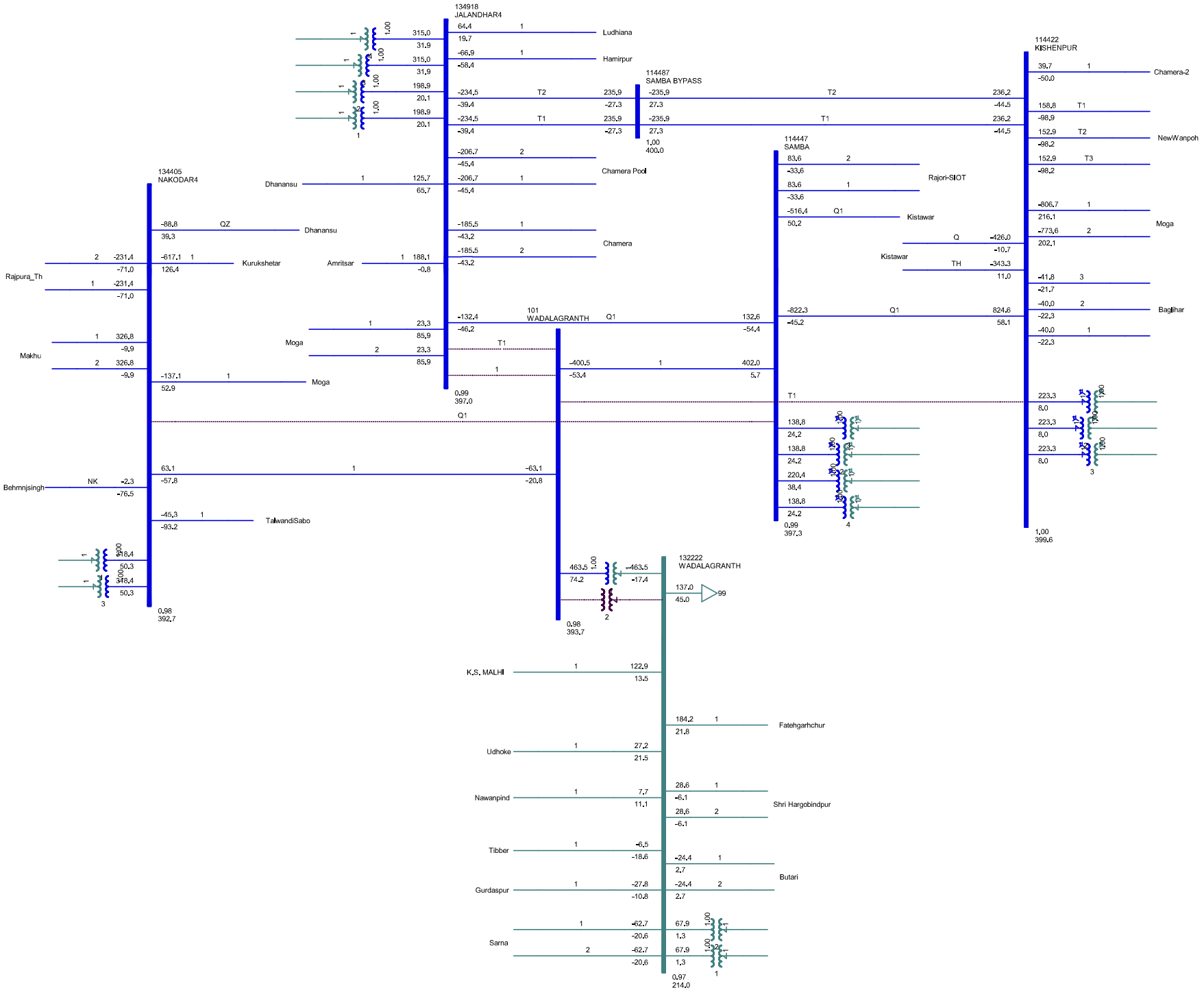
Summer Solar Max

LILO of 400kV Samba-Jalandhar line (Quad)
N-1 of Kishenpur ICT



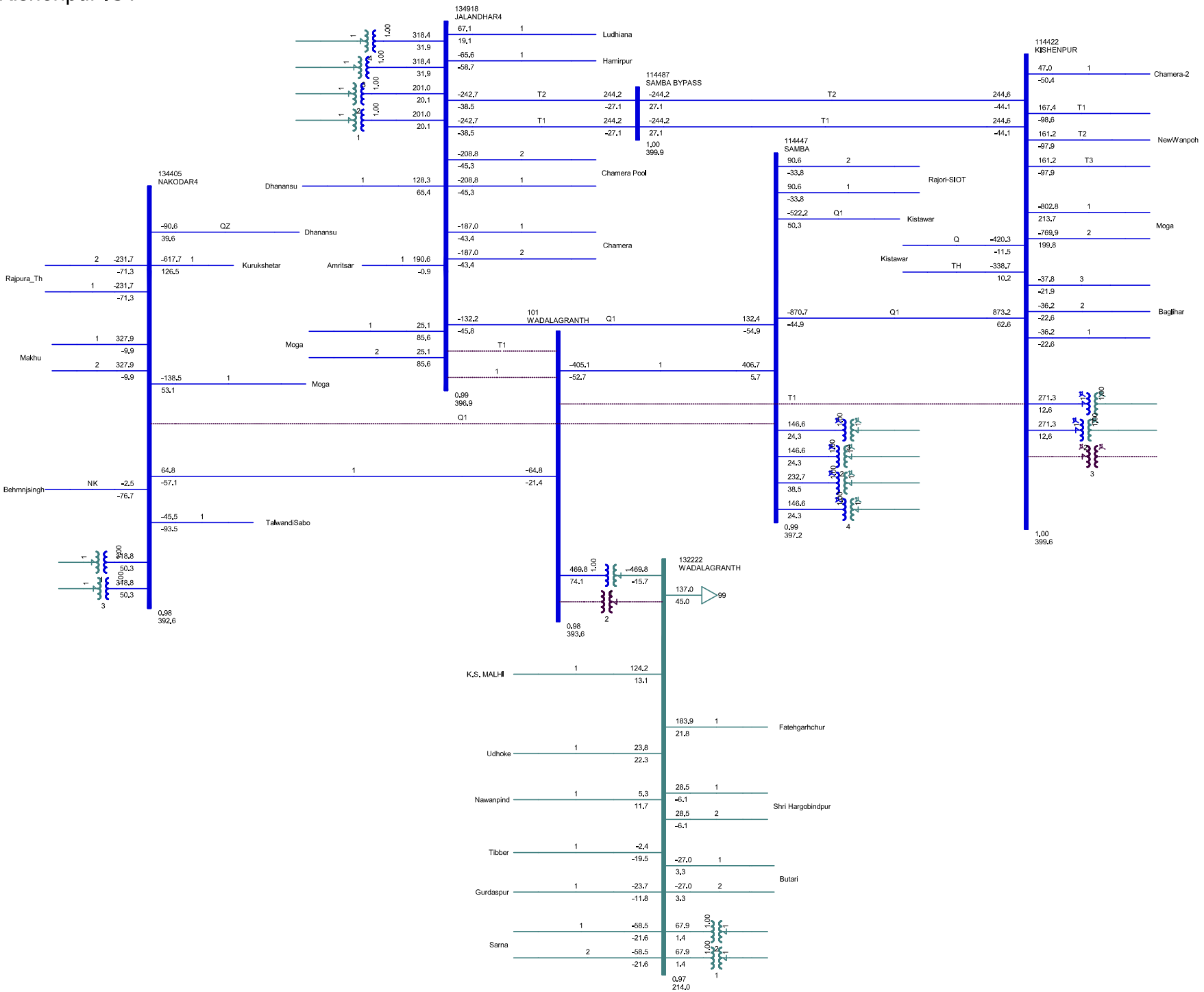
Summer Solar Max

LILO of 400kV Samba-Nakodar line (Quad)



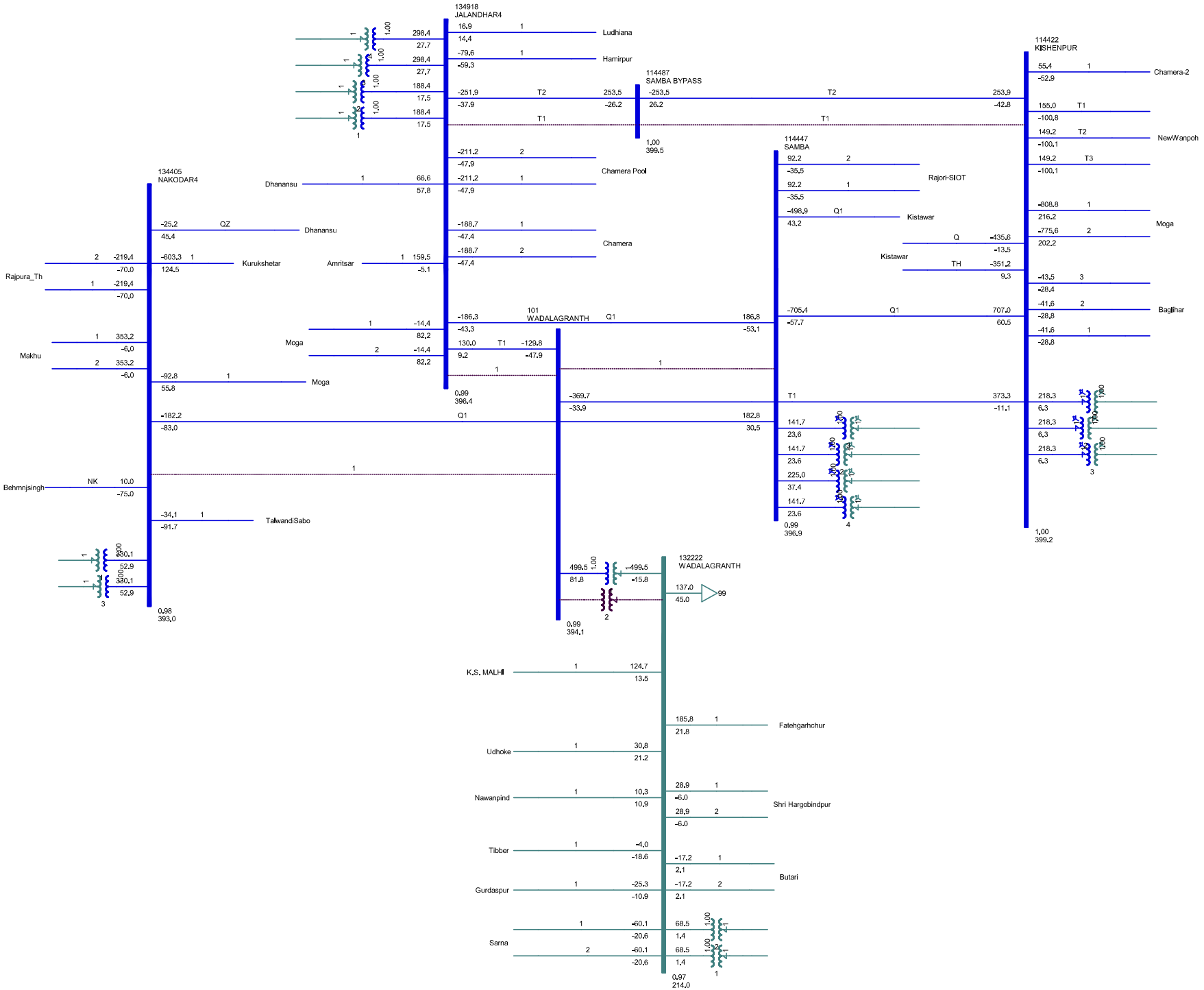
Summer Solar Max

LILO of 400kV Samba-Nakodar line (Quad)
N-1 of Kishenpur ICT



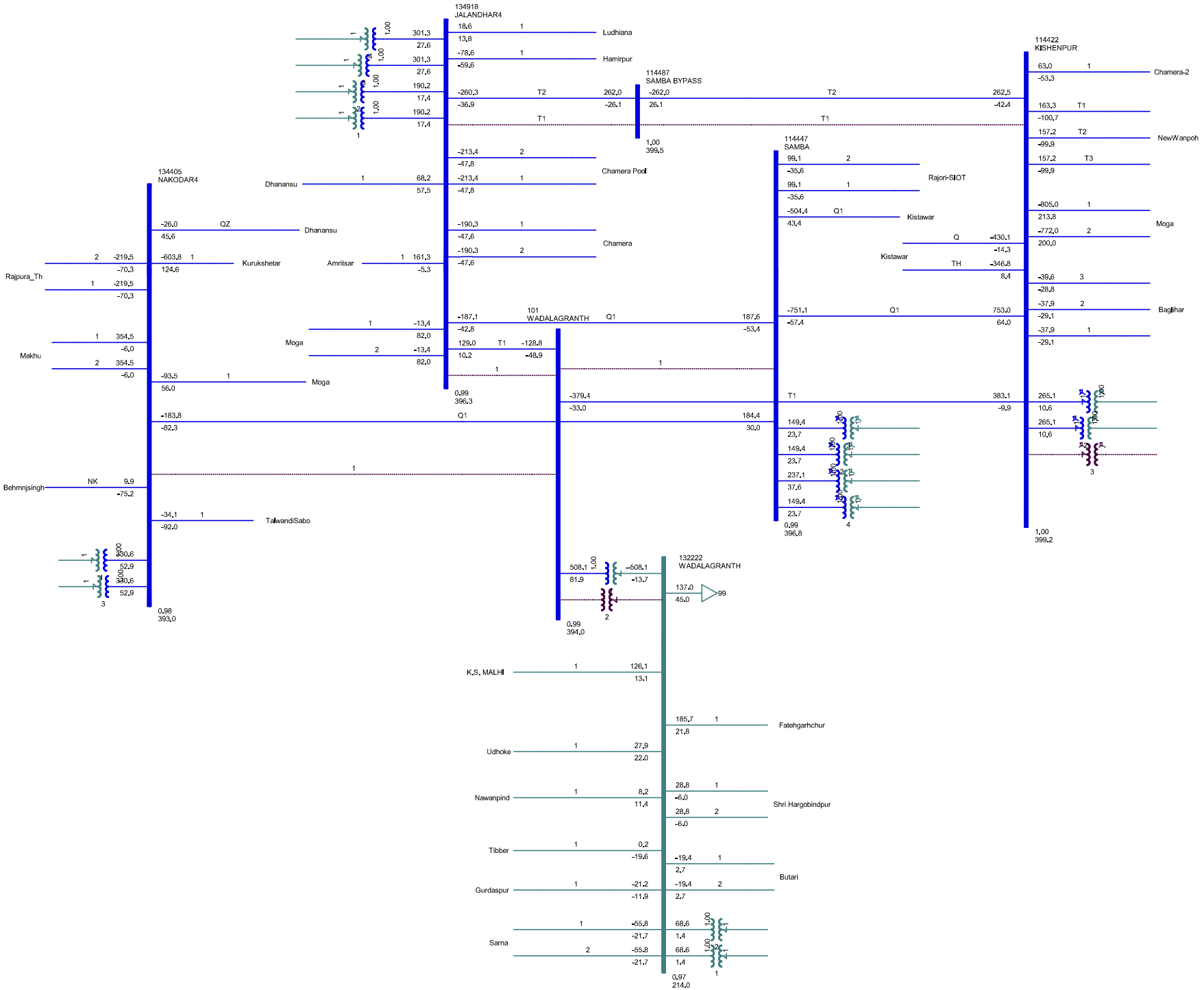
Summer Solar Max

LILO of 400kV kishenpur-Jalandhar line (Twin)



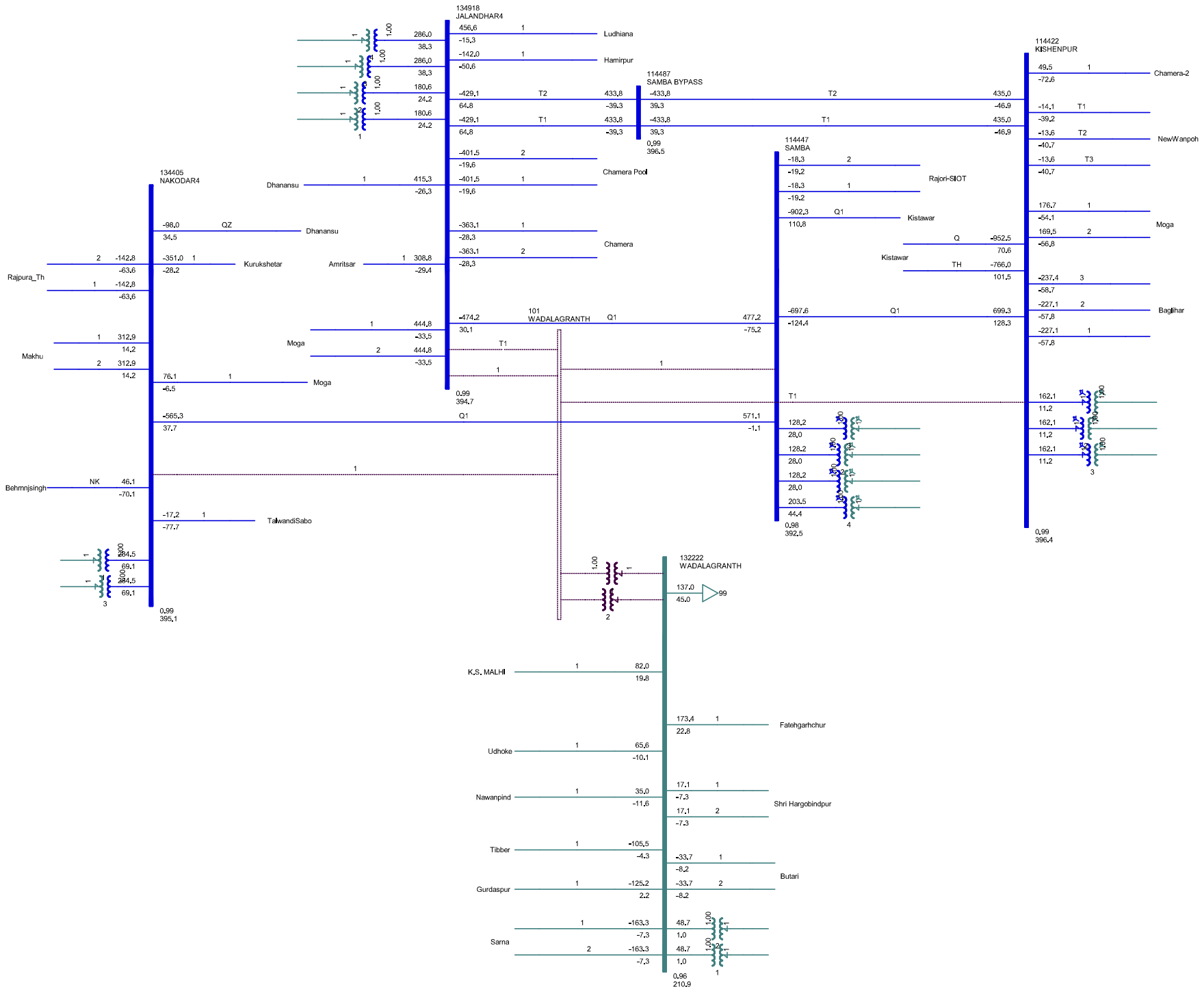
Summer Solar Max

LILO of 400kV kishenpur-Jalandhar line (Twin)
N-1 of Kishenpur ICT



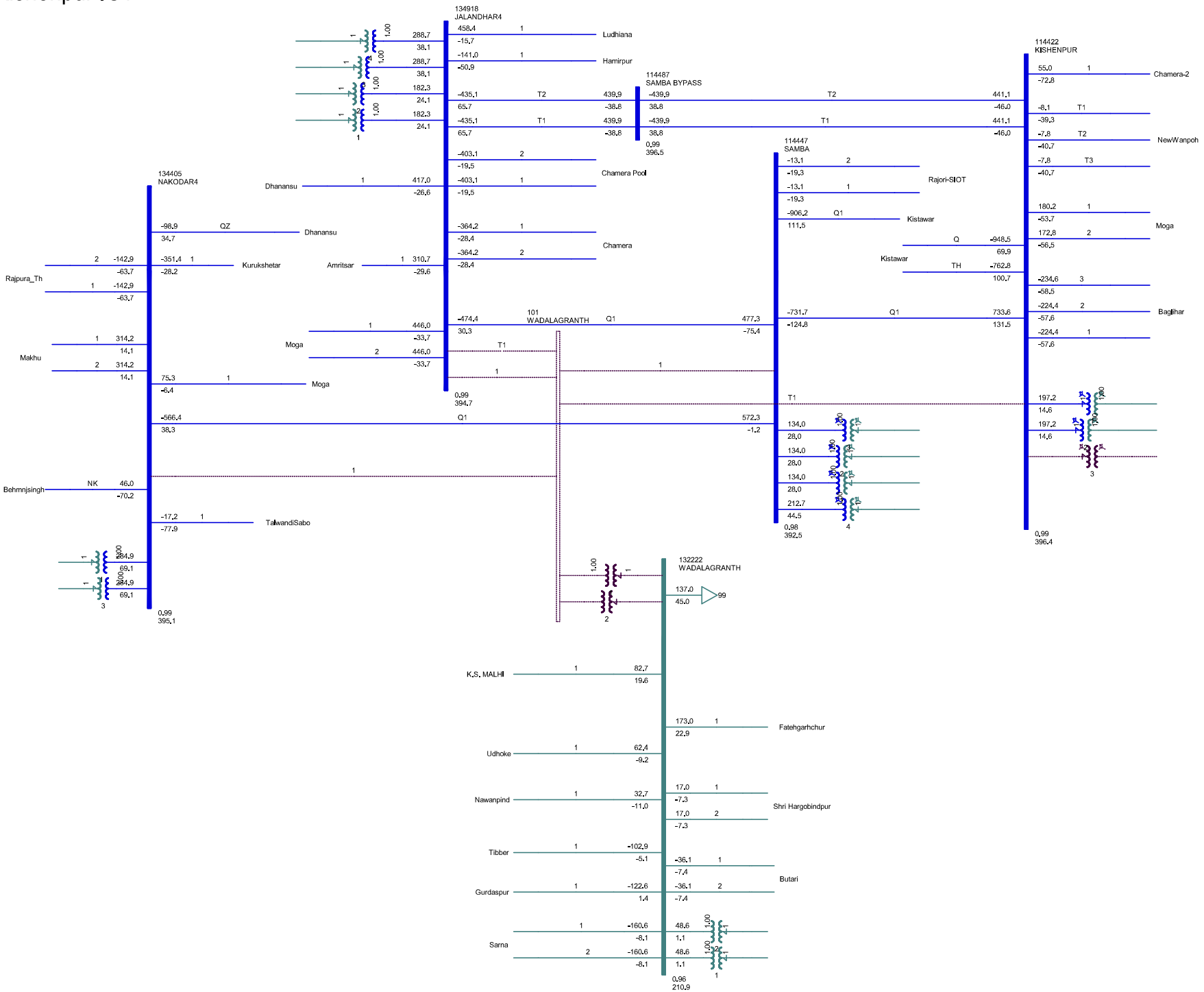
Summer Evening Peak

Without Proposal



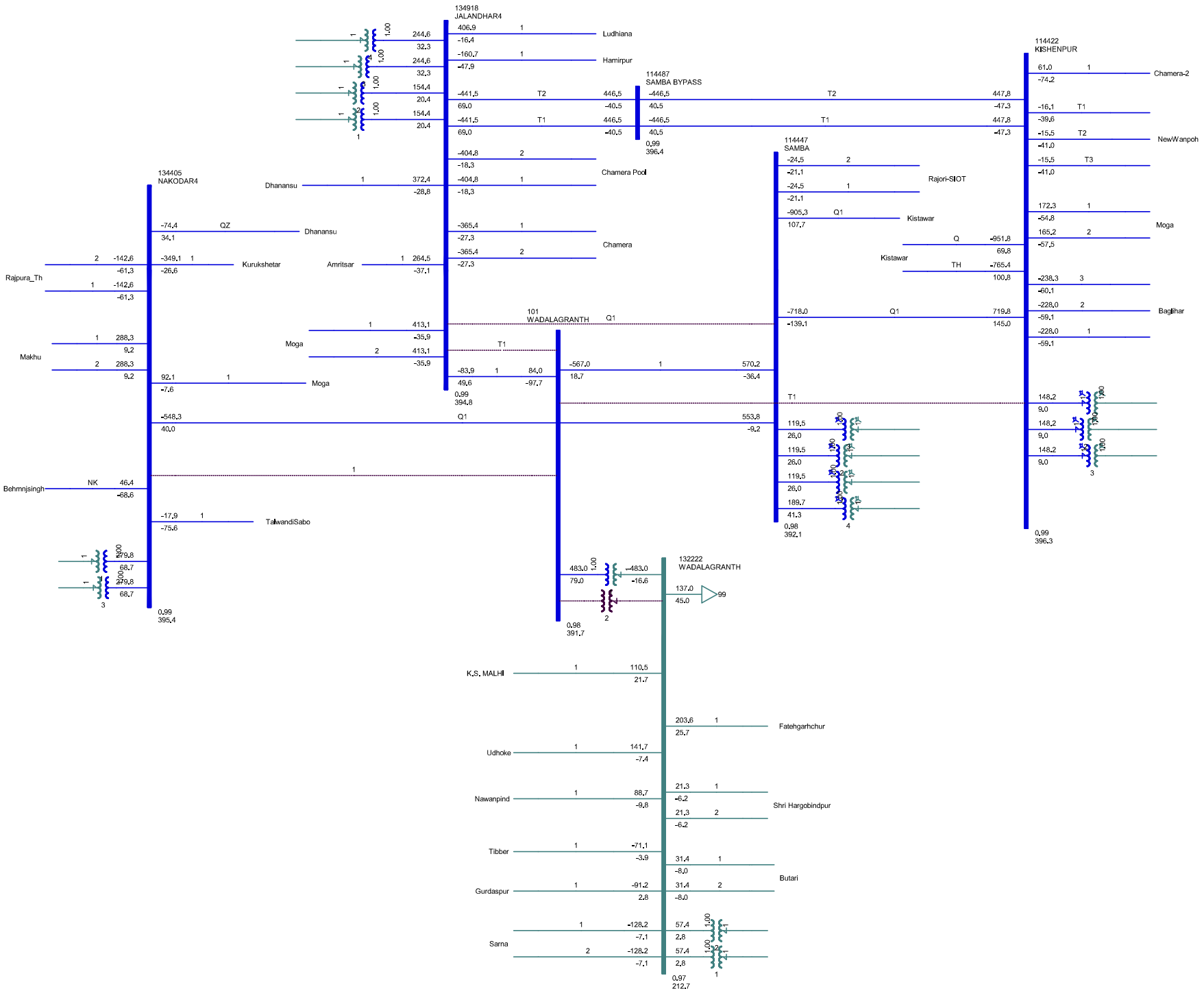
Summer Evening Peak

Without Proposal
N-1 of Kishenpur ICT



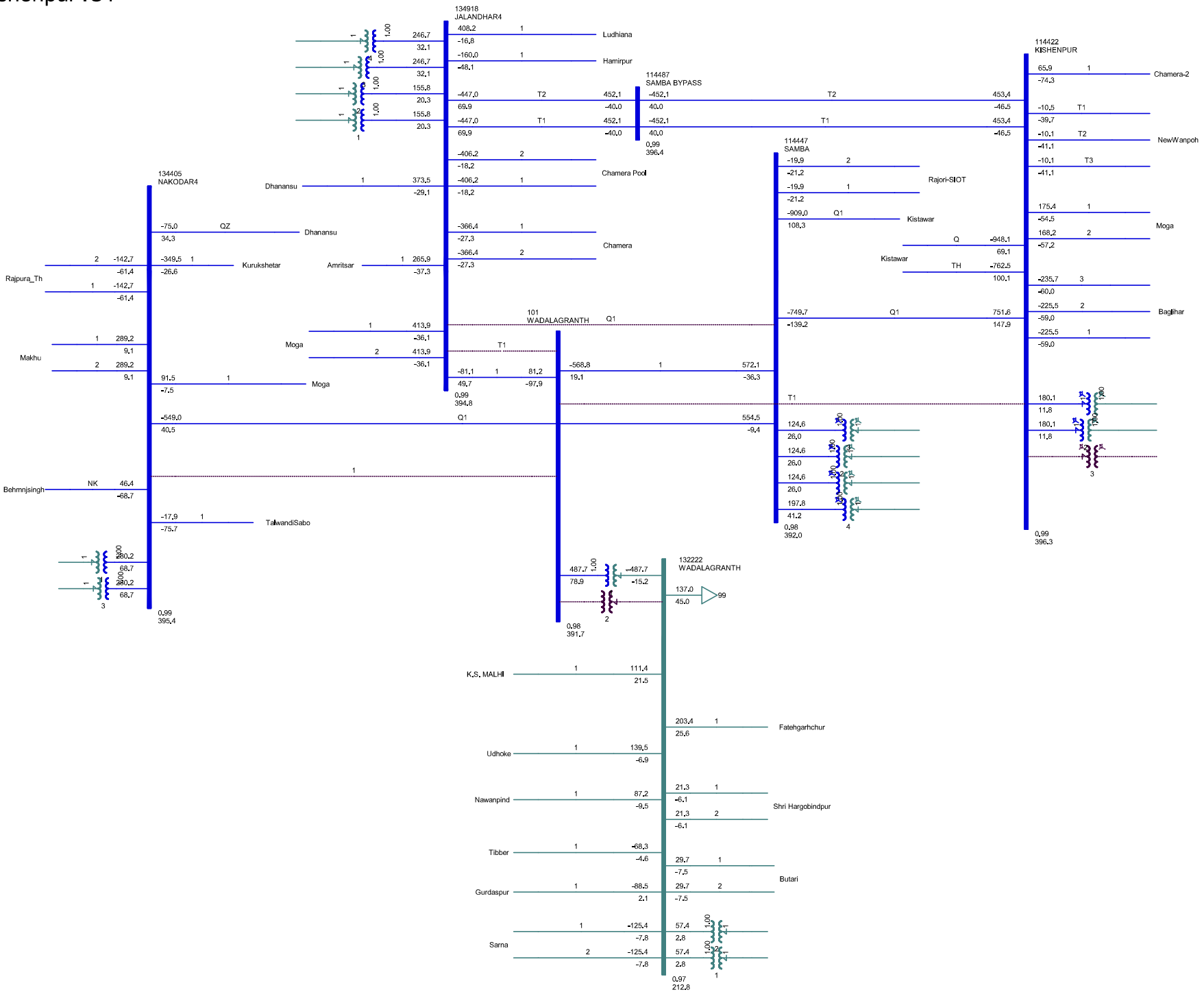
Summer Evening Peak

LILO of 400 kV Samba-Jalandhar line (Quad)



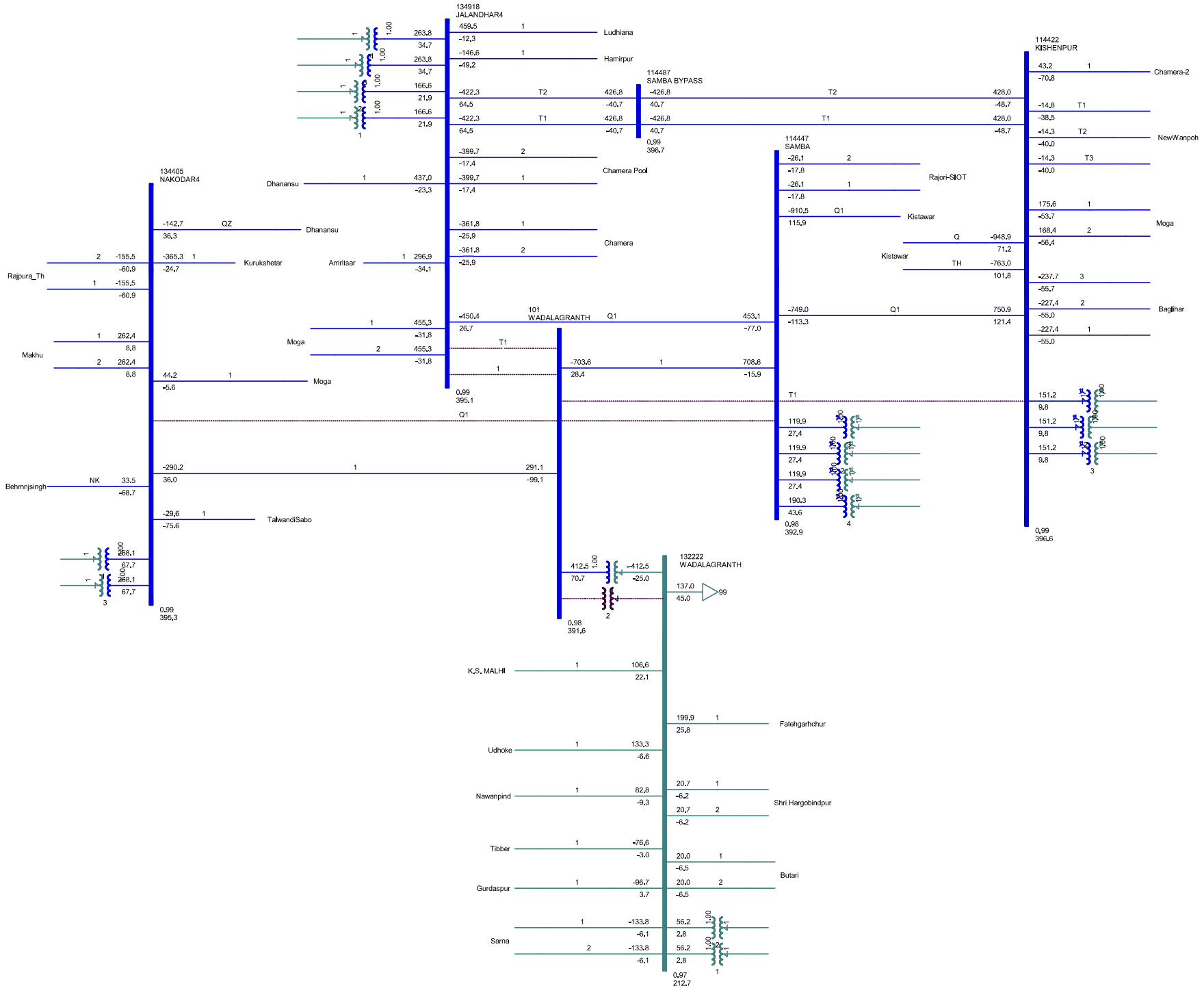
Summer Evening Peak

LILO of 400 kV Samba-Jalandhar line (Quad)
N-1 of Kishenpur ICT



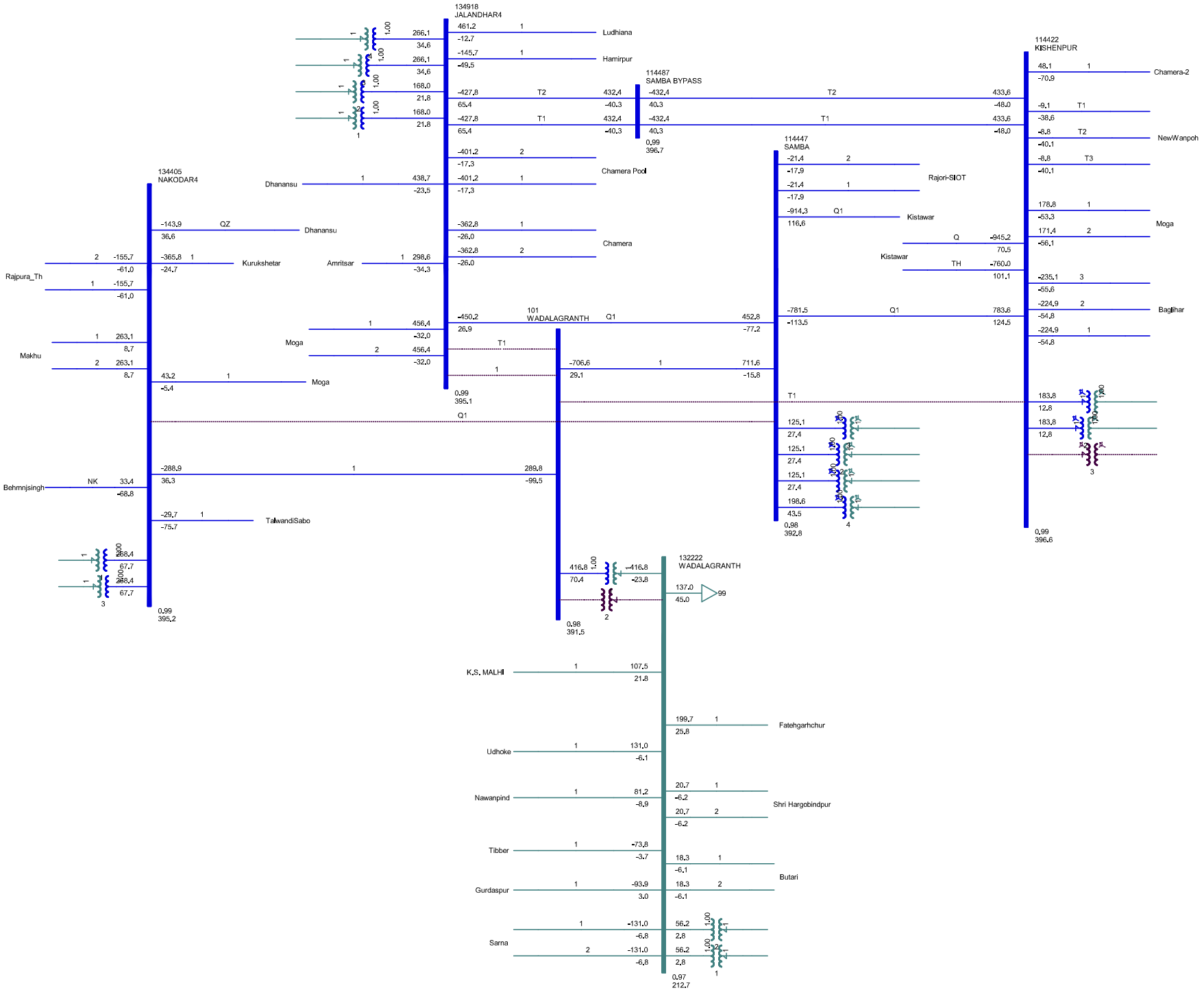
Summer Evening Peak

LILO of 400kV Samba-Nakodar line (Quad)



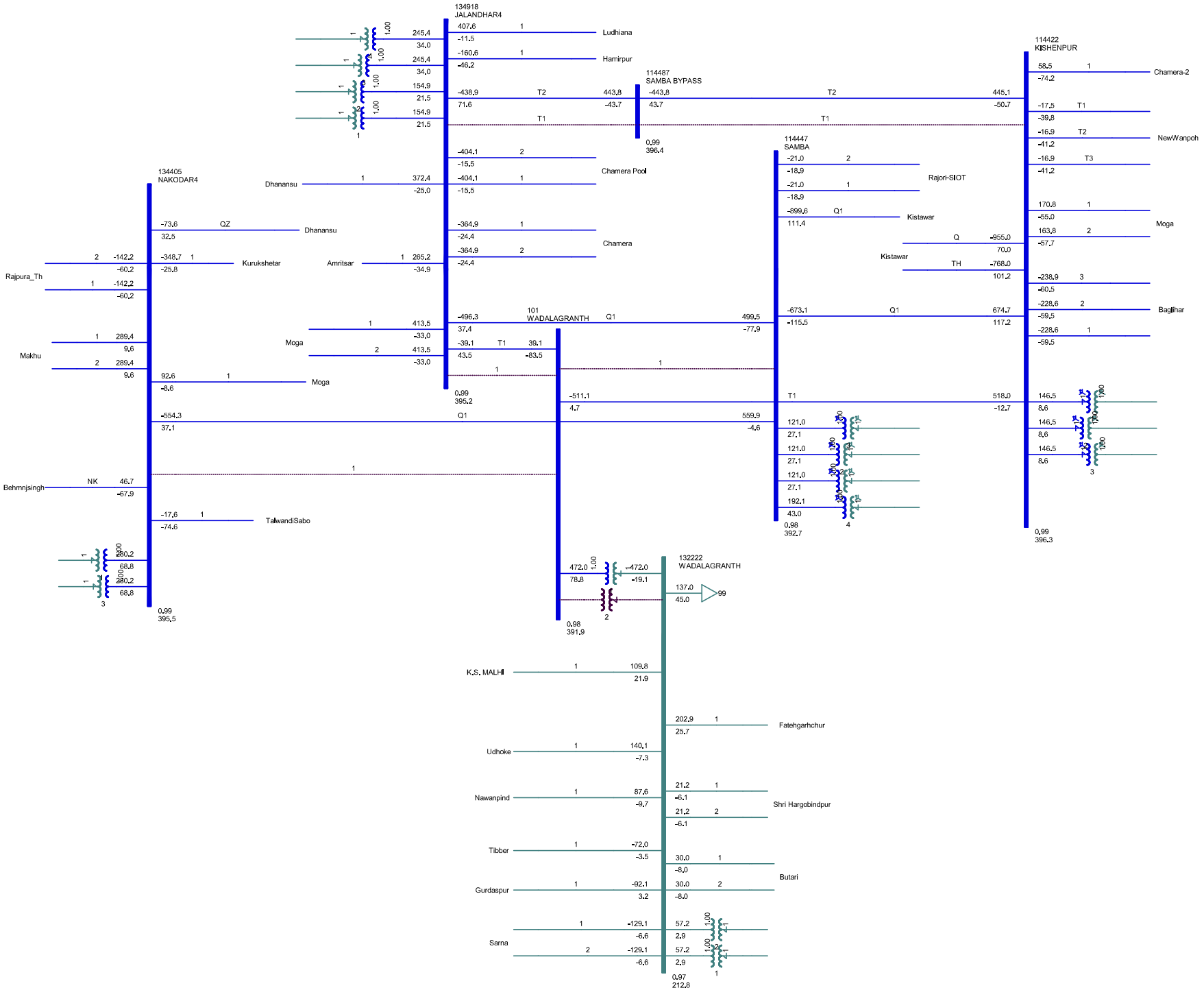
Summer Evening Peak

LILO of 400kV Samba-Nakodar line (Quad)
N-1 of Kishenpur ICT



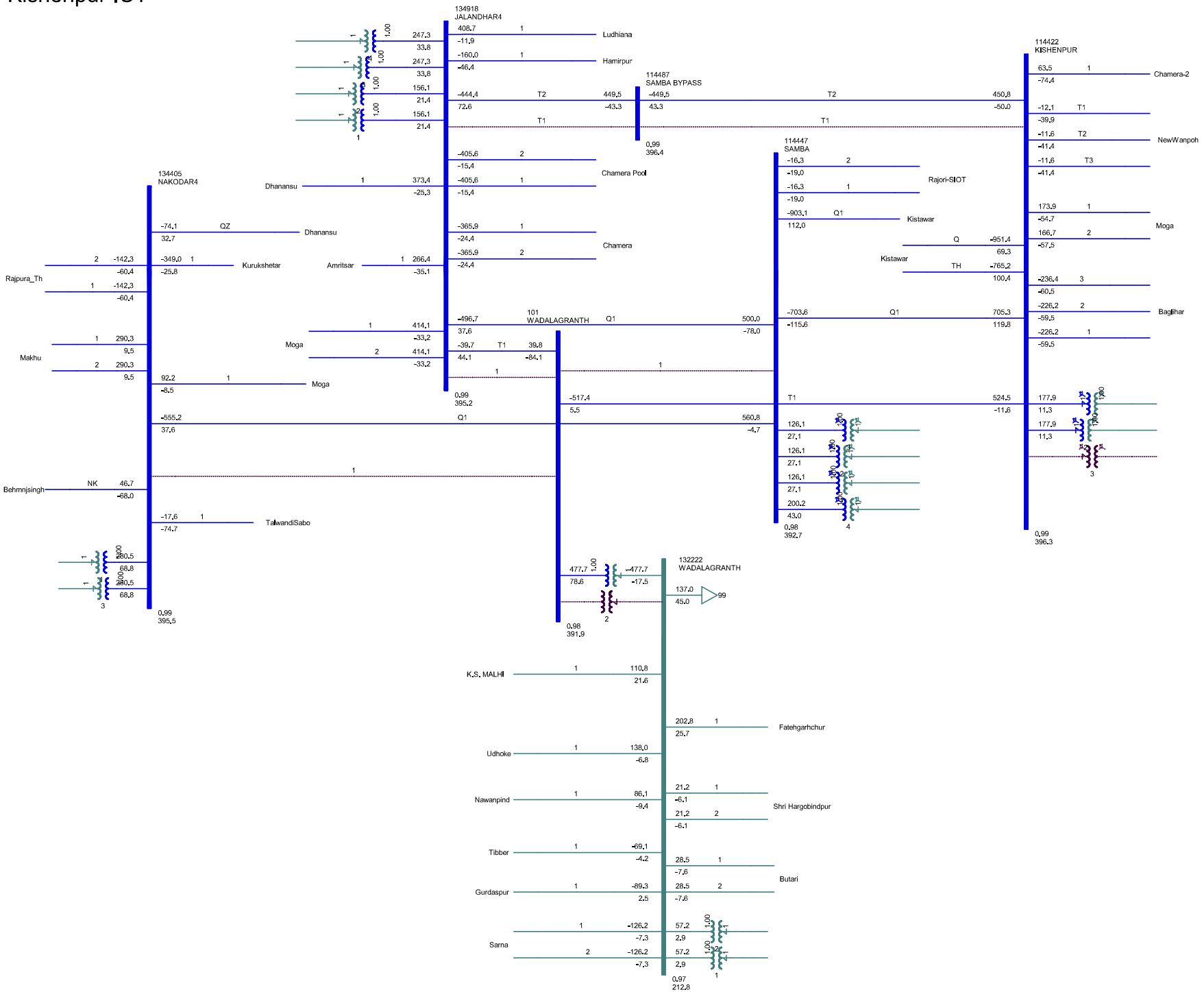
Summer Evening Peak

LILO of 400kV kishenpur-Jalandhar line (Twin)



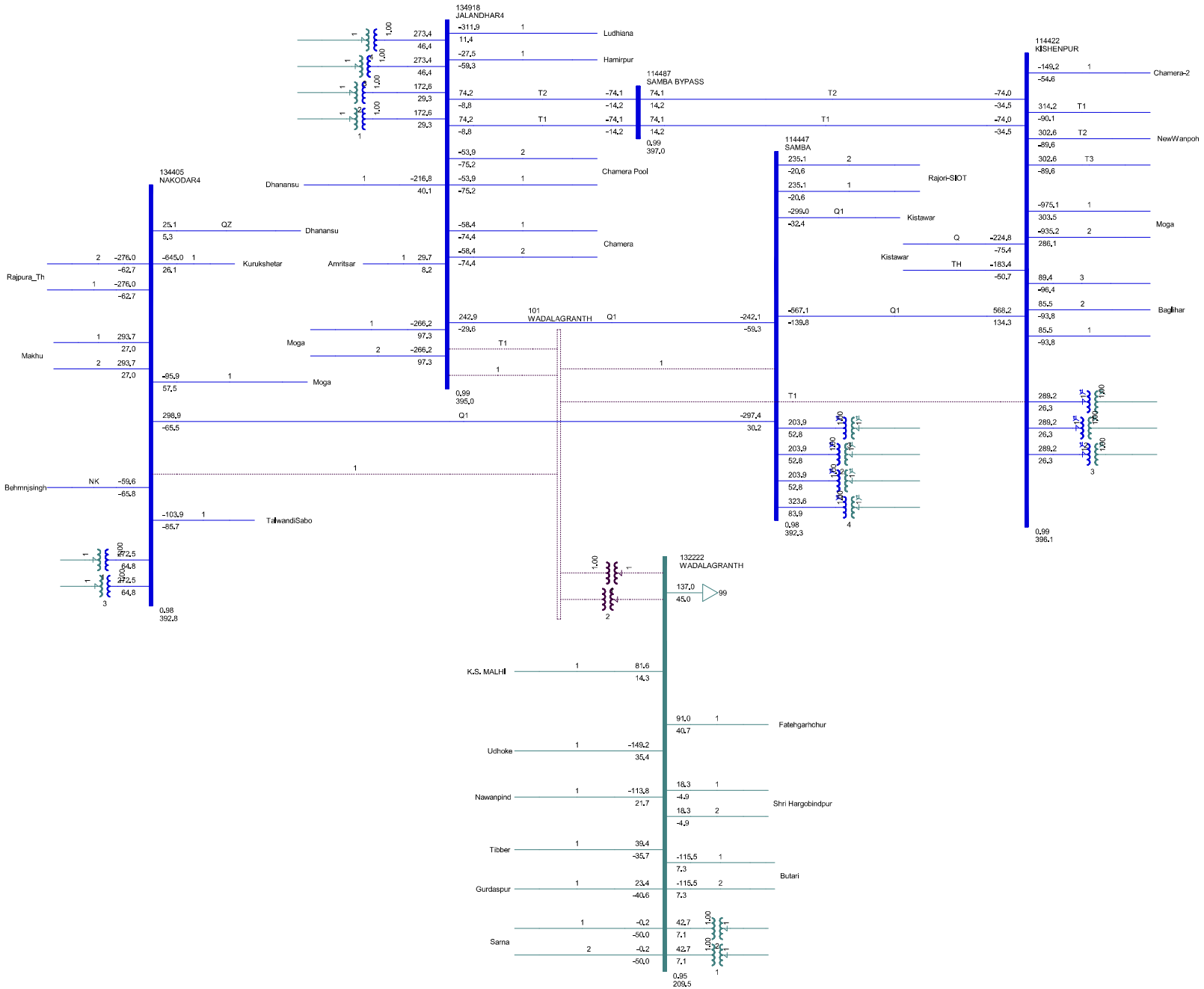
Summer Evening Peak

LILO of 400kV kishenpur-Jalandhar line (Twin)
N-1 of Kishenpur ICT



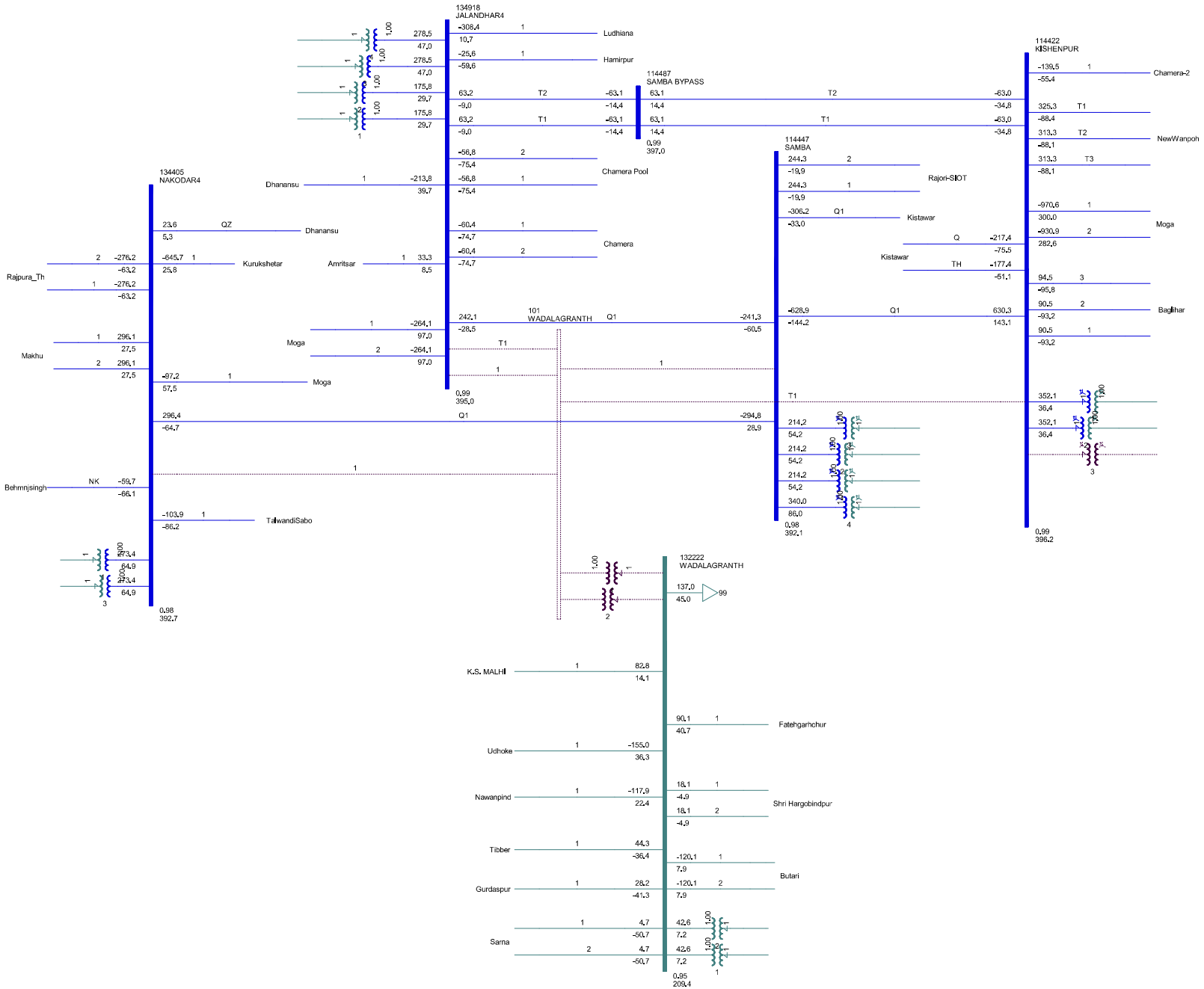
Winter Solar Max

Without Proposal



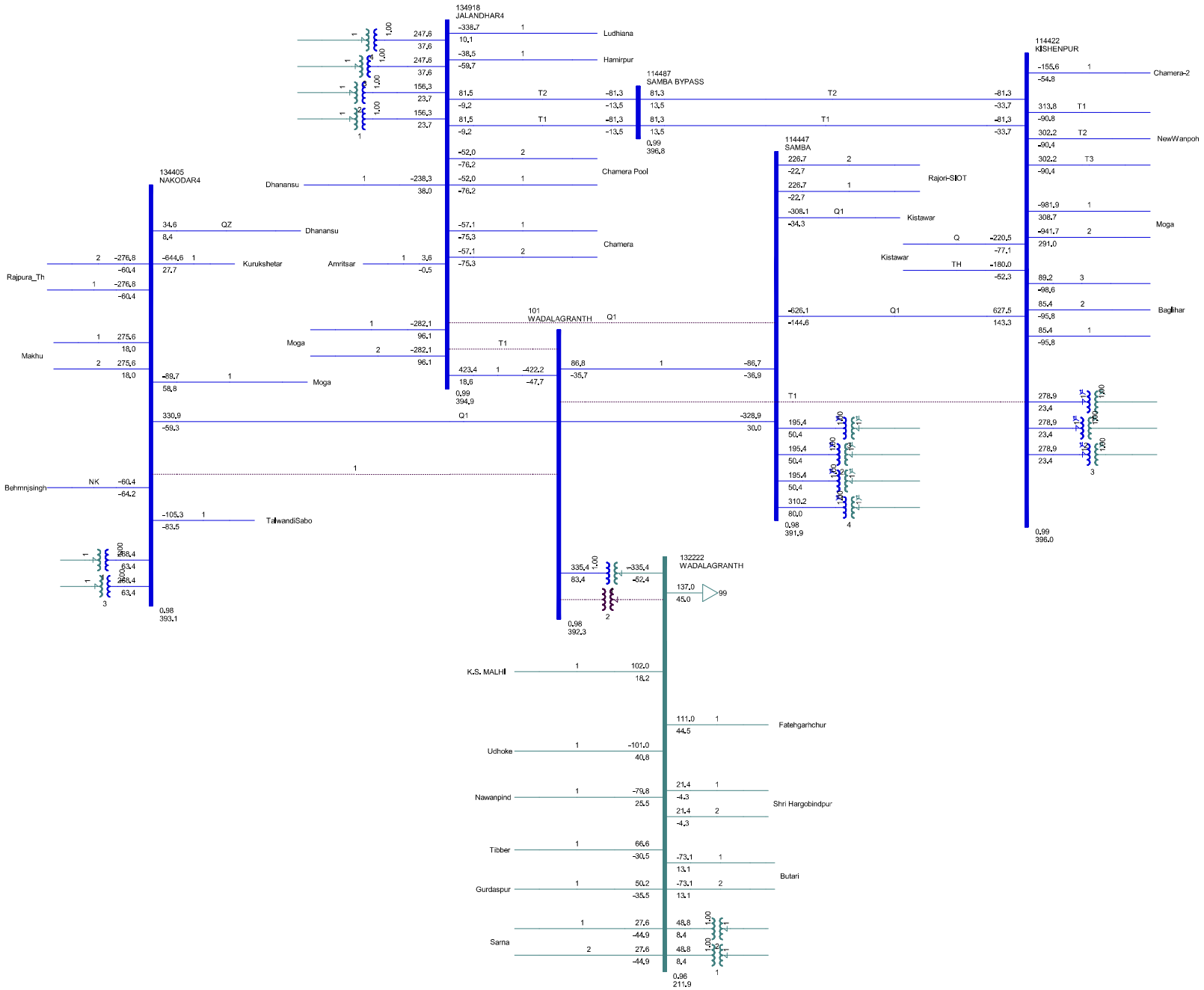
Winter Solar Max

Without Proposal
N-1 of Kishenpur ICT



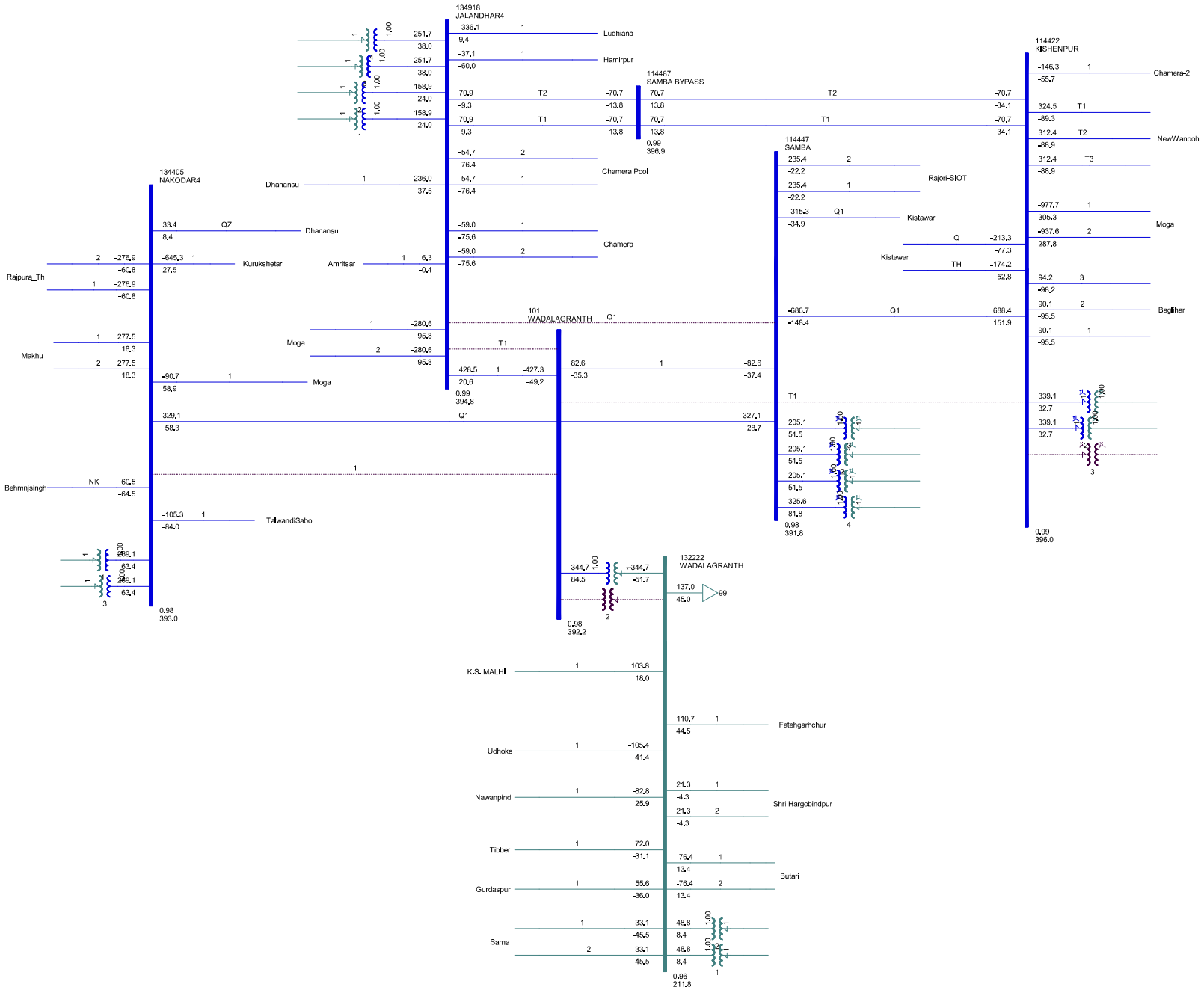
Winter Solar Max

LILO of 400 kV Samba-Jalandhar line (Quad)



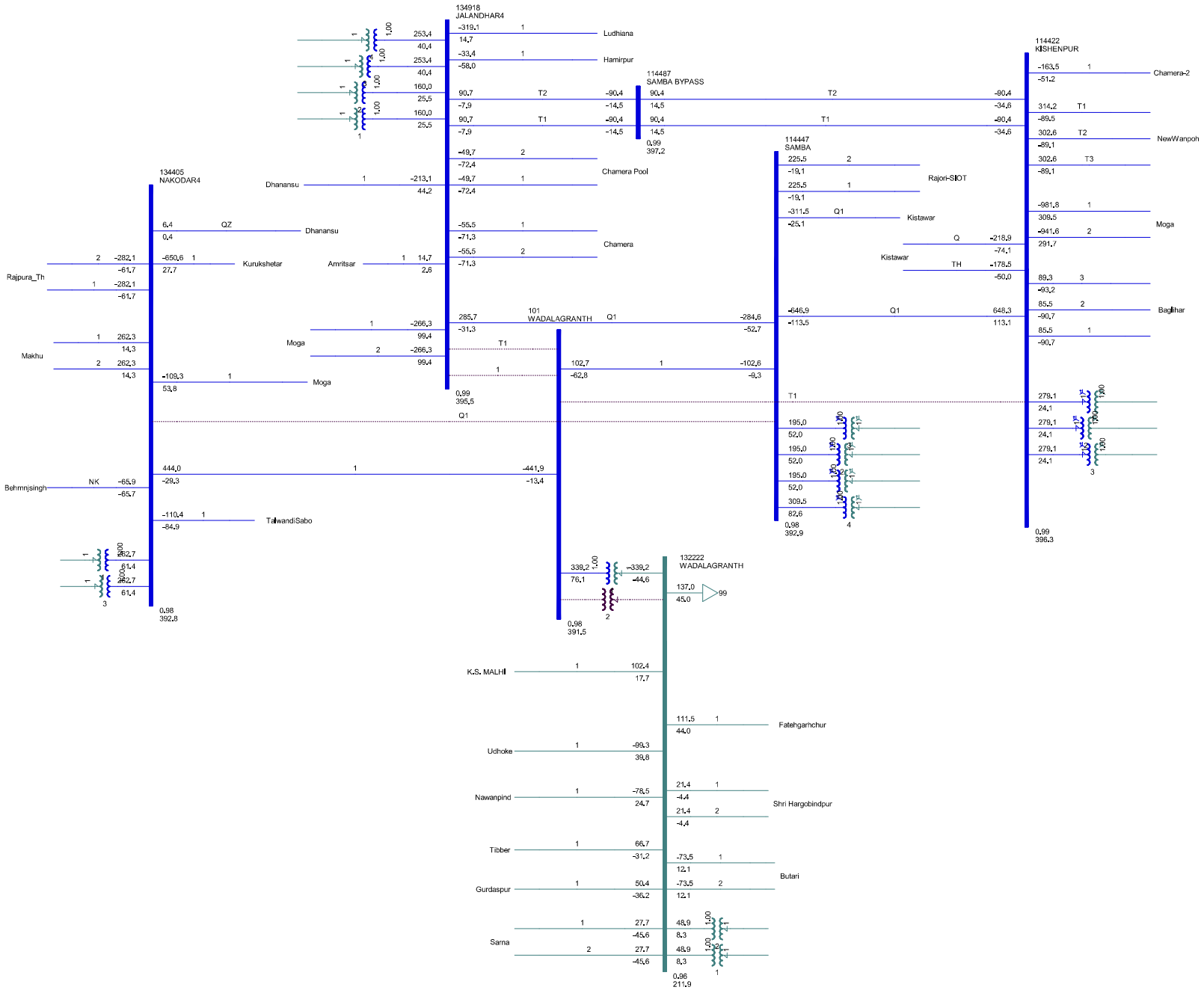
Winter Solar Max

LILO of 400 kV Samba-Jalandhar line (Quad)
N-1 of Kishenpur ICT



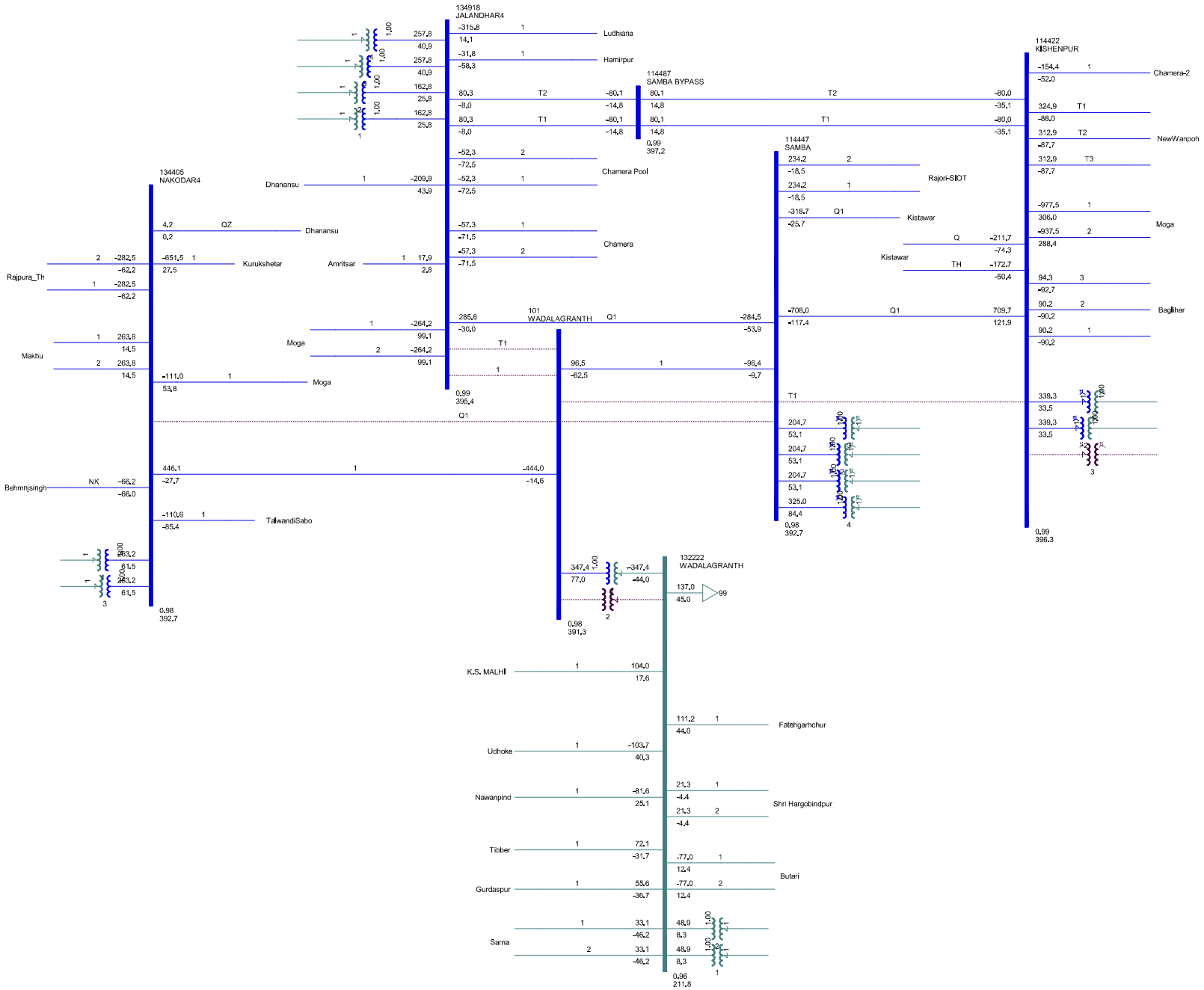
Winter Solar Max

LILO of 400kV Samba-Nakodar line (Quad)



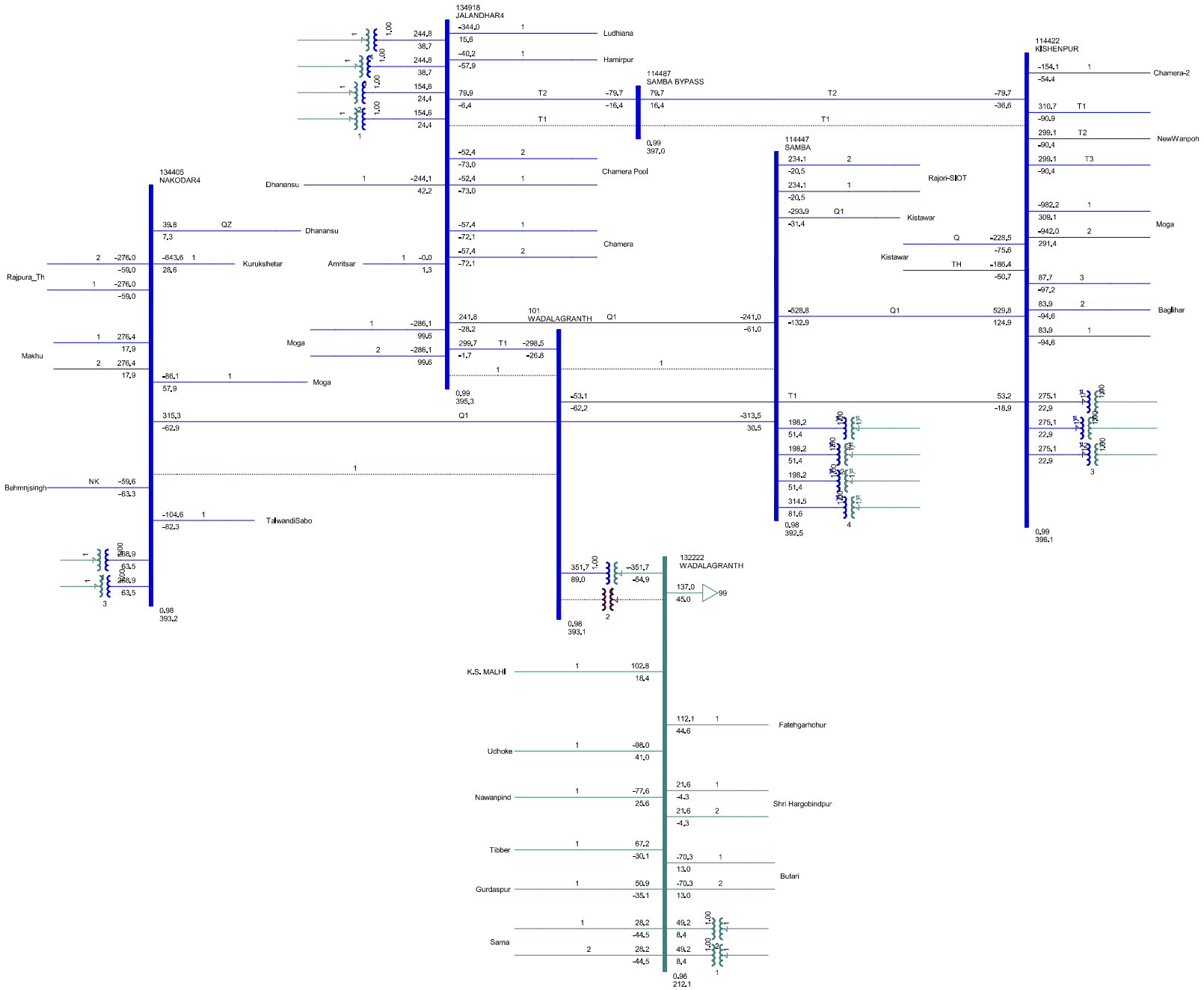
Winter Solar Max

LILO of 400kV Samba-Nakodar line (Quad)
N-1 of Kishenpur ICT



Winter Solar Max

LILO of 400kV kishenpur-Jalandhar line (Twin)



Winter Solar Max

LILO of 400kV kishenpur-Jalandhar line (Twin)
N-1 of Kishenpur ICT

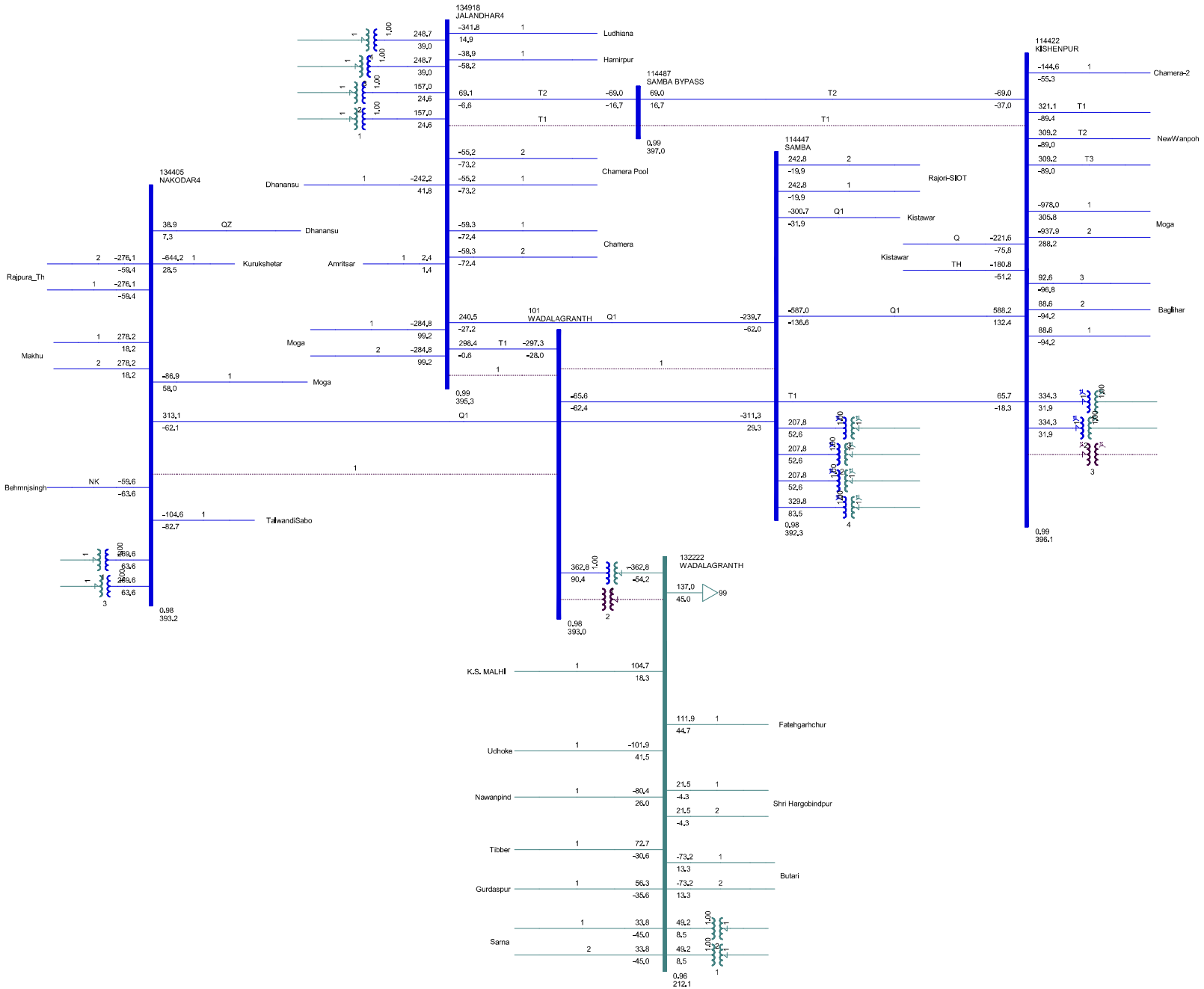
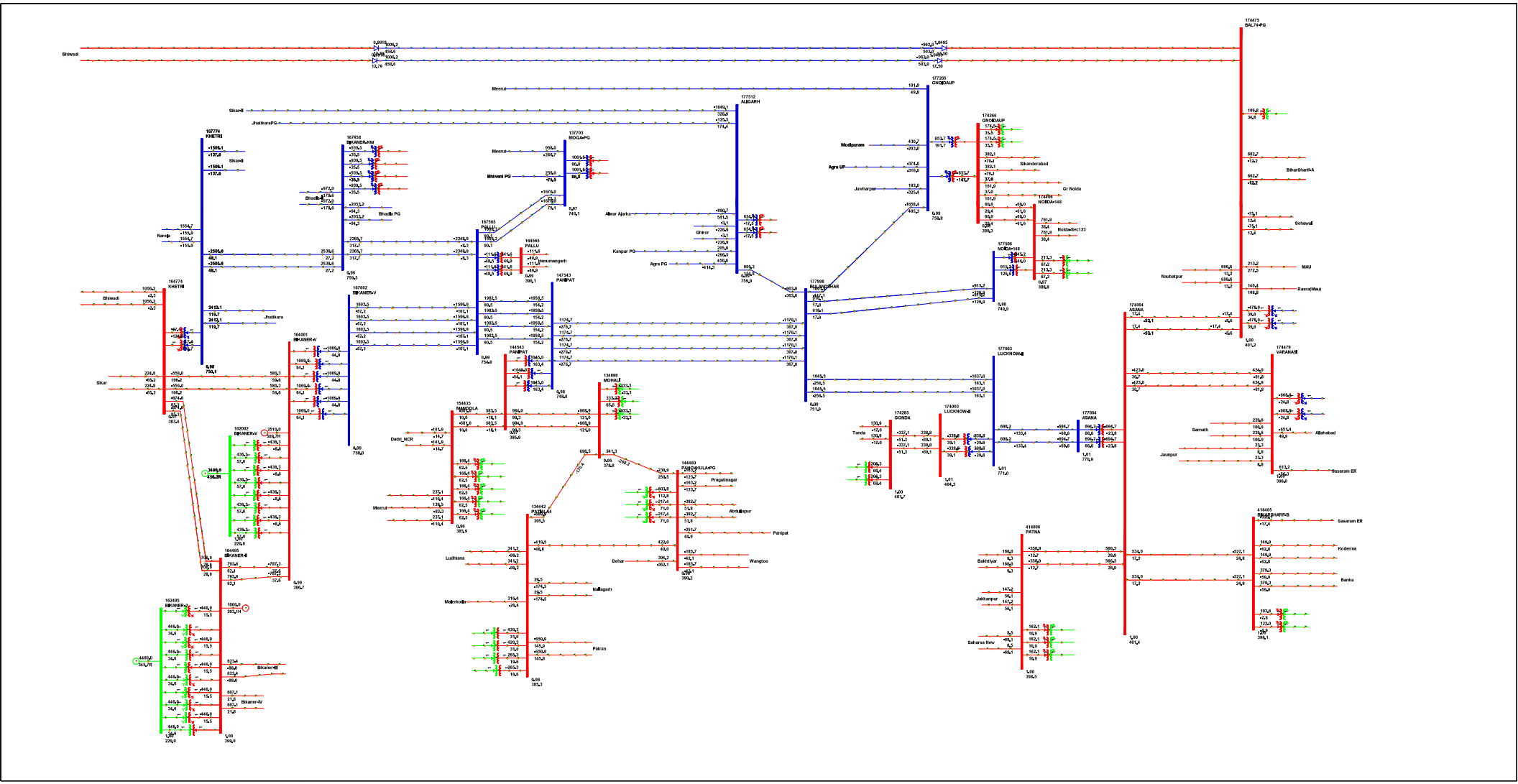
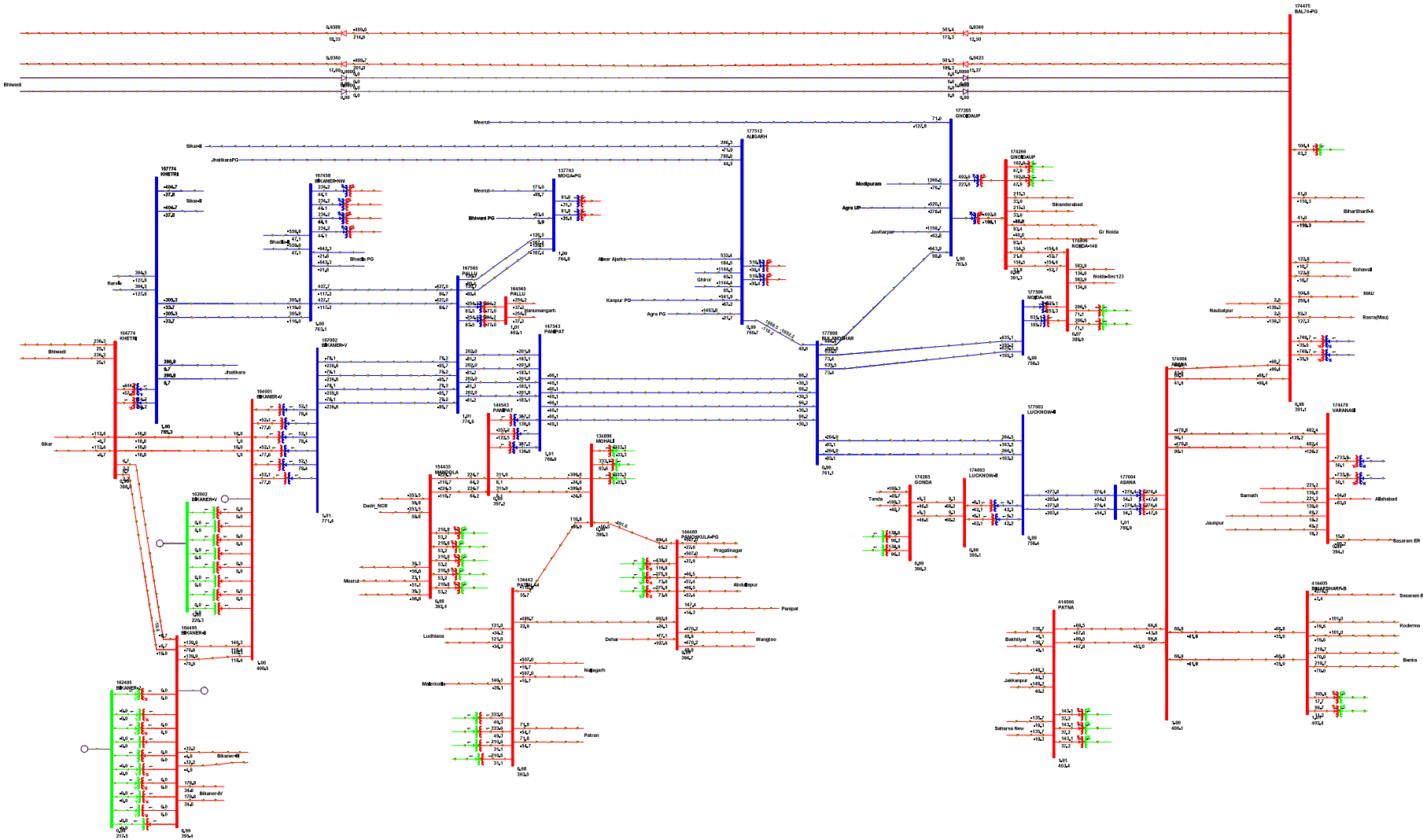


Exhibit-II

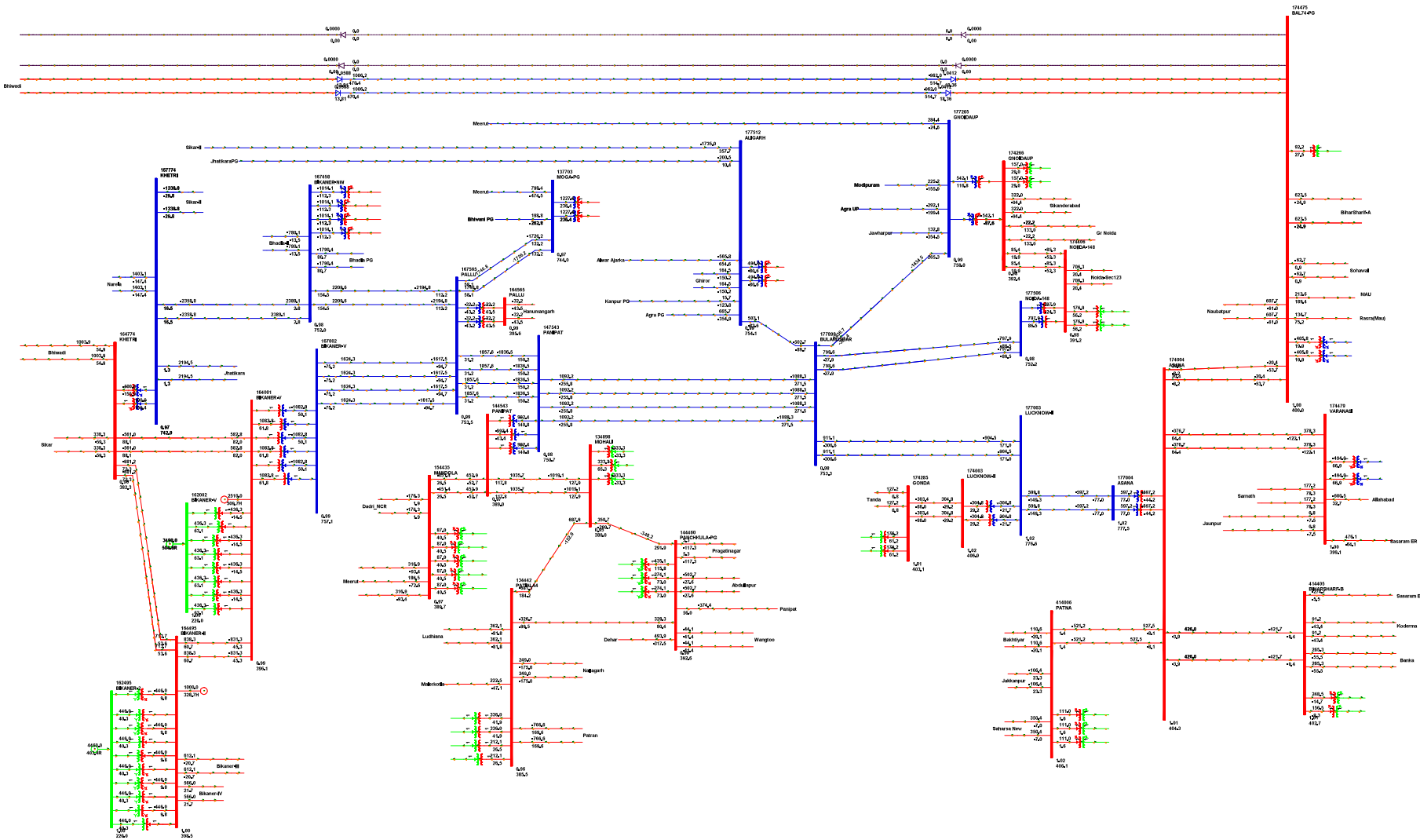
Summer Solar Max
Base Case



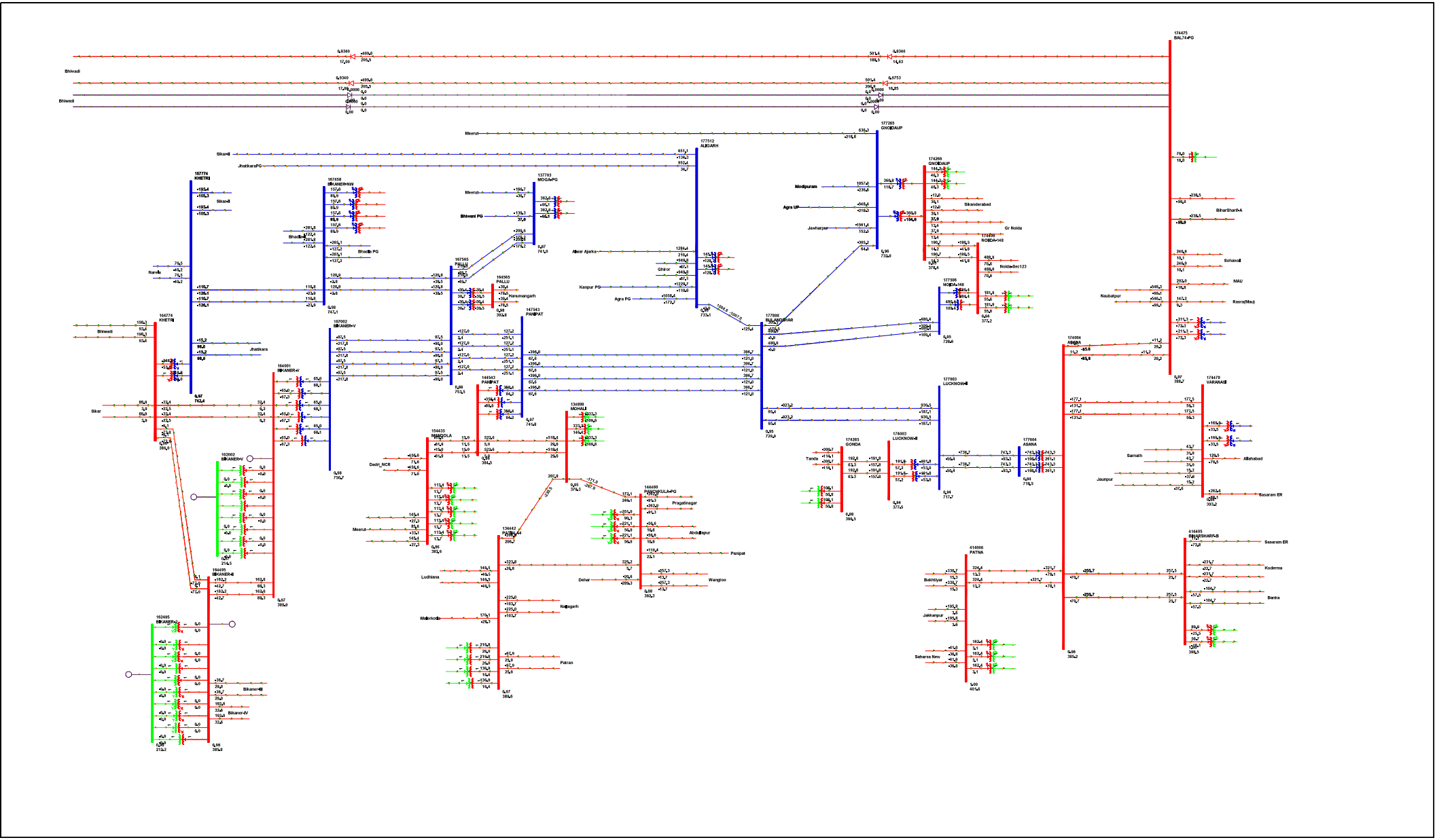
Summer Evening Peak
Base Case



Winter Solar Max
Base Case



Winter Evening Peak
Base Case



Winter Night Off Peak
Base Case