सत्यमेव जयते

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

To

-As per list enclosed-

Subject: 1st Meeting of Northern Regional Power Committee (Transmission Planning) (NRPCTP) - Agenda note

Sir/ Madam,

The 1st meeting of Northern Regional Power Committee (Transmission Planning) (NRPCTP) is scheduled to be held on **24th January 2020.**

The agenda note for 1st meeting of Northern Regional Power Committee (Transmission Planning) (NRPCTP) has already been uploaded on CEA website: www.cea.nic.in (path to access: Home Page - Wing - Power System - PSPA-I - Standing Committee on Power System Planning - Northern Region).

The venue of the meeting will be intimated shortly.

Yours faithfully,

Signature Not Verified
Digitally signed by GOUTAM ROY
Date: 2020.01.06 11:21:36 IST

(Goutam Roy)
Chief Engineer

List of Addressee:

1.	Member Secretary, NRPC, 18-A ShajeedJeet Singh Sansanwal Marg, Katwaria Sarai, New Delhi - 110016 (Fax-011-26865206)	2.	Director (W &P) UPPTCL, Shakti Bhawan Extn,3rd floor, 14, Ashok Marg, Lucknow - 226 001 (Fax:0522-2287822)	3.	Director (Projects) PTCUL, Vidhyut Bhawan, Near ISBT -Crossing, Saharanpur Road, Majra, Dehradun-248002. Uttrakhand
4.	Director (Technical), Punjab State Transmission Corporation Ltd. (PSTCL) Head Office The Mall Patiala -147001	5.	Member (Power) BBMB, Sectot-19 B Madhya Marg, Chandigarh-1 60019 (Fax-01 72-2549857	6.	Director (Operation) Delhi Transco Ltd. Shakti Sadan, Kotla Marg, New Delhi-110002 (Fax-01123234640)
7.	Director (PP&D) RVPN, 3rd Floor, Room no 330, Vidhyut Bhawan, Janpath, Jaipur-302005.	8.	Director (Technical) HVPNL Shakti Bhawan, Sector-6 Panchkula-134109	9.	Director (Technical) HPSEB Ltd. Vidut Bhawan, Shimla -171004 Fax-0177-2813554
10.	Managing Director, HPPTCL, Barowalias, Khalini Shimla-171002 Fax-0177-2623415	11.	Chief Engineer (Operation) Ministry of Power, UT Secretariat, Sector-9 D Chandigarh -161009 Fax-0172-2637880	12.	Development Commissioner (Power), Power Department, Grid Substation Complex, Janipur, Jammu, Fax: 191-2534284
13.	COO (CTU) POWERGRID, Saudamini, Plot no. 2, Sector -29, Gurgaon-122 001 (Fax-0124-2571809)	14.	Director (System operation), POSOCO B-9, Qutab Institutional Area, Katwaria Sarai New Delhi – 110010	15	MD, SECI, Prius Platinum, D-3, District Centre, Saket, New Delhi -17
16	CMD, NTPC, NTPC Bhawan, Core 7, Scope Complex-6, Lodhi Road. New Delhi	17	CMD, NHPC, NHPC Office Complex, Sector-33, NHPC, Faridabad-121003 (Fax-0129-2256055)		

Agenda note for 1st Meeting of Northern Regional Power Committee (Transmission Planning) (NRPCTP):

1.0 Confirmation of the Minutes of the 5th meeting of Northern Region Standing Committee on Transmission held on 13.09.2019.

1.1 The 5th meeting of Northern Region Standing Committee on Transmission (NRSCT) was held on 13.9.2019 and the minutes of the meeting were issued vide CEA letter no. File No.CEA-PS-11-21(19)/2/2019-PSPA-I Division dated 9.8.2019.

1.2 Subsequently, POSOCO vide its letter NLDC/SO2/TS24/SCM/1404 dated 27.8.2019 has forwarded their observations on the Agenda item no. 3 of the minutes of the meeting. POSOCO mentioned that that few suggestions provided by POSOCO in context of transmission planning studies of RE has not been incorporated in the minutes. therefore , Para no 2.18 of the minutes of 5th meeting of NRSCT is modified as follows:

2.18 POSOCO suggested that oscillatory behaviour and small signal stability of the system should also be studied. POSOCO enquired that normally the STATCOMs are placed at the load side, however in the present scheme, the STATCOMs are proposed near the generating station/s. The study results signifying the need to install STATCOMs at three place i.e. Fathegarh -2 Bhadla-2 & Bikanere-2 have not been provided in the agenda and same may be provided to substantiate the requirement of STATCOMs. It was also suggested that the cost of the implementation of these 3 STATCOMs may be mentioned for better comparison of overall cost of HVDC and HVAC alternatives. In response, CTU informed that the cost of installing STATCOMs at above mentioned 03 locations is around INR 850 crores."

Also despite being the costly alternative, the HVDC scheme was preferred over HVAC one in the last standing committee meeting. Now, as the HVDC alternative has been replaced by HVAC scheme by the standing committee within a month time, it is requested that the technical justification for preferring the HVAC scheme over HVDC may be clearly brought out in the minutes for ease of reference and record.

1.3 The minutes of 5th meeting of NRSCT along with the modifications mentioned at 1.2 above may please be confirmed.

2.0 Constitution of Northern Regional Power Committee (Transmission Planning) (NRPCTP) for planning of Transmission System in the Region:

2.1 In supersession of Ministry of Power's Office order of even number dated 13.04.2018, constituting Northern Region Standing Committees on Transmission (RSCTs) and in the light of the fact that the present transmission system is in the nature of One Nation – One Grid and the whole system as National System has to transport power seamlessly form one corner of the country to another corner of the country in the form of one single market, MoP decided to revise the existing NRSCT by replacing the same with a new Northern Region Power Committees (Transmission Planning) (RPCTPs)" with the following composition with immediate effect:

Northern Regional Power Committee (Transmission Planning) (NRPCTP):

1	Member (Power System), Central Electricity Authority (CEA)	Chairperson
2	Chief Operating Officer, Central Transmission Utility (POWERGRID)	Member

3	Director (SystemOperation), Power System Operation Corporation Ltd.	Member
4	Heads of State Transmission Utilities (STUs) of UT of Jammu & Kashmir, UT of Ladakh, Himachal Pradesh, Punjab Haryana, Rajasthan, Delhi, Uttar Pradesh, Uttarakhand, UT of Chandigarh *	Member
5	Member Secretary of Northern Regional Power Committee	Member
6	CMD/ MD/ Chairman of NTPC, NHPC and SECI	Members
7	Chief Engineer (from Power System Wing), Central Electricity Authority	Member Secretary

STUs to coordinate with their respective Distribution Companies (DISCOMs)
* To be nominated by the Central Electricity Authority.

2.2 The Terms of Reference (ToR) of the Committee are:

I. Carry out a quarterly review of the Transmission System in the region; assess the growth in generation capacity and the demand in various parts of the region; and draw up proposals for strengthening Inter- Regional transmission system. The transmission planning is required to keep in mind the areas where the generation is likely to grow and areas where load demand will grow so that the transmission system at any point of time is capable to meet the demand in every corner of the country and comply with the mandate under the Tariff Policy of developing transmission system ahead of the generation for ensuring smooth operation of the grid.

II. Assess the transmission system requirements in the near, medium and long term and draw up transmission schemes to meet these requirements. While doing this a perspective plan for the next 15-20 years may also be kept in mind and accordingly the requisite allowance/margin may be factored in the system during planning process.

III. Examine applications for connectivity and access and ensure that these are granted speedily, provided that the requisite fees/charges are paid.

IV. Review the upstream and downstream network associated with transmission schemes.

V. Examine and evaluate the intra-state transmission proposals.

VI. Review and facilitate the construction of the inter-regional grid strengthening schemes.

2.3 The RPCTPs shall take steps to ensure that the transmission capacity is capable of wheeling the electricity to different parts of the region and outside the region as per the demands of the market. They shall carry out the quarterly reviews and make recommendation for system strengthening and expansion keeping in mind the guidelines laid down by the Tariff Policy.

2.4 The RPCTPs will forward their review of the transmission systems and their recommendation for system expansion/ strengthening to the National Committee on Transmission (NCT) at the end of every quarter- by 15th July; 15th October; 15th January and 15th April. The NCT will examine the proposals and forward them to Government with their recommendations.

2.5 Members may like to note.

3.0 Agenda by HVPNL: Creation of 132/66kV S/s at Nanakpura with LILO of Ropar – Pinjore 132kV line at Nanakpura and LILO of Pinjore-Solan 66kV line at Kalka 66kV S/s:

3.1 HVPNL vide its letter no. Ch-7/HSS-391 dated 22.10.2019 has mentioned that they are intending to construct 132 kV cum 66 kV AIS substation at village Nanakpur near Kalka (Haryana) by making LILO arrangement of 132 kV Ropar-Pinjore D/C line (Owned by Haryana) and to provide alternate source for existing 66 kV S/Stn Kalka by making LILO arrangement of 66 KV Pinjore-Solan S/C line (owned by HP). The details are as follows:

(i) Creation of 132 kV cum 66 KV AIS substation at village Nanakpur (Pinjore) in Kalka constituency with 1x10/16 MVA 132/11 kV and 1x12.5/16 MVA 66/11 kV transformers capacity (already approved by HVPNL vide R-1670 / Ch-9/406/K-280 dated 12.09.2019 for FY 2021-22) to cater the load growth in Nanakpur area. Considering the scarcity of ROW and utilization of existing ROW, the connectivity to said substation has been provided by LILO arrangement of 132 kV Ropar-Pinjore D/C line at 132 kV cum 66 kV AIS substation Nanakpur.

(ii) At present, 66 kV Kalka is being fed from 220 kV Pinjore through 66 kV Pinjore-Kalka S/C line. Further to provide reliability of supply to 66 kV Kalka substation and considering utilization of existing ROW, Alternate connectivity to 66 kV substation Kalka approve videR-1427 dated 28.07.2016 through LILO arrangement of 66 kV Pinjore –Solan S/C line at 66 66 KV substation Kalka. The 132 kV Ropar –Pinjore D/C line and 66 kV Pinjore –Solan line being interstate in nature, the approval of NRPCTP has been sought by HVPNL.

3.2 To discuss the above proposals, a meeting was held in CEA on 3.12.2019 (copy of the minutes enclosed as **Annexure- I**) , wherein HVPNL informed that, 132kV cum 66kV AIS substation with 1x10/16 MVA, 132/11kV and 1x12.5/16 MVA, 66/11 kV ICTs would be created by LILO of both circuits of existing 132kV Ropar – Pinjore line (0.15sr ACSR conductor) in following way:

(i) Ropar - Nanakpur D/C line to be charged at 132kV level from Ropar

(ii) Pinjore - Nanakpur D/C line to be charged at 66kV level from Pinjore

HVPNL also informed that for the above works that they would utilize 66/11kV spare transformer in Haryana's system. The existing 1x10/16 MVA, 132/11kVtranformer at Pinjore would also be utilized at Nanakpur substation.

3.3 Regarding the 2nd proposal, HVPNL informed that the LILO of Pinjore - Solan 66 kV S/C line at Kalka substation has been proposed to provide reliability of supply to 66kV Kalka substation. HVPNL added that the 66kV Pinjore - Solan S/C line is a very old line and there is very small or no drawl by HP through this line. HVPNL stated that, the peak drawl of Kalka substation is around 25MVA. After the proposed LILO, length of Pinjore to Kalka portion of Pinjore- Kalka line would be around 7.45 kms and would provide alternate power supply to Kalka.

3.4 After deliberations, following was agreed:

I. LILO of Ropar – Pinjore 132kV D/C line at Nanakpur was agreed in-principle subject to confirmation from PSTCL and ratification by Northern Regional Power Committee (Transmission Planning).

II. *LILO of Pinjore – Parwanoo 66kV line at Kalka was agreed in-principle subject*

to ratification by Northern Regional Power Committee (Transmission Planning). However, the issues related to shifting of ISTS point, ownership and commercial issues may be sorted out mutually between HPPTCL and HVPNL

3.5 Subsequently, PSTCL vide its letter no. 1039/P-1/288 dated 9.12.2019 has forwarded its consent for implementation of Nanakpura S/s by HVPNL with LILO 132 kV Ropar-Pinjore D/C line. A copy of PSTCL letter is enclosed as **Annexure-II**.

3.6 Members may like to deliberate.

4.0 Augmentation of transformation capacity at 400/220 kV Math, Mathura(UPPTCL) substation from 2x315 MVA to 1x500+2x315MVA

4.1 In 40th Meeting of Standing Committee of Northern Region held on 22.06.2018 at NRPC, New Delhi, augmentation/ replacement of 400 kV S/s Math, Mathura (UPPTCL) has been approved form 2x315 MVA to 1x315 MVA + 1x500 MVA or 3x315 MVA depending upon the availability of space.

4.2 Subsequently, UPPTCL vide their letter no 3936/TP&PSS/UPPTCL/2019/CEA-SCM dated 2.11.2019 has intimated that they have planned to augment the transformation capacity of 400/220kV Mathura substation by 1x500+2x315MVA, which was earlier 2x315 MVA, due to envisaged load growth.

4.3 Members may like to note.

5.0 Proposal of DTL to replace a ICT of 315 MVA with 500 MVA ICT at Bawana 400 kV substation.

5.1 DTL vide its letter no. F.DTL/202/Opr(Plg)/2019-20/F-8/67 dated 9.08.2019 had submitted that the transformer No. 4 at 400 kV Bawana switchyard was installed on 1997 and due to deterioration of its health the same needs to be replaced. Therefore, DTL proposed for replacement of 4th 315 MVA ICT with 500 MVA ICT at Bawana 400 kV substation. DTL also mentioned that at present, the installed capacity of Bawana 400 kV substation of DTL is 1890 MVA (6X315 MVA) and with the proposed replacement, transformation capacity at Bawana would become 2075 MVA (1x500+5X315 MVA), which is higher than the maximum transformation capacity i.e. 2000 MVA for a 400 kV substation, as specified in CEA's Transmission Planning Criteria.

5.2 To discuss the above issue, a meeting was held in CEA on 26.9.2019 (copy of minutes is enclosed at Annexure-III), wherein, proposal of DTL for replacement of 1 no. of 315 MVA ICT with 500 MVA ICT at Bawana 400 kV substation was agreed with the condition that in future, if any ICT replacement is done by DTL, the capacity would not exceed much beyond 2000 MVA.

5.3 Members may like to note.

6.0 Evacuation system for Singrauli STPP Stage III (2x800 MW)

6.1. NTPC is implementing Singrauli STPP Stage III generation within the existing Singrauli TPS complex in UP and NTPC has commitment for purchase of 85% of power from UP. To discuss the evacuation system for Singrauli STPP-III (2x660 MW), a meeting was held in CEA on 7.05.2018, wherein, keeping in view the high short

circuit level in Singrauli, Anpara generation complex, following was proposed in respect of transmission system for evacuation of power from Singrauli STPP –III:

i) Singrauli St-III to be connected to Vindhyachal 765/400kV pooling station through Vindhyachal St-IV/V.

ii) Singrauli-III–Rihand-III 400kV D/c line to provide additional evacuation path to both generations, Singrauli St-III and Rihand-III.

6.2. To examine availability of space at Vindhyachal St-V, Rihand St-III, Vindhyachal 765/400kV pooling station and feasibility of 400kV link with Rihand St-III, a site visit was carried out by CEA, CTU and NTPC during the period 01.06.2018 to 02.06.2018 wherein it was found that termination of a new D/C line may not be possible at Vindhyachal-IV due to extensive ROW constraints in the vicinity of the yard. Therefore, LILO of both circuits of Tie line (Vindhyachal Stage-IV to Vindhyachal Stage-V 400kV D/C Twin Moose line) at Singrauli Stage- III along with reconductoring of Singrauli Stage-III - Vindhyachal stage-IV 400 kV D/C TM line formed after LILO with HTLS conductor to meet n-1 criteria of power flow was proposed.

6.3. Matter was further discussed in 40th Standing Committee Meeting on Power System Planning for Northern Region held on 22.06.2018 wherein NTPC intimated that plant capacity of Singrauli STPP Stage III has been revised to 2x800 MW from 2x660 MW and it was decided that joint studies involving CEA, CTU and POSOCO for the increased capacity of Singrauli STPP-III generation from 2x660 MW to 2x800 MW. Now, NTPC vide its letter dated 21.06.2019 has intimated that tendering for the project is in advanced stage and has requested to finalize the evacuation system of Singrauli III project.

6.4. A meeting was held in CEA on 4.10.2019, wherein, following was discussed:

(i) In the load flow studies carried out considering the evacuation system proposed in earlier meetings, no constraint have been observed in the transmission system due to revision in the plant capacity of Singrauli STPP Stage III from 2x660 MW to 2x800 MW except the high loading on 765/400kV transformers at Vindhyachal Pool. To cater the high loading, a 3rd 765/400kV transformer may be added at Vindhyachal Pool.

(ii) Regarding the issue of high short circuit level in Singrauli, Anpara generation complex, it was suggested that 3 phase fault current reduces significantly with the opening of Singrauli-Anpara 400kV line and there would not be any issue in opening this line as very less power flows on Singrauli-Anpara 400kV line and it is floating most of the time. In view of above following was agreed for evacuation of power from Singrauli Stage-III TPS (2x800 MW)

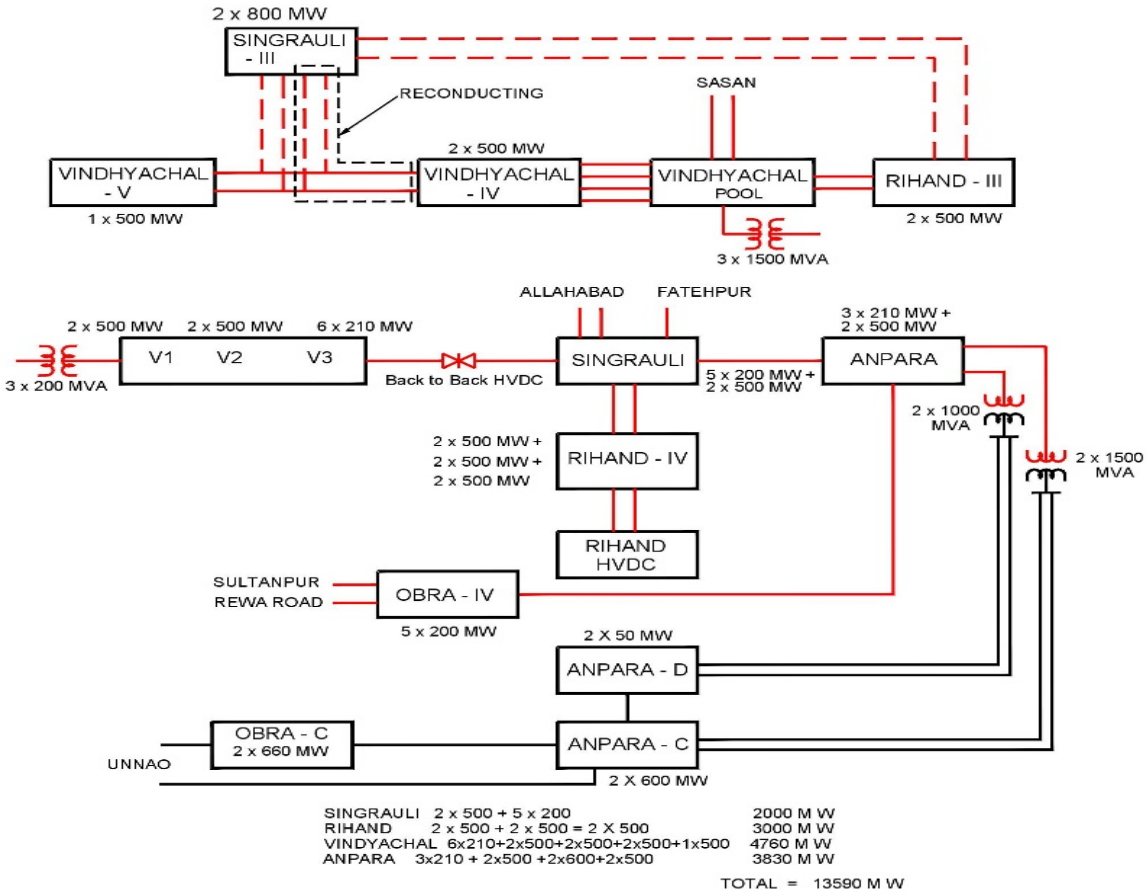
(iii) LILO of both circuits of Tie line (Vindhyachal Stage-IV to Vindhyachal Stage-V 400kV D/C Twin Moose line) at Singrauli Stage-III.

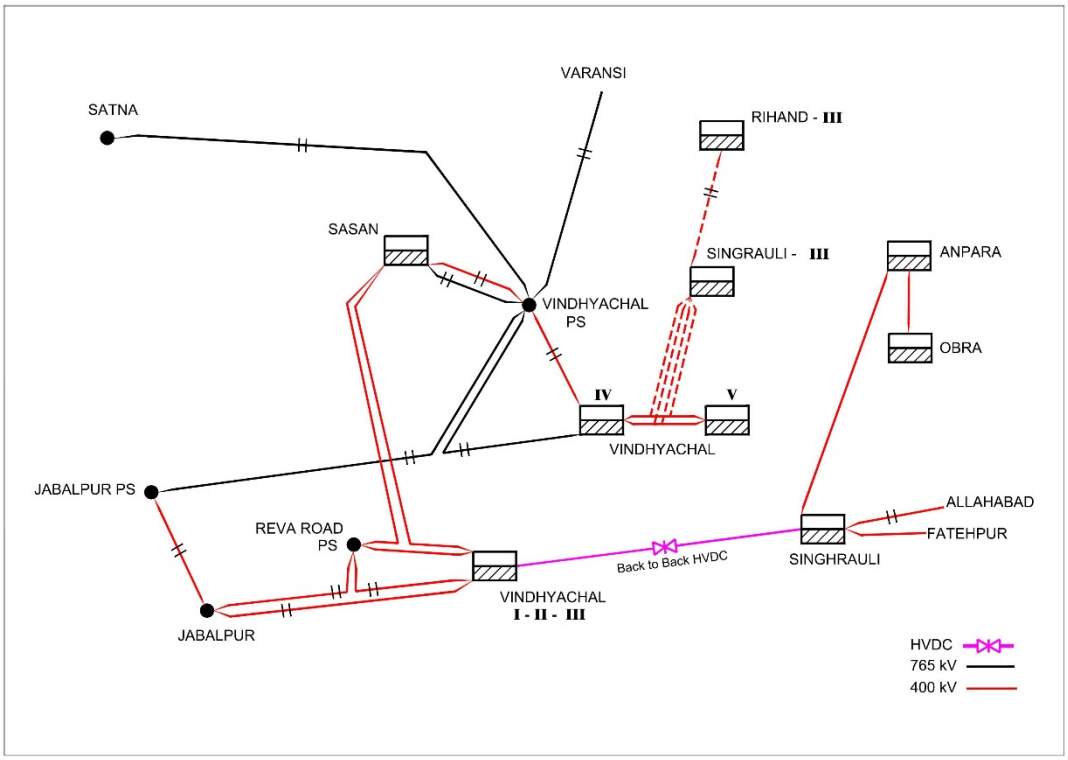
(iv) Reconductoring of Singrauli Stage-III - Vindhyachal stage-IV 400 kV D/C TM line (formed after above proposed LILO) with HTLS conductor.

(v) Singrauli-III–Rihand-III 400kV D/c line

6.5. A schematic arrangement of the Anpara- Vindhyachal –Singrauli complex is enclosed

herewith.





6.6. Members may like to deliberate.

7.0 Transmission system for evacuation of power from Pakaldul (1000MW), Kiru (624 MW) and Kwar (540 MW) HEPs of CVPPL:

7.1 CVPPL is implementing three major HEPs viz Pakaldul (1000MW), Kiru (624 MW) and Kwar (540 MW) HEP in J&K. Works on various components of PakalDul HEP are in progress. Works of Kiru and Kwar HEPs are in advanced stage of tendering. The power from these projects was planned to be pooled to Kishtwar S/s. In the 2nd meeting of NRSCT, following was agreed in regard of the connectivity of PakalDul HEP (1000 MW):

i) 400 kV D/c (Triple HTLS Conductor) line from PakalDul HEP–Kishtwar Switching station along with associated bays at both ends – under scope of generation developer.
ii) Establishment of 400 kV switching station at Kishtwar(GIS) by LILO one circuit of Kishenpur – Dulhasti 400kV D/c (Quad) line (Single Circuit Strung) –under ISTS.
iii) GIS switchyard equipment, XLPE cables and other associated equipment may be designed for current carrying capacity of 4000 Amps - under scope of generation developer.
iv) 420 kV, 125 MVAR Bus Reactor at PakalDul HEP -under scope of generation developer.
v) 420 kV, 125 MVAR Bus Reactor at Kishtwar Switching Station - under ISTS.
vi) One and a half breaker switching scheme for 400kV Generation switchyard - under scope of generation developer.

7.2 The matter was again deliberated in 3rd meeting of NRSCT wherein, CEA suggested that, in view of limited space for laying the transmission line corridor in Chenab Valley, it would be better that CVPPL lay a dedicated line from Pakal Dul HEP to Kishtwar which could be extended to Kawar and Kiru HEPs and suitable provisions in the dedicated line can be made so that power from Kirthai I and Kirthai II projects in Jammu & Kashmir (around 1300 MW) could also be evacuated through the Pakal Dul HEP–Kishtwar line. CVPPL agreed with the suggestion given by CEA to use quad HTLS for PakalDul HEP–Kishtwar line instead of triple HTLS conductor.

7.3 Subsequently, CVPPL intimated that they are facing some difficulties in implementation of Pakal Dul HEP–Kishtwar line with quad HTLS conductor. If 1300 MW power from Kirthai I and Kirthai II projects in Jammu & Kashmir would also be evacuated through the PakalDul HEP–Kishtwar line, current would be of the order of 5000 Amps. CVPPL also mentioned that earlier it was agreed that the GIS switchyard equipment, XLPE cables and other associated equipment may be designed for current carrying capacity of 4000 Amps, therefore, the same has been mentioned in the tender documents and works of Pakaldul HEP switchyard has been awarded accordingly. The works on various components of PakalDul HEP are already under progress. CVPPL therefore requested to plan a separate corridor for evacuation of power from Kirthai I and Kirthai II projects in Jammu & Kashmir -2 and for evacuation of power from CVPPL projects (i.e. Pakaldul, Kiru & Kwar HEPs), the dedicated line to Kishtwar may be implemented with triple HTLS conductor.

7.4 To deliberate on the above issue, a meeting was held in CEA on 26.09.2019 (copy of minutes is enclosed at **Annexure- IV**), wherein, CTU opined that as per the master

plan, two corridors were planned in J&K i.e one corridor for 1500 MW power coming from HP in addition to Kirthai I & II and 2nd corridor for Kiru, Kwar and Pakaldul projects. Therefore, there is possibility of laying two corridors and after deliberations, following was agreed in- principle:

i) Implementation of Kiru-Kwar-Pakaldul to Kishtwar 400 kV D/c line with triple HTLS conductor instead of quad HTLS conductor was agreed subject to ratification from the NRSCT.

ii) The possibility of 2nd corridor in Chenab basin need to be discussed with JKPDD. iii) The matter for change in conductor of Kiru-Kwar-Pakaldul to Kishtwar 400 kV D/c line from quad HTLS conductor to triple HTLS needs to discussed in NRSCT.

7.5 CTU/CVPPL may respond. Members may pl. note.

8.0 Establishment of 400 kV switching station at Kishtwar (GIS) under ISTS:

8.1 In the 2nd meeting of NRSCT, following transmission system was agreed for grant of LTA to Pakaldul HEP (1000 MW):

(i) Establishment of 400 kV switching station at Kishtwar(GIS) by LILO one circuit of Kishenpur – Dulhasti 400kV D/c (Quad) line (Single Circuit Strung) –under ISTS.

(ii) GIS switchyard equipment, XLPE cables and other associated equipment may be designed for current carrying capacity of 4000 Amps - under scope of generation developer.

(iii) 420 kV, 125 MVAR Bus Reactor at PakalDul HEP -under scope of generation developer.

(iv) 420 kV, 125 MVAR Bus Reactor at Kishtwar Switching Station - under ISTS.

(v) One and a half breaker switching scheme for 400kV Generation switchyard - under scope of generation developer.

8.2 The above works needs to be taken up for implementation under ISTS matching with the readiness of the generation at Pakaldul (1000MW), Kiru (624 MW) and Kwar (540 MW) HEPs of CVPPL, whichever is earliest.

8.3 Members may deliberate.

9.0 RVPN's proposal regarding uprating, updating and strengthening intra-State transmission schemes for Renewable Energy Evacuation in Western Rajasthan to be implemented by RVPN:

9.1 RVPN letter no. RVPN/SE(P&P)/XEN-2(P&P)/AE-2/F/D/974 dated 22.10.2019 submitted a proposal for the Transmission System regarding Uprating, Upgrading and Strengthening of Intra-State Transmission Schemes for Renewable Energy Evacuation in Western Rajasthan to be implemented by RVPN. The proposal includes (i) 765 kV Up-gradation of GSS Jodhpur, (ii) A new 400 kV GSS at Pokaran along with associated transmission lines, (iii) Four nos. of 220 kV GSS, (iv) Three no. of new

Transmission lines, (v) Transformer augmentation at 3 locations, (vi) Up-rating of 8 nos. of 200 kV and 13 nos. of 132 kV lines, (vii) Addition of shunt reactors at 8 locations, (viii) TCR at 4 locations and (ix)Power Flow Control Device for 2 transmission lines.

9.2 With respect to the above proposal, Rajasthan informed the following:

1. In compliance to RERC Order dated 11.01.2019, Rajasthan Discoms have proposed following year wise trajectory for RE bids for Solar & Wind capacity addition to meet RPO upto FY 2023-24:

Particulars	2020-21	2021-22	2022-23	Total
Proposed Solar Capacity addition	1500 MW	1600 MW	1785 MW	4885 MW
Proposed Non-Solar /Wind Capacity addition	500 MW	500 MW	426 MW	1426 MW
Total	**2000 MW**	**2100 MW**	**2211 MW**	**6311 MW**

2. Based on above trajectory, following Solar & Wind capacity has been considered for load flow study for condition corresponding to FY 2022-23:

RE Projects	Installed Capacity (as on 31.3.2019)	Balance approved capacity to be commissioned	Envisaged RE Projects	Total Installed capacity	Generation Schedule @75% considered in LFS
Solar	3074 MW*	864 MW	4885 MW	8823 MW	6618 MW
Wind	4310 MW	492 MW	1426 MW	6228 MW	4671 MW
Total	7385 MW	1356 MW	6311 MW	15052 MW	11289 MW

*****Excluding Captive Solar Projects

3. Following assumptions have been made for planning the requirement of additional transmission system:

- Envisaged 6311 MW new Solar/Wind Power Projects have been considered for grid connectivity in intra-state transmission system.
- In the Load Flow Studies, the net dispatch from Solar and Wind generators has been assumed as 75% of Total Installed Solar/Wind Capacity (15052 MW) i.e. the studies have been conducted for 11289 MW Solar/Wind generation.
- The additional transmission system is planned for approx. 5000 MW (75% of 6311 MW) Solar/Wind capacity.

9.3 Based on the above assumptions, Load Flow studies were carried out by RVPN and following transmission schemes were proposed for renewable energy evacuation from Western Rajasthan:

PART-A

9.3.1 **Proposed 765 kV GSS Kankani (Jodhpur) (Up-gradation)**

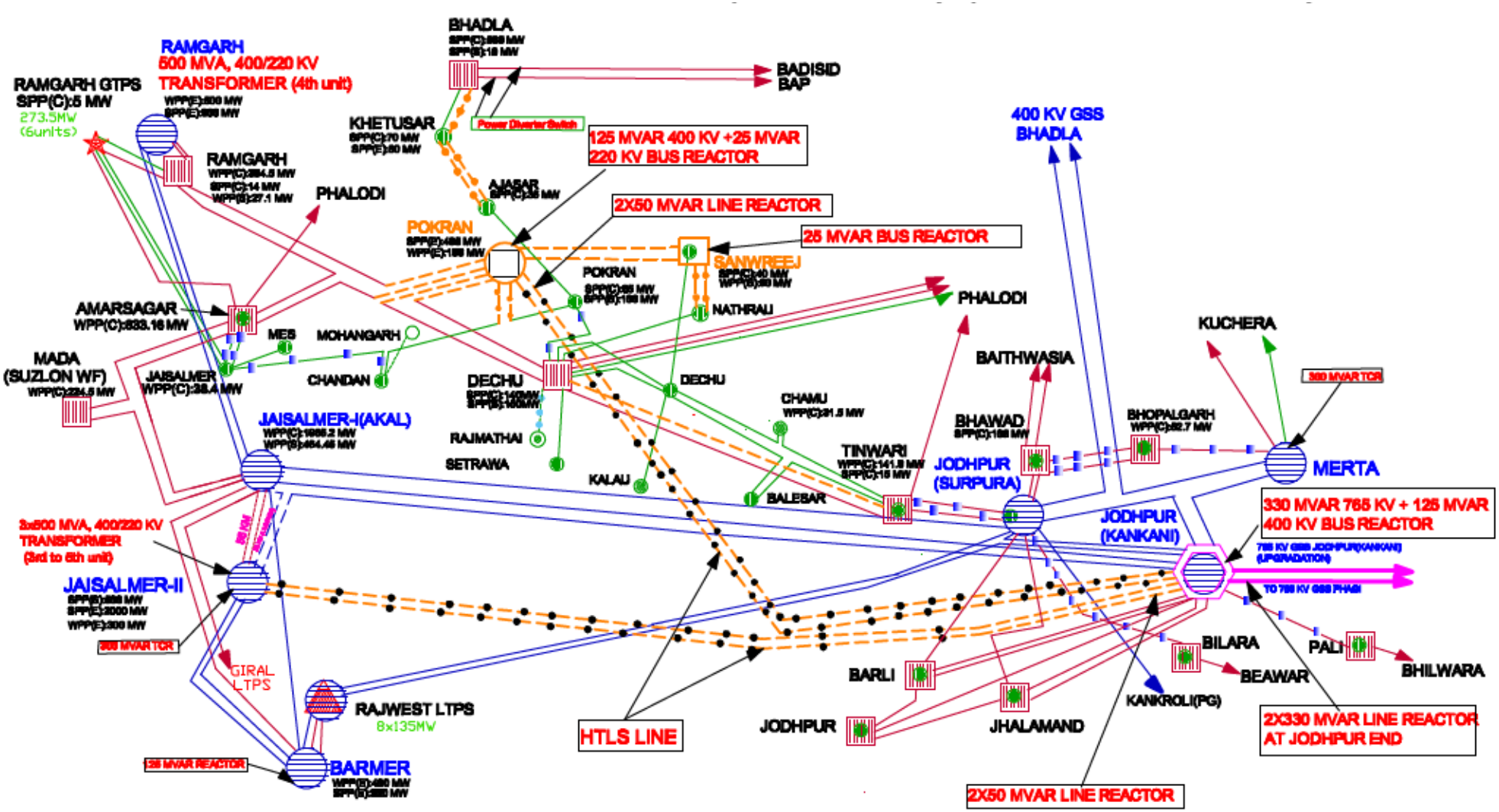
- 3x1500 MVA, 765/400 kV Substation by upgrading 400 kV GSS Kankani(Jodhpur) with 1 x 330 MVAR 765 kV Bus Reactor.
- 300 km, 765 kV D/C Kankani (Jodhpur) - Phagi line with 2x330 MVAR switchable reactors at Kankani (Jodhpur) end and 2x240 MVAR switchable reactors at Phagi end of the line.
- 200 km 400 kV D/C Kankani (Jodhpur) - Jaisalmer-II twin HTLS line with 2x50 MVAR, 420 kV switchable reactors at Kankani (Jodhpur) end of the line.

PART-B

9.3.2 400 kV GSS Pokaran and associated transmission lines

- 2x500 MVA, 400/220 kV and 2x160 MVA, 220/132 kV Power Transformers at 400 kV GSS Pokaran (Proposed) with 125 MVAR, 420 kV Shunt Bus Reactor and 25 MVAR, 245 kV Shunt Bus Reactor.
- 150 km 400 kV D/C Twin HTLS line from 400 kV GSS Pokaran to 765 kV GSS Kankani (Jodhpur) with 2x50 MVAR, 420 kV switchable reactors at Pokaran end of the line.
- 25 km LILO of 220 kV S/C Ramgarh-Dechu line at 400 kV GSS Pokaran (Proposed)
- 25 km LILO of 220 kV S/C Amarsagar-Dechu line at 400 kV GSS Pokaran (Proposed)
- 30 km LILO of 132 kV S/C Chandan-Pokaran (132 kV GSS) line at 400 kV GSS Pokaran (Proposed)

Fig: Proposed 765 kV GSS Kankani (Jodhpur) (Up-gradation) and 400 kV GSS Pokaran with associated transmission lines



9.3.3 220 kV GSS at Sawa and associated transmission lines

- 1x160 MVA, 220/132 kV Power Transformer and 1x20/25 MVA, 132/33 kV Power Transformer and 25 MVAR, 245 kV Bus Reactor at 220 kV GSS Sawa (Proposed)
- 100 km 220 kV D/C line from 400 kV GSS Barmer to 220 kV GSS Sawa (Proposed)
- 50 km LILO of 220 kV S/C Dhorimanna-Sanchore line at 220 kV GSS Sawa (Proposed)
- 5 km LILO of existing 132 kV S/C Sawa (132 kV GSS)-Chouhtan line at 220 kV GSS Sawa (Proposed)
- 5 km LILO of existing 132 kV S/C Sawa (132 kV GSS)-Ranasar line at 220 kV GSS Sawa (Proposed)

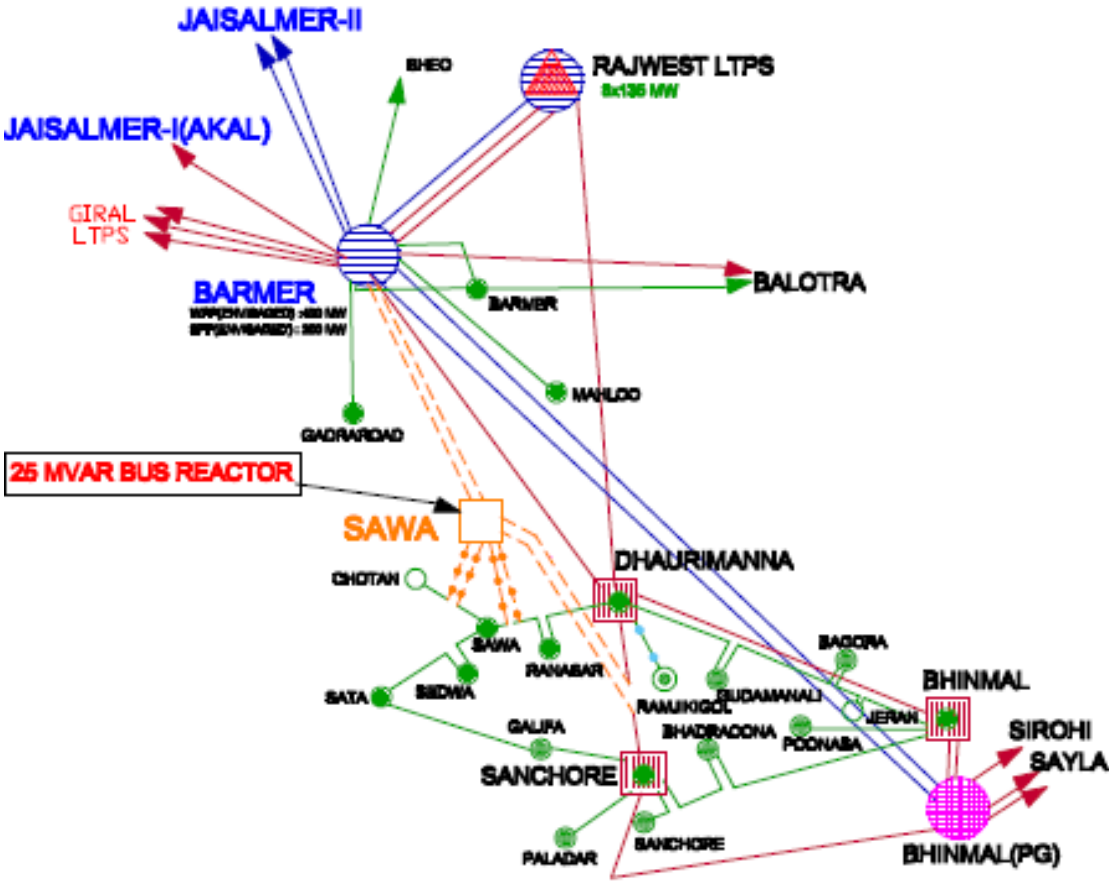
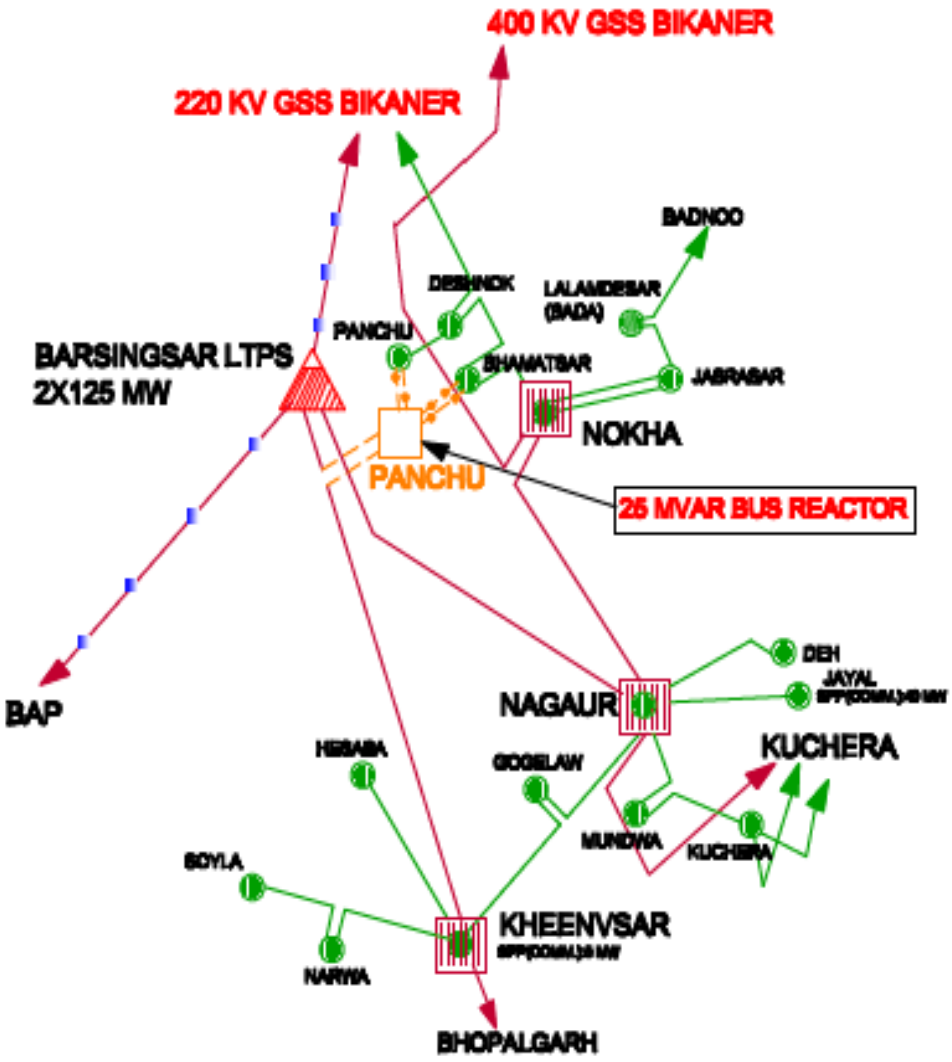


Fig: 220 kV GSS at Sawa and associated transmission lines

9.3.4 220 kV GSS Panchu and associated transmission lines

- 1x160 MVA, 220/132 kV Power Transformer and 1x20/25 MVA, 132/33 kV Power Transformer and 25 MVAR, 245 kV Bus Reactor at 220 kV GSS Panchu (Proposed)
- 3 km LILO of existing 220 kV S/C BLTPS-Khinvsar line at 220 kV GSS Panchu (Proposed)
- 0.6 km 132 kV D/C line from 220 kV GSS Panchu (Proposed) to 132 kV GSS Panchu (Existing)
- 28 km 132 kV D/C Panchu (220 kV GSS)-Bhamatsar line

Fig: 220 kV GSS Panchu and associated transmission lines



9.3.5 220 kV GSS Lohawat and associated transmission lines

- 1x160 MVA, 220/132 kV Power Transformer and 1x40/50 MVA, 132/33 kV Power Transformer and 25 MVAR, 245 kV Bus Reactor at 220 kV GSS Lohawat (Proposed)
- 70 km 220 kV D/C HTLS Transmission line from 220 kV GSS Badisid to 220 kV GSS Lohawat (Proposed)
- 5 km LILO of 220 kV Phalodi-Tinwari line at 220 kV GSS Lohawat (Proposed).
- 10 km 132 kV D/C line from 220 kV GSS Lohawat (Proposed) to 132 kV GSS Lohawat (Existing)
- 35 km 132 kV D/C line from 220 kV GSS Lohawat (Proposed) to 132 kV GSS Matora

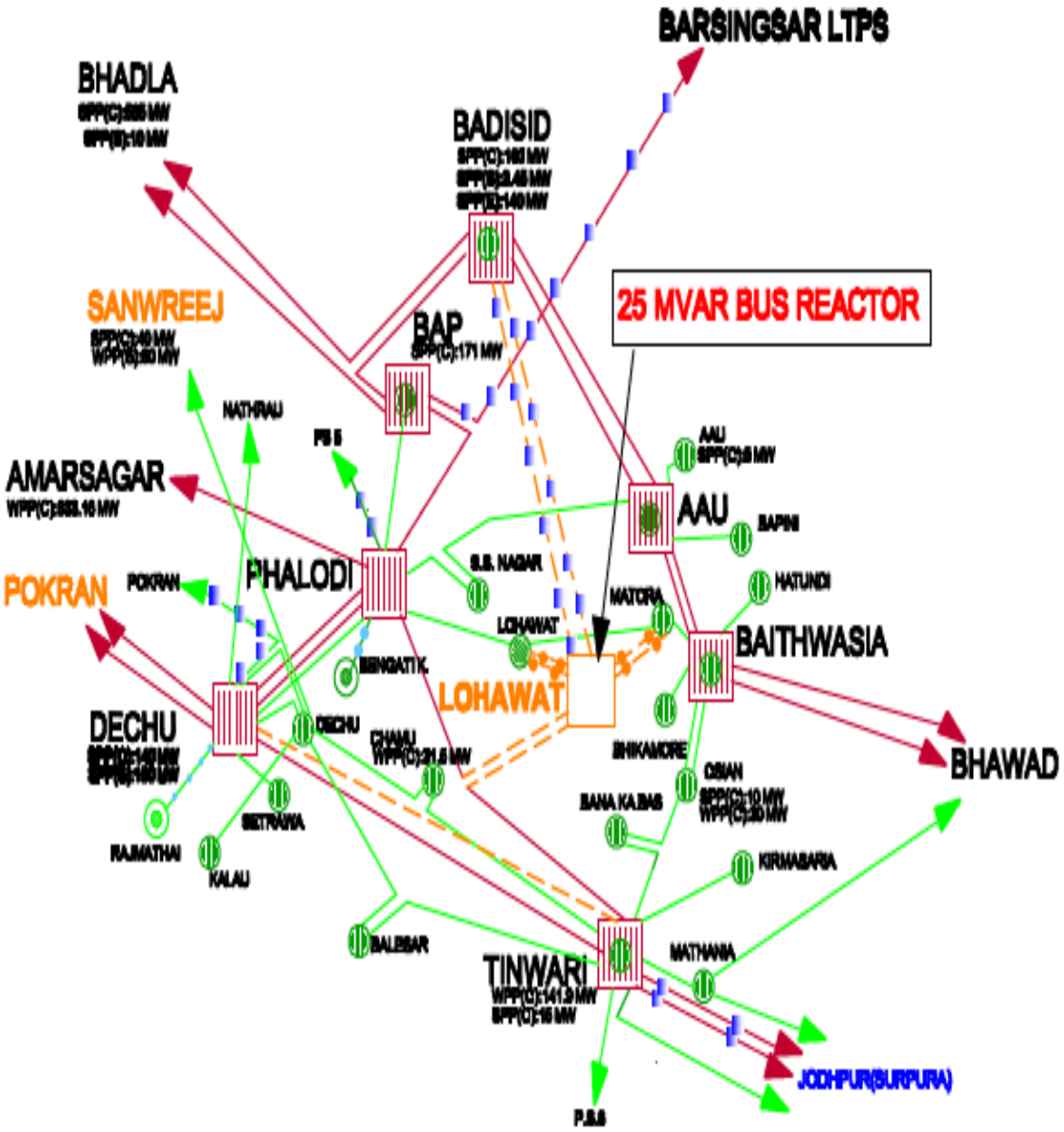
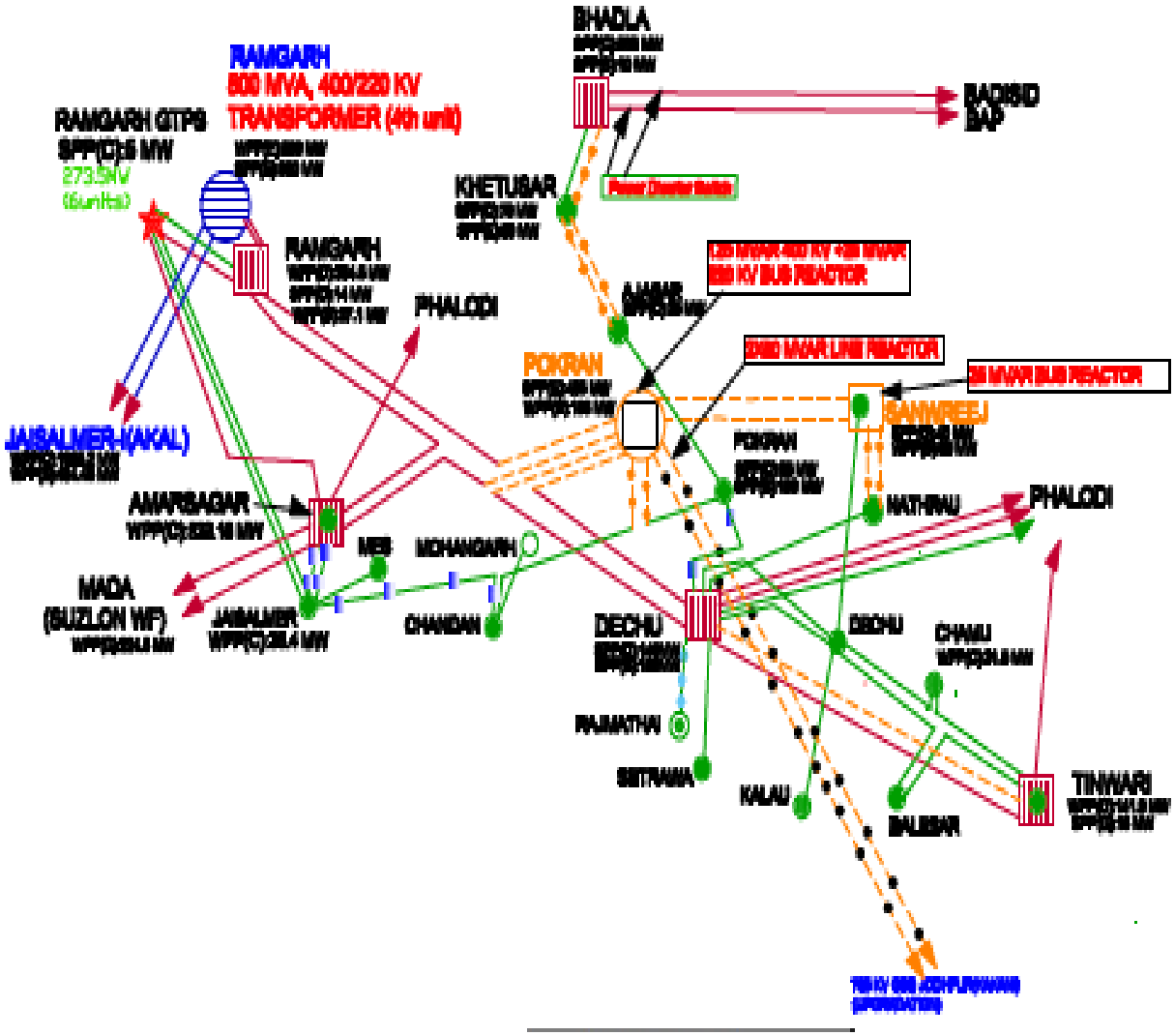


Fig: 220 kV GSS Lohawat and associated transmission lines

9.3.6 220 kV GSS Sawareej (Upgradation) and associated transmission lines

- 1x160 MVA, 220/132 kV Power Transformer and 25 MVAR, 245 kV Bus Reactor at 220 kV GSS Sanwreej (Proposed)
- 30 km 220 kV D/C line from 400 kV GSS Pokaran to 220 kV GSS Sanwreej (Proposed)
- 38 km 132 kV D/C line from 132 kV GSS Sanwreej to Nathrau

Fig: 220 kV GSS Sawareej (Upgradation) and associated transmission lines



9.3.7 New EHV Lines/ Circuits

- 72 km 220 kV S/C line from 220 kV GSS Dechu to 220 kV GSS Tinwari
- 38 km 132 kV D/C Khetusar-Ajasar line
- 28 km stringing of second circuit of existing 132 kV S/C Bhadla-Khetusar line on D/C towers

9.3.8 New Transformer Additions-

- 1x500 MVA, 400/220 kV ICT at Bhadla
- 1x500 MVA, 400/220 kV ICT at Ramgarh

- 3x500 MVA, 400/220 kV ICTs at Jaisalmer-II

9.3.9 Up-rating of Existing Transmission Corridors

A. 220 kV LINES

1. 46.6 km, 220 kV D/C Bhawad-Bhopalgarh Line
2. 56.89 km, 220 kV S/C Bhopalgarh- Merta(400 kV) Line
3. 38.21 km, 220 kV S/C Tinwari-Jodhpur(400 kV) Line (First Circuit)
4. 28.947 km, 220 kV S/C Tinwari-Jodhpur(400 kV) Line (Second Circuit)
5. 142.2 km, 220 kV S/C Bap-Barsinghsar LTPS Line
6. 36 km, 220KV S/C Barsingsar-Bikaner line
7. 61.8 km, 220KV S/C Jodhpur(New)- Pali line
8. 81.18 km, 220KV S/C Jodhpur (Surpura)-Bilara line

B. 132 kV LINES

1. 8 km, 132 kV S/C Phalodi(220 kV) -PS(5) Line
2. 22 km, 132 kV S/C PS(5) -PS(4) Line
3. 12 km, 132 kV S/C PS(4) -PS(3) Line
4. 12 km, 132 kV S/C PS(2) -PS(1) Line
5. 58 km, 132 kV S/C PS(1) -Bajju Line
6. 45.845 km, 132 kV S/C Bajju-Kolayat Line
7. 21.815 km, 132 kV S/C Kolayat - Gajner Line
8. 39.97 km, 132 kV S/C Gajner-Bhinasar Line
9. 21.815 km, 132 kV S/C Gajner-Pugal Road Line
10. 19.25 km, 132 kV S/C Pugal Road-Bikaner(220 kV) Line
11. 9.61 km, 132 kV D/C Amarsagar-Jaisalmer Line
12. 43.9 km, 132 kV S/C Jaisalmer- Chandan Line
13. 41.754 km, 132 kV S/C Pokran-Dechu(220 kV) Line

9.3.10 Reactive Power Compensation

Proposed Static Reactors:

S. no.	Name of GSS	Voltage level	Capacity of Shunt Reactor in MVAR
1	765 kV GSS Anta	765 kV	240
		420 kV	125
2	400 kV GSS Heerapura	420 kV	125
3	400 kV GSS Ajmer	420 kV	125
4	400 kV GSS Bhilwara	420 kV	125
5	400 kV GSS Babai	420 kV	125
6	400 kV GSS Chhitorgarh	420 kV	125
7	400 kV GSS Jodhpur(Kankani)	420 kV	125
8	400 kV GSS Barmer	420 kV	125
	Total (765 kV)		240 MVAR (1 no.)
	Total (400 kV)		1000 MVAR (8x125 MVAR)

Proposed Dynamic Reactors:

S. No.	Name of 400 kV GSS	Voltage level	Capacity of TCR in MVAR

1	400 kV GSS Merta	420	300
2	400 kV GSS Bikaner	420	300
3	400 kV GSS Bhadla	420	300
4	400 kV GSS Jaisalmer-2	420	300
	Total		1200 MVR (4x300)

i. Power flow Control Device/ Solution

Power flow control devices with degree of compensation for each device/solution equal to 45MVAR (at 245 kV) are proposed on the following transmission lines:

- 220 kV S/C Bhadla-Bap line
- 220 kV S/C Bhadla-Badisid line

b. To discuss the above proposal, a meeting was held on 13.11.2019 in New Delhi with participation from CEA, CTU and RVPNL, wherein, it was pointed out that the load flow studies for RE power evacuation from Rajasthan has already been done by CTU and CEA incorporating the proposed transmission system of RVPN and it has been found that the system is adequate for evacuation of RE power from western Rajasthan and would supplement the ISTS system already been agreed for RE power evacuation. In the meeting, RVPN informed that the Transmission schemes are divided in two parts. Part-A includes the transmission schemes which are proposed to be funded from domestic financial institutions such as PFC, REC etc. or through TBCB and Part-B includes the Transmission schemes which are proposed to be funded through ADB .

The proposal submitted by RVPN was agreed in principle, subject to ratification in the next NRSCT/ Northern Region Power Committee (Transmission Planning).

c. Members may like to deliberate.

10.0 Connectivity of 220kV transmission line from 400kV GSS Ajmer to 220/25 kV TSS Kishengarh through 2 phase line on double circuit towers and associated bay at 400kV GSS Ajmer

10.1 Indian Railways vide their letter dated 5th September, 2019 has requested CEA to issue technical advisory to RVPNL to grant two-phase connectivity for 220 kV transmission line between 400 GSS Ajmer to 220/25 kV TSS Kishangarh. In its letter, Indian Railways have intimated that Rajasthan has conveyed its unwillingness in providing the two-phase connectivity to the TSS of Railways at 220 kV voltage level on account of the unbalance created by 2-phase load. This meeting has been convened to deliberate upon this issue.

10.2 To deliberate on the issue, a meeting was held on 8.11.2019 in CEA (copy of minutes is enclosed as **Annexure-V**). In the meeting, RVPNL opined that with rapid growth in Railway electrification, traction load is increasing significantly. Traction load is intermittent, creates unbalanced loadings and generates harmonics in the power system. With increase in connectivity of Indian Railways in State Transmission network, STU is directly subjected to intermittent and unbalanced traction loads. Therefore, there is a need for suitable guidelines from CEA for grant of connectivity to Railway Traction loads. After deliberations, following was agreed in the meeting:

(i) Indian Railways may be granted two phase connectivity for 220 kV transmission line between 400/220 kV GSS Ajmer to 220/25 kV TSS Kishengarh subject to the following conditions:

(a) Grant of such two phase connectivity is limited to this case only.

(b) Necessary filters for limiting the current/ voltage harmonics within permissible limits as specified in CEA (Technical Standards for Connectivity to Grid) Regulations 2007 and amendments thereof, would be implemented by Indian Railways at their 220/25 kV Kishangarh TSS.

(ii) Indian Railways to explore the option of drawing three phase supply from grid substation and converting it into single-phase 25 kV supply for their traction load at their TSS to address the associated operational and protection issues associated with 2-phase supply from Grid substation.

10.3 Subsequently, RVPN vide its letter dated 4.12.2019 has requested for modification under para no 9.0(ii) of the minutes of meeting held on 8.11.2019 *(para no 9.0(ii) is mentioned as 10.2(ii) above)*

Therefore, following para 9.0(iii) is added below para 9(ii):

(iii) In future, all connectivity from any State grid S/s to any TSS of Indian railways on 220 or 132kV voltage level for catering traction load shall be given on 3 phase and Indian railways shall install Scott Connection Transformer (s) at their TSS to convert 3 –phase supply to 1-phase or 2-phase. Indian Railways shall also install filters at their TSS for limiting the current/voltage harmonics as specified in CEA (Technical Standards for Connectivity to Grid) Regulations 2007 and amendments thereof, at their own cost.

10.4 Members may like to deliberate.

11.0 Additional transmission system proposed for obviating the evacuation constraints in Kalisindh- Chhabra- Kawai generation which includes (i) Construction of 400/220kV, 2X500MVA GSS at Sangod with 220/132kV, 160 MVA transformer and associated lines (ii) Revised interconnections at Kalisindh TPS"

11.1 The issue of evacuation constraints in Kalisindh-Chhabra- Kawai Generation Complex due to single 315 MVA, 400/220kV ICT each at Chhabra and Kalisindh as well as non-compliance of (N-1-1) Transmission Planning Criteria was continuously raised by OCC, TCC/NRPC and NRSCT.

Therefore, in the 2nd meeting of Northern Region Standing Committee on Transmission, the following transmission system had been agreed to be implemented by RVPNL as intra-state transmission system:

i) 2x500 MVA, 400/220 kV power transformers at existing 765 kV GSS Anta (Distt. Kota)
ii) 2x160 MVA, 220/132 kV Power transformers at proposed 220 kV GSS Sangod (Distt. Kota)
iii) Anta (765)-Baran (220) 220kV D/C line-6 km
iv) Anta (765)-Sangod (220) (Proposed) 220 kV D/C line-30 km
v) Extension of existing Dahra (220)-Anta (NTPC) 220 kV S/C line upto Anta (765) 220 kV S/Cline-44 km

11.2 Subsequently, RVPN vide their letter dated 19.11.2019 has informed that, they have reviewed the above mentioned transmission system due to the following reasons:-

a. With installation of 400/220 kV transformer at 765/400 kV Anta GSS, it would expose the 400 kV bus to frequent faults that would occur on 220 kV systems & they would directly travel to generating power systems connected to this bus.
b. There is no space in alignment of 400 kV Bus at Anta to accommodate an additional 400 kV transformer bay so the 400 kV bus would be extended (L shape) and bus sectionaliser would be provided between 765/400 kV and 400/220 kV switchyard at 400 kV.

c. Construction of 220 kV bus bar arrangement at 765 kV Anta GSS is possible only in the space reserved for future 2 No. of 765 kV bays i.e. future 765 kV interconnections would be eliminated. These bays may be required as RVPN is in the process of planning expansion of 765 kV network in the state.

11.3 In view of above, the transmission system for obviating the evacuation constraints in Kalisindh, Chhabra and Kawai generation complex has been restudied and following is mentioned:

11.4 **At present the installed capacity of Generations and Associated Transmission System in the Kalisindh, Chhabra and Kawai generation complex is as under:-**

S.No.	Generating Plant	Installed capacity in MW	
1.	Kalisindh TPS	2x 600	1200
2.	Kawai TPS	2x 660	1320
3.	Chhabra TPS	4x 250	1000
4.	Chhabra SCTPS	2x 660	1320
TOTAL			**4840**

11.5 The existing transmission system available for evacuation of 4840 MW is as under:-

Kalisindh TPS (2x600MW)

- 400 kV D/C (Quad Moose) Kalisindh TPS-Anta line
- 1x315 MVA, 400/220 kV ICT at Kalisindh TPS
- 220 kV interconnection to 220 kV Jhalawar GSS and 220 kV Bhawanimandi GSS

Chhabra TPS (4x250 MW)

- 400 kV S/C (Twin Moose) Chhabra TPS-Anta –Kota(PG) line
- 400 kV S/C (Twin Moose) Chhabra TPS-Hindaun line
- 400 kV S/C (Twin Moose) Chhabra TPS-Bhilwara line
- 1x315 MVA, 400/220 kV ICT at Chhabra TPS
- 220 kV interconnection to 220 kV Jhalawar GSS and 220 kV Kawai GSS

Chhabra SCTPS (2x660 MW)

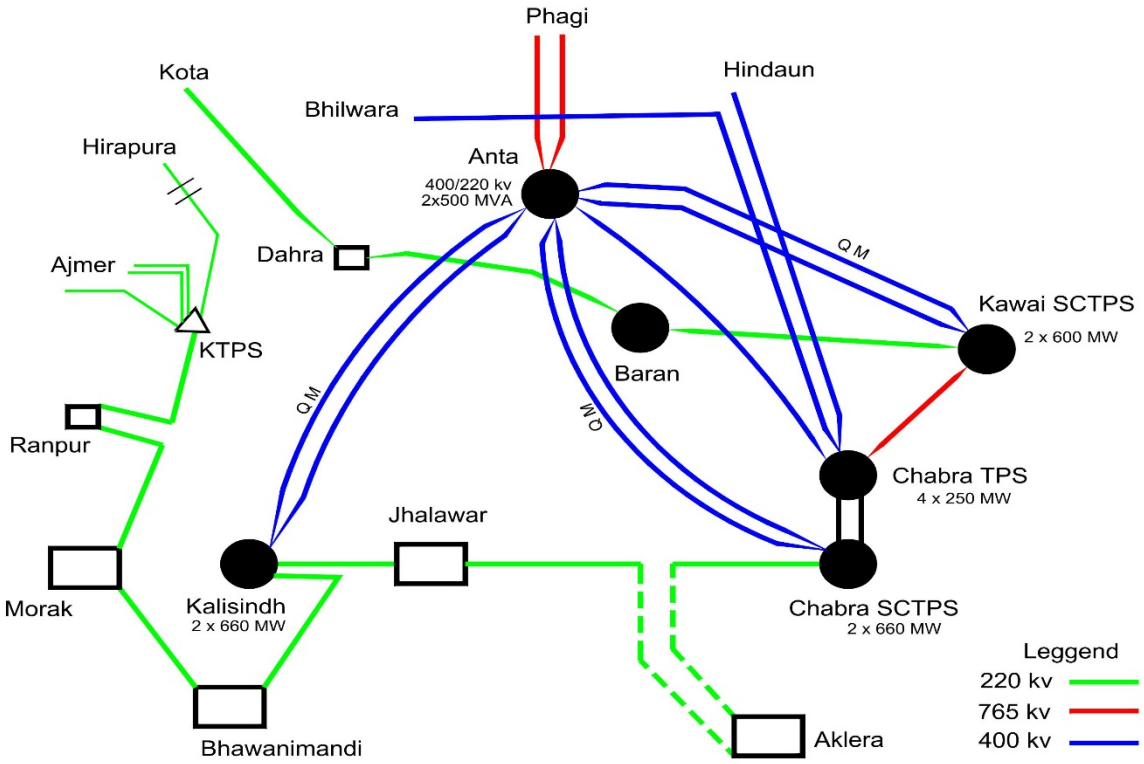
- 400 kV D/C (Quad Moose) Chhabra SCTPS-Anta line
- 400 kV D/C (Quad Moose) Chhabra SCTPS- Chhabra TPS line

Kawai TPS (2x660 MW)

- 400 kV D/C (Quad Moose) Kawai TPS-Anta line
- 400 kV S/C (Twin Moose) Kawai TPS-Chhabra TPS

765/400 kV Anta GSS

- 2xS/C 765 kV Anta-Phagi lines
- 3x1500 MVA, 765/400 kV ICT at Anta



The above evacuation system was planned for N-1 contingency condition but in order to comply with (N-1-1) Transmission Planning Criteria, new transmission elements have been identified.

11.6 A sub-committee of NRSCT was formed to resolve the above issue and its first meeting was held on 2.04.2018 wherein CEA had advised to explore the possibility of creating a new 400kV GSS by RVPN in this corridor in place of additional ICT each at Chhabra TPS and Kalisindh TPS.

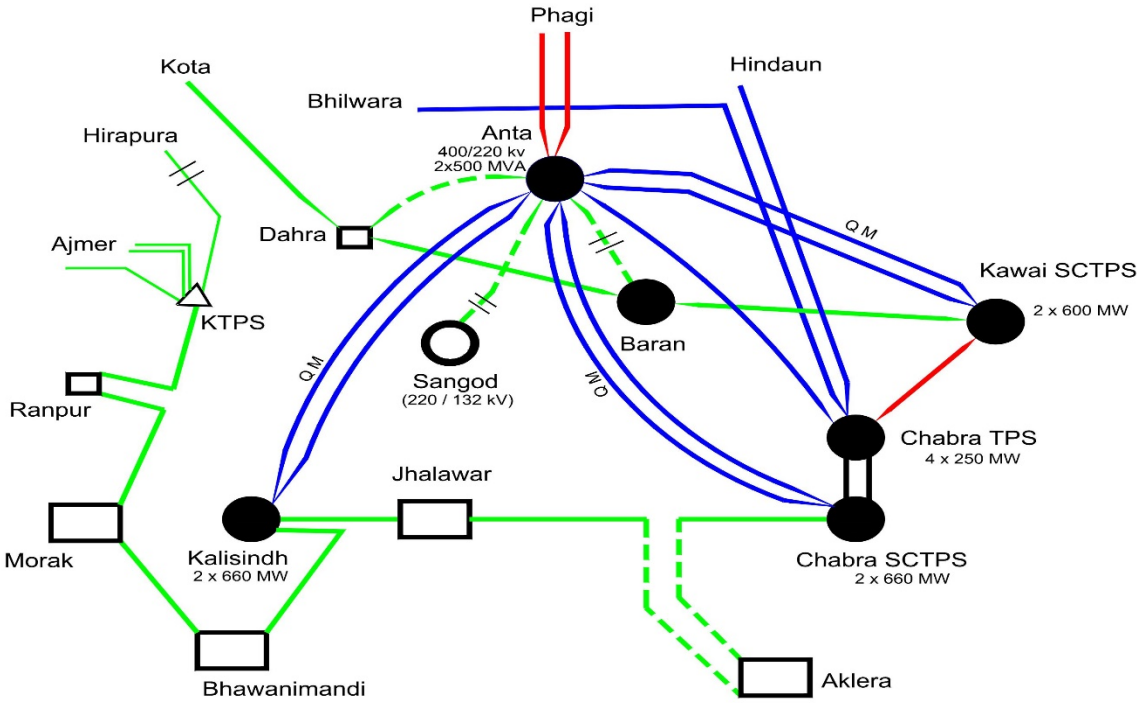
Various proposals viz. creating 400kV GSS at Dahara/ Sangod/ Anta or placing additional ICT at Chhabra and augmenting capacity of ICT at Kalisindh by 500 MVA, 400/220 kV instead of existing 315MVA were considered. The proposals were examined on the basis of results of load flow studies, the feasibility of their constructions was explored w.r.t available ROW other physical constraints and also financially compared based on their tentative cost to consider most suitable alternative.

Further, to feed load centres in and around Jhalawar, Modak and Baran through alternate source and to mitigate load contingencies in this corridor, a new 400/220kV GSS or a 220/132 kV GSS at Sangod found to be necessary.

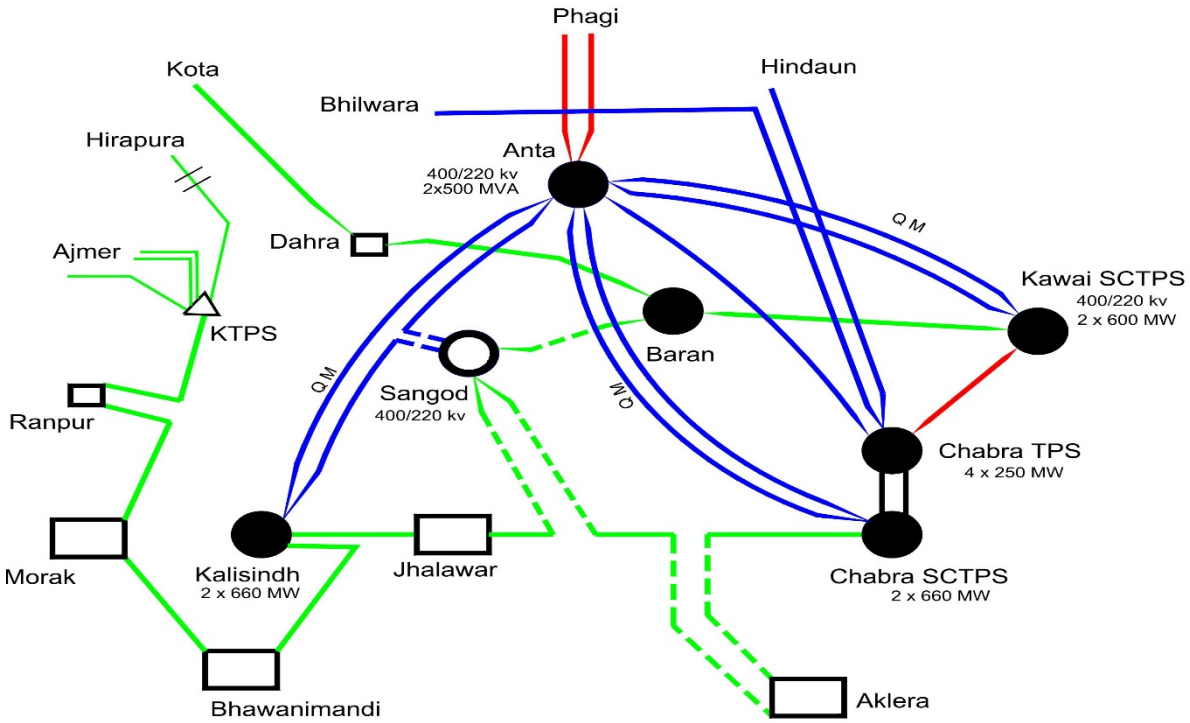
11.7 Also, a proposal was forwarded to RVUN to consider replacement of 1x315 MVA, 400/220 kV ICT with 1x500 MVA, 400/220 kV ICT at Kalisindh TPS and provide one additional 220 kV feeder as a deposit work of RVPN. The feasibility of creating a new 220 kV feeder bay at Kalisindh TPS has been examined and it was proposed to RVUN that new 220 kV bay can be created by shifting Bus Coupler from existing place to in between Main Bus-I and Main Bus-II by inserting circuit breaker, CT and isolator and the line breaker, CT, CVT and LA in front of bus coupler towards line end as the sufficient space is available. The consent letter from RVUN has been received.

11.8 The load flow studies have been carried out by RVPN for the total system load of 14430 MW corresponding to FY 2021-22. RVPN has considered creation of 400/220 kV system at 765 kV Anta GSS and 220 kV GSS at Sangod at Proposed Case-1 and have considered creation of 400/220 kV GSS at Sangod along with associated transmission line at proposed case-2 as given below:

Proposed Case-1	**Proposed Case-2**
400/220 kV system at 765 kV Anta GSS and 220 kV GSS at Sangod.	400/220 kV GSS at Sangod (Distt. Kota) along with associated 400 kV and 220 kV Interconnecting lines
• 2x 500MVA, 400/220 kV Power Transformer at existing 765kV GSS Anta (Distt. Kota).	• 2x500MVA, 400/220 kV Power Transformer at proposed 400kV GSS Sangod (Distt. Kota).
• 1x160MVA, 220/132kV Power Transformer at proposed 220kV GSS Sangod (Distt. Kota).	• 1x160MVA, 220/132kV Power Transformer at 400kV GSS Sangod (Distt. Kota).
• 220kV D/C Anta (765kV)-Baran (220kV) line (6 kM)	• LILO of one circuit of 400kV D/C Kalisindh TPS (400kV)-Anta (765kV) line at 400kV GSS Sangod (20kM)
• 220kV D/C Sangod (220kV)(Proposed)-Anta (765kV) line (35kM)	• 220kV D/C line Sangod (400kV)-Baran (220kV) line (35kM)
• 220kV S/C line extension of existing 220kV S/C Dahara (220kV)-Anta (NTPC) line upto Anta (765) -(15 kM)	• LILO of 220kV S/C Aklera-Jhalawar line at 400kV GSS Sangod (40kM)
• LILO of 132 kV S/C Sangod-Khanpur line at 400 kV GSS Sangod (Approx. 5KM)	• LILO of 132 kV S/C Sangod-Khanpur line at 400 kV GSS Sangod (Approx. 5KM)
• LILO of 132 kV S/C Sangod-Bapawar line at 400 kV GSS Sangod (Approx. 7KM)	• LILO of 132 kV S/C Sangod-Bapawar line at 400 kV GSS Sangod (Approx. 7KM)



PROPOSED CASE I



PROPOSED CASE II

Further, in both cases, revised inter-connection at Kalisindh TPS has been considered which are as follows:

- 1x500 MVA, 400/220 kV ICT in place of 1x315 MVA, 400/220 kV ICT
- 220 kV D/C Kalisindh TPS-Jhalawar line.(Work involved : Removal of T-off of one circuit)
- 220 kV S/C Kalisindh TPS-Bhawanimandi line (by utilising the 220 kV feeder bay)(Work involved:Construction of 1.5241 KM 220 kV S/C line from Kailisindh to T-off point) and 220 kV Bay at Kalisindh TPS.

Load flow studis has been carried out and the results are summarised as **Annexure-VI**(Appendix-I & II).

11.9 Further, to evaluate the sufficiency of above proposed transmission system, the following contingency conditions have been considered.

Contingency-1: Outage of 2xS/C 765 kV Anta-Phagi lines.

Contingency-2: Outage of 400 kV Anta-Kota (PG) line and 1X500 MVA, 400/220 kV ICT at Kalisindh TPS.

Contingency-3: Outage of 400 kV S/C Chhabra TPS-Hindaun line and 400 kV S/C Chhabra TPS- Bhilwara line.

11.10 Observations for both the cases is summersied as follows:

Case-I	**Case-II**
• The existing and new transmission system are sufficient for all N-1-1/N-2 contingencies except when both 765 kV 2xS/C Anta- Phagi line are out, the frequency of occurance of which is very rare. • With installation of 400/220 kV transformer at 765/400 kV Anta GSS it will expose the 400 kV and 765 kV buses to the frequent faults that would occur on 220 kV systems & they will directly travel to generating power systems connected to this bus. • There is no space in alignment of 400 kV Bus at Anta to accommodate an additional 400 kV transformer bay so the 400 kV bus would be extended (L shape) and bus sectionaliser would have to be provided between 765/400 kV and 400/220 kV switchyard at 400 kV. • Construction of 220 kV bus bar arrangement at 765 kV Anta GSS is possible only in the space reserved for future 2 No. of 765 kV bays i.e. further 765 kV interconnections would be eliminated. • Total system losses would reduce from 503.203 MW to 492.617 MW, thus saving of approximate 10.586 MW (400.608 LUs/Annum).	• The existing and new transmission system is sufficient for all N-1-1/N-2 contingencies except when both 765 kV 2xS/C Anta- Phagi line are out, the frequency of occurance of which is very rare. • LILO of one circuit of 400 kV D/C Kalisindh TPS-Anta (765 kV) line can be used to provide inter-connectivity to proposed 400 kV GSS at Sangod. This would obviate laying of long 400 kV lines from 765/400 kV Anta GSS. • By creating new 400/220 kV switchyard at Sangod will help to reduce the loading on the 220 kV lines in the regions under contingency conditions compared to the Proposed Case-1. • This will also help to avoid any constraints during future expansion at 765 kV GSS Anta. • Total system losses would reduce from 503.203 MW to 493.407MW, thus saving of approximate 9.796 MW (370.712LUs/Annum).

10.1 Based on the above, RVPN has mentioned that creation of 400/220 kV GSS at Sangod will be technically more suitable and feasible compared to the 400/220 kV System at 765 kV GSS Anta and 220 kV GSS Sangod.

10.2 Members may deliberate.

12.0 Charging of second Bus Reactor of 125 MVAr, 400KV at SSCTPP, RVUNL, Suratgarh

12.1 Power evacuation system for Suratgarh Super Critical TPS (2x660 MW) had been approved in the 38th Standing Committee meeting held on 30th May, 2016 wherein 1x125 MVAR, 400 kV bus reactors was approved. RVUN has proposed second Bus Reactor of 125MVAr Capacity at 400KV switchyard of SSCTPP, Suratgarh which is required to avoid/minimize tripping on overvoltage protection during the charging. Also, it has been proposed that this reactor will be utilized whenever the voltage profile of 400KV system at SSCTPP becomes high during the event of low generation at STPS and SCSTPS.

12.2 RVPN has carried put the load flow studies for the condition corresponding to FY 2022-2023 for total system load of 15169 MW for high RE scenario (75%) to analyse the feasibility of proposed 125 MVAR (2nd), 400 kV reactor. Voltages on nearby buses are tabulated below:

S. No.	Name of Bus	Voltage in Base Case	Voltage in Proposed Case
1	400 kV SC-STPS	401	398
2	400 kV STPS	401	398
3	400 kV Bikaner	404	402
4	400 kV Ratangarh	405	403
5	400 kV Babai	404	403

12.3 With implementation of the 2nd bus reactor, there is improvement in voltage profile of 400 kV SCSTPS bus.

12.4 In view of above, RVUNL has requested to grant approval for second bus reactor of 125 MVAr, 400 KV rating at SSCTPP, RVUNL, Suratgarh so that the same could be charged at the earliest.

12.5 Members may discuss.

13.0 Creation of 400/220 kV, 2x315 MVA S/S at Akhnoor/Rajouri as ISTS

13.1 JKPDD had submitted a comprehensive transmission plan for Jammu Region which inter-alia included establishment of 400/220 kV, 2x315 MVA S/s at Akhnoor/ Rajouri as ISTS works. The issue of establishment of Akhnoor S/s was also deliberated in 37th meeting of Standing Committee on Power System Planning held on 20th Jan 2016, wherein, it was decided that proposal of new substation at Akhnoor may be considered only after the 220 kV downstream from Samba, New Wanpoh and Amargarh are taken up for implementation by JKPDD. JKPDD was advised to implement their downstream network expeditiously so as to optimally utilize the already created transmission elements.

13.2 Now, JKPDD vide their letter dated 26.12.2019 has requested to take up 400/220kV Akhnoor S/s for implementation. JKPDD may present their proposal. Members may deliberate.

14.0 Transmission works to be implemented in Jammu Region under Intra –State transmission system

14.1 In order to strengthen the transmission system in Jammu region, JKPDD submitted a comprehensive transmission plan for Jammu Region which included some transmission elements to be implemented by JKPDD under Intra-state transmission works. These transmission works mainly includes creation of 5 nos. of 220kV substations, 2 nos. of 132kV substations along with associated transmission lines, some transformer augmentation works, works related to replacement of conductors and replacement of bus bars at some S/Ss. The list of these transmission works are given at Annexure-VII.

14.2 CEA has carried out the system studies; the same is enclosed as Annexure-VIII.

14.3 Members may like to deliberate.

15.0 New Butwal (Nepal) – Gorakhpur PG (India) cross border 400kV D/c (Quad) line

15.1 In the 39th meeting of SCPSPNR held at New Delhi on 29th-30th May 2017, New Butwal (Nepal) – Gorakhpur (New) 400kV D/c (Quad) line along with a new 400kV switching station at Gorakhpur (New) was discussed. In this meeting, it was informed that sharing of cost for the project between India and Nepal was not finalised until that moment. As and when the cost sharing methodology between India and Nepal would be decided the proposal would be put up in the SCPSPNR for the consent of the constituents.

15.2 In a joint meeting of Technical Teams of India and Nepal, it was decided that New Butwal – Gorakhpur 400kV D/c (Quad Moose) line can be terminated by constructing 2 no. of 400kV GIS line bays in existing Gorakhpur (POWERGRID) S/s instead of investing in construction of a new switching station at Gorakhpur.

15.3 Accordingly, the transmission system for the Gorakhpur – New Butwal line has been modified as given below:

Indian Side

(a) Indian Portion of Gorakhpur – New Butwal 400 kV D/c (Quad) line [approx. 120km]

(b) 2 nos. 400kV GIS line bays for termination of Gorakhpur – New Butwal (Nepal) 400kV D/c (Quad Moose) line at Gorakhpur S/s

Nepal Side

(a) Nepal Portion of Gorakhpur – New Butwal 400 kV D/c (Quad) line [approx. 20km]

(b) Up-gradation of 220kV New Butwal S/s to 400/220kV level with 2x500MVA ICTs

(c) 2 nos. 400 kV line bays along with 420 kV, 50 MVAR Switchable Line Reactors at New Butwal end for the termination of Gorakhpur – New Butwal 400 kV D/c (Quad) line

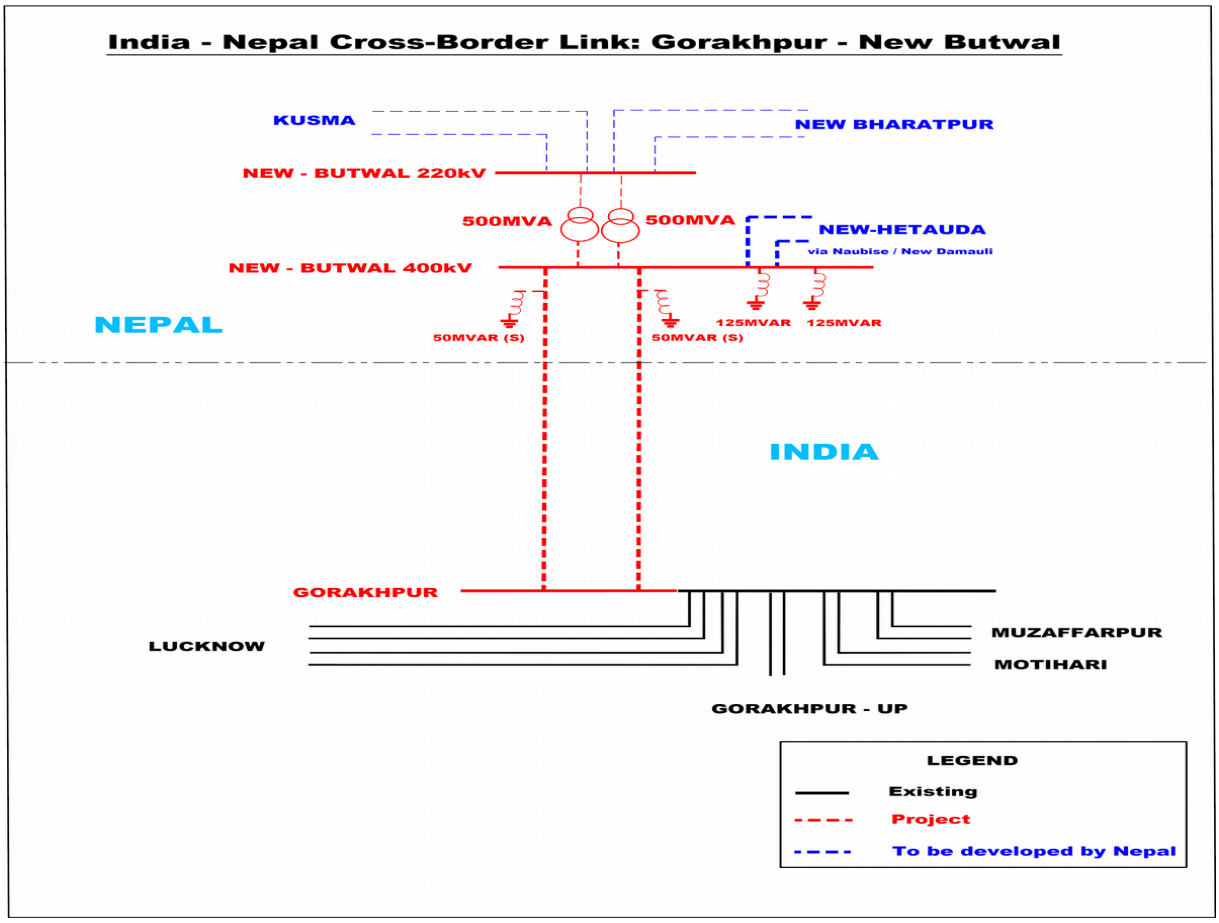
(d) 2 nos. 420 kV,125 MVAR Bus reactors at New Butwal

15.4 Subsequently, in the 7th meeting of JWG/JSC on India – Nepal Cooperation in Power Sector held on 14th-15th Oct 2019 at Bangalore, the above modification was informed. In the meeting, it was also decided that Nepal Electricity Authority (NEA) will pay the transmission service charges of the Indian portion of the line for 25 years for availing the entire capacity of the Indian portion of the transmission line. Further, following was agreed with regard to implementation of Indian portion of the cross-border line:

(i) Formation of JV company between NEA and POWERGRID with 50:50 equity participation and 80:20 debt-equity ratio.

(ii) Signing of Implementation & Transmission Service Agreement (ITSA) between JV company and NEA (the ITSA may also inter alia include detailed scope of works).

15.5 The schematic of the cross border interconnection is shown below. The detailed scope of works is attached at **Annexure-*IX*.**



15.6 Members may like to deliberate.

16.0 Any other issue with permission of the chair.

ANNEXURE-I

Minutes of the meeting held on 03.12.19 to discuss the proposals of HVPNL

List of participants is enclosed as Annexure-I.

Chief Engineer, PSPA-I welcomed all the participants to the meeting. He stated that the meeting has been called to discuss two numbers of proposals submitted by HVPNL vide their letter dated 22.10.2019 .These two proposals involves LILO of two transmission lines which are inter-state in nature. He requested Director, CEA to furnish details of HVPNL's proposals.

1. Creation of 132kV cum 66kV AIS substation at village Nanakpur (Pinjore)

1.1 Director, CEA informed that HVPNL vide above letter has proposed creation of 132kV cum 66kV AIS substation at village Nanakpur (Pinjore) in Kalka constituency to cater the load growth in Nanakpur area by LILO of 132kV Ropar-Pinjore D/C line at Nanakpur S/s. He further informed that, PSTCL vide letter dated 21.11.2019 has mentioned that LILO of 132kV Ropar – Pinjore line at Nanakpur would increase the loading of Ropar – GGSSTP 132kV line and also overload the 220kV GGSSTP Ropar.

1.2 SE, HVPNL stated that, 132kV cum 66kV AIS substation with 1x10/16 MVA, 132/11kV and 1x12.5/16 MVA, 66/11 kV ICTs would be created at Nanakpur by LILO of both circuits of existing 132kV Ropar – Pinjore line (0.15sr ACSR conductor) in following way:

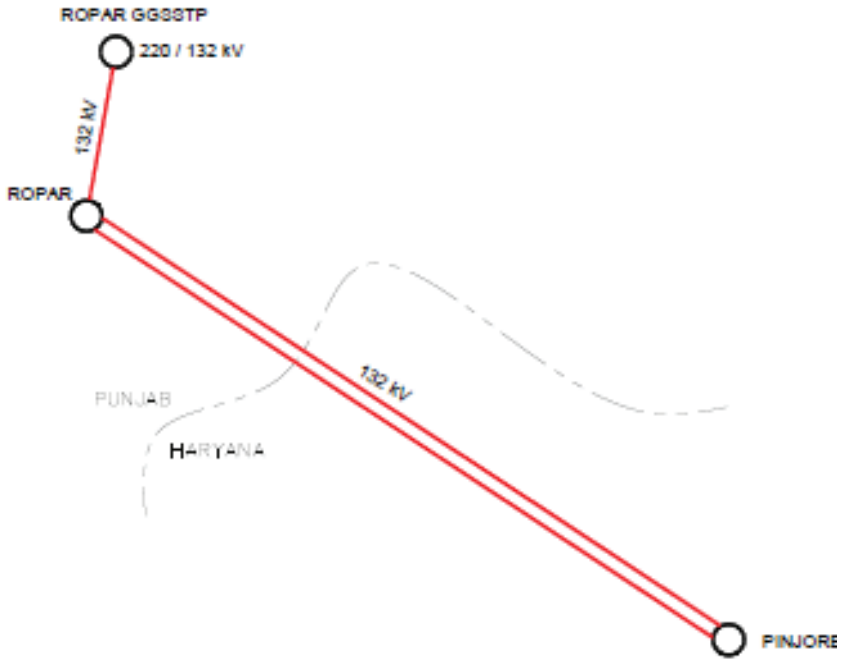
(i) Ropar - Nanakpur D/C line to be charged at 132kV level from Ropar

(ii) Pinjore - Nanakpur D/C line to be charged at 66kV level from Pinjore

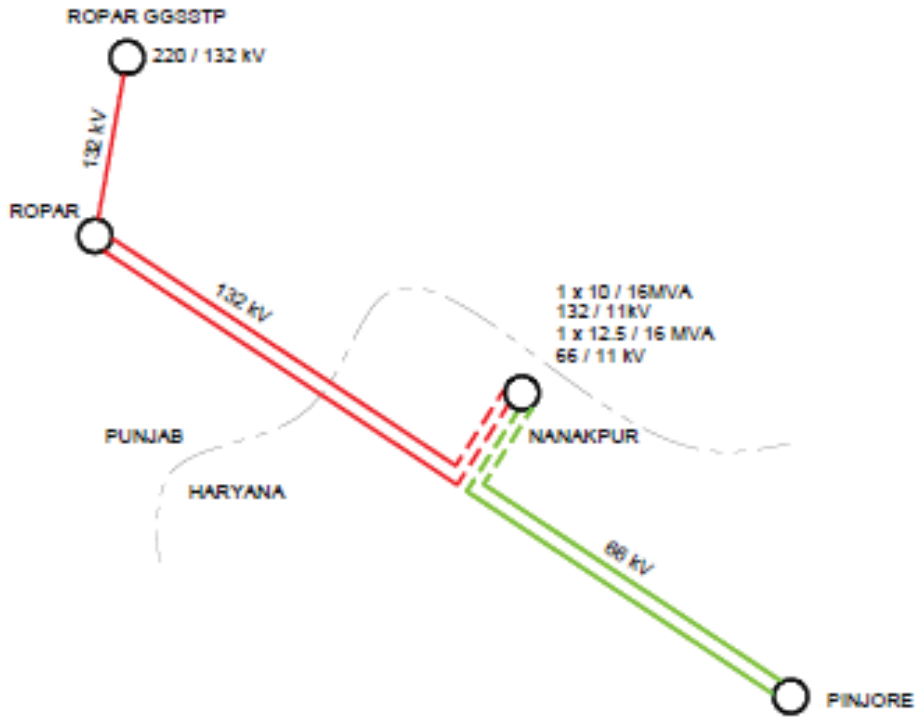
HVPNL informed that for the above works that they would utilize 66/11kV spare transformer in Haryana's system. The existing 1x10/16 MVA, 132/11kVtranformer at Pinjore would also be utilized at Nanakpur substation.

The schematic of above system is as below:

(i) Existing system (before LILO)



(ii) Proposed system (after LILO at Nanakpur)



1.3 SE, PSTCL stated that, they have studied the proposal considering the LILO of Ropar – Pinjore 132kV D/C line at Nanakpur. Since, HVPNL has clarified that proposed Pinjore – Nanakpur section would be charged at 66kV level, so prima-facie, the proposal seems to be in order, however, PSTCL would require to examine the same for intimating their seniors.

1.4 After deliberations, the proposal of LILO of Ropar – Pinjore 132kV D/C line at Nanakpur was agreed in-principle subject to confirmation from PSTCL and ratification by Northern Regional Power Committee (Transmission Planning).

2. <u>Alternate connectivity to 66kV Kalka substation through LILO of Pinjore - Solan 66 kV S/C line at Kalka substation</u>

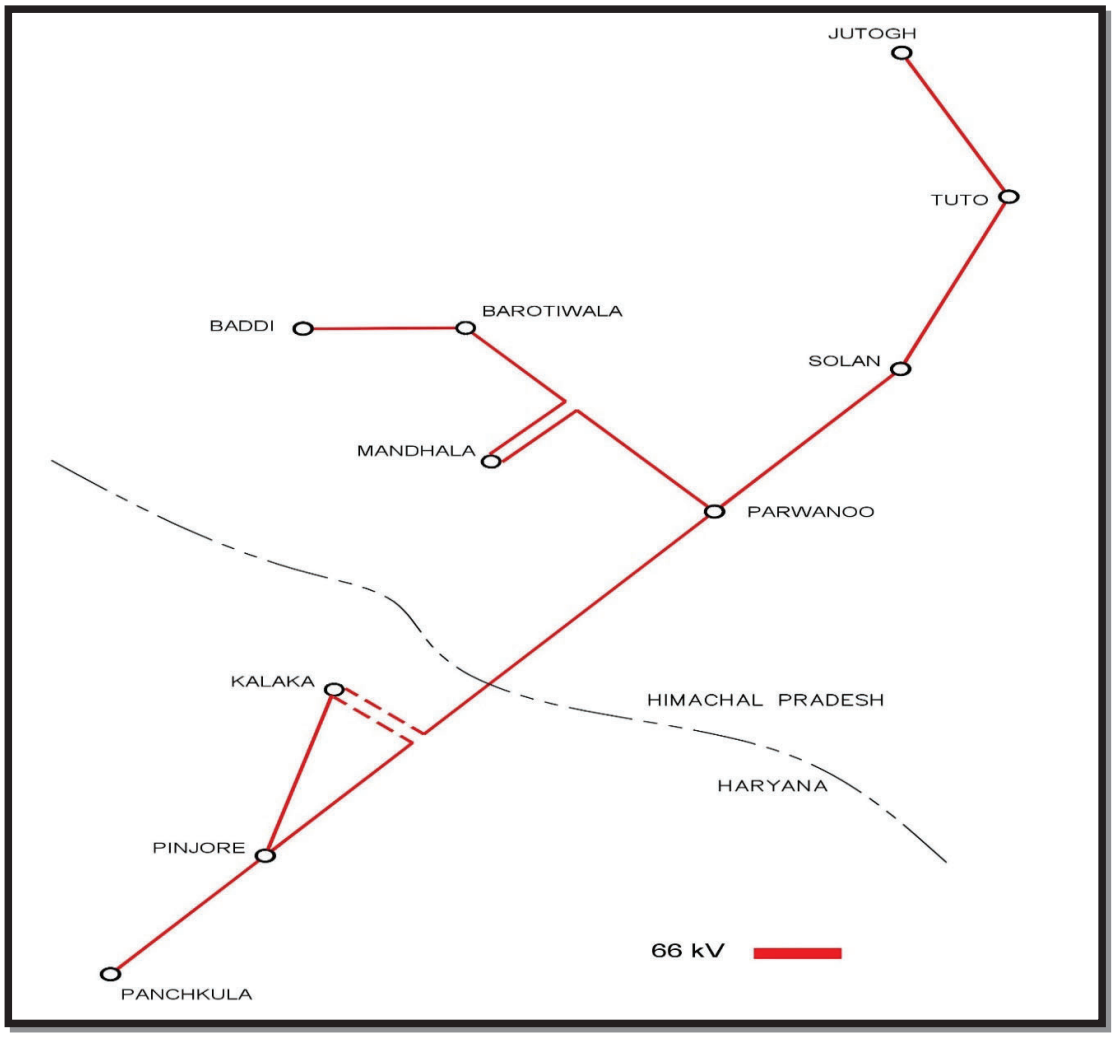
2.1 Director, CEA informed that presently, 66kV Kalka S/s is fed from 220kV Pinjore S/s of HVPNL through Pinjore-Kalka 66kV line. In order to provide alternate connectivity to 66kV Kalka substation, HVPNL has proposed LILO of Pinjore - Solan 66 kV S/C line at 66 kV Kalka substation.

2.2 HVPNL stated that the LILO of Pinjore - Solan 66 kV S/C line at Kalka substation has been proposed to provide reliability of supply to 66kV Kalka substation. HVPNL added that the 66kV Pinjore - Solan S/C line is a very old line and there is very small or no drawl by HP through this line. HVPNL stated that, the peak drawl of Kalka substation is around 25MVA. After the proposed LILO, length of Pinjore to Kalka portion of Pinjore-Kalka line would be around 7.45 kms and would provide alternate power supply to Kalka.

2.3 HPPTCL stated that 66kV line from Pinjore- Parwano-Solan is an old line and has Dotterel conductor with capacity of around 254 Ampere (25 MVA) taking ageing factor into account. HPPTCL/HPSEBL added that earlier Parwanoo was fed by Pinjore through the 66kV Pinjore – Parwanoo S/C line. Presently, power to Parwanoo (with peak demand

of 35 MVA) is supplied through Mandhla/Baddi, which is the source station. HPPTCL added that Parwanoo is also connected to Solan and from Solan to Totu to Jutogh. HPPTCL/HPSEBL added that there is limitation in supplying power from Jutogh, so HPSEBL does not have spare capacity to feed Parwanoo during contingency conditions, in case of breakdown of 66 kV S/C Mandhala - Parwanoo Line, therefore there would be need of drawl from HVPNL based on availability and contingent drawl of HP shall be maintained.

The Schematic of the proposed system is below:



2.4 HPSEBL/HPPTCL further stated that as the HP system has limitations and cannot supply power to Kalka along with Parwanoo so there should be restriction on drawl from Parwanoo towards Kalka.

2.5 CTU stated that with the proposed LILO, reliability of the power to Parwanoo would certainly increase.

2.6 POSOCO stated that the Parwanoo - Pinjore 66kV is by default inter-state transmission line and the ownership of this line lies with HP. However, after LILO of above line, ISTS point would change and the Pinjore – Kalka 66kV portion would be completely in Haryana.

2.7 HVPNL proposed that the O&M of Pinjore - Kalka portion as well as the LILO section would be done by Haryana and the O&M from the LILO point to Parwanoo may be done

by HPPTCL/HPSEBL, however, the ownership of Pinjore – Parwano Section (excluding the LILO portion) may be retained with HP.

2.8 *After deliberations, the proposal of LILO of Pinjore – Parwanoo 66kV line at Kalka was agreed in-principle subject to ratification by Northern Regional Power Committee (Transmission Planning). However, the issues related to shifting of ISTS point, ownership and commercial issues may be sorted out mutually between HPPTCL and HVPNL.*

Meeting ended with thanks to the chair.

Annexure-I

List of Participants of the meeting held on 03.12.19 to discuss the proposals of HVPNL

S.No.	Name (Ms/Smt/Shri)	Designation
	CEA	
1	Goutam Roy	Chief Engineer (PSPA-I)
2	Manjari Charturvedi	Director
3	Nitin Deswal	Assistant Director
4	Komal Dupare	Assistant Director
	CTU	
5	R. Verma	Sr. DGM
6	P.K. Das	Sr.GM
7	Yatin Sharma	Asst. Manager
	POSOCO	
8	Alok Verma	Sr. DGM
9	Gaurav Malviya	Deputy Manager
	HPPTCL	
10	Sandeep Sharma	GM
11	Harmanjit Singh	DM
	PSTCL	
12	Sonia	SE/Plg
	HVPNL	
13	M.M. Matte	SE/Plg.
14	B.S. Dahiya	SE/Plg
	HPSEBL	
15	Jivitesh	AEE

ANNEXURE-II

PUNJAB STATE TRANSMISSION CORPORATION LIMITED
PUNJAB STATE TRANSMISSION CORPORATION LIMITED
Regd. Office: - PSEB Head Office, The Mall, Patiala – 147001, Punjab, India
O/o SE/Planning & Communication, PSTCL, Patiala
Fax/Ph: - 0175-2205502, Email: - se-planning@pstcl.org
CIN-U 40109 PB 2010 SGCO 33814

From,

CE/TS,
PSTCL, Patiala.

To,

Chief Engineer/Planning,
Haryana Vidyut Prasaran Nigam Limited,
Shakti Bhawan, Sector-6, Panchkula.

Memo No.: 1039/P-1/288 **Dated: 09.12.2019**

Subject: - **Agenda note for placing before Northern Region Standing Committee on Transmission (NRSCT).**

This is with reference to the recent meeting with CEA New Delhi on 03-12-2019 on the subject cited above. The new options for feeding proposed 132 /66KV grid Nanakpura were also studied. As per the study outcome:-

I. The option of connectivity of proposed grid Nanakpura at 132 KV level through termination of 132 KV Ropar Pinjore D/C line at Pinjore end, and extending its to proposed grid by a 1.5 KM long D/C line seems to be in order. However PSTCL conveys its consent on the presumption that:-
   a. PSTCL shall not provide any extra 132 KV bay at existing 132 KV S/s Ropar.
   b. Loading conditions of feeding line i.e. 132 kv Ropar-Pinjore line shall remain the same in new proposal from Ropar to Nanakpura.

II. It is further added that the option of connectivity of proposed grid Nanakpura with a 66 KV D/C line from 66 KV bus of existing grid Pinjore to proposed grid does not seem to be technically justified. Because in this case, the loading of proposed grid shall be controlled through 132/66 KV transformer at 132 KV S/s Pinjore, and as per information gathered, loading on this transformer is restricted due to low value of its winding I.R.

It may also be noted that there seems to be no necessity for providing an intermediate. Link of 1.5 KM (i.e. from termination point up to the proposed grid) with such a heavy conductor of 0.4Sq" size, as its capacity shall also be restricted to the capacity of feeding 132 KV Ropar-Pinjore D/C line. This points needs to be reviewed at your level.

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

1040 Dt:- 09.12.2019

CC:-

Director/CEA, PSPA-I New Delhi. (Memo No. 1040/P-1/288 dated 09.12.2019)

Minutes of the meeting held on 26.09.2019 to discuss the proposal of DTL to replace a 315 MVA ICT with 500 MVA ICT at Bawana 400 kV substation.

List of participants is enclosed at Annexure-I.

CE (PSPA-I) welcomed the participants to the meeting and requested Director (PSPA-I) to take up the agenda of the meeting.

Director (PSPA-I) stated that DTL vide its letter no. F.DTL/202/Opr(Plg)/2019-20/F-8/67 has submitted that the transformer No. 4 at 400 kV Bawana switchyard was installed on 1997 and due to deterioration of its health the same needs to be replaced. Therefore, DTL has proposal for replacement of 4th 315 MVA ICT with 500 MVA ICT at Bawana 400 kV substation. She added that at present, the installed capacity of Bawana 400 kV substation of DTL is 1890 MVA (6X315 MVA) and with the proposed replacement, transformation capacity at Bawana would become 2075 MVA (1x500+5X315 MVA), which is higher than the maximum transformation capacity i.e. 2000 MVA for a 400 kV substation, as specified in CEA's Transmission Planning Criteria.

CE (PSPA-I) enquired about the peak loading as well as fault current observed at Bawana S/s and possibility of meeting the load without adding 6th new transformer in view of planned S/s at Narela and Tikri Khurd.

DTL stated that this year, the peak loading of approx. 1200 MVA has been observed at Bawana substation and it is expected to increase further in coming years as load growth is high in Bawana area. With further growth in load, system with 5 ICTs won't be N-1 compliant. Therefore, there is a need to have the 6th ICT. Also, as there is a very little difference in the cost and space requirement for 315 MVA ICT and 500 MVA ICT. As such, replacement of 315 MVA ICT with 500 MVA ICT has been proposed.

Director (PSPA-I) informed that fault level at all the 400 kV station including Bawana substation is high. Proposal for bus splitting/series compensation to contain the high fault level was recommended, however, the same has not been implemented so far. She stated that studies carried out indicates that with 500 MVA ICT there is no appreciable change in fault level at Bawana 400 kV substation.

CTU stated that the cost difference between 315 MVA ICT and 500 MVA ICT is less, it is better to go with 500 MVA ICT instead of 315 MVA ICT and marginal increase of 75 MVA over 2000 MVA capacity of 400 kV substation prescribed in the planning criteria of CEA may be allowed. However, DTL should ensure that in future, if any ICT replacement is done, the capacity should not exceed much beyond 2000 MVA. DTL stated that they would take care of the same while doing any ICT replacement in the future.

POSOCO stated that the ratings of bay equipment may be checked with respect to the new transformer capacity 500MVA.

After deliberations, proposal of DTL for replacement of 1 no of 315 MVA ICT with 500 MVA ICT at Bawana 400 kV substation was agreed.

Meeting ended with the thanks to chair.

Annexure I

List of participants of meeting held on 26.09.2019 to discuss the proposal of DTL to replace a 315 MVA ICT with 500 MVA ICT at Bawana 400 kV substation:

S.No.	Name	Designation	Organization	Contact No.	Email ID
1.	Goutam Roy	Chief Engineer	CEA	8376817933	Goutamroy.715@gmail.com
2.	Manjari Chaturvedi	Director	CEA	9810502209	Manjari.cea@gmail.com
3.	Kanhaiya Singh Kushwaha	AD-II	CEA	8334951500	kanhaiyasinghk@gmail.com
4.	Komal Dupare	AD-II	CEA	9425618454	komal.dupare16@gmail.com
5.	Mukesh Khanna	(GM)(CTU-plg)	Powergrid	9910378098	mkhanna@powergridindia.com
6.	Alok Kumar	Sr.DGM	POSOCO	9999039321	alok.kumar@posoco.in
7.	Suruchi Jain	Manager	POSOCO	9971038956	Suruchi.jain@posoco.in
8.	Bharat Tiwari	Manager (T) Plg	DTL	9999533931	managersystemstudy@gmail.com
9.	Pramod Kumar	AM(T)	DTL	9711003106	pramod@dtl.gov.in

Minutes of the meeting held on 26.09.2019 to discuss transmission system for evacuation of power from Pakaldul (1000MW), Kiru (624 MW) and Kwar (540 MW) HEPs of CVPPL.

List of participants is enclosed at Annexure-I.

CE (PSPA-I) welcomed the participants to the meeting and requested Director (PSPA-I) to take up the agenda of the meeting.

Director (PSPA-I) stated that CVPPL is implementing three major HEPs viz Pakaldul (1000MW), Kiru (624 MW) and Kwar (540 MW) HEP in J&K. Works on various components of PakalDul HEP are in progress. Works of Kiru and Kwar HEPs are in advanced stage of tendering. The power from these projects was planned to be pooled to Kishtwar S/s. She further stated that in the 2nd meeting of NRSCT, following was agreed in regard of the connectivity of Pakal Dul HEP (1000 MW):

i) 400 kV D/c (Triple HTLS Conductor) line from PakalDul HEP–Kishtwar Switching station along with associated bays at both ends – under scope of generation developer

ii) Establishment of 400 kV switching station at Kishtwar(GIS) by LILO one circuit of Kishenpur – Dulhasti 400kV D/c (Quad) line (Single Circuit Strung) –under ISTS

iii) GIS switchyard equipment, XLPE cables and other associated equipment may be designed for current carrying capacity of 4000 Amps - under scope of generation developer

iv) 420 kV, 125 MVAR Bus Reactor at PakalDul HEP -under scope of generation developer

v) 420 kV, 125 MVAR Bus Reactor at Kishtwar Switching Station - under ISTS

vi) One and a half breaker switching scheme for 400kV Generation switchyard - under scope of generation developer

The matter was again deliberated in 3rd meeting of NRSCT wherein, CEA suggested that, in view of limited space for laying the transmission line corridor in Chenab Valley, it would be better that CVPPL lay a dedicated line from Pakal Dul HEP to Kishtwar which could be extended to Kawar and Kiru HEPs and suitable provisions in the dedicated line can be made so that power from Kirthai I and Kirthai II projects in Jammu & Kashmir (around 1300 MW) could also be evacuated through the Pakal Dul HEP–Kishtwar line. CVPPL agreed with the suggestion given by CEA to use quad HTLS for PakalDul HEP–Kishtwar line instead of triple HTLS conductor.

Director (PSPA-I) further stated that now CVPPL has intimated that they are facing some difficulties in implementation of Pakal Dul HEP–Kishtwar line with quad HTLS conductor. As they have stated that if 1300 MW power from Kirthai I and Kirthai II projects in Jammu & Kashmir would also be evacuated through the PakalDul HEP–Kishtwar line, current would be of the order of 5000 Amps. Earlier it was agreed that the GIS switchyard equipment, XLPE cables and other associated equipment may be designed for current carrying capacity of 4000 Amps, therefore, the same has been mentioned in the tender documents and works of Pakaldul HEP switchyard has been awarded accordingly. The works on various components of PakalDul HEP are already under progress. CVPPL therefore requested to plan a separate corridor for evacuation of power from Kirthai I and Kirthai II projects in Jammu & Kashmir

and for evacuation of power from CVPPL projects (i.e. Pakaldul, Kiru & Kwar HEPs), the dedicated line to Kishtwar may be implemented with triple HTLS conductor.

CTU stated that as per the master plan, two corridors were planned in J&K i.e one corridor for 1500 MW power coming from HP in addition to Kirthai I & II and 2nd corridor for Kiru, Kwar and Pakaldul projects. Therefore, there is possibility of laying two corridors.

CE (PSPA-I) stated that the possibility of 2nd corridor may be discussed with JKPDD. Since PakalDul HEP–Kishtwar line with quad HTLS conductor has been agreed in the Northern Region Standing Committee on Transmission (NRSCT), the matter for change in conductor of PakalDul HEP–Kishtwar line from quad HTLS conductor to triple HTLS needs to discussed in NRSCT.

After further deliberations, the followings were agreed in principle:

i) Implementation of Kiru-Kwar-Pakaldul to Kishtwar 400 kV D/c line with triple HTLS conductor instead of quad HTLS conductor was agreed subject to ratification from the NRSCT.
ii) The possibility of 2nd corridor in Chenab basin need to be discussed with JKPDD.
iii) The matter for change in conductor of Kiru-Kwar-Pakaldul to Kishtwar 400 kV D/c line from quad HTLS conductor to triple HTLS needs to discussed in NRSCT.

Meeting ended with thanks to chair.

Annexure I

List of participants of meeting held on 26.09.2019 to discuss transmission system for evacuation of power from Pakaldul (1000MW) , Kiru (624 MW) and Kwar (540 MW) HEPs of CVPPL.

S.No.	Name	Designation	Organization	Contact No.	Email ID
1.	Goutam Roy	Chief Engineer	CEA	8376817933	Goutamroy.715@gmail.com
2.	Manjari Chaturvedi	Director	CEA	9810502209	Manjari.cea@gmail.com
3.	Kanhaiya Singh Kushwaha	AD-II	CEA	8334951500	kanhaiyasinghk@gmail.com
4.	Komal Dupare	AD-II	CEA	9425618454	komal.dupare16@gmail.com
5.	Mukesh Khanna	(GM)(CTU-plg)	Powergrid	9910378098	mkhanna@powergridindia.com
6.	Alok Kumar	Sr.DGM	POSOCO	9999039321	alok.kumar@posoco.in
7.	Suruchi Jain	Manager	POSOCO	9971038956	Suruchi.jain@posoco.in
8.	Amrik Singh	GM	CVPPL	9560455326	Amrik1474_28@gmail.com

ANNEXURE-V

Minutes of the meeting to discuss the connectivity of 220 kV transmission line from 400 kV GSS Ajmer to 220/25 kV TSS Kishengarh through 2 phase line on D/c towers and associated bay at 400 kV GSS Ajmer

Director, CEA welcomed the participants to the meeting and intimated that Chief Engineer, PSPA-I is pre-occupied with another official meeting. However, he has conveyed the message to continue the meeting and arrive at an appropriate decision based on the deliberations.

CEA stated that India Railways vide their letter dated 5th September, 2019 has requested CEA to issue technical advisory to RVPNL to grant two-phase connectivity for 220 kV transmission line between 400 GSS Ajmer to 220/25 kV TSS Kishangarh. In its letter, Indian Railways have intimated that Rajasthan has conveyed its unwillingness in providing the two-phase connectivity to the TSS of Railways at 220 kV voltage level on account of the unbalance created by 2-phase load. This meeting has been convened to deliberate upon this issue.

List of participants is attached as **Annexure-I**

1.0 RVPNL stated that with rapid growth in Railway electrification, traction load is increasing significantly. Traction load is intermittent, creates unbalanced loadings and generates harmonics in the power system. Indian Railways is seeking 2-phase connectivity at 132 kV and 220 kV from State Transmission Utility transmission system, thereby STU system is directly subjected to intermittent and unbalanced traction loads. Therefore, there is a need for suitable guidelines from CEA for grant of connectivity to Railway Traction loads.

2.0 Indian Railways representative stated that earlier RVPNL has granted 2-phase connectivity at 132 kV, therefore requested RVPNL to grant the 2-phase connectivity to 220/25 kV TSS Kishangarh from 400/220 kV Ajmer substation.

3.0 RRVPNL stated that earlier, TSSs of Indian Railways in Rajasthan have been granted 2-phase connectivity at 132 kV voltage level from 132 kV S/stn of State Utility. Since the supply to Railway TSS was through different phases from different 132 kV substation, there was a balancing effect at 132 kV level of the 220/132 kV substation feeding the 132 kV substations. There was not any significant reflection of the unbalanced loading in the 220 kV transmission system. But most of these 132 kV substation feeding Railway TSS has been upgraded to 220 kV level and significant current harmonic distortion has been observed. The values measured by RVPNL on Traction feeders under Kota is as given below:

THD information of traction feeders under KOTA							
TRACTION FEEDER	**Phase**	**THD**		**THD**		**THD**	
		I	**Ithd**	**I**	**Ithd**	**V**	**Vthd**
132 KV SAKATPURA-RAILWAY 1	R	12	18.90%	50	15.10 %	76.1kV	0.51%
	Y	12	19%	50	15%	74.5kV	0.48%
	B	0	0	0	0	77.1kV	0.49%
132 KV SAKATPURA-RAILWAY 2	R	12	18.80%	49	15.10 %	75.9kV	0.50%
	Y	12	18.90%	50	15.20 %	74.7Kv	0.46%
	B	0	0	0	0	77.1kV	0.49%

132 KV MORAK-RAILWAY 1	R	10	18.50%	32	4.92%	74.2kV	0.68%
	Y	0		0		75.1kV	0.56%
	B	10	17.45%	32	4.92%	75.2kV	0.58%
132 KV BARAN-RAILWAY 1	R	18	6.80%	40	3.30%	75.1kV	1.10%
	Y	18	6.80%	40	3.30%	74.2kV	1.20%
	B	0	0	0	0	75.3kV	1.10%

4.0 RVPNL further stated that two-phase supply to Railway TSS from 220 /132 kV Grid substation results in generation of harmonics, unbalanced current and many technical issues which needs to be addressed. These includes:

i) Provision of Distance protection not possible due to non-availability of 3 phase line CVTs
ii) Paralleling of two feeders at Railway TSS causes delay in tripping as there is no protection system at TSS for feeder.
iii) 2-phase supply results in under-utilization of transformer, requires blocking of broken conductor protection, negative sequence current in transformer etc.

Most of these issues gets addressed in case Railways avails 3-phase supply to their TSS. The Dedicated Freight Corridor Corporation of India Limited. (M/s DFCCL) which is seeking 3-phase connectivity from Utility Power System for their traction load and the same is converted to 2-phase power supply for catering their traction load through Scott connection at their end. Scott connection facilitates balance loading on all three phases. RRVPNL requested Indian Railways to seek 3-phase connectivity for its Kishengarh TSS.

5.0 CEA and CTU stated that Part IV of CEA (Technical Standards for Connectivity to Grid) Regulations 2007 specifies the Grid Connectivity Standards applicable to the Distribution Systems and Bulk Consumers. The applicable Standards for Voltage and Current harmonics are as follows:

(1) The total harmonic distortion for voltage at the connection point shall not exceed 5% with no individual harmonic higher than 3%.
(2) The total harmonic distortion for current drawn from the transmission system at the connection point shall not exceed 8%.

The above standards needs to maintained by Indian Railways.

6.0 Indian Railways representative stated that Railway has been taking 3-phase supply for heavy traffic/load route wherein 2X25 kV traction system is used. However, in the present case, Kishengarh TSS at which two phase connectivity from 220 kV Ajmer GSS is sought will be used to cater to light traffic and 1x25 kV traction system is in use. Moreover, Kishengarh TSS has been awarded on EPC basis to L&T and is almost completed. In view of above, IR requested that for the present case of Kishengarh TSS, grant of two-phase connectivity may be allowed.

7.0 Regarding the issue of high current harmonics being injected from Railway TSS in Kota area and similar injection from Kishengarh TSS side (after its connection with state grid) into transmission utility power system, it was observed that the same can be mitigated by installing harmonic filters. IR representative stated that if the requirement was raised by RVPNL, the same could be implemented by RVPNL and Railways would bear the implementation cost.

8.0 RRVPNL stated that the implementation and subsequent maintenance of harmonic filters required at Railway's TSS end has to be carried out by Indian Railways. The necessary technical assistance required (as far as specifications are concerned) would be provided by RVPNL. RVPNL further stated that Indian Railways may explore the option of drawing three-phase supply and directly

converting it into single phase. Such models are in use and can be replicated by Indian Railways in future. This would resolve all associated operational and protection issues.

9.0 After detailed deliberations, the following were agreed:

(i) Indian Railways may be granted two phase connectivity for 220 kV transmission line between 400/220 kV GSS Ajmer to 220/25 kV TSS Kishengarh subject to the following conditions:

(a) Grant of such two phase connectivity is limited to this case only.
(b) Necessary filters for limiting the current/ voltage harmonics within permissible limits as specified in CEA (Technical Standards for Connectivity to Grid) Regulations 2007 and amendments thereof, would be implemented by Indian Railways at their 220/25 kV Kishangarh TSS and other TSS and the cost for the same need to be borne by Indian railways.
(c) RVPNL would need to raise the requirement of filters to Indian railways.
(d) The implementation and subsequent maintenance of harmonic filters required at Railway's TSS end has to be carried out by Indian Railways. The necessary technical assistance required (as far as specifications are concerned) would be provided by RVPNL.

(ii) For future requirement Indian Railways would explore the option of drawing three-phase supply from Utility Power System and directly converting it into single phase 25 kV supply for their traction load at their TSS or to 2-phase power supply for catering their traction load through Scott connection at their end. This would address the operational and protection issues associated with 2-phase supply from Grid substation.

Meeting ended with thanks to the chair.

Annexure-I

List of Participants for the meeting to discuss the Connectivity of 220 kV transmission line from 400 kV GSS Ajmer to 220/25kV TSS Kishengarh through 2 phase line.

Date 08.11.2019

S.No.	Name (S/Shri)	Designation	Mb. No.	Email
I	CEA			
1	Awdhesh Kumar Yadav	Director	9868664087	awdhesh@nic.in
2	Manjari Charturvedi	Director	9810502209	manjari.cea@gmail.com
3	Priyam Srivastava	Assistant Director	9717650473	priyam.cea@gmail.com
4	Vikas Sachan	Assistant Director	7838263649	vikas.cea@gmail.com
5	Komal Dupare	Assistant Director	9425618454	komal.dupare16@gmail.com
II	**RVPNL**			
6	S.K. Baswal	CE(PPD)	9413387178	ceppm@rvpn.com
7	Mukesh Singhal	SE	9414061406	ce.ppm@rvpn.co.in
III	**POWERGRID**			
8	Rajesh Verma	Sr. DGM	9599192370	rverma@powergridindia.com
IV	**Indian Railways**			
9	H.C Meena	CPD	9001046000	

Appendix-1

Proposed case-1 (400/220 kV system at 765kV Anta GSS and 220 kV GSS at Sangod)

S. N.	Transmission lines/Transformers	Proposed case-1 (400/220 kV system at 765 kV Anta GSS and 220 kV GSS at Sangod)			
		Base Case	Contingency-1 (Outage of 2xS/C 765 kV Anta-Phagi line)	Contingency-2 (Outage of 400 kV Anta-Kota(PG) line and 1x500 MVA, 400/220 kV ICT at Kalisindh TPS)	Contingency-3 (Outage of 400 kV S/C Chhabra TPS-Hindaun line and 400 kV S/C Chhabra TPS-Bhilwara line)
A	**765/400 kV Anta GSS**				
1	3X1500 MVA, 765/400 kV transformer at 765 kV GSS Anta	-1744	0	-2234	-2193
2	765kV S/C Anta-Phagi line (Ckt-I)	868	0	1112	1092
3	765kV S/C Anta-Phagi line (Ckt-II)	876	0	1122	1101
4	400 KV Anta-Kota (PG) Line	581	1408	0	845
5	400kV S/C Chhabra TPS-Anta (765kV) line	255	158	204	1151
6	220 kV S/C Anta-Dahara (220 kV) line (Proposed)	112	217	187	149
7	220 kV D/C Anta-Sangod (220 kV) line (Proposed)	98	123	140	105
8	220 kV D/C Anta-Bara (220 kV) line (Proposed)	271	398	403	294
B	**Chhabra TPS**				
6	400kV S/C Chhabra TPS-Kawai (400kV) line	27	-121	-52	272
7	400kV S/C Chhabra TPS-Hindaun (400kV) line	514	748	579	0
8	400kV S/C Chhabra TPS-Bhilwara (400kV) line	376	616	481	0
9	315 MVA, 400/220 kV Transformer at 400 kV GSS Chhabra TPS	188	220	287	240
10	220kV S/C Chhabra TPS(400kV)-Aklera(220kV) line	69	86	180	89
11	220kV S/C Chhabra TPS(400kV)-Kawai(220kV) line	119	132	105	150
C	**Chhabra SCTPS**				
12	400kV D/C Chhabra SCTPS-Anta (765kV) line	718	456	579	1151
13	400kV D/C Chhabra SCTPS-Chhabra TPS line	464	726	603	31
D	**Kalisindh TPS**				
14	400kV D/C Kalisindh (400kV)TPS-Anta (765kV) line	639	480	1075	593
15	500 MVA, 400/220 kV transformer at 220 kV GSS Kalisindh TPS	436	595	0	482
16	220 kV S/C Kalisindh (400 kV)-Bhawanimandi (220 kV) line	136	184	40	153
17	220 kV D/C Kalisindh (400 kV)-Jhalawar (220 kV) line	297	407	-40	326

E	**Kawai TPS**				
18	400 kV D/C Kawai (400kV)-Anta(765kV) line	1209	1061	1130	1453
F	**Total System losses (MW)**	**492.617**	**624.797**	**514.2595**	**539.683**

Appendix-2

Proposed case-2 (400/220 kV system at Sangod)

The results of load flow studies of Base Case and contingency cases have been tabulated below and power plots are placed at **Exhibts R4, R4C1, R4C2 and R4C3.**

S. N.	Transmission lines/Transformers	Proposed case-3 (400/220 kV system at Sangod)			
		Base Case	Contingency-1 (Outage of 2xS/C 765 kV Anta-Phagi line)	Contingency-2 (Outage of 400 kV Anta-Kota(PG) line and 1x500 MVA, 400/220 kV ICT at Kalisindh TPS)	Contingency-3 (Outage of 400 kV S/C Chhabra TPS-Hindaun line and 400 kV S/C Chhabra TPS-Bhilwara line)
A	**765/400 kV Anta GSS**				
1	3X1500 MVA, 765/400 kV transformer at 765 kV GSS Anta	-1772	0	2265	2246
2	765kV S/C Anta-Phagi line (Ckt-I)	882	0	1124	1114
3	765kV S/C Anta-Phagi line (Ckt-II)	890	0	1133	1124
4	400 KV Anta-Kota (PG) Line	607	1499	0	887
5	400kV S/C Chhabra TPS-Anta (765kV) line	251	147	209	412
B	**Chhabra TPS**				
6	400kV S/C Chhabra TPS-Kawai (400kV) line	21	-138	-45	268
7	400kV S/C Chhabra TPS-Hindaun (400kV) line	517	764	584	0
8	400kV S/C Chhabra TPS-Bhilwara (400kV) line	382	638	488	0
9	315 MVA, 400/220 kV Transformer at 400 kV GSS Chhabra TPS	199	241	249	252
10	220kV S/C Chhabra TPS(400kV)-Aklera(220kV) line	57	62	69	73
11	220kV S/C Chhabra TPS(400kV)-Kawai(220kV) line	141	178	179	177
C	**Chhabra SCTPS**				
12	400kV D/C Chhabra SCTPS-Anta (765kV) line	708	426	592	1145
13	400kV D/C Chhabra SCTPS-Chhabra TPS line	474	756	590	37
D	**Kalisindh TPS**				
14	400kV Kalisindh (400kV)TPS-Anta (765kV) line	292 (D/C)	131 (S/C)	461 (S/C)	247 (S/C)
15	500 MVA, 400/220 kV transformer at 220 kV GSS Kalisindh TPS	411	562	0	458
16	220 kV S/C Kalisindh (400 kV)-Bhawanimandi (220 kV) line	135	183	73	151
17	220 kV D/C Kalisindh (400 kV)-Jhalawar (220 kV) line	274	375	-73	304

18	400 kV S/C Kalisindh(400kV)-Sangod(400kV) line	372	382	614	369
E	**Kawai TPS**				
19	400 kV D/C Kawai (400kV)-Anta(765kV) line	1203	1044	1137	1450
F	**400 kV GSS Sangod**				
20	2x500 MVA, 400/220 kV transformer at 400 kV GSS Sangod	432	623	375	474
21	400kV S/C Anta (765kV)-Sangod (400kV) line	62	243	125	106
22	400kV S/C Kalisindh (400kV)-Sangod (400kV) line	372	382	614	369
23	220kV D/C Sangod (400kV)-Baran (220kV) line	248	374	308	279
24	220kV S/C Sangod (400kV)-Jhalawar (220kV) line	24	54	242	38
26	220kV S/C Sangod (400kV)-Aklera (220kV) line	31	27	19	15
G	**Total System losses (MW)**	**493.407**	**628.439**	**511.162**	**540.19**

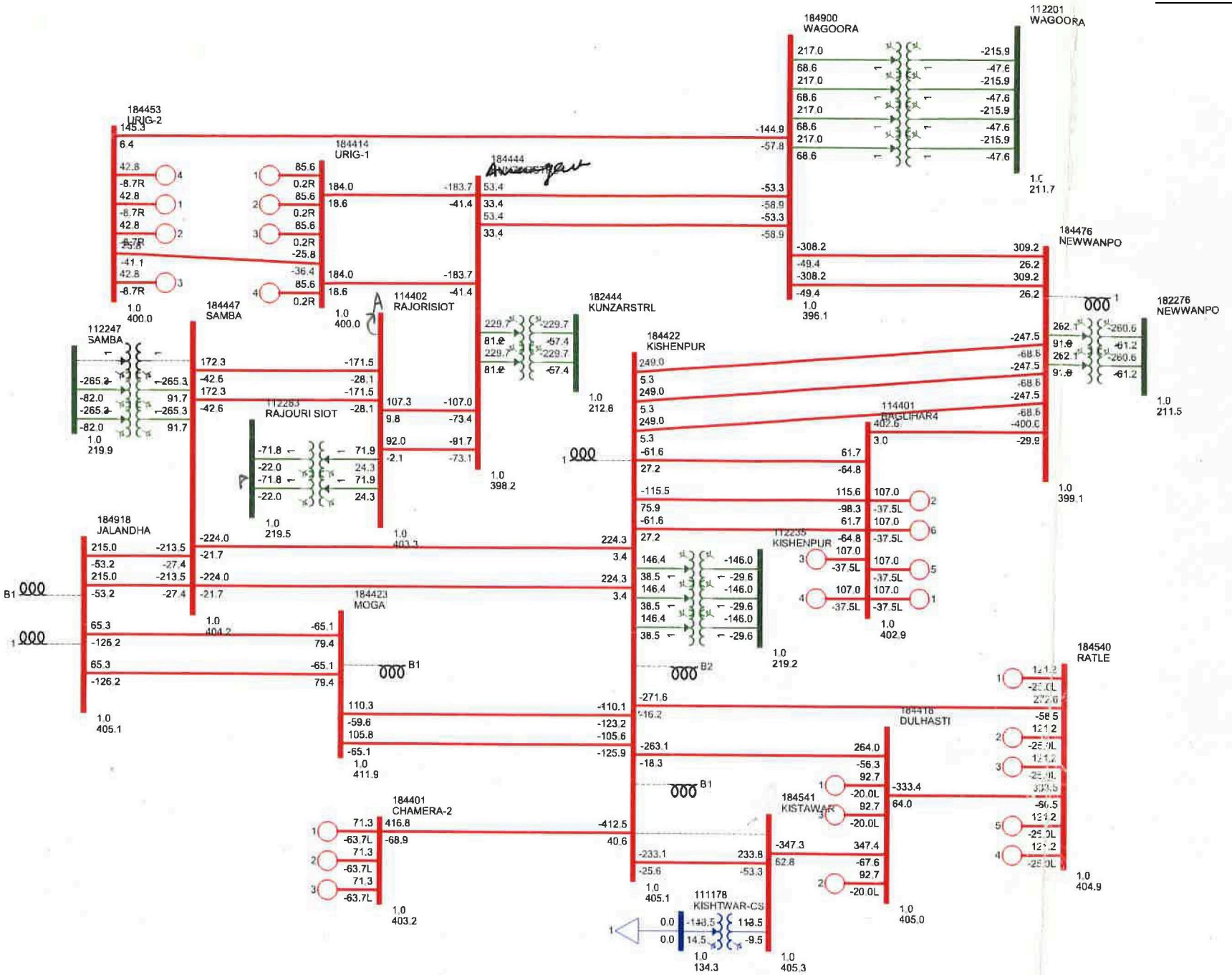
Annexure-VII

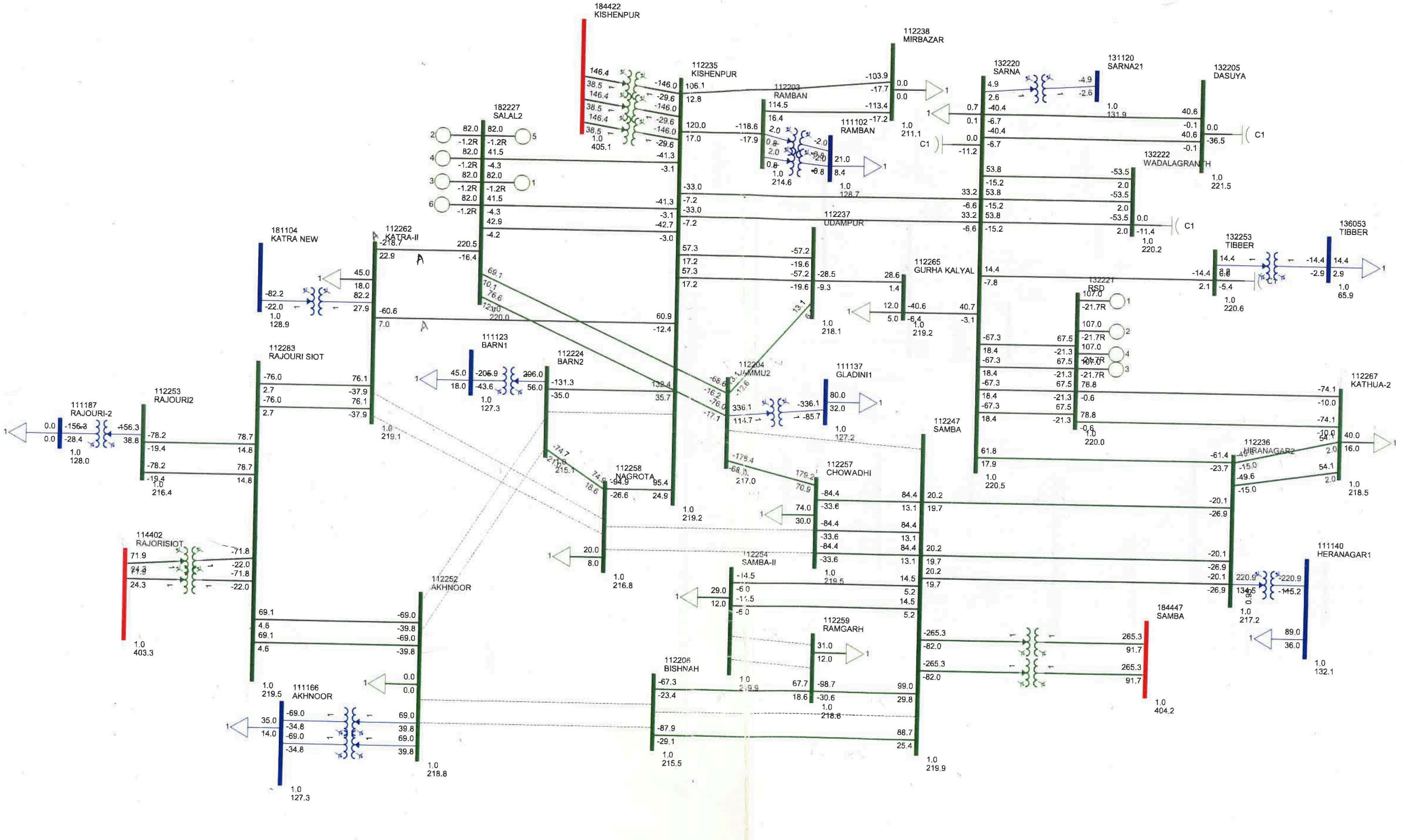
S.No.	Transmission Element
1.	Creation of 2X160MVA,220/132KV Grid Station at Rajouri/Siot
2.	220KV D/C line from 400/220KV Grid Station Siot/Rajouri to 220/132KV Grid Station Rajouri (55 Kms)
3.	Creation of 2x160 MVA, 220/132KV and 2X50 MVA 132/33KV Grid Station Katra-II (Preferably GIS)
4.	LILO of one Circuit of D/C 220KV Salal-Kishanpur Transmission line at Katra-II
5.	Laying of 2Km of 4Ckt (80 Ckt Kms) 132KV line on Multi Circuit towers with ACSR Panther for LILO of 132KV Katra-Reasi line D/c line
6.	Creation of 2X50MVA, 132/33KV GIS at Old City (Muthi)
7.	LILO of 132KV Barn –canal section of the ring main around Jammu City using 400 Sq. mm Power Cable (2X4 Cables) 8Kms with 2 nos. 132KV line & 8 nos. 33KV line Bays.
8.	Creation of **2X160MVA,220/132KV & 2X50**MVA 132/33KV Grid Station at Akhnoor-II
9.	220KV D/C line from 400/220KV Grid Station Rajouri/ Siot to 220/132/33KV Grid Station Akhnoor-II (60 Kms)
10.	Erection of new 220KV line from 220/132/33KV Grid Station Akhnoor-II to220/132/33KV Grid Station Barn (15 Kms)
11.	LILO of D/c between the Pounichak/ Muthi - Canal Section of ring main around Jammu City by Laying of 20Km of 4Ckt (80 Ckt Kms) 132KV line on Multi Circuit towers with HTLS Conductor
12.	Creation of 2X50 MVA, 220/33KV Grid Station Gurah Ramgarh
13.	LILO of one circuit of samba- Bishnah 220kV D/c line at Gurah Ramgarh
14.	Creation of 2X50 MVA, 220/33KV Grid Station Gurah Karyal
15.	LILO of Udampur- Sarna 220kV line at Gurah Karyal
16.	Creation of New 40(2X20) MVA,132/33KV Grid Station Mendhar (50 MVA)
17.	Darba- Mendhar 132 kV S/c line (30 kms)
18.	Thickening of D/C 220KV Barn-Kishenpur Trans. Line from ACSR Zebra to HTLS conductor(37.44 kms)
19.	Augmentation of 220/132KV Transformation capacity at 220/132/66KV Grid Station Hiranagar from 320 to 400MVA by replacement of Existing (120x3+1X40)MVA Bank with 200(3+1X66.67)MVA Bank.
20.	Replacement of over lived 220/132kV ,400 MVA single phase auto transformer bank at Gladni. Transformation capacity addition of 50 MVA at 132/33kV level to meet the load demand.
21.	Replacement of one of outdated 3x40MVA (+1 Spare) 1-ph 220/132KV Transformers Bank at 220/132/33KV Grid Station, Udhampur.

22.	Thickening of 132KV Busbar of Hiranagar S/s from Twin Zebra to Twin Moose or HTLS.
23.	Thickening of 132KV Busbars of Grid Station Barn from Twin Moose to Twin HTLS (ACCC Grosbeak)
24.	Thickening of 132KV BusBar of Grid Station Sidhra from Twin Zebra to Twin HTLS equivalent to Twin Moose.
25.	Thickening of 132KV Busbar of Grid Station Katra from Single Moose to Twin Moose
26.	Twinning of 132KV Busbar at Grid Station Rajouri from Single Zebra to Twin Zebra
27.	Twinning of 132KV Busbar at Grid Station Draba from Single Zebra to Twin Zebra
28.	Thickening of D/C 132KV Ring-Main Line of Jammu City by replacement of ACSR Panther by HTLS conductor on Live Line. i) Gladni-Sidhra link ii) Sidhra-Janipur link iii) Barn-Canal link iv) Barn-Janipur link v) Gladni-Bari Brahmana-II link Total= 55Kms (110 Ckt. KMs)
29.	Augmentation of 132/33 KV Grid Station Ramban from 1 X 20 to 2 X 20 MVA
30.	Augmentation of 132/66 KV Transformation capacity at 220/132/66KV Grid Station Hiranagar from 72.5 to 100MVA by replacement of 22.5(3X7.5)MVA Bank with 50MVA.
31.	Augmentation of Grid Station Jourian from 20MVA to 50 MVA
32.	Augmentation of Grid Station Draba from 40(2X20)MVA to 70(1X20 + 1x50)MVA
33.	Augmentation of 132/33 KV Transformation capacity at 132/33KV Grid Station Akhnoor from 70 to 100MVA by replacing existing 20MVA with 50MVA.
34.	Augmentation of 132/33 KV Grid Station Udhampur from (1 X 50 + 1 X 20) MVA to 2 X 50 MVA
35.	Augmentation of grid Station BB-I from 2X50+31.5 to 3X50MVA by replacement of 132/11KV 31.5 MVA transformer by 132/33kV, 50MVA transformer along with construction of new 132KV and 33KV incomer bays other allied works.
36.	Augmentation of 132/33 KV Grid Station Udhampur from (1 X 50 + 1 X 20) MVA to 2 X 50 MVA
37.	LILO of 132kV D/c line between 132/33 KV Rajouri and 132/33kV Draba S/s at 220/132kV Rajouri S/s(12km)
38.	laying of new 132 KV S/C Transmission line from 132/33 KV Grid Station Katra-II to 132/33 KV Grid Station Jhajjar Kotli on ACSR Panther-20 Kms
39.	Thickening of 33KV Busbars at Grid Station Barn from Twin Moose to Twin HTLS
40.	Thickening of 33 KV Busbar at Grid Station Sidhra from Single Zebra to Twin Moose

41.	Twinning of 33KV Busbar at Grid Station Rajouri from Single Zebra to Twin Zebra
42.	Twinning of 33KV Busbar at Grid Station Draba from Single Zebra to Twin Zebra
43.	Thickening of 66KV Busbars at Grid Station Kathua from ACSR Zebra to HTLS (equivalent 1.5KM)
44.	Thickening of 33 KV Bus-Bar at Grid Station Udhampur with Moose conductor

Annexure VIII

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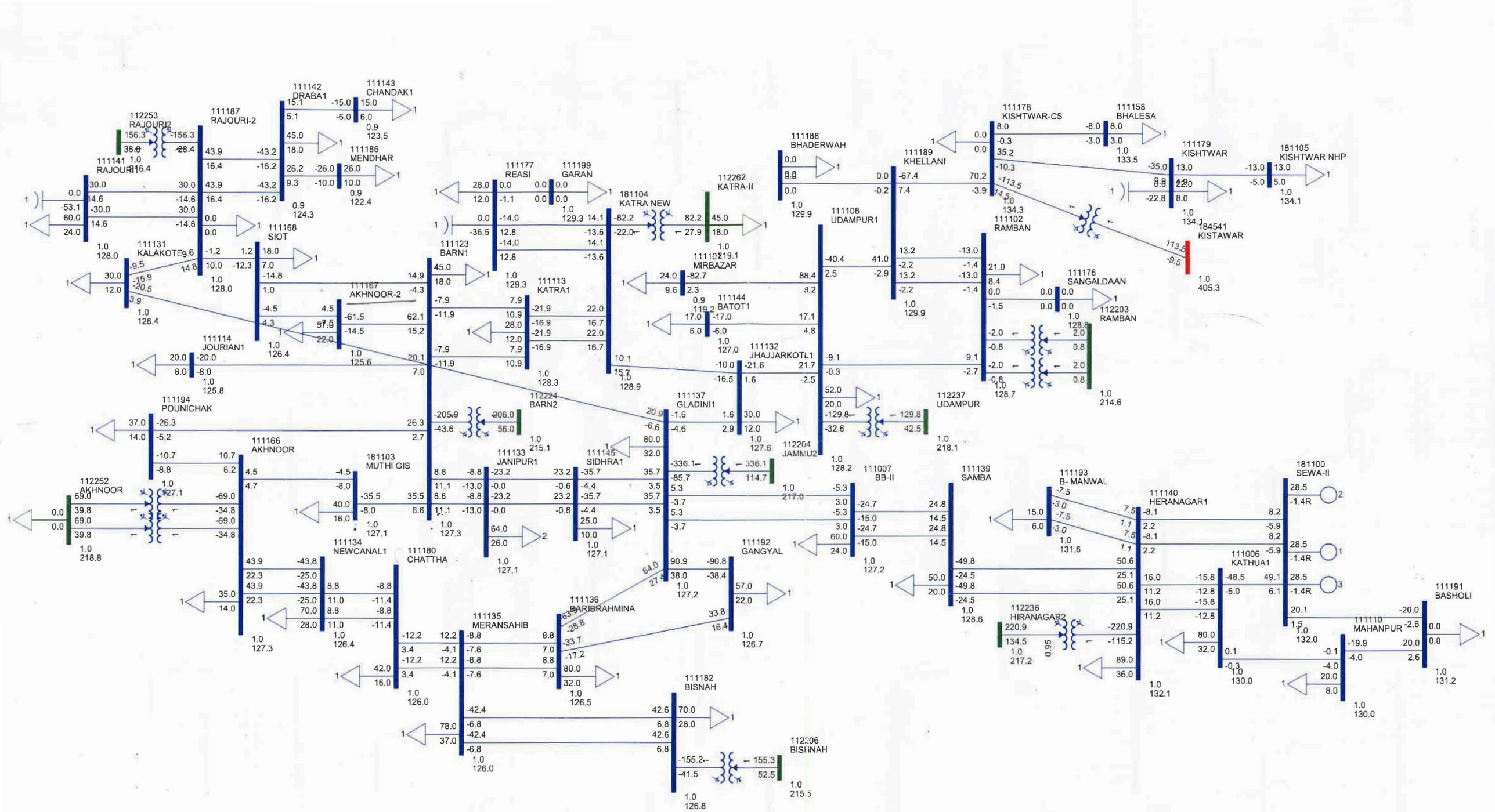
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111133 JANIPUR1
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111191 BASHOLI

Annexure-IX

Scope of works of Gorakhpur – New Butwal 400kV D/c (Quad) line

A. Indian Side

Transmission Line

(a) Gorakhpur – New Butwal 400kV D/c (Quad Moose) line (Indian Portion)

Substation

(a) Extension at 400kV Gorakhpur S/s
- 2 nos. 400kV GIS line bays for the termination of Gorakhpur – New Butwal 400 kV D/c (Quad) line

B. Nepalese Side

Transmission Line

(a) Gorakhpur – New Butwal 400kV D/c (Quad Moose) line (Nepalese Portion)

Substation

(a) Up-gradation of **New Butwal** S/s to 400kV

- Creation of 400kV level and Installation of 400/220kV, 2x500MVA ICT along with associated bays
- **400kV Line bays: 2 nos.**

- 2 nos. 400kV line bays along with 420kV, 50MVAR switchable line reactors in each bay for the termination of Gorakhpur – New Butwal 400 kV D/c (Quad) line

- **Reactive compensation**

- 420kV, 2x125 MVAR Bus reactors along with associated bays

- **Space for future**

- 400kV line bays (incl. space for sw. line reactor): 8 nos.
- 400/220kV, 2x500MVA ICT
- 400kV ICT bays: 2 nos.
- 220kV ICT bays: 2 nos.
- 220kV line bays: 8 nos.