Agenda for 2nd meeting of Eastern Region Standing Committee on Transmission

1. Confirmation of the minutes of 1st meeting of Eastern Region Standing Committee on Transmission (ERSCT).

1.1 The minutes of the 1st meeting of Eastern Region Standing Committee on Transmission (ERSCT) held on 16th July 2018 at Kolkata were circulated vide CEA letter No. CEA-PS-12-15/2/2018-PSPA-II Division-Part(1) dated 19th September, 2018.

1.2 WBSETCL vide their letter No. CE/CPD/CEA/2450 dated 29.10.2018 has requested for amendment in item No. 17 of the Minutes of the meeting and a corrigendum was issued by CEA vide letter No. CEA-PS-12-15/2/2018-PSPA-II Division-Part(1) dated 06th June, 2019.

1.3 Members may confirm the minutes of 1st meeting of ERSCT and the corrigendum of the minutes.

Follow up issues of Previous Standing Committee Meetings

2. Termination of 400kV lines at Jeerat (WBSETCL) substation under the ERSS-XV and ERSS-XVIII schemes – Agenda by POWERGRID

2.1 Following 400kV lines are existing / under construction at 400/220kV substation of Jeerat (WBSETCL):

Existing:

(i) Jeerat (WBSETCL) – Baharampur/Farakka 400kV S/c line of POWERGRID

(ii) Jeerat (WBSETCL) – Rajarhat/Subhashgram 400kV S/c line of POWERGRID

(iii) Jeerat (WBSETCL) – Barkeshwar (WBSETCL) 400kV S/c line of WBSETCL

(iv) Jeerat (WBSETCL) – Kolaghat (WBSETCL) 400kV S/c line of WBSETCL

Under Construction:

(v) LILO of Sagardighi – Subhashgram 400kV S/c line at Jeerat (WBSETCL) as a part of ERSS-XV by POWERGRID

(vi) Jeerat (New) – Jeerat (WBSETCL) 400kV D/c line (Quad) as a part of ERSS-XVIII being implemented under TBCB by POWERGRID Medinipur-Jeerat Transmission Ltd.

2.2 There was RoW problem for termination of new 400kV lines being implemented under ERSS-XV and ERSS-XVIII at Jeerat (WBSETCL) S/s. Accordingly, in the 19th meeting of SCPSPER, following was decided to resolve the issue:

(i) Dismantling of dead end towers and termination of existing lines mentioned at 2.1 (i) to (iv) through GIS duct, at the existing 400kV Jeerat AIS S/s (WBSETCL) as ISTS.

(ii) The new lines mentioned at 2.1 (v) and (vi) can be directly terminated on separate double circuit towers at normal height (around 45 meters) to new GIS extension area.

(iii) Further, it was also acknowledged that implementation of LILO of Sagardighi-Subhasgram 400kV S/c line at Jeerat along with associated line bays shall get delayed due to addition of above mentioned GIS duct arrangement.

2.3 Since the work to be carried out under ISTS may not match the timeline of ERSS-XV & ERSS-XVIII schemes, it was requested to extend the completion of ERSS-XV & ERSS-XVIII schemes in the 1st meeting of ERSCT. Further, in the 1st ERSCT it was also decided that "after finalization of implementing agency for the work, a separate meeting in CEA with CTU, POWERGRID, WBSETCL and implementing agency will be held to discuss the extension of completion schedule of ERSS-XV & ERSS-XVIII schemes. Decision of the meeting will be put up before ERSCT for ratification."

2.4 In the 2nd meeting of ECT held on 06-08-2018, POWERGRID has been entrusted with the works mentioned above at 2.2 (i) through RTM.

2.5 A meeting was held at CEA on 26-03-2019, wherein representative of CTU stated that for dismantling and termination of various lines of POWERGRID and WBSETCL through GIS duct, agreement was signed by POWERGRID with WBSETCL on 07-11-2017, i.e. WBSETCL is implementing the said works on POWERGRID's behalf at its substation. The work has been awarded to JV of M/s Techno & M/s ABB in Nov'18 after approval of mode of implementation in the 2nd ECT meeting. The expected commissioning schedule of the GIS works is 15 months (i.e. Feb 2020) from award.

2.6 Members may approve revised completion schedule of ERSS-XV scheme as Feb 2020.

3. Replacement of existing SMT bus scheme with DM at 132kV level at Malda (POWERGRID) S/s in GIS along with new 132kV bays

3.1 In the 1st meeting of ERSCT, replacement of existing Single Main & Transfer (SMT) scheme with Double Main (DM) scheme at 132kV level at Malda (POWERGRID) substation through GIS was agreed. It was also agreed to provide 2 no. of 132kV GIS line bays for Manikchak/Paranpur – Malda (POWERGRID) 132kV D/c line. These works were approved to be implemented as ISTS.

3.2 Above scheme was decided for implementation under RTM by POWERGRID in 3rd meeting of Empowered Committee on Transmission

held on 21-12-2018. The subject scheme is being implemented as ERSS-XXII.

3.3 As per information provided by WBSETCL, Malda (POWERGRID) – Manikchak/Paranpur 132kV D/c line is expected to be commissioned in Dec 2021.

3.4 Members may note.

4. Conversion of 50MVAr bus reactor at Farakka generation switchyard to switchable line reactor under ERSS-15 – Agenda by POWERGRID

4.1 In the 19th meeting of Standing Committee on Power System Planning of Eastern Region held on 01-09-2017 it was informed that one spare future bay has been selected for termination of one circuit of Farakka – Baharampur D/c line at 400kV bus at Farakka generation switchyard, however, due to non-availability of adjacent bay for termination of the other circuit it is proposed to terminate the second circuit in the exiting 50MVAR bus reactor bay along with conversion of this reactor to switchable line reactor. This arrangement would result in connection of 50MVAR switchable line reactor in one circuit of Farakka – Baharampur 400kV D/c line at Farakka end to be utilised as bus reactor.

4.2 In the meeting, members agreed for conversion of 50MVAR (3x16.67) bus reactor at Farakka to switchable line reactor to be installed in one circuit of Farakka – Baharampur 400kV D/c line as ISTS. Subsequently, in the 2nd meeting of ECT it has been decided that the said works would be implemented by POWERGRID under RTM. Accordingly, as per ECT approval the scheme has already been implemented by POWERGRID under the ERSS-XV scheme.

4.3 Members may please note.

5. Interim connectivity to generation projects in ER through LILO arrangement

5.1 Numbers of generation projects were granted Connectivity / Long Term Access (LTA) with strengthening of transmission system. In few cases generation projects were to be commissioned ahead of the anticipated commissioning of the associated transmission system. In such cases, generation projects were given temporary connectivity through loop-in & loopout (LILO) of nearby transmission lines so as to enable them connect with the grid and commission their generation projects. The temporary connectivity through LILO was to be withdrawn after commissioning of the associated transmission system. Associated transmission system of some of such generation projects have been commissioned and their temporary connectivity through LILO has been disconnected; however, some are still connected through LILO arrangement.

5.2 CERC in its order dated 07-102015 on Petition No.112/TT/13 and dated 28-09-2016 in Petition no. 30/MP/2014 has directed that the interim (LILO) arrangement has to be removed.

5.3 The progress of dedicated transmission lines of IPPs in Eastern Region, which are connected through interim arrangement is summarized below:

Generation Project in ER connected through temporary LILO arrangement					
Sl. No.	**Generation Project**	**IC (MW)**	**Present Connectivity through LILO**	**Final Connectivity Arrangement**	**Anticipated Completion Schedule (as per 1st ERSCT)**
1	Gati Infrastructure Ltd. (Chuzachen HEP)	2x55	LILO of Rangpo - Gangtok 132kV S/c line *(granted in Nov'07)*	Chuzachen - Rangpo 132kV D/c (with Zebra conductor)	Line completed. Project commissioned on interim arrangement. Line bays at Rangpo end are being implemented by E&PD, Govt. of Sikkim is expected by **Sept'18.**
2	Sneha Kinetic Power Projects Pvt. Ltd. (Dikchu HEP)	2x48	LILO of one circuit of Teesta-III – Rangpo 400kV D/c line at Dikchu *(granted in Dec'14 by CERC)*	Dikchu – Dikchu Pool 132kV D/c	**Separate meeting will be held with Sikkim Government at CEA.**
3	Shiga Energy Pvt. Ltd. (Tashiding HEP)	2x48.5	LILO of one circuit of Rangpo-New Melli 220kV D/c line at Tashiding through Tashiding-New Melli 220kV D/c	Tashiding – Legship Pool 220kV D/c line	• Legship Pool S/s is expected by **Dec, 19.** • Representative of **E&PD, Govt. of Sikkim stated that** status of 2 no. 220kV line bays at New Melli **would be intimated later.**

5.4 E&P Dept., Govt. of Sikkim may provide status update on above matters.

6. Status of downstream 220kV or 132kV network by STUs from the various commissioned and under-construction ISTS substations

6.1 Numbers of ISTS sub-stations have been commissioned and some are under construction for which the downstream system is being implemented by the STUs. Based on the information provided by the states, updated information on planned/under-construction downstream system is as follows:

A. <u>Existing substations:</u>

(a) Rajarhat 400/220kV S/s

i. Rajarhat (POWERGRID) – New Town AA3 220kV D/c – Commissioned

ii. Rajarhat (POWERGRID) – New Town AA2 220kV D/c – Dec '19

iii. Rajarhat (POWERGRID) – Barasat/Jeerat 220kV D/c – Feb '19

(b) Subashgram 400/220kV S/s

i. Subashgram (POWERGRID) – Baraipur 220kV D/c line – Mar'20

(c) Pandiabil 400/220kV S/s

i. Pratapsasan (OPTCL) – Pandiabil (POWERGRID) 220kV D/c – Mar'19

(d) Bolangir 400/220kV S/s

i. LILO of one ckt of Sadeipalli – Kesinga 220kV D/c at Bolangir – Mar'19

(e) Keonjhar 400/220kV S/s

i. Keonjhar (POWERGRID) – Turumunga (OPTCL) 220kV D/c – Dec '19

(f) Daltonganj 400/220/132kV S/s

i. Daltonganj (POWERGRID) – Latehar 220kV D/c – Apr'19

ii. Daltonganj (POWERGRID) – Garhwa 220kV D/c – Mar'19

iii. Daltonganj (POWERGRID) – Chatarpur/Lesliganj 132kV D/c – Oct'19

(g) Chaibasa 400/220kV S/s

i. Chaibasa (POWERGRID) – Jadugoda (JUSNL) 220kV D/c – Nov'21

B. <u>Under Construction substations:</u>

(h) Sitamarhi 400/220/132kV S/s – Expected by Mar'21

i. Sitamarhi (New) – Motipur (BSPTCL) 220kV D/c line

ii. Sitamarhi (New) – Raxaul (New) 220kV D/c (Twin Moose) line

iii. Sitamarhi (New) – Runni Saidpur 132kV D/c line

iv. LILO of Benipatti – Pupri 132kV S/c at Sitamarhi (New)

(i) Saharsa 400/220/132kV S/s – Expected by Mar'21

i. Saharsa (New) - Khagaria 220kV D/c line

ii. Saharsa (New) - Begusarai 220kV D/c line

iii. Saharsa (New) - Saharsa 132kV D/c line formed by LILO of Saharsa - Banmankhi and Saharsa - Uda Kishanganj 132kV S/c lines

(j) Chandauti 400/220/132kV S/s – Expected by Mar'21

i. LILO of Gaya (POWERGRID) – Sonenagar 220kV D/c at Chandauti (New)

ii. LILO of Chandauti (BSPTCL) – Rafiganj 132kV S/c at Chandauti (New)

iii. LILO of Chandauti (BSPTCL) – Sonenagar 132kV S/c at Chandauti (New)

(k) Dhanbad 400/220kV S/s – Expected by Oct'20

i. LILO of 220 kV Tenughat - Govindpur D/c line at Jainamore and Dhanbad

6.2 Members may provide the updated status.

7. Status of 400kV substations being implemented by STUs in ER under intra-state schemes

7.1 Following 400kV substations have been approved in the previous meetings under intra-state strengthening schemes in ER. Respective STUs are requested to update the expected commissioning schedule of the same:

(a) <u>Bihar (to be implemented by BSPTCL/BGCL)</u>

(i) Naubatpur GIS: 400/220/132/33kV, 2x500MVA + 2x160MVA + 2x80MVA

(ii) Bakhtiyarpur GIS: 400/220/132kV, 2x500MVA + 2x160MVA

(iii) Jakkanpur GIS: 400/220/132/33kV, 2x500MVA + 3x160MVA + 4x80MVA

(b) <u>Odisha (to be implemented by OPTCL)</u>

(i) Meramundali-B: 400/220kV, 2x500MVA

(ii) Narendrapur (New): 400/220kV, 2x500MVA

(iii) Khuntuni: 400/220kV, 2x500MVA

(iv) Bhadrak: 400/220kV, 2x500MVA

(v) Paradeep: 400/220kV, 2x500MVA

(vi) Begunia: 765/400kV, 2x1500MVA along with Angul-Begunia 765kV D/c line and LILO of Pandiabil – Narendrapur 400kV D/c line at Begunia

(vii) Narendrapur – Therubali – Jeypore 400kV D/c line along with 400kV switching station at **Therubali** and 420kV, 1x125MVAr bus reactor

(c) <u>Jharkhand (to be implemented by JUSNL)</u>

(i) Jarsidih: 400/220kV, 2x500MVA

(ii) Chandil (New): 400/220kV, 2x500MVA

(iii) Koderma: 400/220kV, 2x500MVA

(iv) Mander: 400/220kV, 2x500MVA

(v) Dumka (New): 400/220kV, 2x500MVA

7.2 BSPTCL, OPTCL, and JUSNL may update on the matter.

<u>New Transmission system proposals</u>

8. Augmentation of transformation capacity at Muzaffarpur (POWERGRID) S/s – (Agenda by BSPTCL)

8.1 BSPTCL has informed that the load in Muzaffarpur area is growing very fast. The load demand in Muzaffarpur & adjoining areas is largely fed by Muzaffarpur (PG) with transformation capacity of 1x500+2x315 MVA. During peak hours following loading is being observed:

<u>Present scenario:</u>

Sl. NO.	Lines	Maximum Load (MW)
1	Muzaffarpur (PG)-MTPS (D/C)	420
2	Muzaffarpur (PG)-Hazipur (D/C)	296
3	Muazaffarpur (PG)-Dhalkebar (Nepal) (400kV Transmission Line charged at 220kV)	150

	Total	**866**

Future scenario:

In future Amnor (Chappra) GSS(220/132/33 KV) will be connected to Muzaffarpur (PG) through 220 KV D/C lines as approved in 18th Standing Committee Meeting of CEA under 13th Plan. Further Amnor has been proposed to be connected to Digha (new) GSS (220/132/33 KV) at 220 KV level. BSPTCL has also proposed one 220/132/33 KV GSS at Garaul (Dist. Vaishali) under State Plan, approved in the Bihar cabinet, is getting source at 220 KV level with D/C from Muzaffarpur(PG). Both proposed GSSs (Digha and Garaul) are likely to be commissioned in March-2020. In future the loading pattern on 220kV line will be as follows:-

Sl. NO.	Lines	Maximum Load (MW)
1	Muzaffarpur (PG)-MTPS (D/C)	80
2	Muzaffarpur (PG)-Hazipur (D/C)	250
3	Muzaffarpur (PG)-Amnor (BGCL) (D/C)	300
4	Muzaffarpur (PG)-Goraul (Proposed) (D/C)	200
	Total	**830**

In present scenario itself, Muzaffarpur (PG) is not able to fulfill N-1 criteria and in case of outage of any power transformer, the situation will be critical.

In view of above facts, it is proposed that, either replacement of 2x315 MVA transformers by 2x500 MVA or addition of one 500 MVA transformer of Muzaffarpur (PG) may be considered under N-1 scheme to ensure uninterrupted power to Muzaffarpur and adjoining areas in the event of outage of any transformer. Moreover, if the generation at Kanti (MTPS) reduces, the power supply position at Muzaffarpur 220kV level further aggravates under N-1 of ICTs.

8.2 A meeting was held on 26.03.2019 at CEA, wherein Chief Engineer (PSPA-II) suggested that additional one no. of 500MVA ICT may be installed to meet the load under N-1 criteria. He informed that Muazaffarpur (PG)-Dhalkebar (Nepal) 400kV D/c line is being operated at 220kV and the power flow is around 240MW.

8.3 With regard to availability of space at Muzaffarpur S/s, CTU informed that space is available for new 400/220kV, 500MVA ICT. The 400kV ICT bay could be implemented as AIS, however, 220kV ICT bay needs to be implemented as GIS along with 220kV cable from ICT to GIS bay.

8.4 After deliberations, participants agreed for installation of new 400/220kV, 500MVA ICT at Muazaffarpur (PG) under ISTS.

8.5 Members may discuss.

9. Additional 400kV connectivity at 400/220/132kV Saharsa (new) S/s being implemented under ERSS-XXI through TBCB – (Agenda by BSPTCL)

9.1 BSPTCL has informed that the present connectivity of upcoming 400/220/132 kV Saharsa (New) GSS at 400 kV level is LILO of Patna (PG) - Kishanganj (PG) 400 kV D/C line and this work is being done by POWERGRID under TBCB route.

9.2 They have further stated that the Saharsa (New) GSS has to be fed from two reliable sources, whereas one of the feed i.e. Patna (PG) - Saharsa (New) 400 kV D/c line is having river crossing and tower failure may occur during floods. Therefore, to improve the reliability at 400 kV level, it is proposed to provide an additional source by making LILO of Darbhanga (DMTCL) - Kishanganj (PG) 400 kV D/C line at 400 kV Saharsa (New) S/S.

9.3 A meeting was held on 26.03.2018 at CEA, wherein Chief Engineer (PSP&A-II), CEA, and representative of CTU stated that Kishanganj (PG) - Saharsa(New) 400 kV D/c line with Quad moose conductor can meet the load of Saharsa (New) S/S , in case of tower failure of Patna (PG) – Saharsa (New) 400kV D/c line. Under worst case scenario, i.e. with only one circuit of Kisanganj (PG) - Saharsa(New) 400 kV line (with quad moose), the load of Saharsa (New) S/S would be met in the present condition. Based on operational experience, the alternatives may be discussed.

9.4 It was opined that N-1 criteria can only be considered while planning, whereas tower failure in river crossing cannot be considered as a general case in the studies. However, representative of BSPTCL insisted that the 2nd 400kV LILO line i.e. LILO of Kishanganj – Darbhanga may be considered at Saharsa to improved power supply reliability, as the Kishanganj – Patna line during the last two monsoon seasons has suffered prolonged outage due to tower collapse at various locations during flood.

9.5 Members may discuss.

10. Establishment of Goraul 220/132/33kV S/s and construction of Muzaffarpur (POWERGRID) – Goraul 220kV D/c by BSPTCL as intra state scheme – (Agenda by BSPTCL)

10.1 BSPTCL has informed that 220/132/33kV GSS of capacity 2x160+3x50 MVA has been decided to be constructed near Goraul block in Vaishali district. At present, load of Vaishali district is about 300 MW and many more PSSs under different schemes of Central government and under state plan are proposed/under construction. Due to new PSSs, load of Vaishali district is going to increase very rapidly. The upcoming/under construction PSSs are very far away from the existing GSS. In some cases existing PSSs are also far away from existing GSS. Moreover, existing GSS is already saturated and further there is no scope of augmentation due to space constraint. Under 13th plan, load flow study was done considering the load at higher side. The above-

proposed GSS is required, to distribute the load uniformly in the existing-GSS also. In the present scenario, the connectivity of PSS with existing GSS are as follows:

Existing Scenario					
Sl. No.	**Name of GSS**	**Capacity of GSS**	**Name of 33/11 kV PSS**	**Capacity of PSS (MVA)**	**Distance between existing GSS to PSS**
1	Jandaha	90 MVA	Goraul	15	45 Kms.
			Jandaha	15	05 Kms.
			Mahua	20	32 Kms.
			Patepur	15	30 Kms.
			Chehrakalan	15	45 Kms.
			Mahnar	20	15 Kms.
			Patori (Samaastipur)	15	20 Kms.
			Total	**115**	
2	Vaishali	90 MVA	Vaishali	20	0 Kms.
			Lalganj	30	15 Kms.
			Dhanpura	20	26 Kms.
			Pateri Belsar	15	12 Kms.
			Bakhara	10	26 Kms.
			Paroo	20	19 Kms.
			Total	**115**	

Proposed Scenario					
Sl. No.	**Name of GSS**	**Capacity of GSS**	**Name of 33/11 kV PSS**	**Capacity of PSS (MVA)**	**Distance between existing GSS to PSS**
1	Goraul	150 MVA	Chehrakalan	15	10 Kms.
			Goraul	15	03 Kms.
			Ismailpur (Propsed)	10	05 Kms.
			Dabhaich (Propsed)	10	20 Kms.
			Mahudahchatur (Proposed)	10	15 Kms.
			Mahua	20	15 Kms.
			Total	**80**	

The above PSSs are distributed to existing + proposed GSSs as per their geographical position so that losses can be minimized. In addition to above, many more PSS are proposed, which will be connected with proposed / existing GSSs.

Connectivity:-

The connectivity of above Goraul, 220/132/33kV, 2x160MVA + 3x50MVA GSS at 220 kV and 132kV levels will be from:

(i) Muzaffarpur (PG) - Goraul 220 kV D/c (Zebra conductor)

(ii) Proposed GSS Tajpur to proposed GSS Goraul 220kV D/c (Zebra conductor).

(iii) LILO of D/c Vaishali - Muzaffarpur 132 kV tr. line at proposed GSS Goraul.

(iv) 132 KV D/C Mahanar GSS - Goraul proposed GSS

10.2 The proposed GSS is already approved in BSPTCL Board meeting & also in Bihar cabinet under state plan. The above would be implemented as intra-state scheme by BSPTCL

10.3 A meeting was held on 26.03.2019, wherein this proposal was discussed and agreed. With regard to availability of space at Muzaffarpur S/s, CTU informed that space is available for 2 no. 220kV GIS bays at Muzaffarpur for termination of Muzaffarpur-Goraul 220kV D/c line of BSPTCL.

10.4 Members may discuss.

11. New 220kV and 132kV infrastructure in Bihar under intra-state project. (Agenda by BSPTCL)

11.1 BSPTCL has informed that, under 13th plan, system studies were done and three nos. of 400 KV & three nos. of 220 KV sub-station were identified to cater to the enhanced load demand of BSPTCL. At present under different schemes of Central Government and State plan, near about 350 numbers of PSSs are under construction. Moreover it has also been decided to segregate the agriculture feeder. Due to that, the load demand on existing GSSs of 132/33kV level is increasing very rapidly. In this regard, BSPTCL is implementing two new 132kV GSSs as mentioned below:

Sl. no	Substation Name	Voltage levels & transformation capacity	132kV lines (S/c or D/c or S/c on D/c; conductor type; length in km)	Expected 33kV load demand (in MW)
1	**Raghopur GSS**	132/33 KV (3x50 MVA)	1. 220 kV Laukhi – Raghopur D/C, ACSR Zebra(charged on 132 kV): 48 km (tentative) 2. 220 kV Supaul – Raghopur D/C, ACSR Zebra(charged on 132 kV): 52 km (tentative)	90
2	**Kerpa GSS**	132/33 KV (3x50 MVA)	1. 132 kV Dehri – Kerpa S/C, ACSR Panther: 24 km 2. 132 kV Banjari – Kerpa S/C, ACSR Panther: 20 km	25

11.2 To cater to the increasing load demand, BSPTCL has proposed following additional new substations. The new GSSs have been developed after considering all the planned and under construction GSSs in system study.

Sl. no	Substation Name	Voltage levels & transformation capacity	220kV lines (S/c or D/c or S/c on D/c; conductor type; length in km)	132kV lines (S/c or D/c or S/c on D/c; conductor type; length in km)	Expected 33kV load demand (in MW)
1	**Digha (New) GIS**	220/132/33 KV (2x200 + 2x80 MVA)	1. 220 kV Chapra(New) -Digha D/C, ACSR Zebra:	1. 132 kV Digha (New) – Digha (Old) D/C, XLPE Cable: 1 km 2. 132 kV Digha (New) – Board	170

Sl. no	Substation Name	Voltage levels & transformation capacity	220kV lines (S/c or D/c or S/c on D/c; conductor type; length in km)	132kV lines (S/c or D/c or S/c on D/c; conductor type; length in km)	Expected 33kV load demand (in MW)
			80 km	Colony D/C, XLPE Cable: 7 km	
2	**Tajpur GSS**	220/132/33 KV (2x160 + 3x50 MVA)	1. 220 kV Tajpur – Goraul D/C, ACSR Zebra: 60 km 2. 220 kV Samastipur (New) – Tajpur D/C, ACSR Zebra: 20 km	1. 132 kV Samastipur (Old) – Tajpur S/C, ACSR Panther: 25 km 2. 132 kV Dalsingsarai – Tajpur S/C, ACSR Panther: 27 km 3. 132 kV Sahapur Patori – Tajpur D/C, ACSR Panther: 40 km	50
3	**Thakurganj GSS**	220/132/33 KV (2x160 + 3x50 MVA)	1. 220 kV Kishanganj (New) – Thakurganj D/C, ACSR Zebra: 50 km	1. 132 kV Thakurganj – Araria D/C, ACSR Panther: 80 km	40
4	**Asthawan GSS**	220/132/33 KV (2x160 + 3x50 MVA)	1. 220 kV Biharsarif-Asthawan D/C, ACSR Zebra: 20 km 2. 220 kV Sheikhpura (BGCL) – Asthawan D/C, ACSR Zebra: 15 km	1. 132 kV Asthawan – Rajgir S/C on D/C, ACSR Panther: 35 km 2. 132 kV Asthawan – Nalanda S/C on D/C, ACSR Panther: 25 km 3. 132 kV Asthawan – Barh S/C on D/C, ACSR Panther: 32 km	80
5	**Board Colony GIS**	132/33 KV (2x80 MVA)	-	1. 132 kV B Colony- Digha (New) D/C, XLPE Cable: 7 km	70
6	**Palasi**	132/33 KV (2x50 MVA)	-	1. 132 kV Forbisganj – Palasi S/C, ACSR Panther: 75 km 2. 132 kV Kishanganj – Palasi S/C, ACSR Panther: 53 km	50

11.3 A meeting was held on 26.03.2019(MoM is at **Annexure-I**) and after deliberations in the meeting, following was agreed as intra-state transmission scheme of BSPTCL.

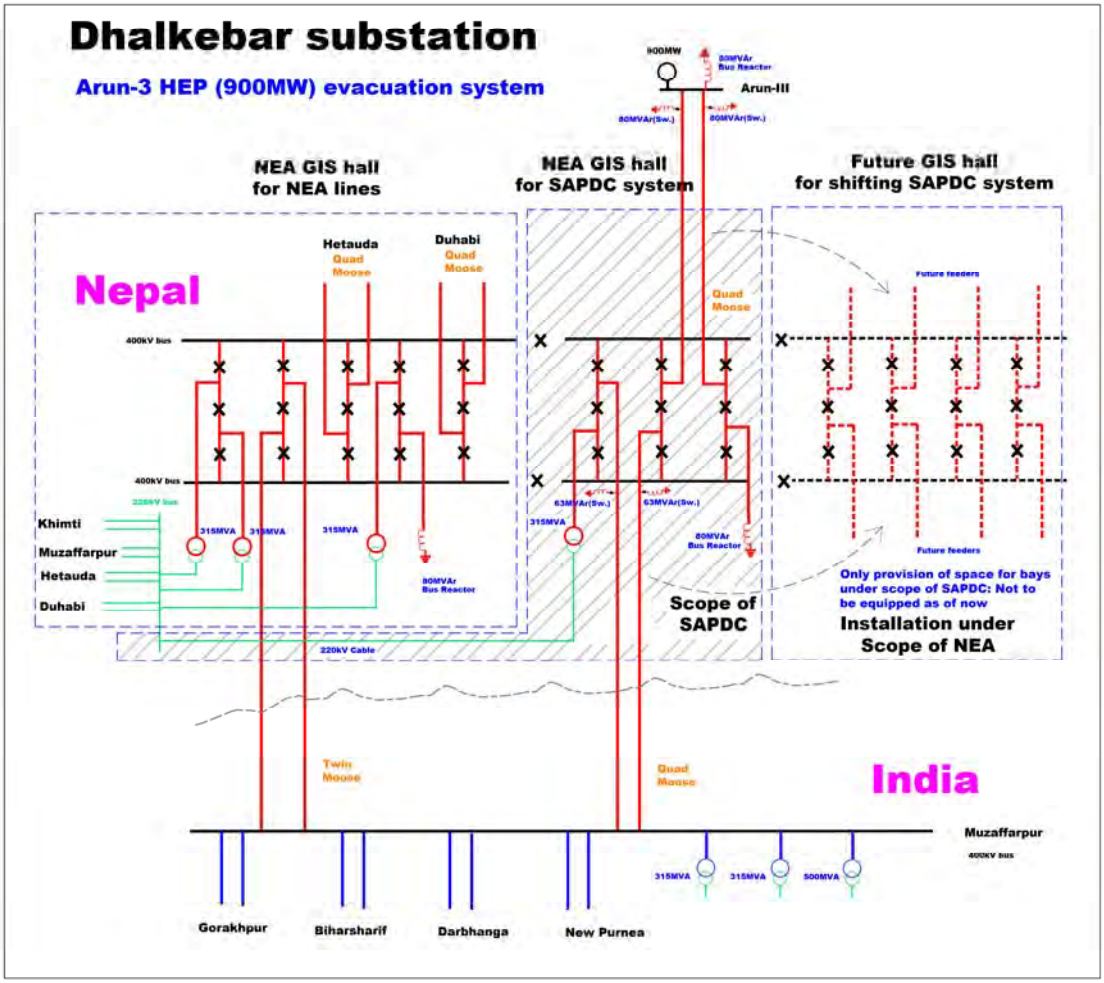
Sl. no	Substation Name	Voltage levels & transformation capacity	220kV lines (S/c or D/c or S/c on D/c; conductor type; length in km)	132kV lines (S/c or D/c or S/c on D/c; conductor type; length in km)
1	**Digha (New) GIS**	220/132/33 KV (2x200 + 2x80 MVA)	1. 220 kV Chapra(New) -Digha D/C, ACSR Zebra: 80 km ***Note:*** *BSPTCL would explore the possibility of 2nd 220kV feed to Digha for reliable power supply.*	1. 132 kV Digha (New) – Digha (Old) D/C, XLPE Cable: 1 km 2. 132 kV Digha (New) – Board Colony D/C, XLPE Cable: 7 km
2	**Tajpur GSS**	220/132/33 KV (2x160 + 3x50 MVA)	1. 220 kV Tajpur – Goraul D/C, ACSR Zebra: 60 km 2. 220 kV Samastipur (New) – Tajpur D/C, ACSR Zebra: 20 km	1. 132 kV LILO of Samastipur (Old) – Dalsingsarai S/C line at Tajpur *[Samastipur (Old) – Tajpur S/C, ACSR Panther: 25 km & Dalsingsarai – Tajpur S/C, ACSR Panther: 27 km]* 2. 132 kV Sahapur Patori – Tajpur D/C, ACSR Panther: 40 km
3	**Thakurganj**	220/132/33 KV	1. 220 kV Kishanganj (New) –	1. 132 kV Thakurganj – Araria D/C,

Sl. no	Substation Name	Voltage levels & transformation capacity	220kV lines (S/c or D/c or S/c on D/c; conductor type; length in km)	132kV lines (S/c or D/c or S/c on D/c; conductor type; length in km)
	GSS	(2x160 + 3x50 MVA)	Thakurganj D/C, ACSR Zebra: 50 km	ACSR Panther: 80 km
4	**Asthawan GSS**	220/132/33 KV (2x160 + 3x50 MVA)	1. 220 kV Biharsarif- Asthawan D/C, ACSR Zebra: 20 km 2. 220 kV Sheikhpura (BGCL) – Asthawan D/C, ACSR Zebra: 15 km	1. 132 kV Asthawan – Rajgir S/C on D/C, ACSR Panther: 35 km 2. 132 kV Asthawan – Nalanda S/C on D/C, ACSR Panther: 25 km 3. 132 kV Asthawan – Barh S/C on D/C, ACSR Panther: 32 km
5	**Board Colony GIS**	132/33 KV (2x80 MVA)	-	1. 132 kV B Colony- Digha (New) D/C, XLPE Cable: 7 km
6	**Palasi**	132/33 KV (2x50 MVA)	-	1. 132 kV LILO of Forbisganj – Kishanganj S/C line at Palasi *[Forbisganj – Palasi S/C, ACSR Panther: 75 km & Kishanganj – Palasi S/C, ACSR Panther: 53 km]* 2. 132kV LILO of Thakurganj – Araria D/C line

11.4 Members may discuss.

12. Transmission system for power evacuation from Arun-3 (900MW) HEP, Nepal of M/s SAPDC

12.1 M/s SJVN Arun-3 Power Development Company Pvt. Ltd. (SAPDC) is establishing a 900MW HEP in Nepal. The power from the hydro project is proposed to be evacuated through Arun-3 – Dhalkebar (Nepal) – Muzaffarpur (POWERGRID) 400kV D/c (Quad) line. As per Power Development Agreement (PDA) signed by M/s SAPDC with Nepal, they have to build the Nepalese portion of above mentioned transmission system. In the 4th meeting of JSC/JWG held on 13th-14th Feb 2017, it was decided that Nepalese portion of the transmission system may be implemented by M/s SAPDC as per PDA. The Indian portion of the cross-border line may be built by an Indian entity. The schematic of final system is given below:



12.2 In the meeting held at MoP on 27-03-2018 under chairpersonship of JS (Trans) it was decided that generation project developer will be bearing the wheeling charges of the Indian portion of the transmission line till any other projects seeks utilisation of the line.

12.3 In view of the above, members may approve construction of Indian portion of Dhalkebar (Nepal) – Muzaffarpur (POWERGRID) 400kV D/c (Quad) line along with 2 no. 400kV line bays at Muzaffarpur (POWERGRID). The charges for the said scope would be completely borne by M/s SAPDC. The decision regarding implementing agency for Indian portion of the cross-border line would be taken in the meeting of ECT.

13. LILO in Odisha portion of ISTS line for connecting M/s JSW Utkal Steel Ltd. – (Agenda by OPTCL)

13.1 OPTCL informed that JSW Utkal Steel Ltd. is setting up an integrated steel plant of 13.2 MTPA capacity and 30 MTPA grinding and beneficiation plant along with 300 KM slurry pipe line to transport iron ore from Joda to Jagatshingpur(at Integrated steel plant) at Odisha. To operate their grinding unit at Joda they have applied for 75 MW power at 220 KV level. Based on

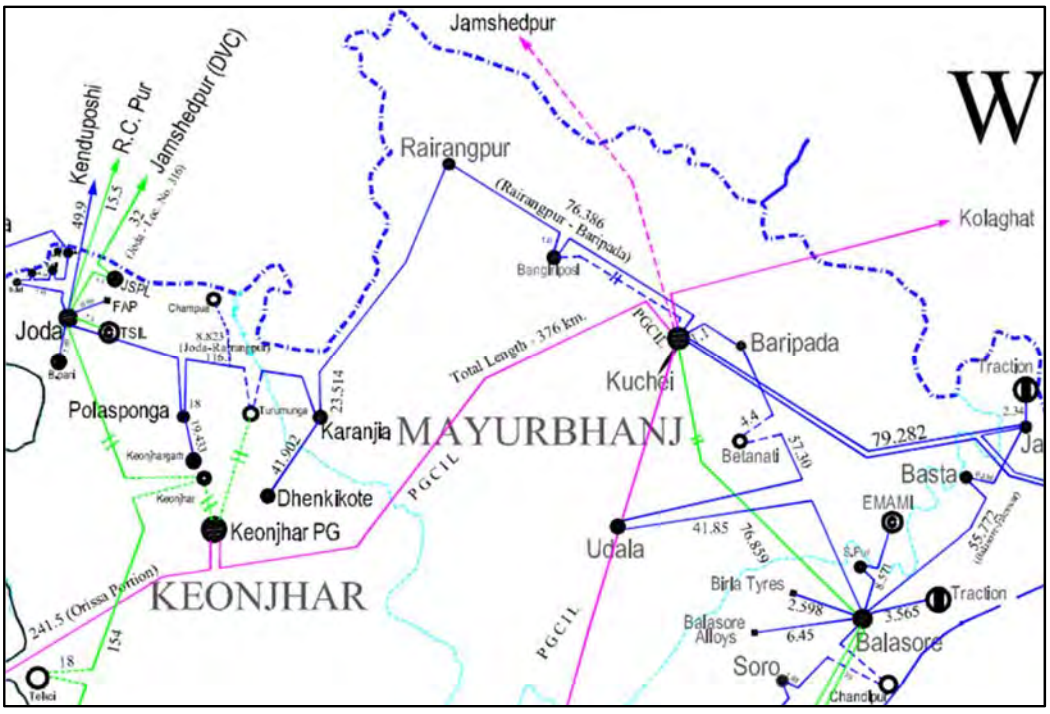
their application, OPTCL has conducted system study and proposed two(2) alternative LILO arrangements of interstate line. The LILO can be made either on Joda-JSPL-Jamsedpur line (including replacing the existing conductor with HTLS conductor from Joda Grid to JSPL) or in Joda-Ramchandrapur line. Location map is at **Annexure-II**

13.2 Members may discuss.

14. Implementation of one 132kV line bay at Baripada (POWERGRID) S/s by OPTCL – (Agenda by OPTCL)

14.1 OPTCL informed that OPTCL is having one no. of 132 kV Bay at Baripada (Kuchei). The Kuchei - Dhenkikote 132 kV S/C line is having LILO at Bangiriposi, Rairangpur and Karanjia. The loads of connected substation are Bangiriposi-8 MW, Rairangpur-28 MW, Karanjia-21 MW and Dhenkikote-10 MW. Thus the 132 kV S/C line is loaded up to 67 MW. In case of outage at Joda, the Polasponga load which is around 40 MW is catered through this line, causes breaching of thermal limit of the line. This matter was discussed during the 153rd OCC meeting held at Kolkata. In the meeting PGCIL informed that the space for the 132 Bay is available at Kuchei. Accordingly, OCC advised OPTCL to submit the proposal to CEA for discussion in the standing committee.

14.2 Hence, OPTCL has requested for allotment of a new 132 kV Bay at Kuchei to limit the line loading (Kuchei–Bangiriposi portion) as well as to meet the n-1 contingency. OPTCL plans to draw a new 132kV S/c line from Kuchei to Bangiriposi as intra-state scheme.



14.3 Nevertheless it may be noted that with commissioning of Keonjhar – Turumunga 220kV D/c line by OPTCL, the reliability of power supply scenario is the area would improve, as this will act as an alternate power source in case of outage at Joda.

14.4 Members may discuss

15. Establishment of 400/132 kV GIS with 3x200 MVA ICTs by D/c LILO of HEL – Subhasgram (PG) 400 kV D/C line of CESC by WBSETCL.- (Agenda of WBSETCL)

15.1 Representative of WBSETCL has informed the following:

(i) South 24 Parganas district is, indeed, a complex district, stretching from the Metropolitan Kolkata to the remote riverine villages up to the mouth of Bay of Bengal. Population density in the district is very high.

(ii) The Sundarbans, the largest mangrove forests on earth, are spread over thirteen of the twenty-nine development blocks in the district. Due to its peculiar geographical location and the dictates of geography, the transmission network in this region was not well developed.

(iii) Present maximum demand in the district is around 1010 MVA which is met from Subhasgram 400 kV sub-station of POWERGRID through Kasba 220 kV, Subhasgram 220 kV & Laxmikantapur 220 kV sub-stations. Installed capacity of Subhasgram 400 kV sub-station is 2x315+1x500 i.e. 1115 MVA (additional 2x315MVA i.e. 630MVA belongs to CESC). Again, Laxmikantapur 220 kV sub-station (maximum demand already recorded as 407 MVA) has only one 220 kV D/C incoming line from Subhasgram.

(iv) WBSETCL is constructing one 220 kV GIS at Baruipur and it will be connected with Subhasgram 400 kV sub-station by a 220 kV D/C line. The sub-station is expected to be commissioned by March 2020.

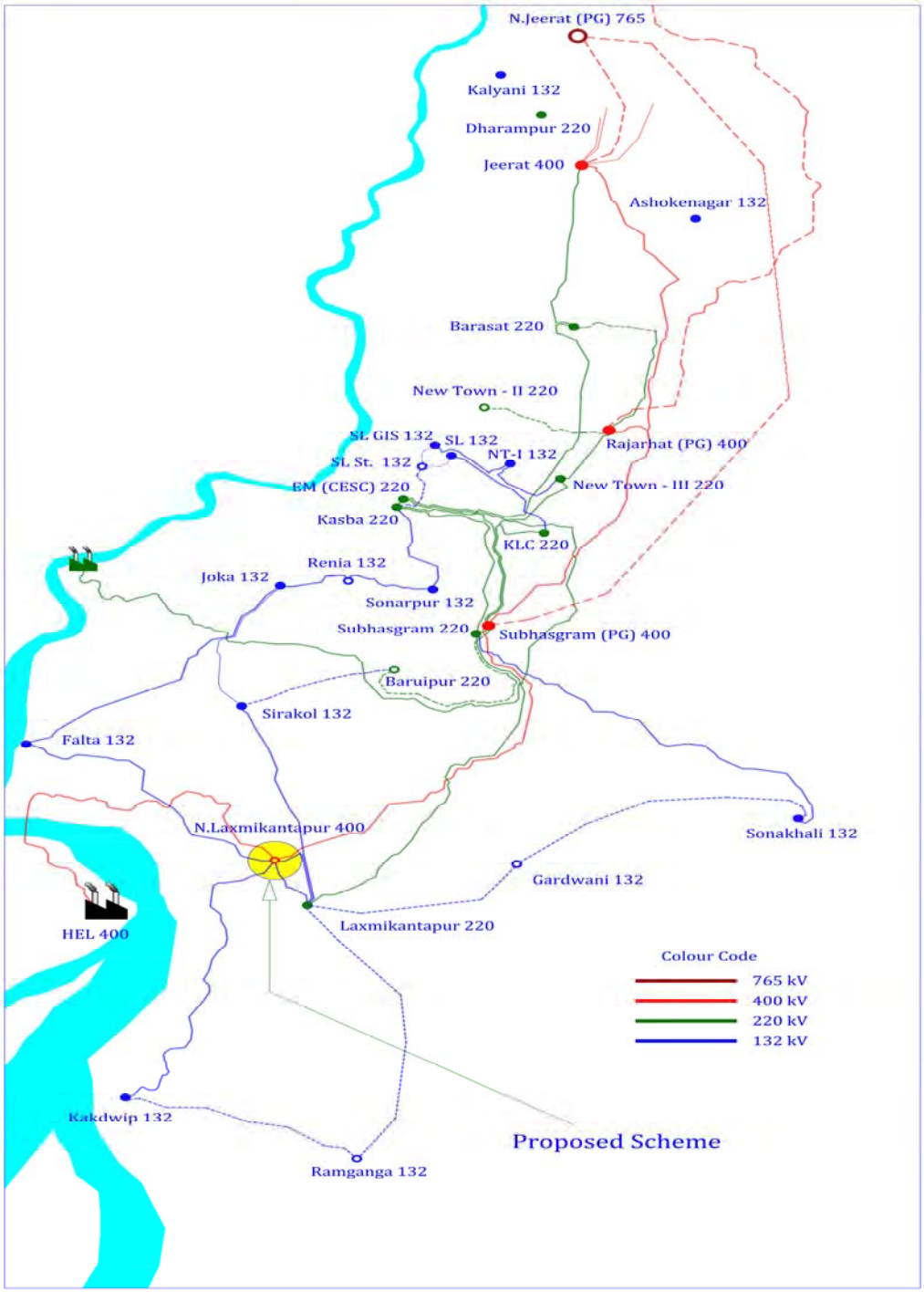
(v) Considering future load growth, another 400 kV sub-station in the district is urgently required for reliable power supply. In view of load demand of Laxmikantapur 220/132 kV ICTs, up-gradation of existing Laxmikantapur 220 kV sub-station to 400 kV GSS is ideal solution. But there is no available space for the up-gradation. WBSETCL is searching suitable land at nearby locations.

(vi) In this backdrop, it may be noted that CESC was allowed to construct 400 kV D/C line from HEL to Subhasgram (PG) 400 kV sub-station with installation of 2x315 MVA ICTs at Subhasgram and 220 kV D/C line from Subhasgram to EM 220 kV sub-station of CESC for evacuation of power from HEL. It was decided in the Standing Committee Meeting on Power System Planning in Eastern Region held on 14/09/2009 at Bhubaneswar.

(vii) The 400 kV D/C line passes through Laxmikantapur area in the southern part of 24 Paraganas (S) District. For development of transmission network in the southern part of the district, WBSETCL contemplated establishment of one 400/132 kV GIS near Laxmikantapur by D/C LILO of HEL – Subhasgram (PG) 400 kV D/C line.

(viii) With the existing network, power is flowing through 400 kV line over Laxmikantapur to Subhasgram and again it is returned back at Laxmikantapur through 220 kV D/C line from Subhasgram to meet the demand. The 400 kV D/C line of CESC passes over the proposed location of new 400 kV GIS. Existing Laxmikantapur – Kakdwip 132 kV D/C and Laxmikantapur – Falta 132 kV D/C lines would be LILOed at the proposed 400/132 kV GIS.

(ix) After development of the proposed network, existing transmission network would be utilised effectively. After meeting the demand of Laxmikantapur 220 kV sub-station, balance power will flow towards Subhasgram. Hence, transmission loss of the system will also be reduced and reliability of power supply will be improved.



(x) The project will be executed by WBSETCL at its own cost. Commercial issues, if any may be settled at appropriate forum. Geographical transmission network map in and around Laxmikantapur and single line diagram of the existing network & proposed scheme is at **Annexure-III**.

15.2 Members may discuss.

16. Modification of construction of 220 kV D/C Barjora-Burdwan line of DVC – Agenda by DVC

16.1 DVC has informed that as per approved 12th plan, the 220 kV GIS infrastructure at Burdwan substation was proposed to be fed from 220 kV Barjora substation (via Panagarh) and 220 kV Kharagpur substation. The proposal was to make a 220 kV D/C ring at lower valley viz. Jamshedpur-Gola-Mejia TPS- Barjora- Panagarh- Burdwan- Kharagpur-Mosabani with a view to provide reliable power supply (Mosabani & Jamshedpur to be connected through 400 kV D/C line).

16.2 As the 220 KV Barjora substation is radially connected from Mejia TPS by a 220 kV D/C line, the above proposal is less reliable. Further, on implementation of original proposal, power towards 132 kV lower valley link i.e., Burdwan- Belmuri- Howrah- Kolaghat- KGP- Mosabani- Jamshedpur will mostly be fed through 220 kV Mejia TPS- Barjora- Panagarh- Burdwan link causing over-loading of MTPS- Barjora line. Situation aggravated after unit after unit retirement of DTPS Unit-3 supplying power towards Burdwan through 132 kV D/C DTPS- Burdwan line. It is also mentioned that the original proposal could not be taken up due to postponement of other associated projects.

16.3 Considering the above & for more reliability and stability of grid as well as to feed 220 kV GIS at Burdwan substation, some minor modification evolved after lot of deliberations i.e., instead of connecting 220 kV Burdwan substation with 220 kV Barjora substation, it was proposed that 220 kV Burdwan substation would be connected to 220 kV Parulia substation of DVC with a future provision of D/C LILO at Panagarh. The DVC Grid map & above load flow study result is at **Annexure-IV.**

16.4 Members may discuss.

17. Connectivity/LTA/Evacuation System for OPGC Ib TPS(2x660MW) in Odisha – Agenda by OPGC

17.1 Odisha Power Generation Corporation (OPGC) is constructing power project of 2x660MW (Ib Valley U-3 & 4), out of which Unit-3 would be connected to STU system through OPGC-Lapanga 400kV D/c line (with twin moose conductor of 85 deg. C rating) and Unit-4 would be connected to ISTS through OPGC-Sundargarh 400kV D/c ISTS line (with triple snowbird conductor, under TBCB route). As the connectivities are separate for the two units, i.e. U-3 with STU and U-4 with ISTS, the system has been planned with a bus sectionaliser in generation switchyard, which would be normally kept open.

17.2 OPGC had taken connectivity and LTA for 660 MW (Unit-4) based on target region (200 MW for Northern Region, 200 MW for Western Region and 200 MW for Southern region).

17.3 Subsequently, OPGC has voluntarily relinquished the LTA granted to them but connectivity agreement with CTU still exists.

17.4 OPGC has explained the following consequences, which are lead to the relinquishment. The coal linkage for the project was cancelled due to coal blocks deallocation. Therefore, OPGC was compelled to purchase the coal from the state owned mining company (OCPL- Odisha Coal Private Limited). Odisha government while providing coal linkage from OCPL, allocated total power of Unit 3 & 4 (1320MW) to GRIDCO, Odisha for a period of 25 years. As per PPA, OPGC has to deliver this power to GRIDCO at their switchyard.

17.5 OPGC requested CEA to approve the proposal of operating the system under common bus mode i.e. by closing the bus sectionaliser between Unit-3 (connected to STU) and Unit-4 (connected to ISTS) for reliable, efficient, secure & stable grid.

17.6 In this connection, a meeting was held in CEA on 26.03.2019 (MoM is at **Annexure-V**), wherein following were concluded:

(a) The proposal of OPGC/GRIDCO regarding closing of bus sectionaliser between U-3 (connected to STU) and U-4 (connected to ISTS) is feasible, but with compromise in N-1 reliability.

(b) There is no constraint in evacuation of power from U-4 in the planned arrangement i.e. with sectionaliser kept as open.

(c) OPGC U-4 is connected with ISTS and they may seek Long term/Short term open access in the ISTS for scheduling their power to Odisha, as per their PPA.

(d) OPGC may approach CERC, if desired, for resolution of above technical/ commercial matters.

17.7 In response to the Minutes of meeting, BSPTCL vide their letter dated 21.05.2019 requested CEA that CEA should ensure that any change in the existing OPGC evacuation system arrangement should not financial burden BSPTCL.

17.8 Members may discuss.

18. Connectivity of newly constructed 220/132/33 kV (2x150+2x50) MVA Grid Substation Giridih of JUSNL through LILO of 220 kV Giridih (DVC)-Koderma (DVC) Transmission Line - Agenda by JUSNL

18.1 Presently Power to Giridih District of Jharkhand is fed through DVC network and is not sufficient to meet demand of Giridih and nearby area. In order to meet the power requirement of Giridih, Jamua and Sariya, JUSNL has completed the construction work of 220/132/33 kV (2x150+2x50) MVA Grid Substation Giridih (JUSNL), 132/33 kV GSS at Jamua and 132/33 kV GSS at Saria.

18.2 On the upstream, 220/132/33 kV Grid Substation Giridih(JUSNL) is to be connected to under-construction 220/132/33 kV GSS Jasidih through 220 KV

D/C Giridih-Jasidih transmission line and 220/132/33 kV GSS Jasidih will be connected to existing 220/132 kV GSS at Dumka(Madanpur) through under construction 220 kV D/C Dumka-Jasidih Transmission line. As an alternate source to 220/132/33 kV GSS Jasidih, Jasidih will be connected to proposed 400/220 kV GSS (TBCB mode) at Jasidih through 220 kV D/C transmission line.

18.3 The details of the present status of the above plan are as follows:

Sr. No.	Transmission Element	Present Status
1	220/132/33 kV Giridih GSS	Ready for commissioning.
2	220/132/33 kV Jasidih GSS	Work is in progress and expected to be completed by May 2019.
3	220 kV D/C Giridih- Jasidih Transmission line	Work awarded but progress is slow and delayed due to delay in forest clearance.
4	220 kV D/C Dumka (Madanpur)-Jasidih Transmission line	Work awarded but progress is slow and delayed due to delay in forest clearance.
5	400/220 kV GSS Jasidih along with associated transmission line.	Under TBCB. Bidding process is going on. It will take approx. 3 years for completion.

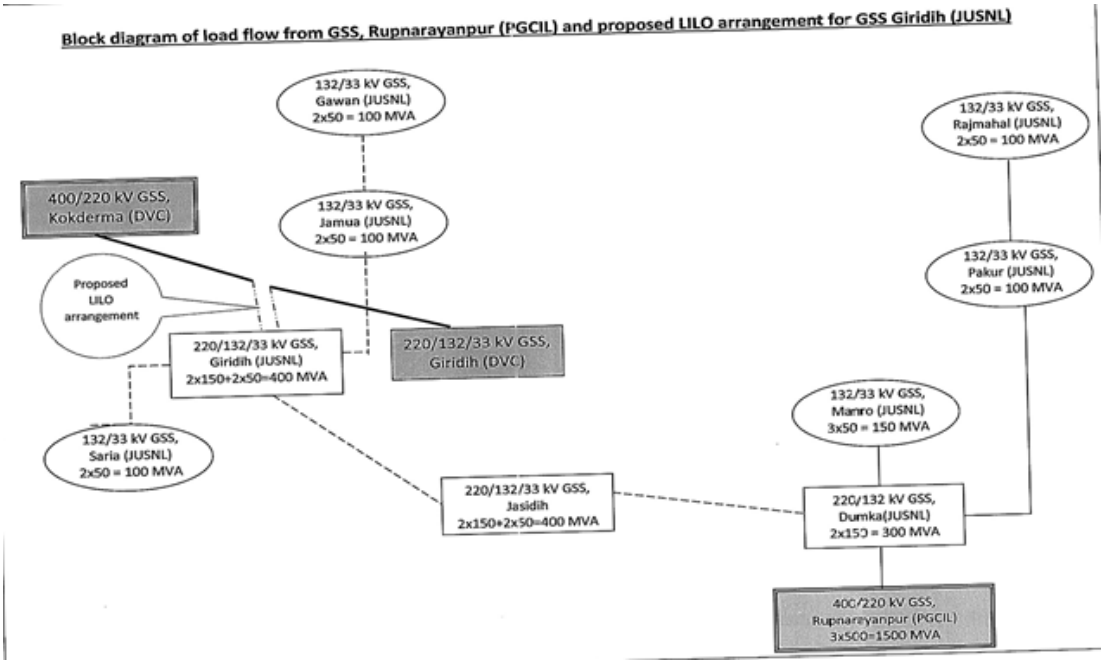
18.4 Till completion of 400/220 kV GSS Jasidih along with associated line upto 220/132 kV GSS Jasidih (which are under TBCB Scheme), the 220/132/33 kV GSS Giridih will remain on only one source i.e. 220/132 kV GSS Dumka, which receives power though 220 kV D/C Dumka — Maithon(PG) transmission line. The availability of power at Dumka will not be sufficient to meet the demand of Giridih, Jamua and Saria GSS in addition to Dumka region.

18.5 For early commissioning of 220/132/33 kV Grid Substation Giridih, JUSNL has explored one possibility and considered the same as the most suitable option of connectivity of Giridih GSS through LILO of 220 kV Giridih (DVC) — Koderma (DVC) Transmission Line at present (line diagram enclosed).

18.6 After completion of 220 kV D/C Giridih- Jasidih Transmission line and 220 kV D/C Dumka(Madanpur)- Jasidih Transmission line, this LILO will also act as an alternate source to 220/132/33 kV GSS Giridih.

18.7 Preliminary survey work for the above proposal has been carried out and the route length from existing tower No. KG-317 has been identified having length 19.30 Km with no involvement of forest and railway crossing.

18.8 After completion of this proposed LILO, commissioning of newly constructed 220/132/33 kV (2x150+2x50) MVA Grid Substation Glridlh (JUSNL) can be done. Further after completion of downstream network of Giridih GSS, power may be extended to 132/33 kV GSS at Jamua and Saria of JUSNL and power crisis to Jamua, Tisri, Gawan, Deori, Rajdhanwar, Birni, Sariya, Bagodar, Pirtand, Dumri and nearby villages will be resolved.



18.9 Members may discuss.

19. Operational feedback report of POSOCO

19.1 The latest operational feedback of Q4-FY 2018-19 of POSOCO has been reviewed wherein various operational constraints have been observed which need action by states. Only the issues which were still found to be persistent in future planning cases have been detailed below:

19.1.1 Durgapur (POWERGRID) – Parulia (DVC) 220kV D/c line

"Parulia (Durgapur) is a major load centre in DVC control area. Since inception it is planned to be fed from internal generation of DVC embedded at 220kV and 132 kV level. However, with decommissioning of DVC units (at Bokaro and CTPS) and low generation from internal plants particularly at Mejia and Waria, the load of Parulia and nearby area is practically met through importing large quantum of power from Durgapur substation of PG

through 220kV Durgapur(PG)-Parulia(DVC) D/C. This resulted in very high loading of above line and even crossed the N-1 security limit."

It has been observed that the line said line is critically loaded in future time-frame also. Accordingly, the subject line may be reconductored by DVC. Even POSOCO has suggested this as one of the corrective measure.

Members may discuss.

19.1.2 High voltage at Angul and Sundargarh (Jharsuguda) substations at 765kV level

In the operational feedback report it has been observed that cumulatively the Angul – Sundargarh (Jharsuguda) ckt-1, 3, and 4 were kept out of service for about 1380 hrs. (ckt-4: 751hrs. 38min.; ckt-3: 521hrs. 28min.; ckt-1: 104hrs. 45min.). Further, POWERGRID site officials have informed that due to persistent overvoltage of the order of 780kV and above (maximum being upto 795kV) at Angul S/s, two CTs, one Circuit Breaker, and isolator have been damaged.

The main Bay B-Phase CT of 765kV Angul-Sundergarh Ckt-4 blasted at 14:28hrs on 24/04/2019 at Angul substation. This blasting of the CT further damaged the main Circuit breaker and isolators. Earlier also the tie CB of the same line was blasted on 03/04/2019 at Angul substation. After commissioning of 765kV Angul-Sundergarh ckt-3 and ckt-4 the bus voltages at Angul and Sundargarh substations is quite high even after keeping all the line and bus reactors in service.

Accordingly, it is proposed to install 765kV, 1x330MVAr bus reactor at Angul (POWERGRID) S/s.

Members may discuss.

20. Scheme for limiting of fault current level at 400kV level at Farakka generation switchyard

20.1 The three phase fault level at Farakka TPS (NTPC) at 400kV bus is found to be exceeding the designed short time current rating of equipment (i.e. 40kA). In the present time-frame, the fault level is observed to be about 53kA (assuming split is operational at Maithon, Biharsharif, Durgapur, and Kahalgaon). Moreover, the fault level of Farakka generation switchyard in 2022-23 time-frame is expected to be about 54.5kA.

20.2 The matter was discussed in a meeting held at CEA on 26-03-2019 (Minutes of meeting is at **Annexure-I**). In the meeting, CTU had proposed for splitting the 400kV Farakka bus using series reactor. With the proposed bus splitting arrangement and a series reactor of 12ohm between the bus sections, it was observed that maximum angular difference between the two sections is

about 4-5 degrees. Representative of NTPC informed that auxiliary power supply for Farakka STPP is designed to derive station and backup power supply for plant auxiliaries from 400kV switchyard through 3 nos. Tie transformers (125MVA, 125MVA and 100MVA). Tie transformer#1 and 2 are fed from 400kV Bus#1 and Tie Transformer#3 is fed from 400kV bus#2. For Farakka STPP stage-1, 2 and 3, there is interconnection between the respective Tie transformers at 33kV, 11/6.6kV and 0.415kV levels. 2x100% / 3x50% redundant feeding configuration is provided at each load centre with two sources fed from different Tie transformers such that there is no loss of plant auxiliaries in case of outage of any one tie transformer. This provision has been kept by design in order to ensure reliability of supply to auxiliaries and avoid loss of generation on outage of Tie Transformer. In case of splitting the 400kV Farakka bus using series reactor arrangement, the phase angle difference between same voltage level buses would be more than 5 degree. Due to this, auxiliary power supply changeover may not take place or heavy circulating currents would flow, which may further trip some of the circuit breakers.

20.3 After system study, NTPC informed that even with 2.5 deg. angle between FSTPP split buses and around 50% loadings of the tie transformer, angular difference at 33kV level is more than 6 deg. which may result in blocking of changeover considering equipment safety. It is also pertinent to highlight here that as per load flow studies with paralleling at 415Volts level, high recirculating currents are observed in the LT system during paralleling which lead to overloading of the transformer and subsequent tripping of the incoming LT transformer. Changeover from one source to second source is not possible under this condition.

20.4 In view of the above, it was decided that alternate solutions to limit fault current at Farakka would be studied.

20.5 Accordingly, in view non feasibility of either bus splitting of installation of series reactor at Farakka generation switchyard, following alternatives involving physically bypassing of 400kV D/c lines outside the generation switchyard have been studied:

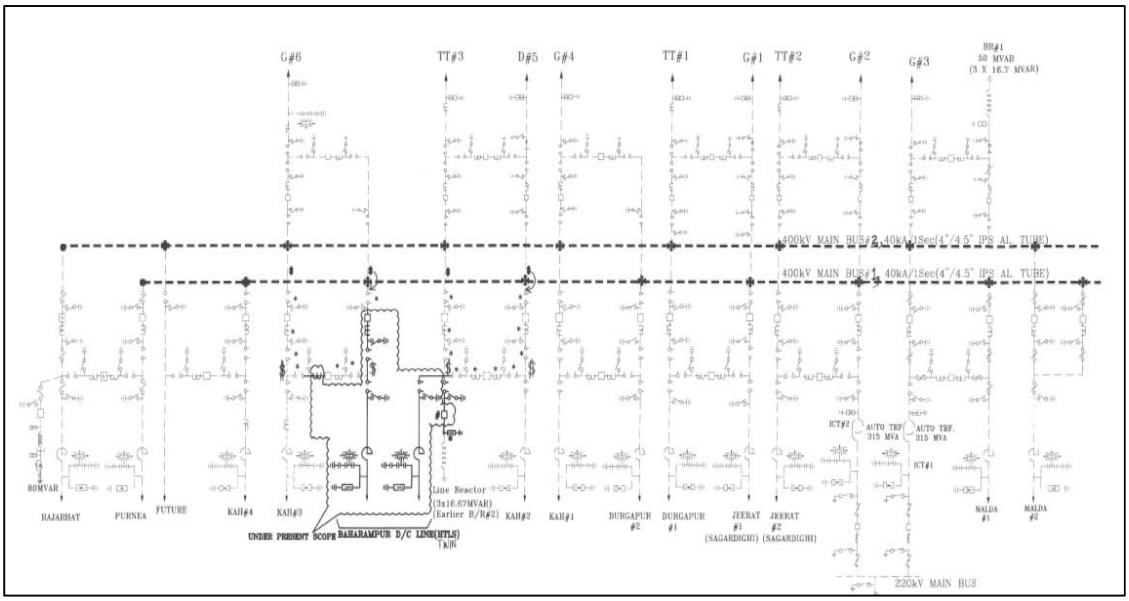
(a) Bypassing Kahalgaon ckt-1 & ckt-2 and Durgapur D/c (about 250km)

(b) Bypassing Kahalgaon ckt-3 & ckt-4 and Durgapur D/c (about 250km)

(c) Bypassing Kahalgaon ckt-3 & ckt-4 and Sagardighi D/c (about 160km)

Case	Fault current at Farakka	Fault current at Sagardighi
(a)	44.16kA	41.85kA
(b)	41.76kA	41.13kA
(c)	43.16kA	41.64kA

20.6 SLD of Farakka generation switchyard is given below:



20.7 From the above, it may be observed that alternative-(b) is the most suitable alternative as the 3-phase short circuit current reaches the lowest value. Only shortcoming of this alternative is Kahalgaon ckt-3 & ckt-4 lines (95km) are designed to operate till 85°C, whereas Durgapur lines (150km) are designed to operate till 75°C, which would result in underutilisation of Kahalgaon-Farakka section of resultant Kahalgaon-Durgapur line. Fault current contribution by elements connected at Farakka after line bypassing is given below:

```
     OPTIONS USED:
          - SET PRE-FAULT VOLTAGE ON ALL BUSES TO  1.00 PU AT 0 PHASE SHIFT ANGLE
          - SET SYNCHRONOUS/ASYNCHRONOUS MACHINE POWER OUTPUTS TO P=0.0, Q=0.0
          - SET GENERATOR POSITIVE SEQUENCE REACTANCES TO SUBTRANSIENT
          - SET TRANSFORMER TAP RATIOS=1.0 PU AND PHASE SHIFT ANGLES=0.0
          - SET LINE CHARGING=0.0 IN +/-/0 SEQUENCES
          - SET LINE/FIXED/SWITCHED SHUNTS=0.0 AND TRANSFORMER MAGNETIZING ADMITTANCE=0.0 IN +/-/0 SEQUENCES
          - SET LOAD=0.0 IN +/- SEQUENCES
          - DC LINES AND FACTS DEVICES BLOCKED
          - IMPEDANCE CORRECTIONS NOT APPLIED TO TRANSFORMER ZERO SEQUENCE IMPEDANCES

AT BUS 444019 [FARAKKA     400.00] AREA    4  *** FAULTED BUS IS: 444019 [FARAKKA     400.00] ***   0 LEVELS AWAY ***
 PRE  FAULT (kV L-G)  VA:/230.94/-0.00
 POST FAULT (kV L-G)  V+:/0.00/0.00  VA:/0.00/0.00  VB:/0.00/0.00  VC:/0.00/0.00
 THEVENIN IMPEDANCE, X/R  (PU)   Z+:/0.003457/86.685, 17.26679
 THEVENIN IMPEDANCE, X/R  (OHM)  Z+:/5.531/86.685, 17.26679
                                 X-----------------------------------------THREE PHASE FAULT-----------------------------------------X
 X--------- FROM ----------X AREA CKT I/Z      /I+/    AN(I+)     /IA/   AN(IA)     /IB/   AN(IB)     /IC/   AN(IC)     /Z+/   AN(Z+)  APP X/R
 SYNCHRONOUS MACHINE              1   AMP/OHM    906.4   -90.00    906.4   -90.00    906.4   150.00    906.4    30.00
 SYNCHRONOUS MACHINE              2   AMP/OHM    906.4   -90.00    906.4   -90.00    906.4   150.00    906.4    30.00
 SYNCHRONOUS MACHINE              3   AMP/OHM    906.4   -90.00    906.4   -90.00    906.4   150.00    906.4    30.00
 SYNCHRONOUS MACHINE              4   AMP/OHM   2307.0   -90.00   2307.0   -90.00   2307.0   150.00   2307.0    30.00
 SYNCHRONOUS MACHINE              5   AMP/OHM   2307.0   -90.00   2307.0   -90.00   2307.0   150.00   2307.0    30.00
 SYNCHRONOUS MACHINE              6   AMP/OHM   2307.0   -90.00   2307.0   -90.00   2307.0   150.00   2307.0    30.00
 414410 [KAHALGAON-A 400.00]    4 1   AMP/OHM   3232.4   -85.81   3232.4   -85.81   3232.4   154.19   3232.4    34.19   29.357   84.653 10.68333
 414410 [KAHALGAON-A 400.00]    4 2   AMP/OHM   3232.4   -85.81   3232.4   -85.81   3232.4   154.19   3232.4    34.19   29.357   84.653 10.68333
 414471 [PURNEA-NW-PG400.00]    4 1   AMP/OHM   3733.1   -86.45   3733.1   -86.45   3733.1   153.55   3733.1    33.55   38.251   86.042 14.45455
 432019 [FARAKKA      220.00]   4 1   AMP/OHM    483.1   -82.43    483.1   -82.43    483.1   157.57    483.1    37.57   19.206   89.9541250.0001
 432019 [FARAKKA      220.00]   4 2   AMP/OHM    483.1   -82.43    483.1   -82.43    483.1   157.57    483.1    37.57   19.206   89.9541250.0001
 444007 [RAJARHAT     400.00]   4 1   AMP/OHM   1744.6   -85.81   1744.6   -85.81   1744.6   154.19   1744.6    34.19   83.334   84.872 11.14393
 444010 [SAGARDIGHI_4400.00]    4 1   AMP/OHM   4175.3   -86.12   4175.3   -86.12   4175.3   153.88   4175.3    33.88   22.334   84.871 11.14023
 444010 [SAGARDIGHI_4400.00]    4 2   AMP/OHM   4175.3   -86.12   4175.3   -86.12   4175.3   153.88   4175.3    33.88   22.334   84.871 11.14023
 444021 [MALDA        400.00]   4 1   AMP/OHM   2556.0   -84.10   2556.0   -84.10   2556.0   155.90   2556.0    35.90   13.288   84.653 10.68346
 444021 [MALDA        400.00]   4 2   AMP/OHM   2556.0   -84.10   2556.0   -84.10   2556.0   155.90   2556.0    35.90   13.288   84.653 10.68346
 444101 [BEHRAMPUR    400.00]   4 1   AMP/OHM   2885.4   -86.37   2885.4   -86.37   2885.4   153.63   2885.4    33.63   24.716   84.651 10.68055
 444101 [BEHRAMPUR    400.00]   4 2   AMP/OHM   2885.4   -86.37   2885.4   -86.37   2885.4   153.63   2885.4    33.63   24.716   84.651 10.68055
 INITIAL SYM. S.C. CURRENT(I''k)(RMS) AMP      41757.2   -86.69  41757.2   -86.69  41757.2   153.31  41757.2    33.31
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20.8 Nevertheless, it may be noted from above that with 41.76kA fault level, most of the Circuit Breakers (CB) at Farakka switchyard are expected to experience fault current less than 40kA as the contribution from each of

elements is mostly greater than 1.76kA, except contribution from 3x200MW generators, 2x315MVA ICTs and a few transmission line.

20.9 Members may discuss.

21. Modification in transmission system required for LTA from Darlipalli (2x800MW), NTPC

21.1 Following LTAs have been granted from Darlipalli (2x800MW) generation project of NTPC Ltd.:

(a) Applicant: NTPC Ltd.

LTA quantum: 793.25MW (Bihar-154.13MW; West Bengal-283.75MW; Jharkhand-102.11MW; Sikkim-15.29MW; Unallocated-237.98MW)

(b) Applicant: GRIDCO Ltd.

LTA quantum: 748MW (Odisha)

21.2 Following transmission system has been indicated as LTA system for above mentioned applicants:

(a) Darlipalli – Jharsuguda (Sundargarh) 765kV D/c line.

(b) Angul – Jharsuguda (Sundargarh) – Dharamjaygarh 765kV D/c (2^{nd}) line.

(c) Jharsuguda (Sundargarh) – Raipur Pool 765kV D/c line.

(d) LILO of both circuits of Rourkela – Raigarh 400kV D/c (2^{nd} line) at Jharsuguda (Sundargarh).

(e) Addition of 2x1500MVA, 765/400kV ICT at Jharsuguda (Sundargarh).

(f) Addition of 2x1500MVA, 765/400kV ICT at Angul.

(g) Split bus arrangement at 400kV and 765kV buses in Angul substation.

(h) Split bus arrangement at 400kV and 765kV buses in Jharsuguda (Sundargarh) substation.

21.3 The "Common Transmission System for Phase-2 generation projects in Odisha" was reviewed in the 19^{th} meeting of Standing Committee on Power System Planning for ER held on 01-09-2017, wherein the elements mentioned at (f) and (g) above were deleted from scope of works. Accordingly, it is proposed to revise the transmission system for LTA from Darlipalli (2x800MW) generation project granted to above mentioned two no. of applicants. The revised transmission system for LTA would be:

(a) Darlipalli – Jharsuguda (Sundargarh) 765kV D/c line.

(b) Angul – Jharsuguda (Sundargarh) – Dharamjaygarh 765kV D/c (2^{nd}) line.

(c) Jharsuguda (Sundargarh) – Raipur Pool 765kV D/c line.

(d) LILO of both circuits of Rourkela – Raigarh 400kV D/c (2nd line) at Jharsuguda (Sundargarh).

(e) Addition of 2x1500MVA, 765/400kV ICT at Jharsuguda (Sundargarh).

(f) Split bus arrangement at 400kV and 765kV buses in Jharsuguda (Sundargarh) substation.

21.4 Members may approve.

22. Modification in transmission system associated with North Karanpura (3x660MW) generation project of NTPC

22.1 The evacuation system for North Karanpura (3x660MW) generation project of NTPC is under implementation through TBCB route by M/s NKTL (subsidiary of Adani). The scope of works inter alia includes construction of following two transmission lines:

(a) North Karanpura – Gaya 400kV D/c (Quad) line

(b) North Karanpura – Chandwa 400kV D/c (Quad) line

22.2 In a meeting held at CEA on 23-04-2019(MoM is at **Annexure-VI**), wherein the status of above mentioned transmission system was reviewed and following was agreed.

i. Revised scope of the project:

a. NKSTPP- Common point would be 13 km multi circuit 400kV line (quad moose conductor).

b. Common point – Chandwa would be 25 km 400kV D/c line(quad moose conductor)..

c. Common point – Gaya would be 98 km 400kV D/c line(quad moose conductor).

d. New 400kV Dhanbad Substation.

e. 1.2 km D/c LILO of Ranchi-Maithon 400kV D/c line.

ii. NKSTPP-Chandwa 400kV D/c line would be completed in 14 months, i.e. by June 2020 and NKSTPP-Gaya 400kV D/c line would be completed in 23 months, i.e. by March 2021. New 400kV Dhanbad S/s with 1.2 km D/c LILO of Ranchi-Maithon 400kV D/c line would be completed in about 18 months, i.e. by October 2020.

iii. Representative of NKTL agreed for the above time lines subject to getting forest clearance for NKSTPP-Chandwa 400kV D/c line within 200 days and for NKSTPP-Gaya 400kV D/c line within 300 days.

22.3 Members may discuss & agree the revised scope of NKTL.

23. Advance intimation for alternate transmission system for Rammam-III (3X40MW) project – (Agenda by NTPC)

23.1 NTPC has informed that Rammam-III (3X40 MW) hydro project is being constructed on river Rammam in Darjeeling district of West Bengal. MOU in this regard was signed between NTPC and WBSEB. TEC for the project was granted by CEA on 12th Sep 2006 and revalidated on 1st Aug 2013. 73% of Power generated from the project has been allocated to WB and 12% to Sikkim by MOP on 31st Jan 2011, 15% of power is yet to be allocated.

23.2 As per terms and conditions of MOU, following transmission system was to be developed by WBSEB/WBSETCL.

(a) 132kV D/c Rammam III-New Jalpaiguri

(b) LILO of 132kV Rammam-II HEP- North Bengal University line at Rammam III.

23.3 Construction work for project has already started and first unit of project is scheduled to be synchronized by Dec 2021 and subsequent units by Jan and Feb 2022. In spite of regular follow up with WBSEB/ WBSETCL, construction work on associated transmission is yet to start.

23.4 In view of above, NTPC has requested for exploring alternate evacuation scheme for the project.

23.5 Members may discuss.

24. Proposal for 132/33 kV sub-station at Nabinagar

24.1 BSPTCL has informed that, one 132/33 kV GSS of capacity 3x50 MVA has been decided to be constructed at Nabinagar, Dist. Aurangabad whose connectivity at 132 kV level has been proposed as LILO of 132kV Sonenagar - Rihanad ckt 1.

24.2 A meeting was held on 26.03.2019 at CEA, wherein it was decided that instead of said LILO, new 132/33kV S/s at Nabinagar may be feed radially from Nabinagar-II generation project (line length: about 15km) as requisite transformation capacity is available in the 400/132kV, 2x200MVA ICTs at the generation switchyard.

24.3 BSPTCL stated that the above would be implemented by BSPTCL as intra-state scheme.

24.4 Members may discuss.

25. Transmission system for power evacuation of Odisha Integrated Power Ltd. (Odisha UMPP-4000MW) for Connectivity and LTA applications – Agenda by POWERGRID

25.1 The 4000MW Connectivity and LTA applications for Odisha UMPP submitted by Odisha Integrated Power Ltd. (OIPL), wholly owned subsidiary of PFCCL, are pending since long (June'14) on account of non-firming of generation project implementation. In this regard, it is to mention that CERC vide

Amendment dated 17-02-2016 has directed CTU not to hold any application in abeyance and process them within the timeline prescribed in Regulation 7 of the Connectivity Regulations.

25.2 In the 19th SCM of ER held on 01-09-2017, the following transmission system was finalized for Odisha-UMPP:

a) Split bus arrangement at Odisha UMPP (3x660MW in Section-A and 3x660MW in Section-B)

b) LILO of Sundargarh-A – Dharamjaygarh 765kV D/c line at Odisha UMPP-A

c) Odisha UMPP-B – Sundargarh-B 765kV D/c line

d) Ranchi (New) – Gaya 765kV D/c line

Note: It was also decided to provide OPGW connectivity to Odisha UMPP-A, 150km of OPGW (24 fibre) and associated communication equipment is to be installed on 765kV D/C Sundergarh-A – Dharamjaygarh line and respective terminal substations respectively by POWERGRID.

25.3 M/s OIPL in their Connectivity and LTA applications, had not clarified the unit size of the generation project and has left the decision of choosing unit size to the successful bidder. Subsequently, M/s OIPL vide email dated 13-03-2018 informed the unit size as 5x800MW.

25.4 Further, M/s OIPL had also not submitted the Ministry of Power's allocation letter. M/s OIPL vide letter dated 17-11-2017 has provided a letter of MoP in which the tentative allocation agreed in the meetings held on 10-07-2006 and 19-09-2006 is mentioned.

25.5 M/s OIPL vide its email dated 17-05-2019 has informed that the start date of connectivity and LTA may be considered as Unit-1: 01-04-2025 and each subsequent unit at an interval of 6 months thereafter.

25.6 As the evacuation system was planned considering 6x660MW units with split bus arrangement at the UMPP bus (3x660MW in Section-A and 3x660MW in Section-B), revised studies for 2023-24 timeframe was carried out with 5x800MW capacity for Odisha UMPP and discussed in the 1st meeting of ERSCT. In meeting it was decided to review the transmission system proposed for Odisha UMPP by CEA, CTU, OPTCL and OIPL.

25.7 Accordingly, a meeting was held at CEA on 26-03-2019. No representative of M/s OIPL was present in the meeting. Revised system studies were carried out 2024 time-frame, with 5x800MW capacity for Odisha UMPP and without Ranchi-Gaya 765kV D/c line. It was observed that there are no constraints in power evacuation from Odisha UMPP. Accordingly, following evacuation system is proposed for Odisha UMPP for grant of Connectivity and LTA:

Transmission System for Connectivity:

- Split bus arrangement at Odisha UMPP with 3x800MW in Section-A and 2x800MW in Section-B. For connectivity of 5x800MW, bus sectionaliser should be kept closed.
- Odisha UMPP-B – Sundargarh-B 765kV D/c line

Transmission System for LTA

- Split bus arrangement at Odisha UMPP with 3x800MW in Section-A and 2x800MW in Section-B. The bus sectionaliser should be kept normally open.
- Odisha UMPP-B – Sundargarh-B 765kV D/c line
- LILO of both circuits of Sundargarh-A – Dharamjaygarh 765kV D/c line at Odisha UMPP-A

Note:

(a) Generation voltage to be stepped-up to 765kV

(b) *Switchgears to be designed for short time current rating of 50kA (or higher) for 1sec*

25.8 Further, it is required to provide OPGW connectivity to Odisha UMPP-A. Accordingly, 150km of OPGW (24 fibre) and associated communication equipment is to be installed on 765kV D/C Sundergarh-A – Dharamjaygarh line and respective terminal substations.

25.9 M/s OIPL vide its email dated 17-05-2019 has informed that the start date of connectivity and LTA may be considered as Unit-1: 01-04-2025 and each subsequent unit at an interval of 6 months thereafter. Accordingly, as requested by M/s OIPL, it is proposed to grant Connectivity and LTA to M/s OIPL for its 4000MW (5x800MW) UMPP project at Bhedabahal, Odisha w.e.f 01-04-2025 (LTA for 25 years from 01-04-2025). Upon grant of Connectivity and LTA, OIPL/beneficiaries need to sign requisite agreements within specified timelines for taking up the evacuation system for implementation, failing which the Connectivity and LTA intimations shall be liable for closure/cancellation.

25.10 Members may discuss.

File No. CEA-PS-12-15/2/2018-PSPA-II Division

सत्यमेव जयते

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

To

As per List Enclosed.

Subject: Minutes of Meeting on follow-up actions of 1st meeting of Eastern Region Standing Committee on Transmission (ERSCT) and other issues.

महोदय(Sir)/महोदया(Madam),

A Meeting on follow-up actions of 1st meeting of Eastern Region Standing Committee on Transmission (ERSCT) and other issues was held on 26.03.2019 at CEA, New Delhi. Minutes of the meeting are enclosed herewith.

भवदीय/Yours faithfully,

01/05/2019

(यू एम राव भोगी / U.M.Rao Bhogi)
उप निदेशक / Deputy Director

सेवा भवन, आर. के. पुरम-I, नई दिल्ली-110066 **टेलीफोन**: 011-26198092 **ईमेल**: cea-pspa2@gov.in वेबसाइट: www.cea.nic.in
Sewa Bhawan, R.K Puram-I, New Delhi-110066 **Telephone**: 011-26198092 **Email**: cea-pspa2@gov.in **Website**: www.cea.nic.in

List of addressee:

1. Member Secretary, Eastern Regional Power Committee, 14, Golf Club Road, Tollygange, Kolkata-700033. Tel. No. 033-24235199 Fax No.033-24171358	2. Managing Director, Bihar State Power Transmission Company, Vidyut Bhavan (4th floor), Baily Road, Patna-800021. Tel. 0612-2504442 Fax No. 0612-2504557
3. Chairman-cum-Managing Director, Jharkhand Urja Sancharan Nigam Limited Engineering Building, H.E.C., Dhurwa, Ranchi-834004.	4. Chairman-cum-Managing Director, Orissa Power Transmission Corporation Ltd, Jan path, Bhubaneshwar-751022. Tel. No. 0674-2540098 Fax No.0674-2541904
5. Managing Director, West Bengal State Electricity Transmission Company Ltd, Vidyut Bhavan (8th Floor), A-block, Salt Lake City, Kolkata-700091. Tel. No. 033-23370206	6. Principal Chief Engineer cum Secretary, Power Department Government of Sikkim, Sikkim. Tel. No. 03592-2022440 Fax No.03592-202927
7. Chief Operating Officer, Central Transmission Utility (CTU), Power Grid Corporation of India “Saudamini” Plot No. 2, Sector-29, Gurugram-122001	8. Director (Technical), NTPC Limited, Engineering Office Complex, A-8, Sector 24, Noida.
9. Shri Yogesh Juneja Executive Vice President PFC Consulting Ltd. (PFCCL) Odisha Integrated Power Ltd. 1st Floor, Urjanidhi, 1, Barakhamba lane, Connaught Place, New Delhi-110001	

Minutes of Meeting on follow-up actions of 1st meeting of Eastern Region Standing Committee on Transmission (ERSCT) and other issues held on 26.03.2019 at CEA, New Delhi.

List of participants are enclosed at **Annexure-I**.

Chief Engineer (PSP&A-II), CEA welcomed the participants and took up the agenda for discussion. The agenda wise deliberations are given below under respective agenda items:

1. Limiting fault current level at 400kV bus at Farakka TPS (NTPC)

1.1 Representative of CTU informed that three phase fault level at Farakka TPS (NTPC) at 400 kV bus is found to be exceeding the designed short time current rating of equipment (i.e. 40 kA). Presently, the fault level is about 46kA. Moreover, the fault level of Farakka generation switchyard in 2021-22 time-frame is expected to be about 57.5kA. Therefore, CTU had proposed for splitting the 400kV Farakka bus using series reactor arrangement, in a meeting held on 13.06.2017 at CEA, New Delhi. The following were decided in the meeting.

(i) Keeping in view the present fault level of 46kA at Farakka substation, it was opined that initially only Durgapur – Farakka (150km) 400kV D/c and Farakka – Kahalgaon (95km) 400kV 1st D/c (ckt-1 & 2) lines may be bypassed outside the switchyard so as to form Durgapur – Kahalgaon 400kV D/c line by POWERGRID. With above modified arrangement the fault level at Farakka in present time-frame reduces to about 35kA (provided Kahalgaon 400kV bus is split by NTPC as planned, otherwise the fault level at Farakka substation would be about 36.5kA).

(ii) CTU would study the maximum voltage and angle difference between the 400 kV bus sections of Farakka-A and Farakka-B with series reactor and share the study results with NTPC and CEA.

(iii) NTPC would study the proposal of series reactor in detail and submit their comments/observations, if any.

(iv) Based on Comments/study results mentioned at (ii) & (iii) above, the proposal of bus splitting and installation and implementation of series reactor at Farakka Generating station would be reviewed in a special meeting at CEA along with NTPC and POWERGRID.

1.2 Representative of CTU further informed that, in the 19th Standing Committee Meeting on Power System Planning of ER (SCMPSP-ER) held on 01.09.2017, it was decided that Durgapur – Farakka (150 km) 400 kV D/c and Farakka – Kahalgaon (95 km) 400 kV 1st D/c (ckt-1 & 2) lines would be bypassed outside the Farakka switchyard so as to form Durgapur – Kahalgaon 400 kV D/c line which would limit fault level at Farakka generation switchyard. He stated that this has not been implemented, as this is not a permanent solution to limit the fault current. As decided in the meeting held on 13.06.2017, CTU has studied the case and stated that the maximum angle difference between the two

sections is about 4-5 degrees. The report is enclosed at **Annexure-II**. CTU reiterated the proposal of splitting the 400kV Farakka bus using series reactor arrangement.

1.3 In the meeting, Representative of NTPC stated that:

(i) Auxiliary power supply for Farakka STPP is designed to derive Station and backup power supply for plant auxiliaries from 400kV switchyard through 3 nos. Tie transformers (125MVA, 125MVA and 100MVA). Tie transformer#1 and 2 are fed from 400kV Bus#1 and Tie Transformer#3 is fed from 400kV bus#2. For Farakka STPP stage-1, 2 and 3, there is interconnection between the respective Tie transformers at 33kV, 11/6.6kV and 0.415kV levels.

(ii) 2x100% / 3x50% redundant feeding configuration is provided at each load centre with two sources fed from different Tie transformers such that there is no loss of plant auxiliaries in case of outage of any one tie transformer. This provision has been kept by design in order to ensure reliability of supply to auxiliaries and avoid loss of generation on outage of Tie Transformer.

(iii) In case of splitting the 400kV Farakka bus using series reactor arrangement, the phase angle difference between same voltage level buses would be more than 5 degree. Due to this, auxiliary power supply changeover may not take place or heavy circulating currents would flow, which may further trip some of the circuit breakers.

1.4 Chief Engineer (PSPA-II) requested NTPC to determine the maximum voltage angle difference at various voltage levels under normal conditions.

1.5 Representative of NTPC informed that a study has been carried out for power flow for Farakka STPP station supply system in order to ascertain prevailing load angle at various Voltage levels. The details of the study is given below:

(i) An input difference of 2.5 Degrees has been considered between FSTPP-A and FSTPP-B bus after installation of series reactor for this study. Typical load angles at various buses considering around 60MVA loading for the Running Tie Transformer (50% of actual rating) are indicated in table below:

Voltage level	**Angle at Bus-A (incoming bus)**	**Angle at Bus-B (running bus)**
400 kV	0.00 Deg	-2.5 Deg
33 kV	0.00 Deg	-6.39 Deg
11/6.6 kV MV Aux. Level	0.00 Deg	-11.52 Deg
0.415 kV LT Aux. Level	0.00 Deg	-15.12 Deg

(ii) As evident, even with 2.5 Deg angle between FSTPP split buses and around 50 percent loadings of the tie transformer, angular difference at 33kV level is more than 6 degrees which may result in blocking of changeover considering equipment safety. Load flow simulations indicating above are attached (**Annexure-III**).

(iii) It is also pertinent to highlight here that as per load flow studies with paralleling at 415Volts level (**Annexure- IV**), high recirculating currents are observed in the LT system during paralleling which lead to overloading of the transformer and subsequent tripping of the incoming LT transformer. Changeover from one source to second source is not possible under this condition.

1.6 After the deliberations, it was decided that CTU would study alternate solutions to limit fault current at Farakka 400kV Bus.

2. Transmission system for power evacuation of Odisha Integrated Power Ltd. (Odisha UMPP-4000MW).

2.1 Representative of CTU informed that transmission system for evacuation of power from Odisha UMPP was proposed in 1st meeting of Eastern Region Standing Committee on Transmission (ERSCT) held on 16.07.2018. In the meeting, it was decided that CEA, CTU, OPTCL and OIPL may jointly study the evacuation system of Odisha UMPP, keeping in view the scheduled commissioning of Odisha UMPP of 2024 and the issues raised on proposed transmission elements. CTU has studied the evacuation system without 765kV Ranchi-Gaya D/c line and found that there is no constraint in power evacuation. Accordingly, CTU proposed following revised evacuation system:

Transmission System for Connectivity:

- Split bus arrangement at Odisha UMPP with 3x800MW in Section-A and 2x800MW in Section-B. For connectivity of 5x800MW, bus sectionaliser should be kept closed.
- Odisha UMPP-B – Sundargarh-B 765kV D/c line

Transmission System for LTA

- Split bus arrangement at Odisha UMPP with 3x800MW in Section-A and 2x800MW in Section-B. The bus sectionaliser should be kept normally open.
- Odisha UMPP-B – Sundargarh-B 765kV D/c line
- LILO of both circuits of Sundargarh-A – Dharamjaygarh 765kV D/c line at Odisha UMPP-A

Note:

(a) Generation voltage to be stepped-up to 765kV

(b) Switchgears to be designed for short time current rating of 50kA (or higher) for 1sec

2.2 No representative from Odisha Integrated Power Ltd. (OIPL) (wholly owned subsidiary of PFCCL) was present in the meeting.

2.3 After deliberations, it was decided that the proposed evacuation system for Odisha UMPP would be taken up in the forthcoming ERSCT.

3. Augmentation of Muzaffarpur (PG) 400/220 kV GSS in Bihar.

3.1 Representative of BSPTCL stated that the load in Muzaffarpur area is growing very fast. The load demand in Muzaffarpur & adjoining areas is largely fed by Muzaffarpur (PG) with transformation capacity of 1x500+2x315 MVA. During peak hours following loading is being observed:

Present scenario:

Sl. NO.	Lines	Maximum Load (MW)
1	Muzaffarpur (PG)-MTPS (D/C)	420
2	Muzaffarpur (PG)-Hazipur (D/C)	296
3	Muazaffarpur (PG)-Dhalkebar (Nepal) (400kV Transmission Line charged at 220kV)	150
	Total	**866**

Future scenario:

In future Amnor (Chappra) GSS(220/132/33 KV) will be connected to Muzaffarpur (PG) through 220 KV D/C lines as approved in 18th Standing Committee Meeting of CEA under 13th Plan. Further Amnor has been proposed to be connected to Digha (new) GSS (220/132/33 KV) at 220 KV level. BSPTCL has also proposed one 220/132/33 KV GSS at Garaul (Dist. Vaishali) under State Plan, approved in the Bihar cabinet, is getting source at 220 KV level with D/C from Muzaffarpur(PG). Both proposed GSSs (Digha and Garaul) are likely to be commissioned in March-2020. In future the loading pattern on 220kV line will be as follows:-

Sl. NO.	Lines	Maximum Load (MW)
1	Muzaffarpur (PG)-MTPS (D/C)	80
2	Muzaffarpur (PG)-Hazipur (D/C)	250
3	Muzaffarpur (PG)-Amnor (BGCL) (D/C)	300
4	Muzaffarpur (PG)-Goraul (Proposed) (D/C)	200
	Total	**830**

In present scenario itself, Muzaffarpur (PG) is not able to fulfill N-1 criteria and in case of outage of any power transformer, the situation will be critical.

In view of above facts, it is proposed that, either replacement of 2x315 MVA transformers by 2x500 MVA or addition of one 500 MVA transformer of Muzaffarpur (PG) may be considered under N-1 scheme to ensure uninterrupted power to Muzaffarpur and adjoining areas in the event of outage of any transformer. Moreover, if the generation at Kanti (MTPS) reduces, the power supply position at Muzaffarpur 220kV level further aggravates under N-1 of ICTs.

3.2 Chief Engineer (PSPA-II) stated that Muazaffarpur (PG)-Dhalkebar (Nepal) 400kV D/c line is being operated at 220kV and the power flow is around 240MW. He suggested that additional one no. of 500MVA ICT may be installed to meet the load under N-1 criteria.

3.3 With regard to availability of space at Muzaffarpur S/s, CTU informed that space is available for new 400/220kV, 500MVA ICT. The 400kV ICT bay could be implemented as AIS, however, 220kV ICT bay needs to be implemented as GIS along with 220kV cable from ICT to GIS bay.

3.4 After deliberations, it was decided to take up the matter regarding installing new 400/220kV, 500MVA ICT at Muazaffarpur (PG) in the forthcoming meeting of ERSCT for approval from constituents.

4. Examination of additional 400kV connectivity at 400/220/132kV Saharsa (new) GSS being implemented under TBCB in Bihar.

4.1 Representative of BSPTCL stated that the present connectivity of upcoming 400/220/132 kV Saharsa (New) GSS at 400 kV level is LILO of Patna (PG) - Kishanganj (PG) 400 kV D/C line and this work is being done by POWERGRID under TBCB route.

4.2 He further stated that the Saharsa (New) GSS has to be fed from two reliable sources, whereas one of the feed i.e. Patna (PG) - Saharsa (New) 400 kV D/c line is having river crossing and tower failure may occur during floods. Therefore, to improve the reliability at 400 kV level, it is proposed to provide an additional source by making LILO of Darbhanga (DMTCL) - Kishanganj (PG) 400 kV D/C line at 400 kV Saharsa (New) S/S.

4.3 Chief Engineer (PSP&A-II), CEA, and representative of CTU stated that Kishanganj (PG) - Saharsa(New) 400 kV D/c line with Quad moose conductor can meet the load of Saharsa (New) S/S , in case of tower failure of Patna (PG) – Saharsa (New) 400kV D/c line. Under worst case scenario, i.e. with only one circuit of Kisanganj (PG) - Saharsa(New) 400 kV line (with quad moose), the load of Saharsa (New) S/S would be met in the present condition. Based on operational experience, the alternatives may be discussed.

4.4 It was opined that N-1 criteria can only be considered while planning, whereas tower failure in river crossing cannot be considered as a general case in the studies. However, representative of BSPTCL insisted that the 2nd 400kV LILO line i.e. LILO of Kishanganj – Darbhanga may be considered at Saharsa to improved power supply reliability, as the Kishanganj – Patna line during the last two monsoon seasons has suffered prolonged outage due to tower collapse at various locations during flood.

4.5 After deliberations, it is decided to take up the issue to the fourth coming ERSCT.

5. Proposal for connectivity of 220/132/33kV GSS Goraul in Bihar to Muzaffarpur (PG) 400/220 kV GSS.

5.1 Representative of BSPTCL stated that 220/132/33kV GSS of capacity 2x160+3x50 MVA has been decided to be constructed near Goraul block in Vaishali district. At present, load of Vaishali district is about 300 MW and many more PSSs under different schemes of Central government and under state plan are proposed/under construction. Due to new PSSs, load of Vaishali

district is going to increase very rapidly. The upcoming/under construction PSSs are very far away from the existing GSS. In some cases existing PSSs are also far away from existing GSS. Moreover, existing GSS is already saturated and further there is no scope of augmentation due to space constraint. Under 13th plan, load flow study was done considering the load at higher side. The above-proposed GSS is required, to distribute the load uniformly in the existing-GSS also. In the present scenario, the connectivity of PSS with existing GSS are as follows:

Existing Scenario					
Sl. No.	**Name of GSS**	**Capacity of GSS**	**Name of 33/11 kV PSS**	**Capacity of PSS (MVA)**	**Distance between existing GSS to PSS**
1	Jandaha	90 MVA	Goraul	15	45 Kms.
			Jandaha	15	05 Kms.
			Mahua	20	32 Kms.
			Patepur	15	30 Kms.
			Chehrakalan	15	45 Kms.
			Mahnar	20	15 Kms.
			Patori (Samaastipur)	15	20 Kms.
			Total	**115**	
2	Vaishali	90 MVA	Vaishali	20	0 Kms.
			Lalganj	30	15 Kms.
			Dhanpura	20	26 Kms.
			Pateri Belsar	15	12 Kms.
			Bakhara	10	26 Kms.
			Paroo	20	19 Kms.
			Total	**115**	

Proposed Scenario					
Sl. No.	**Name of GSS**	**Capacity of GSS**	**Name of 33/11 kV PSS**	**Capacity of PSS (MVA)**	**Distance between existing GSS to PSS**
1	Goraul	150 MVA	Chehrakalan	15	10 Kms.
			Goraul	15	03 Kms.
			Ismailpur (Propsed)	10	05 Kms.
			Dabhaich (Propsed)	10	20 Kms.
			Mahudahchatur (Proposed)	10	15 Kms.
			Mahua	20	15 Kms.
			Total	**80**	

The above PSSs are distributed to existing + proposed GSSs as per their geographical position so that losses can be minimized. In addition to above, many more PSS are proposed, which will be connected with proposed / existing GSSs.

Connectivity:-

The connectivity of above Goraul, 220/132/33kV, 2x160MVA + 3x50MVA GSS at 220 kV and 132kV levels will be from:

(i) Muzaffarpur (PG) - Goraul 220 kV D/c (Zebra conductor)

(ii) Proposed GSS Tajpur to proposed GSS Goraul 220kV D/c (Zebra conductor).

(iii) LILO of D/c Vaishali - Muzaffarpur 132 kV tr. line at proposed GSS Goraul.

(iv) 132 KV D/C Mahanar GSS - Goraul proposed GSS

The proposed GSS is already approved in BSPTCL Board meeting & also in Bihar cabinet under state plan.

5.2 With regard to availability of space at Muzaffarpur S/s, CTU informed that space is available for 2 no. 220kV GIS bays at Muzaffarpur for termination of Muzaffarpur-Goraul 220kV D/c line of BSPTCL.

5.3 After deliberations, it is decided to take up the agenda in the forthcoming ERSCT meeting for approval.

6. New 220kV and 132kV infrastructure in Bihar under intra-state project.

6.1 Representative of BSPTCL stated that under 13th plan, system studies were done and three nos. of 400 KV & three nos. of 220 KV sub-station were identified to cater to the enhanced load demand of BSPTCL. At present under different schemes of Central Government and State plan, near about 350 numbers of PSSs are under construction. Moreover it has also been decided to segregate the agriculture feeder. Due to that, the load demand on existing GSSs of 132/33kV level is increasing very rapidly. In this regard, BSPTCL is implementing two new 132kV GSSs as mentioned below:

Sl. no	Substation Name	Voltage levels & transformation capacity	132kV lines (S/c or D/c or S/c on D/c; conductor type; length in km)	Expected 33kV load demand (in MW)
1	**Raghopur GSS**	132/33 KV (3x50 MVA)	1. 220 kV Laukhi – Raghopur D/C, ACSR Zebra(charged on 132 kV): 48 km (tentative) 2. 220 kV Supaul – Raghopur D/C, ACSR Zebra(charged on 132 kV): 52 km (tentative)	90
2	**Kerpa GSS**	132/33 KV (3x50 MVA)	1. 132 kV Dehri – Kerpa S/C, ACSR Panther: 24 km 2. 132 kV Banjari – Kerpa S/C, ACSR Panther: 20 km	25

6.2 To cater to the increasing load demand, BSPTCL has proposed additional new substations and the details are given at **Annexure-V** and the brief is given below. The new GSSs have been developed after considering all the planned and under construction GSSs in system study.

Sl. no	Substation Name	Voltage levels & transformation capacity	220kV lines (S/c or D/c or S/c on D/c; conductor type; length in km)	132kV lines (S/c or D/c or S/c on D/c; conductor type; length in km)	Expected 33kV load demand (in MW)
1	**Digha (New) GIS**	220/132/33 KV (2x200 + 2x80 MVA)	1. 220 kV Chapra(New) -Digha D/C, ACSR Zebra: 80 km	1. 132 kV Digha (New) – Digha (Old) D/C, XLPE Cable: 1 km 2. 132 kV Digha (New) – Board Colony D/C, XLPE Cable: 7 km	170

Sl. no	Substation Name	Voltage levels & transformation capacity	220kV lines (S/c or D/c or S/c on D/c; conductor type; length in km)	132kV lines (S/c or D/c or S/c on D/c; conductor type; length in km)	Expected 33kV load demand (in MW)
2	**Tajpur GSS**	220/132/33 KV (2x160 + 3x50 MVA)	1. 220 kV Tajpur – Goraul D/C, ACSR Zebra: 60 km 2. 220 kV Samastipur (New) – Tajpur D/C, ACSR Zebra: 20 km	1. 132 kV Samastipur (Old) – Tajpur S/C, ACSR Panther: 25 km 2. 132 kV Dalsingsarai – Tajpur S/C, ACSR Panther: 27 km 3. 132 kV Sahapur Patori – Tajpur D/C, ACSR Panther: 40 km	50
3	**Thakurganj GSS**	220/132/33 KV (2x160 + 3x50 MVA)	1. 220 kV Kishanganj (New) – Thakurganj D/C, ACSR Zebra: 50 km	1. 132 kV Thakurganj – Araria D/C, ACSR Panther: 80 km	40
4	**Asthawan GSS**	220/132/33 KV (2x160 + 3x50 MVA)	1. 220 kV Biharsarif-Asthawan D/C, ACSR Zebra: 20 km 2. 220 kV Sheikhpura (BGCL) – Asthawan D/C, ACSR Zebra: 15 km	1. 132 kV Asthawan – Rajgir S/C on D/C, ACSR Panther: 35 km 2. 132 kV Asthawan – Nalanda S/C on D/C, ACSR Panther: 25 km 3. 132 kV Asthawan – Barh S/C on D/C, ACSR Panther: 32 km	80
5	**Board Colony GIS**	132/33 KV (2x80 MVA)	-	1. 132 kV B Colony- Digha (New) D/C, XLPE Cable: 7 km	70
6	**Palasi**	132/33 KV (2x50 MVA)	-	1. 132 kV Forbisganj – Palasi S/C, ACSR Panther: 75 km 2. 132 kV Kishanganj – Palasi S/C, ACSR Panther: 53 km	50

6.3 CTU has studied the proposals of BSPTCL and the load flow is given at **Annexure-VI**. Following are observations of CTU on the proposal of BSPTCL:

(i) **Digha 220kV S/s:** About 240 MW power drawl is expected (170 MW Digha + 70 MW B.Colony) from this substation. Therefore, only one 220 kV D/c feed from Chappra may not be sufficient and this is unreliable due to river crossing of this line section and it may lead to major power disruption in case of tower outage. Thus, it is suggested that an additional 220 kV feed may be provided to Digha. The nearest substation on other side of river is Hazipur. It is understood that Digha cannot be connected from southern side, due to RoW issues. Accordingly, load flow considering Digha-Hazipur and Digha-Chappra 220kV D/c lines is given in the study**.**

132 kV D/c line between Digha (New) and Digha (Old) cannot be kept normally closed, as this results in power flow from Digha (Old) to Digha (New) of the order of 190MW. This overloads downstream Khagaul-Digha and Bihta-Digha 132 kV S/c lines.

(ii) **Thakurganj 220kV S/s:** The substation may be fed from Kishanganj (POWERGRID) instead of Kishanganj (BSPTCL) 220kV. Further, the 132 kV line from Thakurganj may be terminated at Palasi, instead of Araria.

(iii) **Jakkanpur/Mithapur/Karbigaiya:** Due to deletion of Sipara-Karbigaiya 132kV (HLTS) D/c line, constraints are observed in power supply to said three substations under N-1 condition. Accordingly, additional feed to meet demand of about 550 MW (290 MW-Jakkanpur; 190 MW-Mithapur

& 65 MW-Karbigaiya) may be planned, as the three substations are being fed through three 132kV lines (HTLS) only. Feasibility of Jakkanpur (New)-Jakkanpur(Old) or Jakkanpur(New)-Mithapur 132 kV D/c line may be explored by BSPTCL.

(iv) List of 132 kV lines found to be overloaded under N-1 criteria is at **Annexure-VII**.

6.4 CTU has studied the proposals of BSPTCL with the above proposed changes and the load flow is given at **Annexure-VIII**

6.5 In regard to Digha S/s, BSTPCL mentioned that they would explore the possibility of providing 2nd 220kV feed to Digha in future as there is space constraint at Hazipur.

6.6 Regarding Thakurganj S/s, BSPTCL informed that all four Kishanganj (POWERGRID) – Kishanganj (BSPTCL) 220kV circuits are of AL-59 conductors, each having maximum capacity of 1000 ampere (380MVA per circuit). Therefore, connection with Kishanganj (POWERGRID) may not be required. Further, in regard to 132kV Thakurganj-Araria line, BSPTCL informed that demand of Araria is going to increase upto 60MW in future. Moreover, Araria and Palasi are politically sensitive areas. As such, both Araria and Palasi GSSs require 2nd sources for better reliability. Therefore, LILO of 132 kV Thakurganj – Araria D/C at Palasi may be considered.

6.7 With regard to additional drawl lines at 132kV level from 400kV or 220kV substations in Jakkanpur/Mithapur/Karbigaiya areas, BSPTCL agreed to explore the feasibility and space at Mithapur 132kV GSS.

6.8 It was decided that BSPTCL would review the balance observations of CTU mentioned above.

6.9 Further, CEA made following observations on BSPTCL's proposal:

(a) LILO of 132kV Samastipur- Dalsingsarai S/c line at Tajpur GSS: It was suggested that instead of 132KV Samastipur- Dalsingsarai S/C line LILO at Tajpur, Begusarai- Samastipur 132 KV S/C line be LILO at Dalsingasari GSS.

In this regard BSPTCL mentioned that 132 kV Begusarai – Samatipur (Old) is used to feed power to Gangwara 132 kV GSS via Transfer Bus of Samatipur (Old) GSS as there are only two 220 kV bays at Darbhanga (220kV) GSS. Further, LILO of Begusarai- Samastipur 132 KV S/C at Dalsingasari GSS is not possible due to space constraints at Dalsingasari GSS. Therefore, LILO of 132 KV Samastipur- Dalsingsarai S/C line at Tajpur GSS may be considered.

(b) Asthawan-Rajgir 132kV D/c line: It was suggested to defer implementation of this line.

In this regard BSPTCL mentioned that, there is limited power flow from Barhi (DVC). Moreover, 132kV Barhi – Rajgir/ Nalanda D/C, being very old transmission line, is not a reliable source. Further, Rajgir is an important

GSS as well as tourist place and Nalanda International University is situated at Nalanda district. Hence, the connectivity of 132 kV Asthawan – Rajgir & 132kV Asthawan – Nalanda may be approved.

6.10 After deliberations, it was decided that the below mentioned intra-state transmission system strengthening in Bihar would be taken up for approval in the forthcoming ERSCT meeting.

Sl. no	Substation Name	Voltage levels & transformation capacity	220kV lines (S/c or D/c or S/c on D/c; conductor type; length in km)	132kV lines (S/c or D/c or S/c on D/c; conductor type; length in km)
1	**Digha (New) GIS**	220/132/33 KV (2x200 + 2x80 MVA)	1. 220 kV Chapra(New) -Digha D/C, ACSR Zebra: 80 km ***Note:*** *BSPTCL would explore the possibility of 2nd 220kV feed to Digha for reliable power supply.*	1. 132 kV Digha (New) – Digha (Old) D/C, XLPE Cable: 1 km 2. 132 kV Digha (New) – Board Colony D/C, XLPE Cable: 7 km
2	**Tajpur GSS**	220/132/33 KV (2x160 + 3x50 MVA)	1. 220 kV Tajpur – Goraul D/C, ACSR Zebra: 60 km 2. 220 kV Samastipur (New) – Tajpur D/C, ACSR Zebra: 20 km	1. 132 kV LILO of Samastipur (Old) – Dalsingsarai S/C line at Tajpur *[Samastipur (Old) – Tajpur S/C, ACSR Panther: 25 km & Dalsingsarai – Tajpur S/C, ACSR Panther: 27 km]* 2. 132 kV Sahapur Patori – Tajpur D/C, ACSR Panther: 40 km
3	**Thakurganj GSS**	220/132/33 KV (2x160 + 3x50 MVA)	1. 220 kV Kishanganj (New) – Thakurganj D/C, ACSR Zebra: 50 km	1. 132 kV Thakurganj – Araria D/C, ACSR Panther: 80 km
4	**Asthawan GSS**	220/132/33 KV (2x160 + 3x50 MVA)	1. 220 kV Biharsarif- Asthawan D/C, ACSR Zebra: 20 km 2. 220 kV Sheikhpura (BGCL) – Asthawan D/C, ACSR Zebra: 15 km	1. 132 kV Asthawan – Rajgir S/C on D/C, ACSR Panther: 35 km 2. 132 kV Asthawan – Nalanda S/C on D/C, ACSR Panther: 25 km 3. 132 kV Asthawan – Barh S/C on D/C, ACSR Panther: 32 km
5	**Board Colony GIS**	132/33 KV (2x80 MVA)	-	1. 132 kV B Colony- Digha (New) D/C, XLPE Cable: 7 km
6	**Palasi**	132/33 KV (2x50 MVA)	-	1. 132 kV LILO of Forbisganj – Kishanganj S/C line at Palasi *[Forbisganj – Palasi S/C, ACSR Panther: 75 km & Kishanganj – Palasi S/C, ACSR Panther: 53 km]* 2. 132kV LILO of Thakurganj – Araria D/C line

7. Proposal for 132/33 kV sub-station at Nabinagar

7.1 Representative of BSPTCL stated that, one 132/33 kV GSS of capacity 3x50 MVA has been decided to be constructed at Nabinagar, Dist. Aurangabad whose connectivity at 132 kV level has been proposed as LILO of 132kV Sonenagar - Rihanad ckt 1. After deliberations it was decided that instead of said LILO, new 132/33kV S/s at Nabinagar may be feed radially from Nabinagar-II generation project (line length: about 15km) as requisite transformation capacity is available in the 400/132kV ICTs at the generation switchyard.

7.2 After deliberations, it is decided to take up the issue to the forthcoming ERSCT meeting.

8. Extension of completion schedule of ERSS-XV & ERSS-XVIII schemes considering Jeerat Gas Insulated Line works.

8.1 Representative of CTU informed that following 400kV lines are existing / under construction at 400/220kV substation of Jeerat (WBSETCL):

Existing:

(i) Jeerat (WBSETCL) – Baharampur/Farakka 400kV S/c line of POWERGRID

(ii) Jeerat (WBSETCL) – Rajarhat/Subhashgram 400kV S/c line of POWERGRID

(iii) Jeerat (WBSETCL) – Barkeshwar (WBSETCL) 400kV S/c line of WBSETCL

(iv) Jeerat (WBSETCL) – Kolaghat (WBSETCL) 400kV S/c line of WBSETCL

Under Construction:

(v) LILO of Sagardighi – Subhashgram 400kV S/c line at Jeerat (WBSETCL) as a part of ERSS-XV by POWERGRID

(vi) Jeerat (New) – Jeerat (WBSETCL) 400kV D/c line (Quad) as a part of ERSS-XVIII being implemented under TBCB by POWERGRID Medinipur-Jeerat Transmission Ltd.

8.2 He stated that there was problem for termination of new 400kV lines being implemented under ERSS-XV and ERSS-XVIII at Jeerat (WBSETCL) S/s. In the 19th meeting of SCPSPER, following was decided to resolve the issue:

(i) Dismantling of dead end towers and termination of existing lines mentioned at 8.1 (i) to (iv) through GIS duct, at the existing 400kV Jeerat AIS S/s (WBSETCL) as ISTS.

(ii) The new lines mentioned at 8.1 (v) and (vi) can be directly terminated on separate double circuit towers at normal height (around 45 meters) to new GIS extension area.

(iii) Further, it was also acknowledged that implementation of LILO of Sagardighi-Subhasgram 400kV S/c line at Jeerat along with associated line bays shall get delayed due to addition of above mentioned GIS duct arrangement.

8.3 Representative of CTU stated that since the work to be carried out under ISTS may not match the timeline of ERSS-XV & ERSS-XVIII schemes, it was requested to extend the completion of ERSS-XV & ERSS-XVIII schemes in the 1st meeting of ERSCT. Further, in the 1st ERSCT it was also decided that “after finalization of implementing agency for the work, a separate meeting in CEA with CTU, POWERGRID, WBSETCL and implementing agency will be held to discuss the extension of completion schedule of ERSS-XV & ERSS-XVIII schemes. Decision of the meeting will be put up before ERSCT for ratification.”

8.4 In the 2nd meeting of ECT held on 06-08-2018, POWERGRID has been entrusted with the works mentioned above at 8.2 (i) through RTM.

8.5 Representative of CTU informed that for dismantling and termination of various lines of POWERGRID and WBSETCL through GIS duct, agreement was signed with WBSETCL on 07-11-2017, i.e. WBSETCL is implementing the said works on POWERGRID's behalf at its substation. The work has been awarded to JV of M/s Techno & M/s ABB in Nov'18 after approval of mode of implementation in the 2nd ECT meeting. The expected commissioning schedule of the GIS works is 15 months (i.e. Feb 2020) from award.

8.6 After deliberations, it is decided to take up the matter in the forthcoming ERSCT meeting regarding revision in completion schedule of ERSS-XV scheme as Feb 2020.

Annexure-I

List of participants of Meeting on follow-up actions of 1st meeting of Eastern Region Standing Committee on Transmission (ERSCT) and other issues held on 26.03.2019 at CEA, New Delhi.

Sl. No.	Name	Designation	Organization
1	Pardeep Jindal	CE (PSP&A-II)	CEA
2	Ishan Sharan	Director (PSP&A-II)	CEA
3	U M Rao	Dy. Director (PSP&A-II)	CEA
4	Ashok Pal	CGM (CTU-Plg)	POWERGRID
5	Manish Ranjan Keshari	Dy. Manager(CTU-Plg)	POWERGRID
6	Subhash Thakur	Addl. GM	NTPC
7	Abhishek Khanna	Manager	NTPC
8	Ravi S Prasad	ESE	BSPTCL
9	Abhishek Kumar	EEE/P&E	BSPTCL
10	P. K. Mishra	CGM	OPTCL
11	C.R. Mishra	DGM	OPTCL
12	A K Benarajee	AGM	OPTCL

Annexure-II

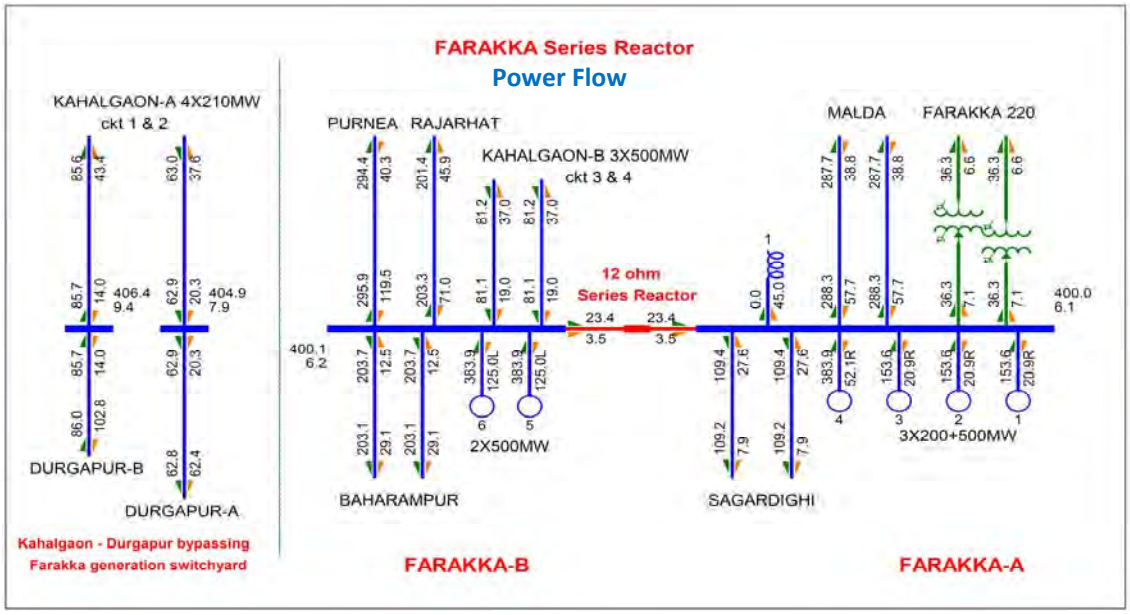
Study results on limiting fault current level at 400kV bus at Farakka TPS (NTPC)

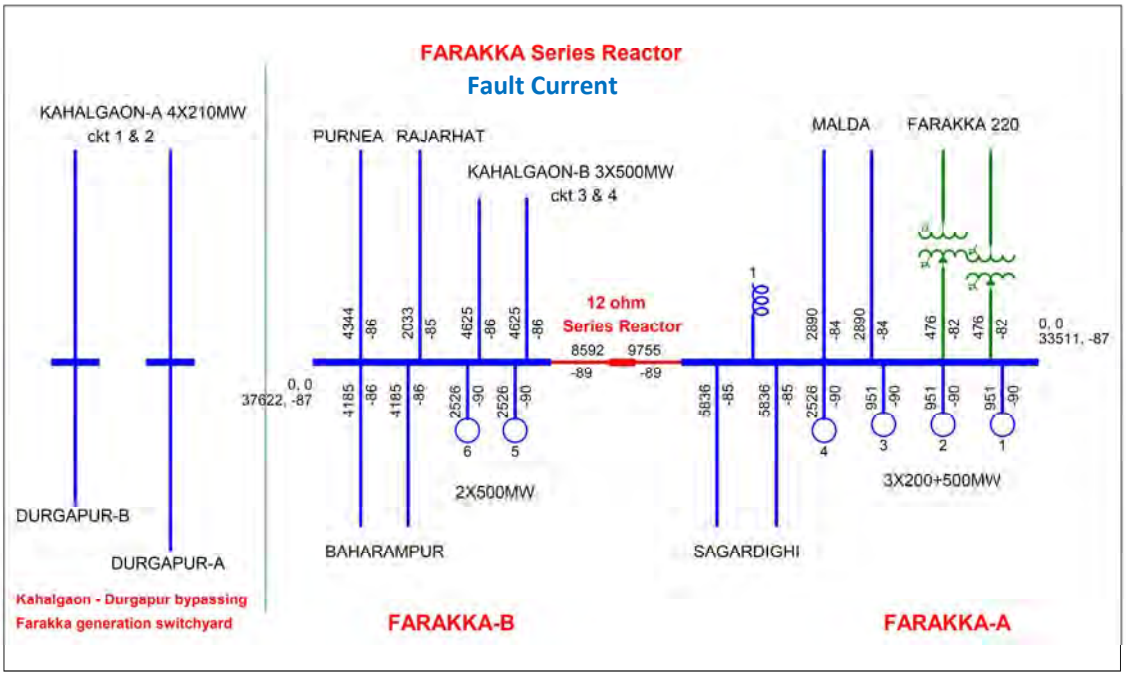
A meeting held on 13.06.2017 at CEA regarding limiting fault current level at 400kV bus at Farakka TPS (NTPC) wherein it was decided that following activities have to be undertaken by CTU and NTPC respectively:

1. **CTU would study for the maximum voltage and angle difference between the 400 kV bus sections between of Farakka-A and Farakka-B after installation of series reactor and the report would be shared with NTPC and CEA**.

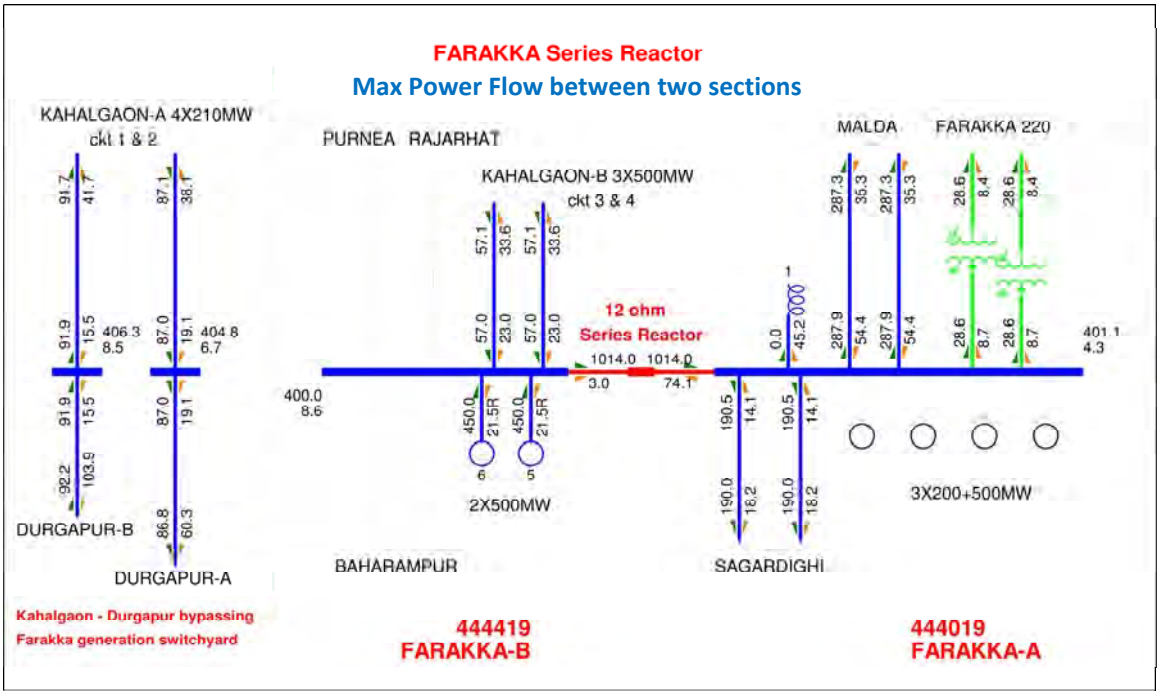
2. **NTPC would study the proposal of series reactor in detail and submit their comments/observations**

The three phase fault level at Farakka TPS (NTPC) at 400kV bus is expected to be about 57.5kA in 2021-22 timeframe. In the meeting held at CEA, a bus splitting scheme was discussed. The power flow and fault level considering this arrangement is given below:





In normal scenario, the power flow between the two sections of Farakka bus is very low (under 100MW). However, worst case has been simulated by switching off the outgoing feeders of section-B and incoming feeders of section-A so that maximum power flow on the series reactor can be simulated. The maximum power flow and the angle of two sections is shown below:



It may be observed that with a power flow of about 1000MW, the maximum angle difference between the two sections is about 4-5 degrees. Further, there is no

appreciable difference in the bus voltage of the two sections. In regard to space availability of the series reactor at Farakka S/s, it is to mention that recently proposal for 12 ohm series reactor at Ballabhgarh and Mandola has been approved and they are under implementation. The General Arrangement and Layout of these two substations are attached.

LEGENDS:-

PRESENT SCOPE

FUTURE/EXISTING

FENCE

BILL OF QUANTITY: 400kV AIS EQUIPMENTS

S.NO.	SYMBOL	DESCRIPTION	QUANTITY
1.		420kV, 3150A, 40kA, 1SEC, SF6, 3-PHASE CIRCUIT BREAKER WITHOUT CLOSING RESISTOR	02
2.		420kV, 3150A, 40kA, 3-PHASE, SF6 ISOLATOR WITH ONE EARTH SWITCH	09
3.		420kV, 3000A, 40kA, 1-PHASE CURRENT TRANSFORMER WITH 120% EXTENDED CURRENT RATING.	06
4.		420kV, 4400pF, 1-PHASE CAPACITIVE VOLTAGE TRANSFORMER	06
5.		336kV, 20kA, 1-PHASE, LIGHTNING ARRESTOR	06
6.		420kV, 12 OHM, 36kH, 2500A, 14kA FOR 1SEC, 1-PHASE AIR CORE, DRY TYPE SERIES BUS REACTOR INCLUDING TRV CAPACITOR BASED ON STUDY REQUIREMENTS)	03
7.		400kV BUS POST INSULATOR	09
8.		400kV (℄) TRV CAPACITOR (15nF) FOR BUS REACTOR	06

BILL OF QUANTITY: 400kV GIS EQUIPMENTS

S.NO.	DESCRIPTION	QUANTITY
1.	420kV, 2500A, 3PH, 40kA FOR 1SEC, SF6 GIS ISOLATOR MODULE WITH ONE EARTH SWITCH.	01
2.	420kV, 2500A, 3PH, 40kA FOR 1SEC, SF6 GIS ISOLATOR MODULE WITHOUT EARTH SWITCH.	01
3.	420kV, 2500A, 1-PHASE, 40kA FOR 1SEC, SF6, GAS INSULATED GIS CT MODULE. (2CORE)	06
4.	420kV, 3150A, 40kA, SF6 TO AIR BUSHINGS	12

SYSTEM PARAMETERS (TABLE-3)

S.No.	DESCRIPTION	400kV SYSTEM
1.	SYSTEM OPERATING VOLTAGE	400kV
2.	MAX. OPERATING VOLTAGE OF THE SYSTEM (rms)	420kV
3.	RATED FREQUENCY	50Hz
4.	NO. OF PHASES	3
5.	RATED INSULATION LEVELS i) FULL WAVE LIGHTNING IMPULSE WITHSTAND VOLTAGE (1.2/50microsec.) ii) SWITCHING IMPULSE WITHSTAND VOLTAGE (250/2500microsec.) DRY & WET iii) ONE MINUTE POWER FREQUENCY DRY WITHSTAND VOLTAGE (rms)	±1550kVp ±1050kVp 630kV
6.	CORONA EXTINCTION VOLTAGE (MIN.)	320kV
7.	MAX. RADIO INTERFERENCE VOLTAGE FOR FREQUENCY BETWEEN 0.5MHz & 2MHz AT 266kV rms FOR 400kV SYSTEM	1000 micro volts
8.	MIN. CREEPAGE DISTANCE	25MM/KV (10500MM)
9.	RATED 3-PH. SYMMETRICAL SHORT CIRCUIT CURRENT WITHSTAND CAPACITY	40kA
10.	SYSTEM NEUTRAL EARTHING	EFFECT. EARTHED

SWITCHYARD CONDUCTOR DETAILS

DESCRIPTION	400kV
EQUIPMENT INTERCONNECTION	4" IPS AL. TUBE (OD=120.0mm, ID=98mm)
MAIN BUS	4" IPS AL. TUBE
JACK BUS	TWIN MOOSE ACSR CONDUCTOR
EARTHWIRE	10.98mm DIA GI WIRE

400kV MINIMUM AIR CLEARANCE TABLE

Sl.No.	DESCRIPTION	400kV SYSTEM
1	FOR CONDUCTOR-CONDUCTOR FOR ROD-CONDUCTOR	4000mm 4200mm
2	PHASE TO EARTH	3500mm
3	GROUND CLEARANCE SECTIONAL CLEARENCE	8000mm 6500mm

NOTES

1. ALL DIMENSIONS ARE IN MM.
2. FOR BMC LOCATIONS PLEASE REFER CIVIL FOUNDATION & CABLE TRENCH LAYOUT.
3. IF REQUIRED ELECTRICAL CLEARANCES AS PER TECHNICAL SPECIFICATIONS ARE NOT ACHIEVED AT SITE DURING ERECTION, SAME SHALL BE OBTAINED BY INCORPORATING NECESSARY MODIFICATIONS WITHOUT ANY ADDITIONAL PRICE IMPLICATIONS TO POWER GRID.
4. REACTOR NEUT & PRESENT 220KV CB 6-9H-1B3 & SHALL BE FINALIZED AFTER TRV STUDY.
5. EXISTING TIE CT MARKED WITH * SHALL BE RELOCATED AT NEW LOCATION MARKED WITH ** & NEW CT MARKED WITH ** SHALL BE INSTALLED AT EXISTING TIE CT MARKED WITH *.

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☑ APPROVAL ☐ AS BUILT
☐ QUOTATION ☐ PROJECT
☐ PLANNING ☐ REFERENCE
☐ MANUFACTURING ☐ INDENT
☐ RECORD ☐ EXECUTION

Dt. 15 SEP 2017 — GE T&D India Limited

REV.No.	DESCRIPTION	DATE	DRAWN	REVIEW	APPROVED
R4	REVISED AS PER CUSTOMER COMMENTS	Name SNR 15/09/17		ABH/RB 15/09/17	SSR 15/09/17
R3	REVISED AS PER CUSTOMER COMMENTS	Name SNR 15/09/17		ABH/RB 15/09/17	SSR 15/09/17
R2	REVISED AS PER CUSTOMER COMMENTS	Name KSV 27/04/17		ABH 27/04/17	SSR 27/04/17
R1	REVISED AS PER CUSTOMER COMMENTS DATED: 03.02.17	Name KSV 08/03/17		ABH/VD 08/03/17	SSR 08/03/17
R0	FIRST ISSUE	Name KSV 13/01/17		ABH/VD 13/01/17	SSR 13/01/17
		Name Date Sign.	CHK'D	MECH.	APPROVED

CLIENT: POWER GRID CORPORATION OF INDIA LIMITED (A Government of India Enterprise)

2nd FLOOR, PLOT No-2 SECTOR-29 GURGAON-122 001 HARYANA

CONTRACTOR: GE T&D INDIA LTD. POWER SYSTEMS BUSINESS A-7, SECTOR-65, NOIDA - 201301 UTTAR PRADESH INDIA

LOA No.: CC-CS/739-NR1/RT-3331/GE&NOA-I/6925 DATED: 25.08.2016

PROJECT: SERIES REACTOR PACKAGE (INCLUDING ASSOCIATED BAYS) AT 400V BALLABHGARH & MANDAULA SUB-STATION ASSOCIATED WITH PROVISION OF SERIES BUS REACTOR IN NORTHERN.

TITLE: 400kV ELECTRICAL LAYOUT PLAN FOR 400/220kV BALLABHGARH S/S EXTENSION (SERIES BUS REACTOR)

SIZE	DRAWING No.	TOTAL SH.	Sht.No.	REV.
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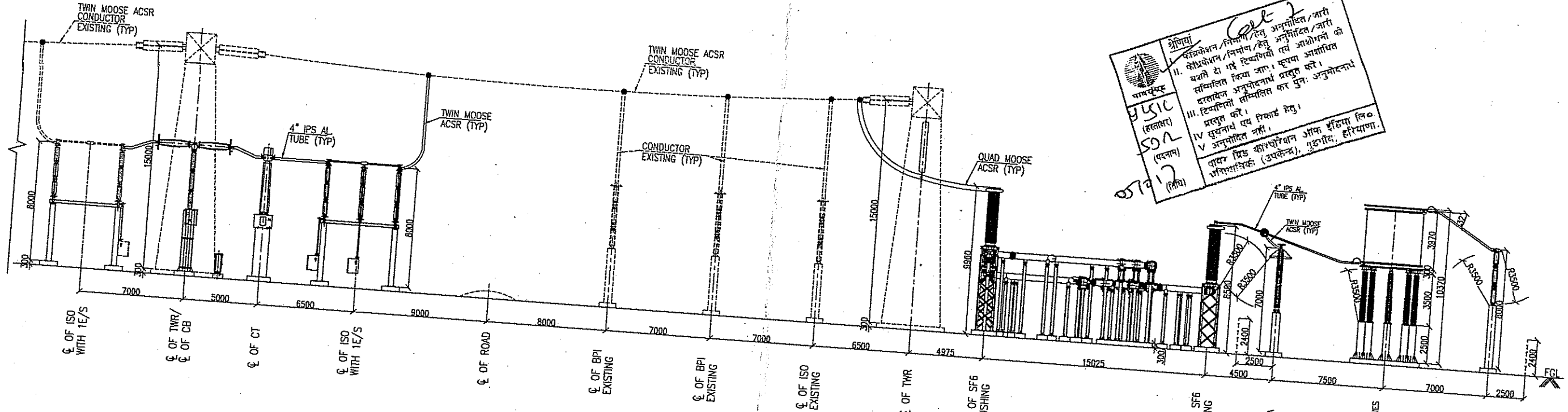
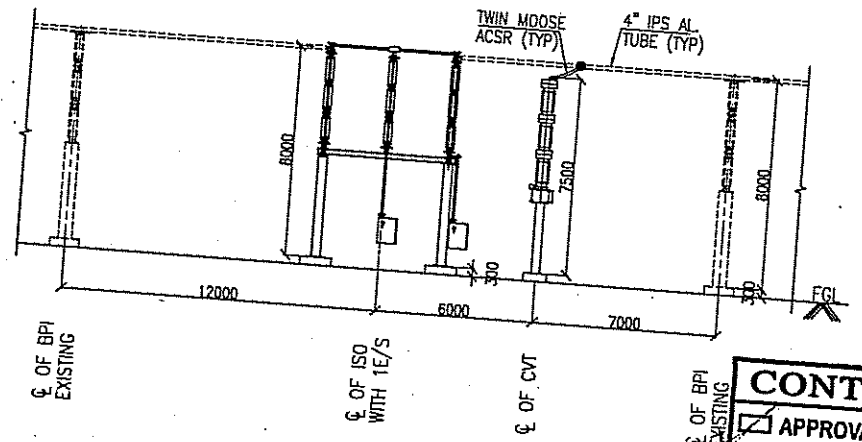
SCALE: 1:400

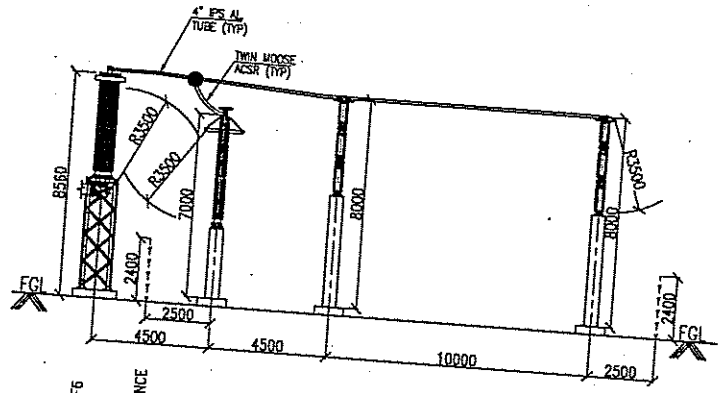
DF002



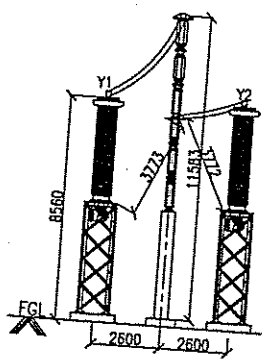
SECTION A-A R2



SECTION B-B R2



SECTION C-C R2



SECTION D-D (BUS REACTOR) (TYP.) R3

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PROTO / CONSTRUCTION
PLANNING / REFERENCE
MANUFACTURING / INDENT
RECORD / EXECUTION
GE T&D India Limited
DT. 15 SEP 2017 AUTH. SIG.

टिप्पणियां
I. परिकल्पन/निर्माण/हेतु अनुमोदित/जारी
II. संशोधन/विमोचन/हेतु अनुमोदित/जारी यथासे दो गये टिप्पणियों एवं आशोधनों को सम्मिलित किया जाए। कृपया आशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. टिप्पणियों सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV सूचनार्थ एवं निकाय हेतु।
V अनुमोदित नहीं।
पावर ग्रिड कॉरपोरेशन ऑफ इंडिया लि०, अभियांत्रिकी (उपकेन्द्र), गुड़गाँव, हरियाणा.

LEGENDS:-
——— PRESENT SCOPE
– – – – FUTURE/EXISTING

NOTES
1. ALL DIMENSIONS ARE IN MM.

REV.No.	DESCRIPTION	DATE	DRAWN	REVIEW	APPROVED	
R4	REVISED AS PER CUSTOMER COMMENTS	Name SUR / Date 15.09.17 / Sign.		ABH/BB 15.09.17	SSR 15.09.17	FOR APPROVAL
R3	REVISED AS PER CUSTOMER COMMENTS	Name SUR / Date 26.08.17 / Sign.		ABH/BB 26.08.17	SSR 26.08.17	FOR APPROVAL
R2	REVISED AS PER CUSTOMER COMMENTS	Name KSV / Date 27.04.17 / Sign.		ABH 27.04.17	SSR 27.04.17	FOR APPROVAL
R1	REVISED AS PER CUSTOMER COMMENTS DATED: 22.02.17	Name KSV / Date 08.03.17 / Sign.		ABH/AD 08.03.17	SSR 08.03.17	FOR APPROVAL
R0	FIRST ISSUE	Name KSV / Date 02.02.17 / Sign.		ABH/AD 02.02.17	SSR 02.02.17	FOR APPROVAL

CHECKED: ELE. / CIVIL / MECH.

REFERENCE NO.	DESCRIPTION
5427PS095-BLB-E-SYD-SYS-0001-GA	ELECTRICAL LAYOUT OF 400/220kV BALLABHGARH S/S EXT.

CLIENT: पावर ग्रिड कार्पोरेशन ऑफ इंडिया लिमिटेड POWER GRID CORPORATION OF INDIA LIMITED. (A Government of India Enterprise)
2nd FLOOR, PLOT No.-2 SECTOR-29 GURGAON-122 001 (HARYANA).

PROJECT: SERIES REACTOR PACKAGE (INCLUDING ASSOCIATED BAYS) AT 400V BALLABHGARH & MANDAULA SUB-STATION ASSOCIATED WITH PROVISION OF SERIES BUS REACTOR IN NORTHERN.

CONTRACTOR: GE T&D INDIA LTD. (FORMERLY ALSTOM T&D INDIA LTD) A-7, SECTOR-65, NOIDA - 201301 UTTAR PRADESH (INDIA)

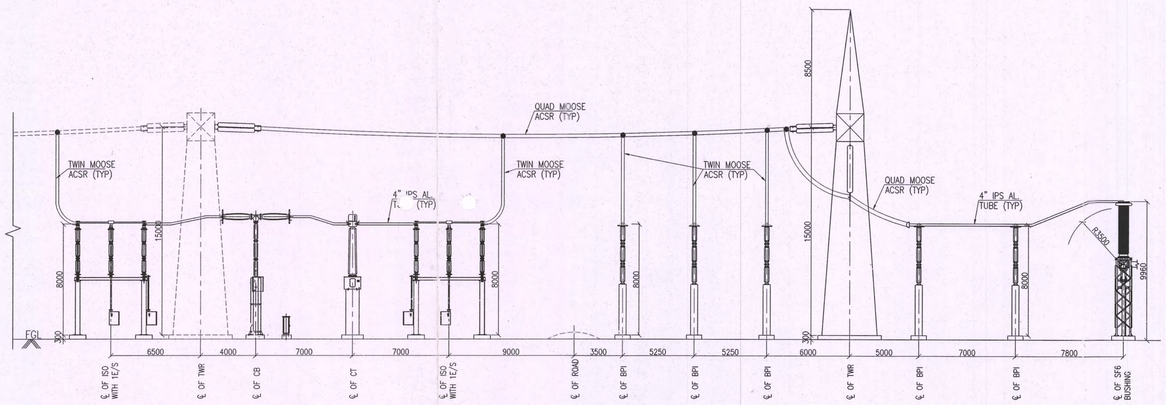
LOA No: CC-CS/739-NR1/RT-3331/3/G8/NOA-I/692S DATED: 26.08.2016

TITLE: 400kV ELECTRICAL LAYOUT SECTION OF 400/220kV BALLABHGARH S/S EXTENSION (SERIES BUS REACTOR)

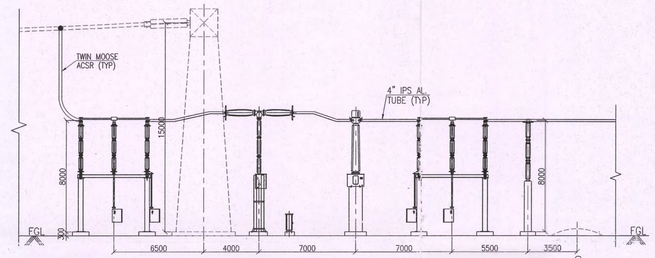
A-3 | DRAWING No. | STATUS

1 2 3 4 A B C D 49

DRAWING No. 5427PS095-MAN-E-SYD-SYS-0001-GA



SECTION A-A



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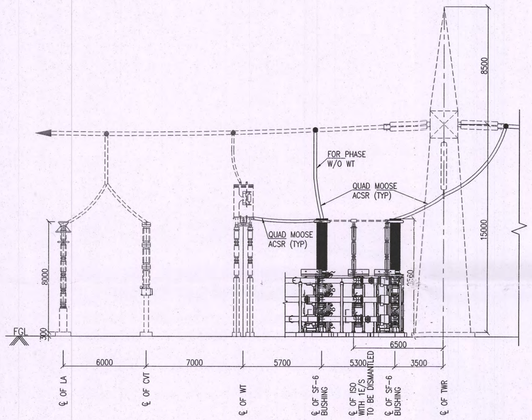

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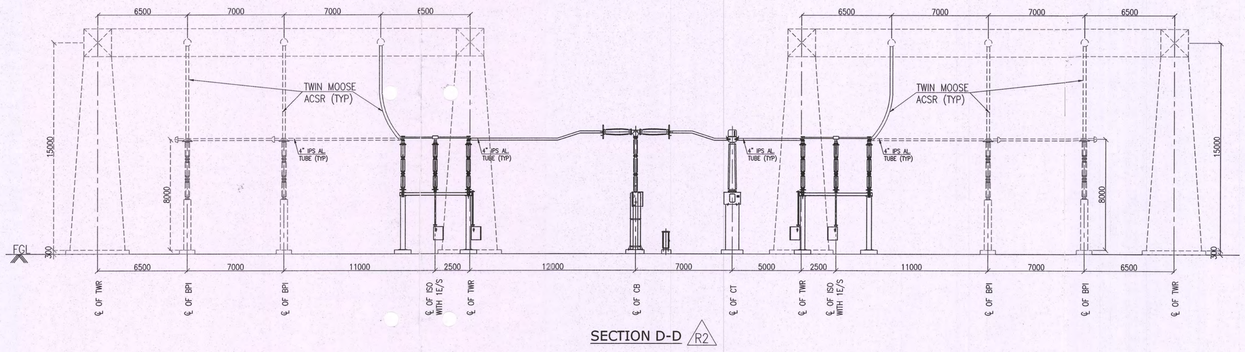
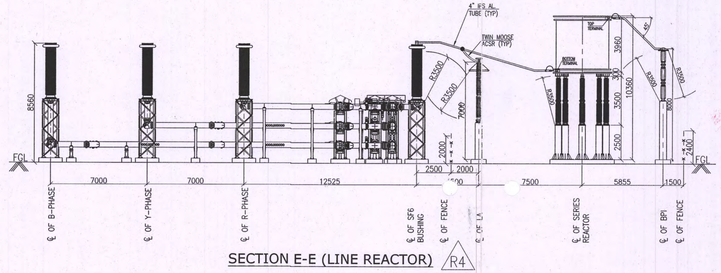
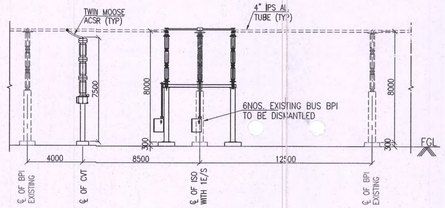


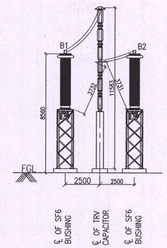
SECTION D-D R2



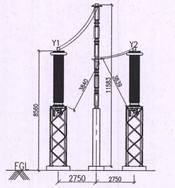
SECTION E-E (LINE REACTOR) R4



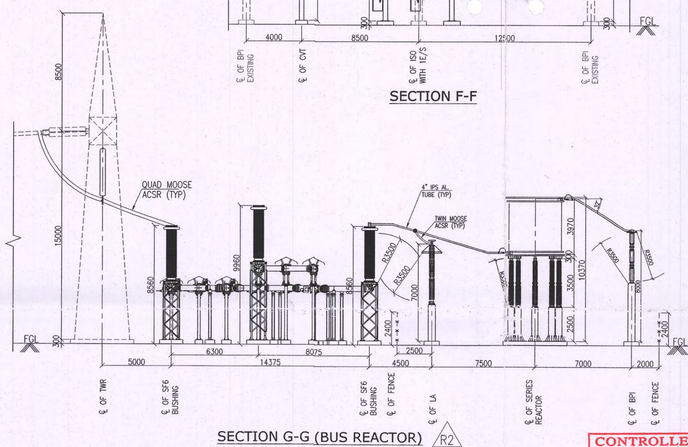
SECTION F-F



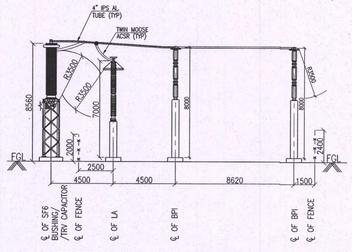
SECTION J-J (BUS REACTOR) (TYP.)



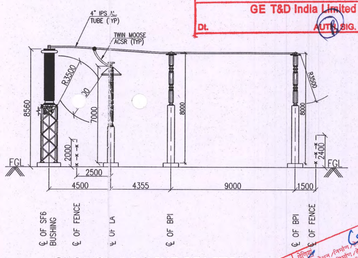
SECTION K-K (LINE REACTOR) (TYP.)



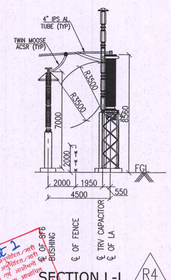
SECTION G-G (BUS REACTOR) R2



SECTION H-H (BUS REACTOR)



SECTION I-I (LINE REACTOR)



SECTION L-L R4

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- [x] APPROVAL
- [ ] PROTO
- [ ] PLANNING
- [ ] MANUFACTURING
- [ ] RECORD
- [ ] AS BUILT
- [ ] CONSTRUCTION
- [ ] REFERENCE
- [ ] INDENT
- [ ] EXECUTION

GE T&D India Limited

DL AUTH. SIG.

LEGENDS:-

PRESENT SCOPE

FUTURE/EXISTING

NOTES

1. ALL DIMENSIONS ARE IN MM.

REV.No.	DESCRIPTION	DATE	DRAWN	REVIEW	ELE.	CIVIL	MECH.	APPROVED	STATUS
R4	REVISED AS PER CUSTOMER COMMENTS R4	Name SUR / Date 06.09.17 / Sign.			ABH/BB / 06.09.17			SSR / 06.09.17	FOR APPROVAL
R3	REVISED AS PER CUSTOMER COMMENTS R3	Name SUR / Date 26.07.17 / Sign.			ABH/BB / 26.07.17			SSR / 26.07.17	FOR APPROVAL
R2	REVISED AS PER CUSTOMER COMMENTS R2	Name KSV / Date 26.04.17 / Sign.			ABH / 26.04.17			SSR / 26.04.17	FOR APPROVAL
R1	REVISED AS PER CUSTOMER COMMENTS	Name KSV / Date 14.03.17 / Sign.			ABH/AD / 14.03.17			SSR / 14.03.17	FOR APPROVAL
R0	FIRST ISSUE	Name KSV / Date 02.02.17 / Sign.			ABH/AD / 02.02.17			SSR / 02.02.17	FOR APPROVAL

CHECKED

REFERENCE NO.	DESCRIPTION
GD53A000268 (REV-3)	GIS LAYOUT PLAN & SECTION FOR 400/220kV MANDOLA S/S EXT.
5427PS095-MAN-E-SYD-SYS-0001-GA (Rev-R0) Sh-001	400kV ELECTRICAL LAYOUT PLAN FOR 400/220kV MANDOLA S/S EXT.

CLIENT: URR ITE UPRAVTEN SIND KAMI LIMITED — POWER GRID CORPORATION OF INDIA LIMITED, (A Government of India Enterprise)

2nd FLOOR, PLOT No.-2 SECTOR-29 GURGAON-122 001 (HARYANA).

PROJECT: SERIES REACTOR PACKAGE (INCLUDING ASSOCIATED BAYS) AT 400V BALLABHGARH & MANDAULA SUB-STATION ASSOCIATED WITH PROVISION OF SERIES BUS REACTOR IN NORTHERN.

CONTRACTOR: GE T&D INDIA LTD. (FORMERLY ALSTOM T&D INDIA LTD) A-7, SECTOR-65, NOIDA - 201301 UTTAR PRADESH (INDIA)

LOA No.: CC-CS/739-NR1/RT-3331/3/G8/NOA-I/6925 DATED: 26.08.2016

TITLE: 400kV ELECTRICAL LAYOUT SECTION FOR 400/220kV MANDOLA S/S EXTENSION (SERIES BUS & LINE REACTOR)

A1	DRAWING No.	TOTAL SH.	SH.No.	REV.
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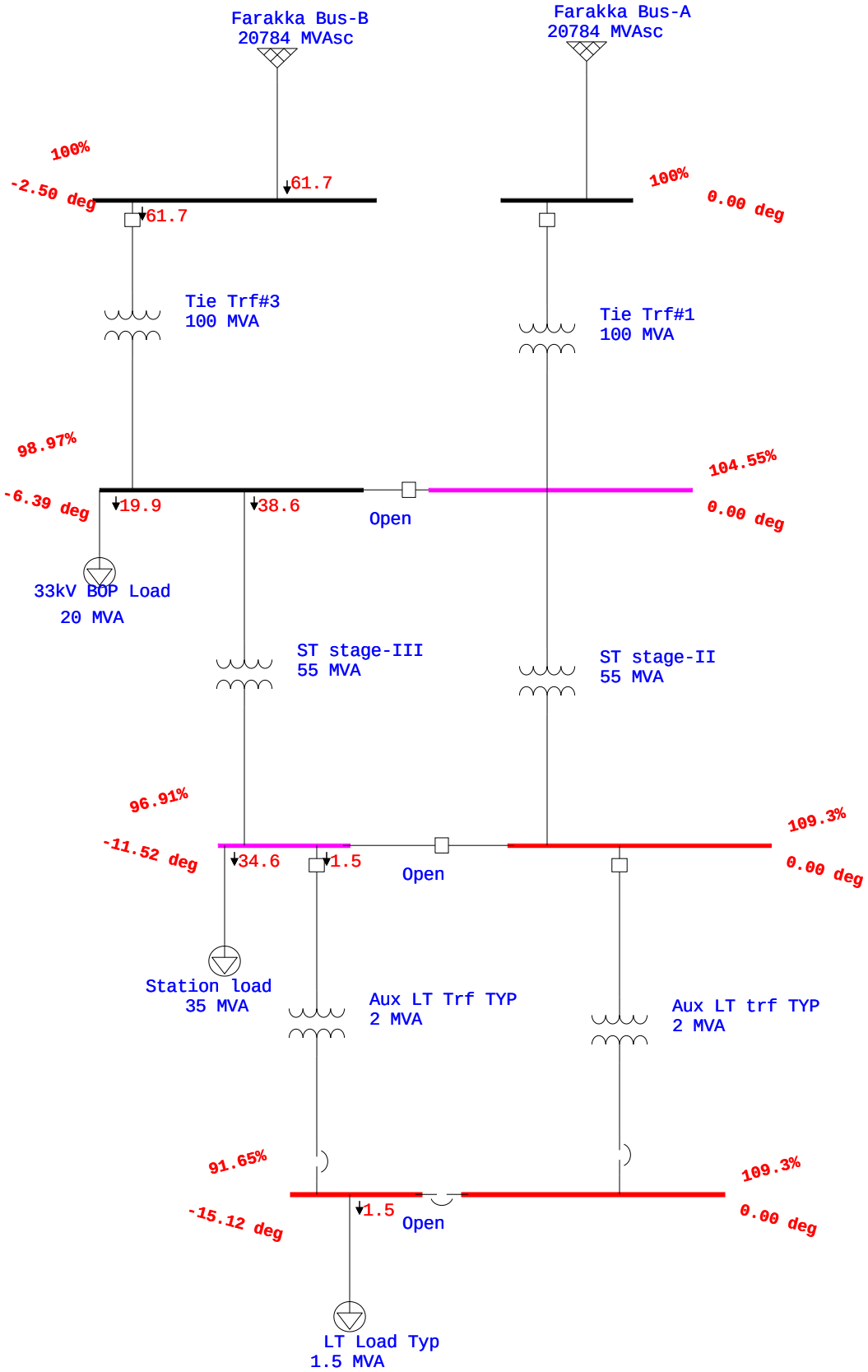
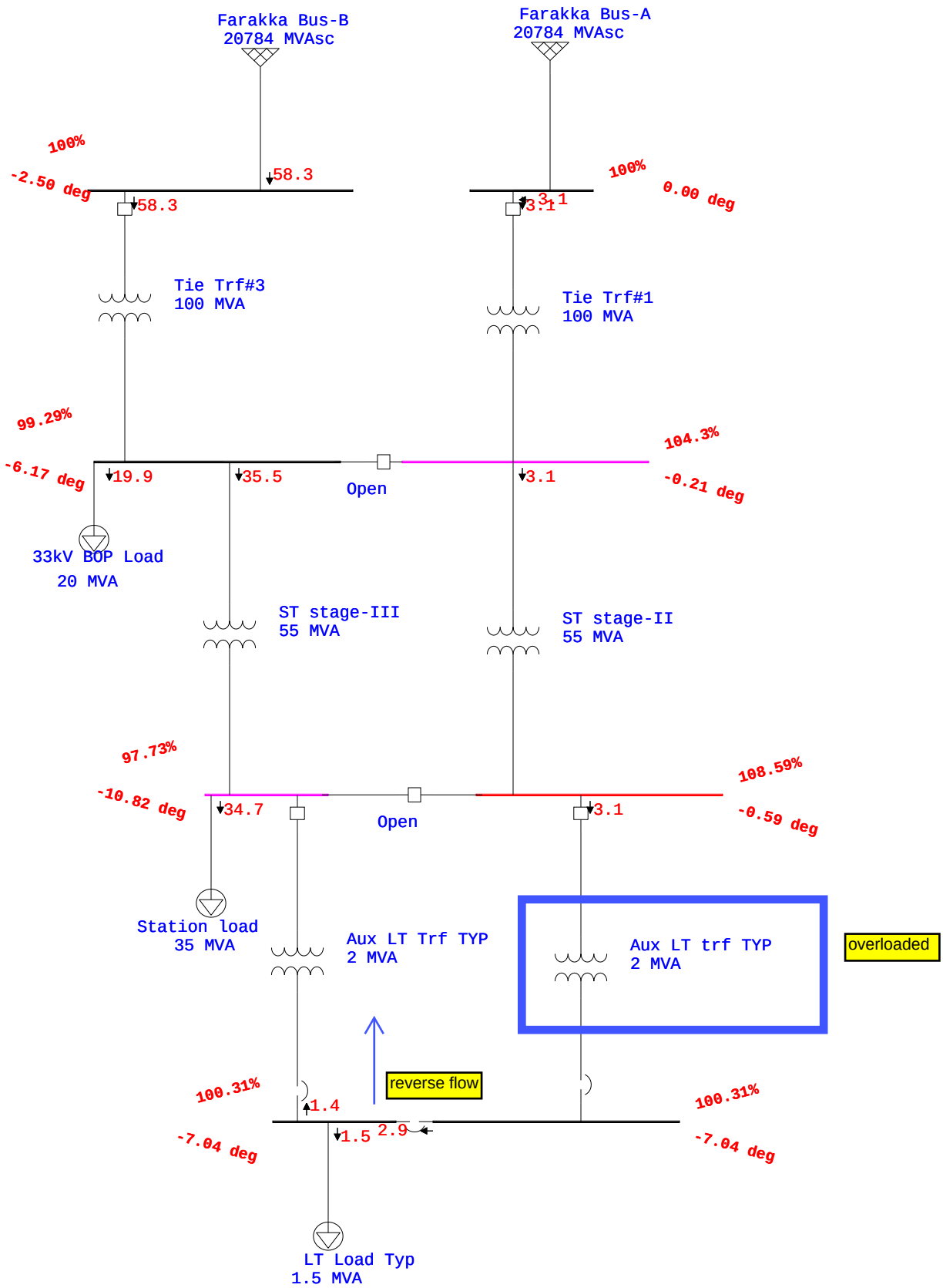

Farakka Bus-B
20784 MVAsc
Farakka Bus-A
20784 MVAsc
100%
-2.50 deg
61.7
61.7
100%
0.00 deg
Tie Trf#3
100 MVA
Tie Trf#1
100 MVA
98.97%
-6.39 deg
19.9
38.6
Open
104.55%
0.00 deg
33kV BOP Load
20 MVA
ST stage-III
55 MVA
ST stage-II
55 MVA
96.91%
-11.52 deg
34.6
1.5
Open
109.3%
0.00 deg
Station load
35 MVA
Aux LT Trf TYP
2 MVA
Aux LT trf TYP
2 MVA
91.65%
-15.12 deg
1.5
Open
109.3%
0.00 deg
LT Load Typ
1.5 MVA


Farakka Bus-B
20784 MVAsc
Farakka Bus-A
20784 MVAsc
100%
-2.50 deg
58.3
58.3
100%
0.00 deg
3.1
Tie Trf#3
100 MVA
Tie Trf#1
100 MVA
99.29%
-6.17 deg
19.9
35.5
Open
104.3%
-0.21 deg
3.1
33kV BOP Load
20 MVA
ST stage-III
55 MVA
ST stage-II
55 MVA
97.73%
-10.82 deg
34.7
Open
108.59%
-0.59 deg
3.1
Station load
35 MVA
Aux LT Trf TYP
2 MVA
Aux LT trf TYP
2 MVA
overloaded
reverse flow
100.31%
-7.04 deg
1.4
1.5
2.9
100.31%
-7.04 deg
LT Load Typ
1.5 MVA

Annexure-V

North Bihar

1. 220/132/33 kV Goraul (District-Vaishali).
2. 220/132/33 kV Tajpur (District-Samastipur).
3. 220/132/33 kV Thakurganj (District-Kishanganj).
4. 132/33 kV Palasi (District-Araria).

South Bihar

1. 220/132/33 kV Digha (New) GIS (District-Patna).
2. 220/132/33 kV Ashthawan (District-Nalanda).
3. 132/33 kV Board Colony GIS (District-Patna).

North Bihar

A. 220/132/33 kV Goraul (District-Vaishali)

1. Grid Voltage level - 220/132/33 kV Goraul
2. Transformation capacity - 2x160 + 3x50 MVA

- Following parameters has been considered during load flow:-
  1. Load on Goraul GSS is 65 MW.
  2. Connectivity at 220 kV level :-
     i. 220 kV D/c Muzaffarpur (PG) – Goraul GSS - 20 Kms.
     ii. 220 kV D/c Goraul – Tajpur (Proposed) GSS - 60 Kms.
  3. Connectivity at 132 kV level :-
     i. LILO of 132 kV D/c Vaishali – Muzaffarpur Tr. Line at Goraul
        a) 132/33 kV D/c Vaishali – Goraul GSS - 30 Kms.
        b) 132/33 kV D/c Muzaffarpur – Goraul GSS - 42 Kms.
     ii. 132 kV D/c 132/33 kV Mahnar – Goraul GSS - 35 Kms.

- **Type of Conductor & Tower :-**
  1. For 220 kV Tr. line, Conductor – ACSR Zebra & Tower – DCDS.
  2. For 132 kV Tr. line, Conductor – ACSR Panther & Tower – DCDS.

- **Benefits :-**
  1. 132/33 kV Vaishali GSS offloaded by 20 MW.
  2. 132/33 kV Hajipur GSS offloaded by 30 MW.
  3. Improve the Power reliability & Quality power will be available.
  4. Provide second source to 132 kV GSS.

- **Load flow study:-**
  Report enclosed.

- **Remarks:-**
  1. Distance between Grids S/s and load on proposed Grid S/s is tentative subject to verification.
  2. It is also being proposed for 2nd circuit stringing from Jandaha GSS to Mahnar GSS as such at present single circuit stringing may be done to Mahnar GSS to proposed GSS Goraul with DCSS tower. In future, if the load will increase then 2nd circuit may be stringed.

B. 220/132/33 kV Tajpur (District-Samastipur)

1. Grid Voltage level - 220/132/33 kV Tajpur
2. Transformation capacity - 2x160 + 3x50 MVA

➢ Following parameters has been considered during load flow:-

1. Load on Tajpur GSS is 50 MW.
2. Connectivity at 220 kV level :-
   - i. 220 kV D/c Samastipur (New) – Tajpur GSS - 20 Kms.
   - ii. 220 kV D/c Goraul (Proposed) – Tajpur GSS - 60 Kms.
3. Connectivity at 132 kV level :-
   - i. LILO of 132 kV S/c Samastipur (Old) – Dalsinghsarai Tr. Line at Tajpur
     - A. 132/33 kV S/c Samastipur (Old) – Tajpur GSS - 27 Kms.
     - B. 132/33 kV S/c Dalsinghsarai – Tajpur GSS - 25 Kms.
   - ii. 132 kV D/c Sahpur Patori – Tajpur GSS - 40 Kms.

➢ **Type of Conductor & Tower :-**

1. For 220 kV Tr. line, Conductor – ACSR Zebra & Tower – DCDS.
2. For 132 kV Tr. line, Conductor – ACSR Panther & Tower – SCSS & DCDS.

➢ **Benefits :-**

1. 132/33 kV Samastipur (Old) GSS offloaded by 25 MW.
2. Improve the Power reliability & Quality power will be available.
3. Provide second source to 132 kV GSS.

➢ **Load flow study:-**

Report enclosed.

➢ **Remarks:-**

1. Distance between Grids S/s and load on proposed Grid S/s is tentative subject to verification.
2. It is also being proposed for 2nd circuit stringing from Sahpur Patori GSS to Samastipur (New) GSS as such at present single circuit stringing may be done to Sahpur Patori GSS to proposed GSS Tajpur with DCSS tower. In future, if the load will increase then 2nd circuit may be stringed

C. 220/132/33 kV Thakurganj (District-Kishanganj)

1. Grid Voltage level - 220/132/33 kV Thakurganj
2. Transformation capacity - 2x160+3x50 MVA

- Following parameters has been considered during load flow:-
  1. Load on Thakurganj GSS is 40 MW.
  2. Connectivity at 220 kV level :-
     i. 220 kV D/c Kishanganj (New) – Thakurganj GSS - 50 Kms.
  3. Connectivity at 132 kV level :-
     i. 132 kV D/c Thakurganj (New) – Araria GSS -80 Kms

- **Type of Conductor & Tower :-**
  1. For 220 kV Tr. line, Conductor – ACSR Zebra & Tower – DCDS.
  2. For 132 kV Tr. line, Conductor – ACSR Panther & Tower – DCDS

- **Benefits :-**
  1. 132/33 kV Kishanganj (Old) GSS offloaded by 40 MW.
  2. Improve the Power reliability & Quality power will be available.

- **Load flow study:-**
  Report enclosed.

- **Remarks:-**
  1. Distance between Grids S/s and load on proposed Grid S/s is tentative subject to verification.

D. 132/33 kV Palasi (District-Araria)

1. Grid Voltage level - 132/33 kV Palasi
2. Transformation capacity - 2x50 MVA

- Following parameters has been considered during load flow:-
  1. Load on Palasi GSS is 50 MW.
  2. Connectivity at 132 kV level :-
     i. LILO of one of the circuit of 132 kV F/c Forbisganj – Kishanganj (Old) Tr. Line at Palasi
        a. 132/33 kV S/c Forbisganj – Palasi GSS - 75 Kms.
        b. 132/33 kV S/c Kishanganj (Old) – Palasi GSS - 53 Kms.

- **Type of Conductor & Tower :-**
  1. For 132 kV Tr. line, Conductor – ACSR Panther & Tower – DCDS

- **Benefits :-**
  1. 132/33 kV Forbisganj GSS offloaded by 25 MW.
  2. 4 nos. of new PSS under DDGJY/IDPS will be connected.
  3. Improve the Power reliability & Quality power will be available.

- **Load flow study:-**
  Report enclosed.

- **Remarks:-**
  Distance between Grids S/s and load on proposed Grid S/s is tentative subject to verification.

South Bihar

A. 220/132/33 kV Digha (New) GIS (District-Patna)

1. Grid Voltage level - 220/132/33 kV Digha (New) GIS
2. Transformation capacity - 2x200 + 2x80 MVA

- Following parameters has been considered during load flow:-
  1. Load on Digha (New) GIS is 100 MW.
  2. Connectivity at 220 kV level :-
     i. 220 kV D/c Chapra (New) Amnour – Digha (New) GIS - 96 Kms.
  3. Connectivity at 132 kV level :-
     i. 132/33 kV D/c Digha (Old) – Digha (New) GIS - 01 Km.
     ii. 132/33 kV D/c Board Colony – Digha (New) GIS - 07 Kms.

- **Type of Conductor & Tower :-**
  1. For 220 kV Tr. line, Conductor – ACSR Zebra & Tower – DCDS.
  2. For 132 kV Tr. line, Conductor – ACSR Panther/ XLPE Cable & Tower –.

- **Benefits :-**
  1. 132/33 kV Jakkanpur GSS offloaded by 60 MW.
  2. Improve the Power reliability & Quality power will be available.
  3. Provide second source to 132 kV GSS.

- **Load flow study:-**
  Report enclosed.

- **Remarks:-**
  1. Distance between Grids S/s and load on proposed Grid S/s is tentative subject to verification.

B. 220/132/33 kV Ashthawan (District-Nalanda)

1. Grid Voltage level - 220/132/33 kV Ashthawan
2. Transformation capacity - 2x160 + 3x50 MVA

- Following parameters has been considered during load flow:-
  1. Load on Ashthawan GSS is 80 MW.
  2. Connectivity at 220 kV level :-
     - i. 220 kV D/c Biharshariff (BSPTCL) – Ashthawan GSS - 20 Kms.
     - ii. 220 kV D/c Sheikhpura (BGCL) GIS – Ashthawan GSS - 15 Kms.
  3. Connectivity at 132 kV level :-
     - i. 132/33 kV S/c Nalanda – Ashthawan GSS - 25 Kms.
     - ii. 132/33 kV S/c Rajgir – Ashthawan GSS - 35 Kms.
     - iii. 132/33 kV S/c Barh – Ashthawan GSS - 32 Kms.

- **Type of Conductor & Tower :-**
  1. For 220 kV Tr. line, Conductor – ACSR Zebra & Tower – DCDS.
  2. For 132 kV Tr. line, Conductor – ACSR Panther & Tower – DCSS.

- **Benefits :-**
  1. 132/33 kV Baripahari GSS offloaded by 20 MW.
  2. Improve the Power reliability & Quality power will be available.
  3. Provide second source to 132 kV GSS.

- **Load flow study:-**
  Report enclosed.

- **Remarks:-**
  1. Distance between Grids S/s and load on proposed Grid S/s is tentative subject to verification.
  2. It is also being proposed that at present single circuit stringing may be done in between Nalanda – Ashthawan GSS, Rajgir – Ashthawa;n GSS and Barh – Ashthawan GSS with DCSS tower. In future, if the load will increase then 2nd circuit may be stringed.

C. 132/33 kV Board Colony GIS (District-Patna)

1. Grid Voltage level - 132/33 kV
2. Transformation capacity - 2x580 MVA

- Following parameters has been considered during load flow:-
  1. Load on Board Colony GIS is 80 MW.
  2. Connectivity at 132 kV level :-
     i. 132/33 kV S/c Board Colony – Digha (New) GIS - 07 Kms

- **Type of Conductor & Tower :-**
  1. For 132 kV Tr. line, Conductor – XLPE Cable

- **Benefits :-**
  1. Improve the Power reliability & Quality power will be available.

- **Load flow study:-**
  Report enclosed.

- **Remarks:-**
  Distance between Grids S/s and load on proposed Grid S/s is tentative subject to verification

Annexure-I/32

Annexure-VI

Transmission System Strengthening in Bihar

Time-frame: 2021-22

(With New Strengthening)

(Nepal) Ram Nagar Narkatiyaganj Dhanaha Bettiah Raxaul (Nepal) Dhalkebar (Nepal) Raxaul New Areraj To Gorakhpur Gopalganj Maharajganj Masrakh Hathua Siwan Siwan-New Ekma Motihari Dhaka Pakridayal Motihari (New) Sitamarhi (New) Sitamarhi Sheohar Pupri Belsand Chakiya Motipur SKMCH Runni Saidpur Benipatti Kanti Muzaffarpur (PG) Muzaffarpur Mushahari Darbhanga (220) Darbhanga (132) Darbhanga (400) Gangwara Jai Nagar Madhubani Pandaul Jhanjharpur Phulparas Laukhi Nirmali Raghopur Supaul Kusaha (Nepal) Kataiyya Triveniganj Forbesganj Araria Palasi Thakurganj Teesta-3 Siliguri Kishngn Dalko Baisi Madhepura Benipur Shahpur patori Samastipur Vaishali Garaul Chhapra Shitalpur Chhapra Tajpur Rosera Kusheshwar Saharsa Banmankhi Purnea Purnea(PG) Siliguri Dhamdaha Uda Kishanganj Barsoi Balia Balia Buxar (2x660) Dumraon (New) Buxar Varanasi Allahabad Fatehpur Karmnasa Karmnasa (New) Sahupuri (UP) Kochas Kudra Mohania Pusauli Ramgarh Bhabhua Sasaram Sasaram- PG Dehri Kerpa Sonenagar (New) Banjari DLTGANJ Garhwa Arrah(PG) Arrah Jagdishpur Digha Khagaul Patna Area Fatuha Bakhtiyarpur Naubatpur Jakkanpur Sipara Patna (PG) Bakhtiyarpur Manhar Hazipur Jandha Manjhaul Bakhri Barh Barh Teghra Barauni TPS Harnaut Hathidah (New) Baripahari Begusarai Balia Saharsa (New) Khagaria Simri Sonebarsa Khagaria-New Naugachhia Korha Manihari Katihar Malda Gokarna Farakka Jehnbad Masaurhi Ataula Ekangar B'Sharif Ashthawan Bkrmgnj Piro Tekari Goh Tehta Bel'gnj Hulas Nalanda Rajgir Biharsharif (PG) Sheikhpura Lakhi Sarai Jamalpur Sltngnj Tarapur Sabour (New) Sbr Khl'gn Nth'ngr Kahalgaon Pirpainti (2X660) Khizirsarai Wajirganj Nawada Warsliganj Barhi Koderma Tenughat Gaya Rafiganj NABI-1 Chandauti (New) Chandauti Aurangabad Nabinagar NABI-2 Sherghat Imamganj Bodhgaya NKSTPP Ranchi via Jharkhand Pool Maithon B Jamui Jamui-New Lakhisarai(PG) Lakhisarai TPS(2X660) Kajra Pool Banka-New Banka Lalmatia Deoghar A B Maithon

765 kV Line
400 kV Line
220 kV Line
132 kV Line

Strengthening Phase-3
Strengthening Phase-4 (Part 1 of 2) : BGCL
Strengthening Phase-4 (Part 2 of 2) : BGCL
Strengthening Phase-4 (Part 2 of 2) : BSPTCL
Generation Linked Phase-5
13th Plan : BSPTCL
13th Plan : POWERGRID

Annexure-VII

```
    PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(R)E     TUE, MAR 19 2019  14:57
                        OUTPUT FOR ZONE 41 [BIHAR       ]
SUBSYSTEM LOADING CHECK (INCLUDED: LINES) (EXCLUDED: BREAKERS AND SWITCHES; TRANSFORMERS)
CURRENT LOADINGS ABOVE  70.0 % OF RATING SET B:

X--------- FROM BUS ----------X X---------- TO BUS -----------X
  BUS# X-- NAME --X BASKV  AREA   BUS# X-- NAME --X BASKV  AREA CKT LOADING  RATING PERCENT

411007 JAKKANPUR   132.00     4 411135 JAKKANPUR-NW132.00*    4  1    191.2   240.0    79.7
411007 JAKKANPUR   132.00     4 411135 JAKKANPUR-NW132.00*    4  2    191.2   240.0    79.7
```

- Due to deletion of Sipara-Karbigaiya 132kV (HLTS) D/c. Additional feed to meet demand of about 550MW (290-Jakkanpur; 190-Mithapur & 65-Karbigaiya) may be planned, as the three substations are being fed through three 132kV lines (HTLS). N-1 or N-1-1 could lead sever power supply constraint.

```
411009 DEHRI       132.00     4 411253 KERPA       132.00*    4  1     81.8    84.0    97.4
```

- BSPTCL may check and plan. Overloading under N-1 of Dehri – Sasaram 132kV.

```
411010 KAHALGN-BSEB132.00     4 411189 KAHALGAON-B 132.00*    4  1     81.5    84.0    97.0
411185 SABOUR      132.00     4 411189 KAHALGAON-B 132.00*    4  1     88.5    84.0   105.3
```

- BSPTCL may check and plan. Overloading on one line under N-1 of other 132kV line.

```
411031 SONENAGAR   132.00     4 411184 CHANDAUTI NW132.00*    4  1     62.9    84.0    74.9
411032 RAFIGANJ    132.00     4 411184 CHANDAUTI NW132.00*    4  1    100.3    84.0   119.4
```

- BSPTCL may check and plan. Overloading on one line under N-1 of other 132kV line.

```
411035 PUSAULI BSPT132.00     4 411109 SASARAM-BSEB132.00*    4  1     58.8    84.0    70.0
```

- BSPTCL may check and plan. Overloading under N-1 of Dehri – Sasaram 132kV line.

```
411036 RAMNAGAR    132.00     4 411053 BETIAH      132.00*    4  1     81.2    84.0    96.7
411052 DHANAHA     132.00     4 411053 BETIAH      132.00*    4  1     65.6    84.0    78.1
411053 BETIAH      132.00     4 411173 NARKATIYAGAN132.00*    4  1     61.3    84.0    73.0
```

- BSPTCL may check and plan. Overloading on one line under N-1 of other 132kV line.

```
411045 ARRAH       132.00     4 411046 ARRAH-PG    132.00*    4  1    112.3    84.0   133.6
```

- BSPTCL may check and plan. Base case overloading.

```
411068 GOPALGANJ   132.00*    4 411130 MASHRAKH    132.00     4  1     81.2    84.0    96.6
```

- Overload under N-1 of Gopalganj-Hathua 132kV line

Following 132kV D/c lines are observed to be overloaded under N-1 of parallel circuit. Some lines are overloaded in base case itself. Base case loading are shown below. BSPTCL may review and plan accordingly.

411070	MOTIHARI-NEW	132.00*	4	411101	RAXAUL	132.00	4	1	86.8	84.0	103.3
411070	MOTIHARI-NEW	132.00*	4	411101	RAXAUL	132.00	4	2	86.8	84.0	103.3
411001	KANTI	132.00	4	411181	SKMCH	132.00*	4	1	66.0	84.0	78.6
411001	KANTI	132.00	4	411181	SKMCH	132.00*	4	2	66.0	84.0	78.6
411009	DEHRI	132.00	4	411031	SONENAGAR	132.00*	4	1	74.6	84.0	88.8
411009	DEHRI	132.00	4	411031	SONENAGAR	132.00*	4	2	74.6	84.0	88.8
411013	KARAMNASA	132.00	4	411015	KARAMNASA NW	132.00*	4	1	59.8	84.0	71.2
411013	KARAMNASA	132.00	4	411015	KARAMNASA NW	132.00*	4	2	59.8	84.0	71.2
411053	BETIAH	132.00	4	411070	MOTIHARI-NEW	132.00*	4	1	89.5	84.0	106.5
411053	BETIAH	132.00	4	411070	MOTIHARI-NEW	132.00*	4	2	89.5	84.0	106.5
411064	LAKHISRA-PG	132.00*	4	411072	LAKISAR-BSEB	132.00	4	1	123.9	160.0	77.4
411064	LAKHISRA-PG	132.00*	4	411072	LAKISAR-BSEB	132.00	4	2	123.9	160.0	77.4
411014	BEGUSRAI	132.00*	4	411025	BARAUNI	132.00	4	1	85.5	84.0	101.8
411014	BEGUSRAI	132.00*	4	411025	BARAUNI	132.00	4	2	85.5	84.0	101.8
411042	MADHEPURA	132.00*	4	411182	SUPAUL	132.00	4	1	105.6	84.0	125.7
411042	MADHEPURA	132.00*	4	411182	SUPAUL	132.00	4	2	105.6	84.0	125.7
411080	KISH-NW-BSEB	132.00*	4	411083	FORBESGANJ	132.00	4	1	74.7	84.0	88.9
411080	KISH-NW-BSEB	132.00*	4	411083	FORBESGANJ	132.00	4	2	74.7	84.0	88.9
411083	FORBESGANJ	132.00	4	411084	KATAIYYA	132.00*	4	1	72.2	84.0	86.0
411083	FORBESGANJ	132.00	4	411084	KATAIYYA	132.00*	4	2	81.3	84.0	96.8
411083	FORBESGANJ	132.00	4	411084	KATAIYYA	132.00*	4	3	72.2	84.0	86.0
411084	KATAIYYA	132.00*	4	411182	SUPAUL	132.00	4	1	67.0	84.0	79.8
411084	KATAIYYA	132.00*	4	411182	SUPAUL	132.00	4	2	67.0	84.0	79.8
411114	MOTIPUR	132.00	4	411180	MUZAFFARPUR	132.00*	4	1	64.0	84.0	76.2
411114	MOTIPUR	132.00	4	411180	MUZAFFARPUR	132.00*	4	2	64.0	84.0	76.2
411127	TEKARI	132.00	4	411177	CHANDAUTI	132.00*	4	1	58.9	84.0	70.1
411127	TEKARI	132.00	4	411177	CHANDAUTI	132.00*	4	2	58.9	84.0	70.1
411177	CHANDAUTI	132.00	4	411184	CHANDAUTI NW	132.00*	4	1	97.6	84.0	116.2
411177	CHANDAUTI	132.00	4	411184	CHANDAUTI NW	132.00*	4	2	79.1	84.0	94.1

Annexure-I/35

Annexure-VIII

Transmission System Strengthening in Bihar

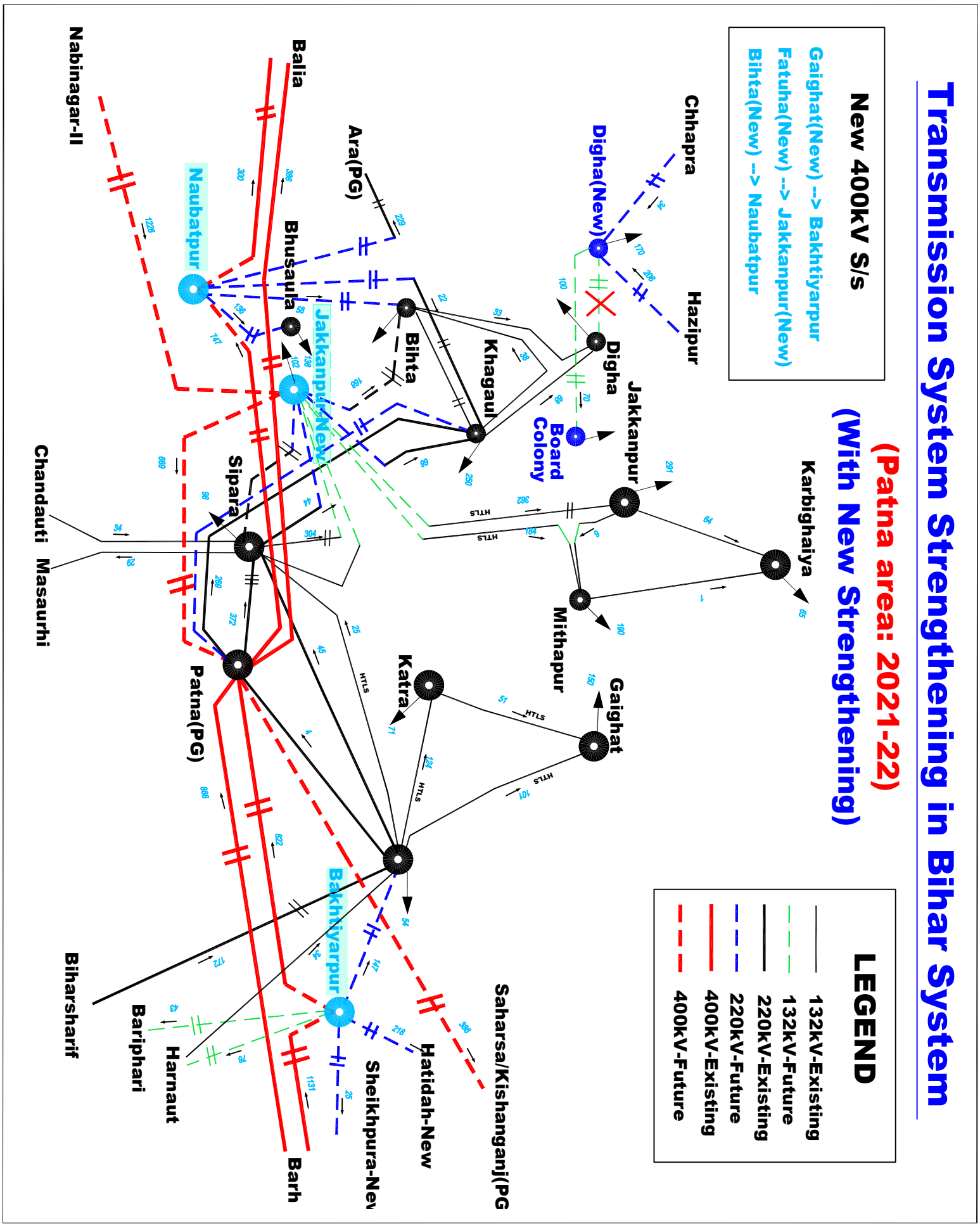
Time-frame: 2021-22

(With New Strengthening-132kV and 220kV)

Gandak (Nepal)
Ram Nagar
Narkatiyaganj
Dhanaha
Bettiah
Raxaul
Parwanipur (Nepal)
Dhalkebar (Nepal)
Raxaul New
Areraj
To Gorakhpur
Gopalganj
Maharajganj
Masrakh
Hathua
Siwan
Siwan-New
Motihari
Dhaka
Pakridayal
Motihari (New)
Sitamarhi (New)
Sitamarhi
Sheohar
Pupri
Benipatti
Chakiya
Belsand
Motipur
SKMCH
Runni Saidpur
Kanti
Mushahari
Darbhanga (220)
Muzaffarpur (PG)
Muzaffarpur
Darbhanga (132)
Darbhanga (400)
Gangwara
Pandaul
Madhubani
Jai Nagar
Kusaha (Nepal)
Phulparas
Laukhi
Nirmali
Jhanjharpur
Raghopur
Supaul
Kataiyya
Forbesganj
Triveniganj
Araria
Palasi
Thakurganj
Teesta-3
Siliguri
Kishngnj
Dalkola
Baisi
Purnea
Purnea(PG)
Barsoi
Dhamdaha
Uda Kishanganj
Madhepura
Saharsa
Saharsa(New)
Banmankhi
Sonebarsa
Simri
Khagaria
Korha
Manihari
Katihar
Naugachhia
Khagaria-New
Begusarai
Bakhri
Manjhaul
Rosera
Dalsingsarai
Kusheshwar
Samastipur
Shahpur patori
Benipur
Tajpur
Vaishali
Garaul
Chhapra
Ekma
Shitalpur
Jandha
Manhar
Hazipur
Digha
Khagaul
Patna Area
Fatuha
Bakhtiyarpur
Naubatpur
Jakkanpur
Sipara
Patna (PG)
Harnaut
Barh
Barh Teghra
Barauni TPS
Hathidah (New)
Balia
Baripahari
Bakhtiyarpur
Masaurhi
Jehnbad
B'Sharif
Ekangar
Ataula
Ashthawan
Biharsharif (PG)
Sheikhpura
Lakhi Sarai
Jamalpur
Sltngnj
Sabour (New)
Sbr
Khl'gn
Tarapur
Nth'ngr
Kahalgaon
Pirpainti (2X660)
Gokarna
Farakka
Banka
Banka-New
Lalmatia
Maithon
Jamui
Jamui-New
Lakhisarai(PG)
Lakhisarai TPS(2X660)
Kajra Pool
Deoghar
Tekari
Goh
Tehta
Bel'gnj
Nalanda
Hulas
Rajgir
Wajirganj
Nawada
Warsliganj
Barhi
Koderma
Tenughat
Khizirsarai
Gaya
Rafiganj
Sonenagar (New)
Banjari
DLTGANJ
Garhwa
NABI-1
Chandauti (New)
Chandauti
Aurangabad
Nabinagar
NABI-2
Sherghat
Imamganj
Bodhgaya
NKSTPP
Ranchi via Jharkhand Pool
Dehri
Sasaram- PG
Sasaram
Ramgarh
Bhabhua
Pusauli
Mohania
Sahupuri (UP)
Karmnasa
Karmnasa (New)
Kudra
Kochas
Bkrmgnj
Piro
Arrah(PG)
Arrah
Jagdishpur
Buxar
Buxar (2x660)
Dumraon (New)
Varanasi
Allahabad
Fatehpur
Balia
Maithon B

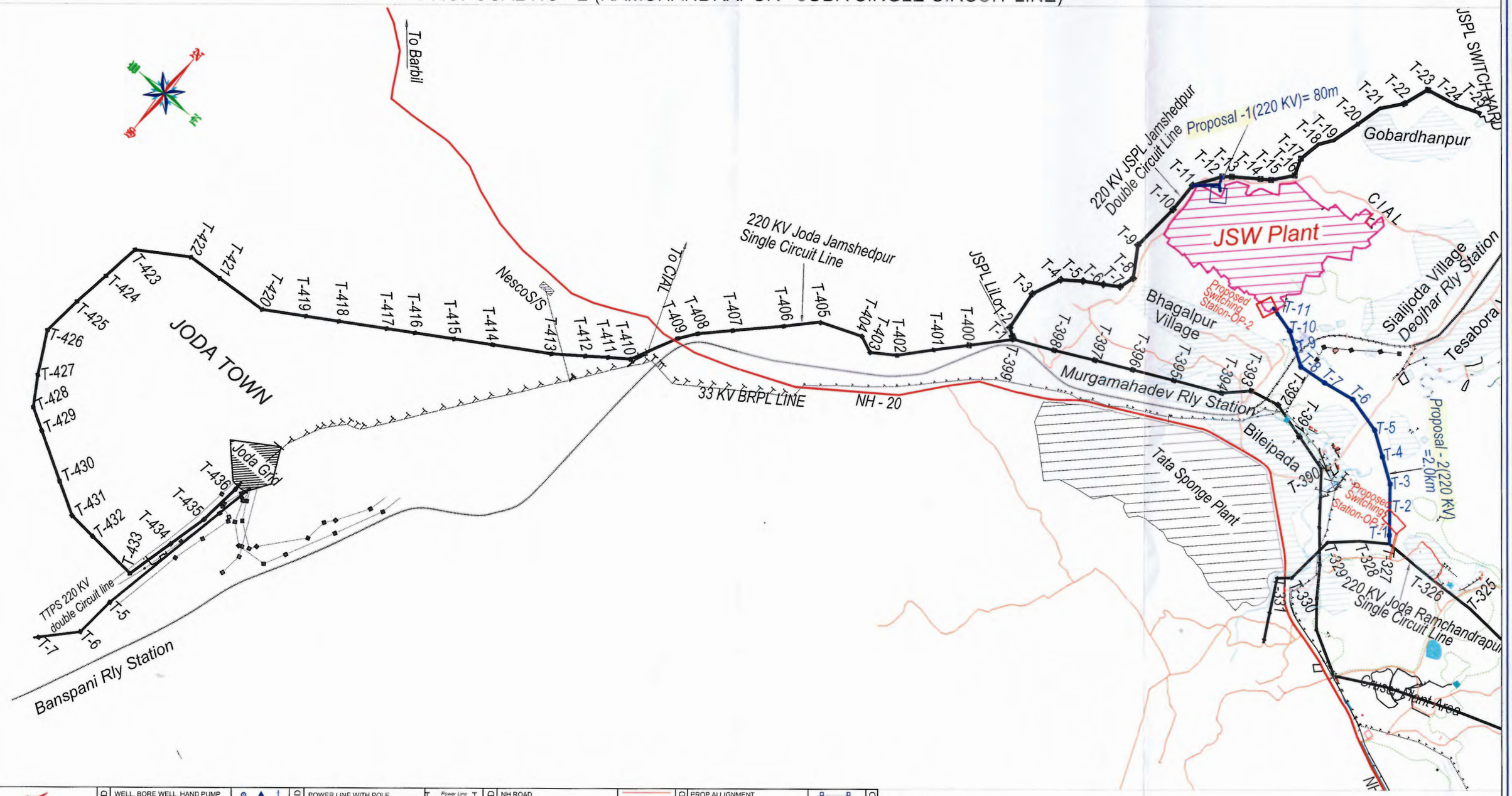
765 kV Line
400 kV Line
220 kV Line
132 kV Line

Strengthening Phase-3
Strengthening Phase-4 (Part 1 of 2) : BGCL
Strengthening Phase-4 (Part 2 of 2) : BGCL
Strengthening Phase-4 (Part 2 of 2) : BSPTCL
Generation Linked Phase-5
13th Plan : BSPTCL
13th Plan : POWERGRID

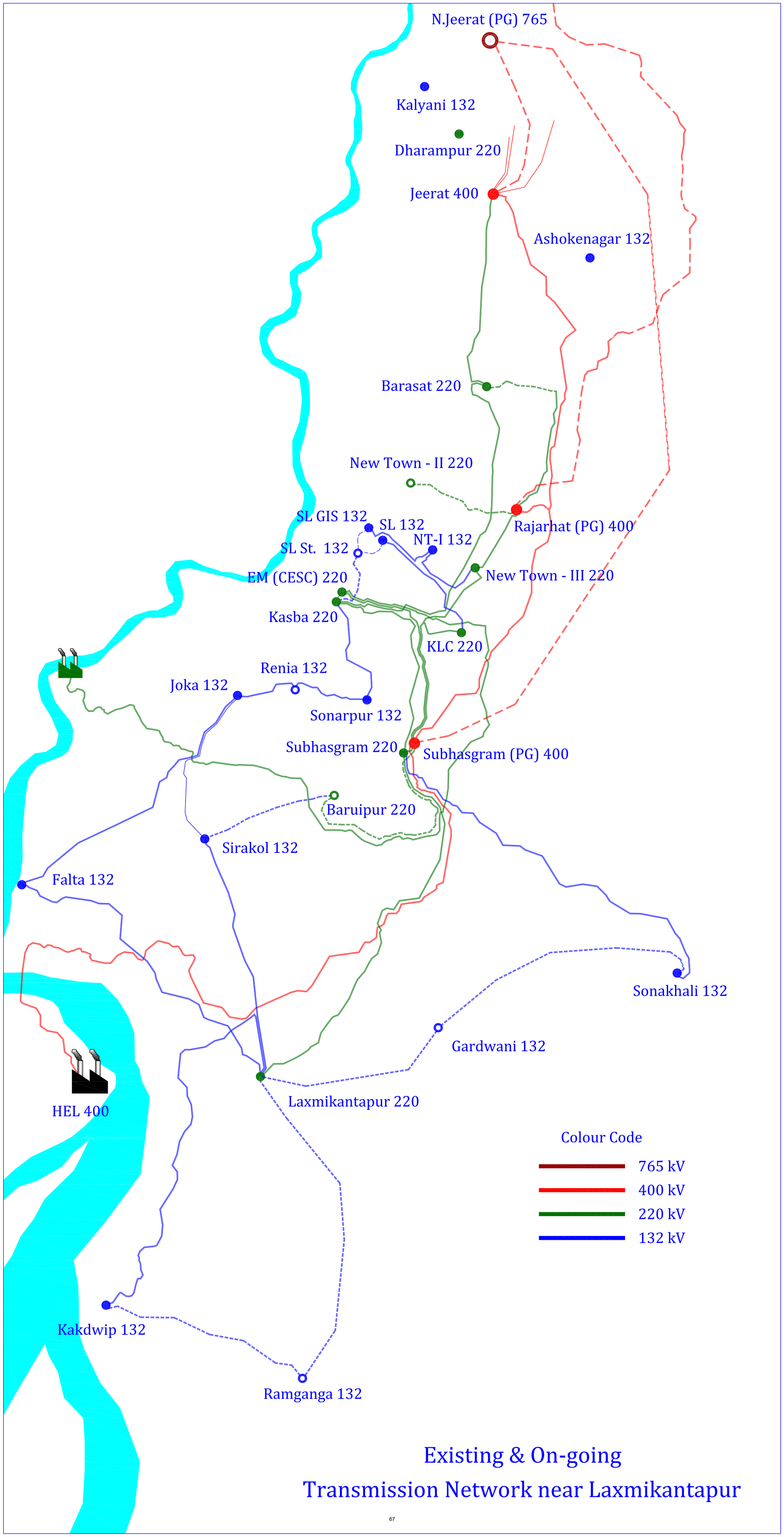

Transmission System Strengthening in Bihar System
(Patna area: 2021-22)
(With New Strengthening)
New 400kV S/s
Gaighat(New) --> Bakhtiyarpur
Fatuha(New) --> Jakkanpur(New)
Bihta(New) --> Naubatpur
LEGEND
132kV-Existing
132kV-Future
220kV-Existing
220kV-Future
400kV-Existing
400kV-Future
Chhapra
Hazipur
Digha(New)
Digha
Board Colony
Jakkanpur
Karbighaiya
Mithapur
Gaighat
Katra
Khagaul
Bihta
Ara(PG)
Bhusaula
Balia
Nabinagar-II
Naubatpur
Jakkanpur(New)
Sipara
Chandauti
Masaurhi
Patna(PG)
Bakhtiyarpur
Barh
Sheikhpura-New
Hatidah-New
Saharsa/Kishanganj(PG
Harnaut
Bariphari
Biharsharif
HTLS

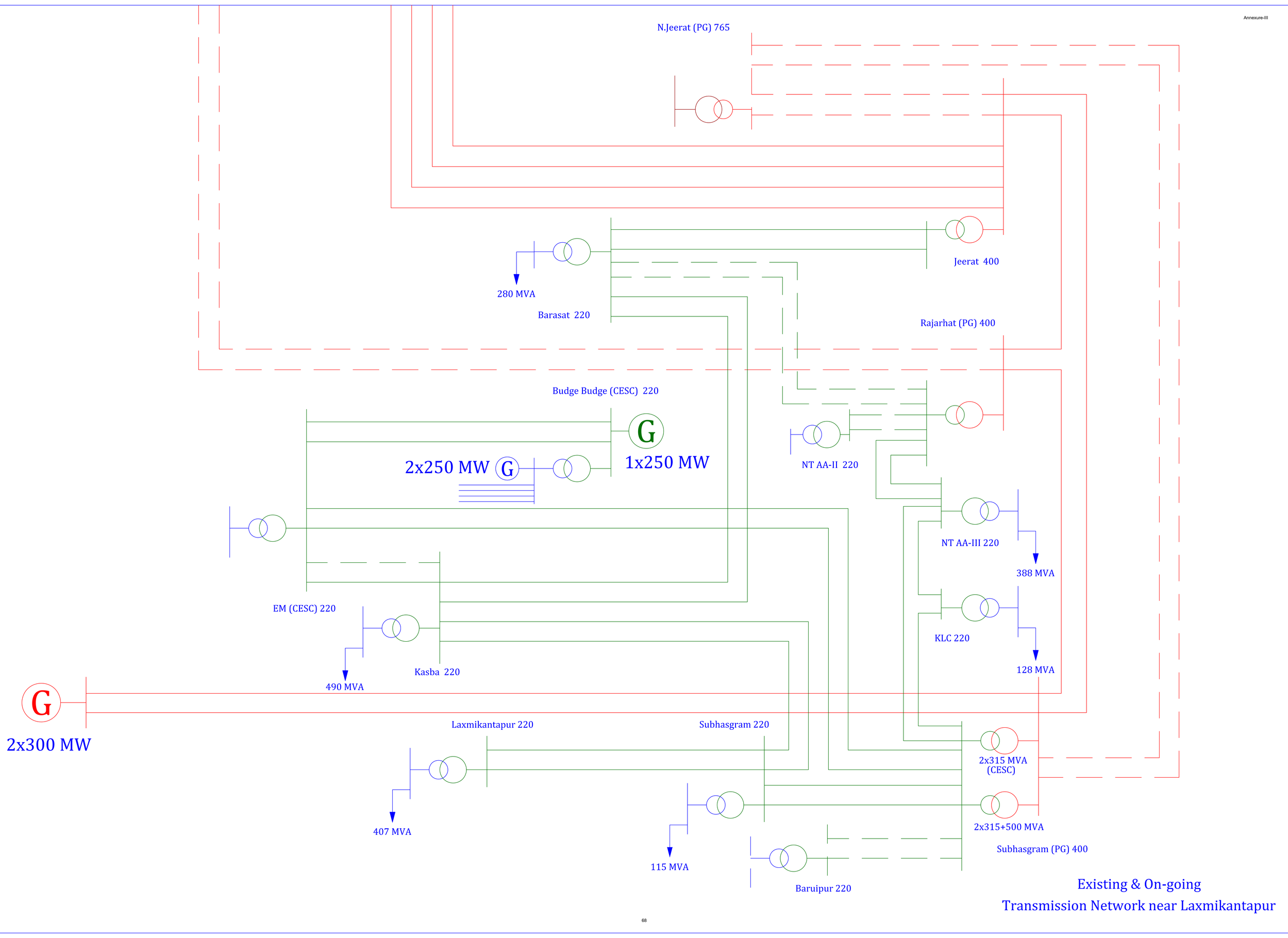
LOCATION MAP OF PROPOSE 220 KV TRANSMISSION LINE TO JSW PLANT AT GOBARDHANPUR, JODA.

PROPOSAL NO - 2 (RAMCHANDRAPUR - JODA SINGLE CIRCUIT LINE)

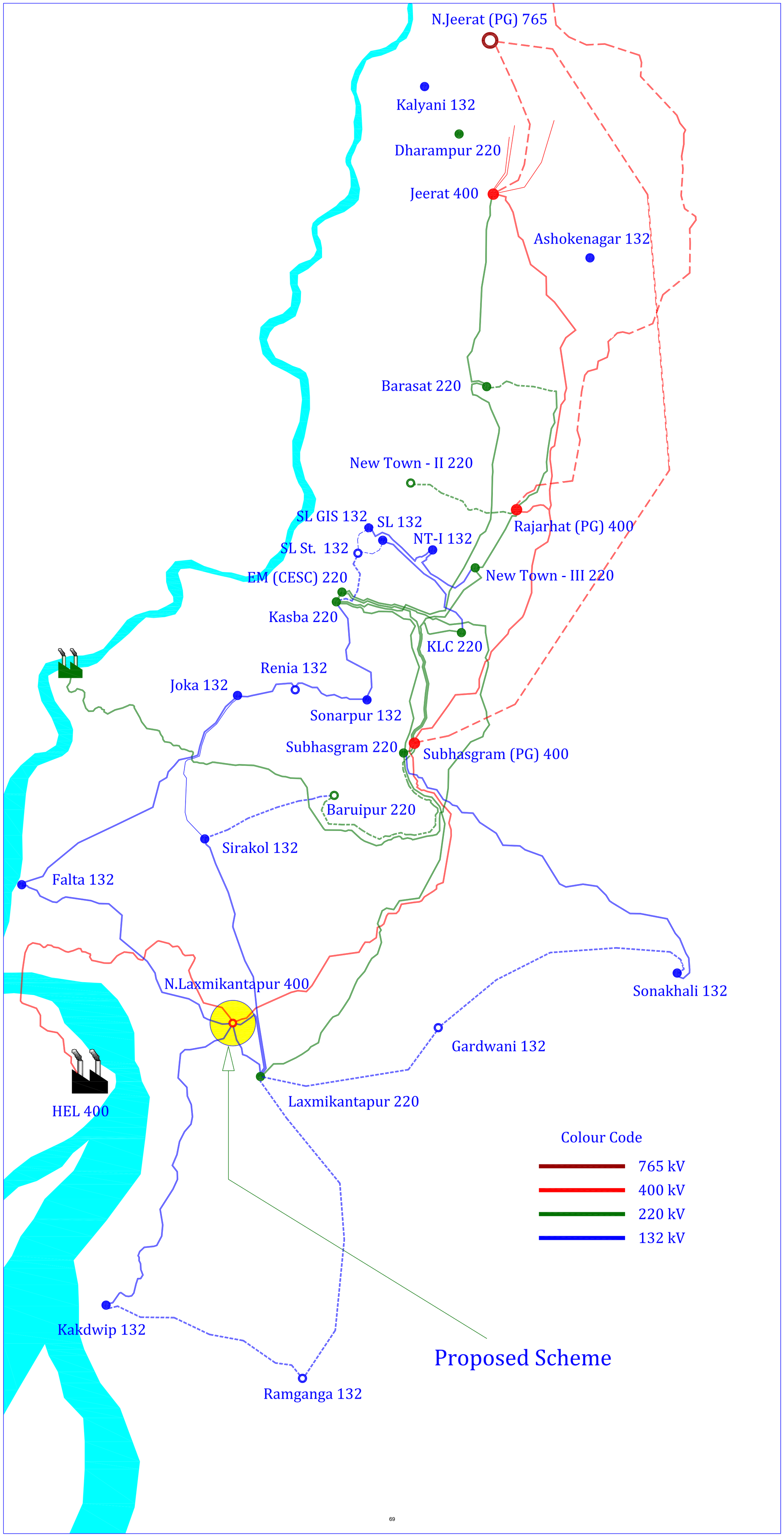


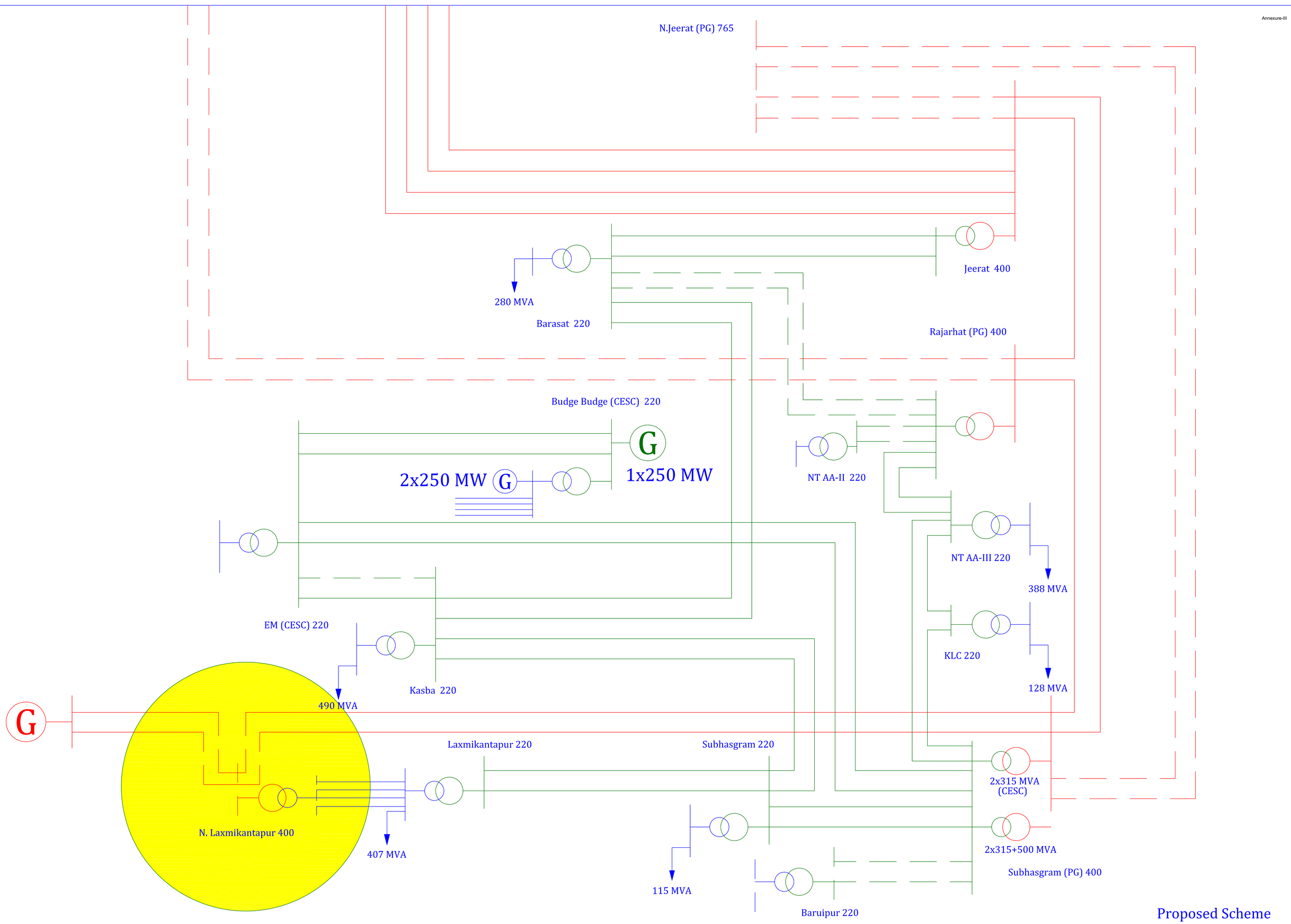
LEGEND	WELL, BORE WELL HAND PUMP	LEGEND	POWER LINE WITH POLE	LEGEND	NH ROAD	LEGEND	PROP.ALLIGNMENT		SCALE = 1 : 40,000		
	LIGHT POST , MAST		MAIN POWER LINE		RAILWAY TRACK		MATIONARY DRAIN		NALA / DOUBLE LINE NALA		
	TEMPLE, SIGN BOARD		WATER LOGGED AREA		BUILDING, SHED		WATER SUPPLY		TELEPHONE POLE		
	HYDRANT, VALVE		VILLAGE AREA		HUT, CABIN		FOOT HILL				

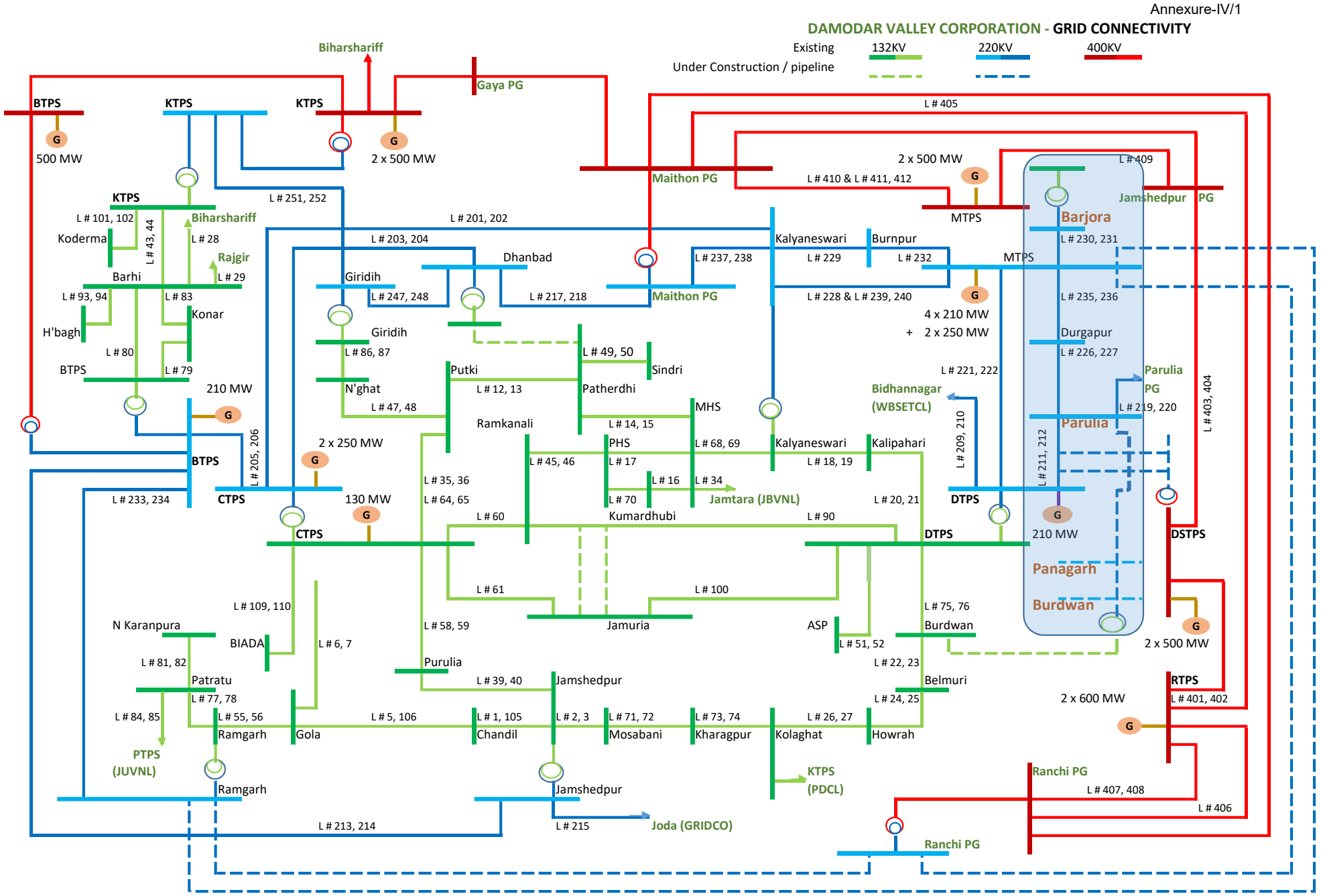

N.Jeerat (PG) 765
Kalyani 132
Dharampur 220
Jeerat 400
Ashokenagar 132
Barasat 220
New Town - II 220
SL GIS 132
SL 132
NT-I 132
SL St. 132
Rajarhat (PG) 400
New Town - III 220
EM (CESC) 220
Kasba 220
KLC 220
Renia 132
Joka 132
Sonarpur 132
Subhasgram 220
Subhasgram (PG) 400
Baruipur 220
Sirakol 132
Falta 132
Sonakhali 132
Gardwani 132
Laxmikantapur 220
HEL 400
Kakdwip 132
Ramganga 132
Colour Code
765 kV
400 kV
220 kV
132 kV
Existing & On-going
Transmission Network near Laxmikantapur



Existing & On-going
Transmission Network near Laxmikantapur


N.Jeerat (PG) 765
Kalyani 132
Dharampur 220
Jeerat 400
Ashokenagar 132
Barasat 220
New Town - II 220
SL GIS 132
SL 132
NT-I 132
SL St. 132
Rajarhat (PG) 400
New Town - III 220
EM (CESC) 220
Kasba 220
KLC 220
Renia 132
Joka 132
Sonarpur 132
Subhasgram 220
Subhasgram (PG) 400
Baruipur 220
Sirakol 132
Falta 132
N.Laxmikantapur 400
Sonakhali 132
Gardwani 132
Laxmikantapur 220
HEL 400
Kakdwip 132
Ramganga 132
Colour Code
765 kV
400 kV
220 kV
132 kV
Proposed Scheme


N.Jeerat (PG) 765
Jeerat 400
280 MVA
Barasat 220
Rajarhat (PG) 400
Budge Budge (CESC) 220
G
2x250 MW
G
1x250 MW
NT AA-II 220
NT AA-III 220
388 MVA
EM (CESC) 220
KLC 220
128 MVA
490 MVA
Kasba 220
G
Laxmikantapur 220
Subhasgram 220
2x315 MVA
(CESC)
N. Laxmikantapur 400
407 MVA
2x315+500 MVA
Subhasgram (PG) 400
115 MVA
Baruipur 220
Proposed Scheme


DAMODAR VALLEY CORPORATION - GRID CONNECTIVITY
Existing
Under Construction / pipeline
132KV
220KV
400KV
Biharshariff
Gaya PG
BTPS
KTPS
KTPS
500 MW
2 x 500 MW
L # 405
2 x 500 MW
Maithon PG
L # 410 & L # 411, 412
MTPS
L # 409
Jamshedpur PG
Barjora
L # 230, 231
KTPS
L # 101, 102
Koderma
L # 43, 44
Biharshariff
L # 28
Rajgir
L # 29
Barhi
L # 93, 94
L # 83
Konar
H'bagh
L # 80
BTPS
L # 79
L # 251, 252
L # 201, 202
L # 203, 204
Dhanbad
L # 237, 238
Kalyaneswari
L # 229
Burnpur
L # 232
MTPS
L # 228 & L # 239, 240
4 x 210 MW
+ 2 x 250 MW
L # 235, 236
Durgapur
L # 226, 227
Giridih
L # 247, 248
L # 217, 218
Maithon PG
Giridih
L # 86, 87
N'ghat
L # 47, 48
Putki
L # 12, 13
L # 49, 50
Sindri
Patherdhi
L # 14, 15
MHS
L # 68, 69
Kalyaneswari
L # 18, 19
Kalipahari
L # 221, 222
Bidhannagar
(WBSETCL)
L # 209, 210
Parulia
PG
L # 219, 220
Parulia
L # 211, 212
L # 403, 404
210 MW
BTPS
L # 205, 206
2 x 250 MW
Ramkanali
L # 45, 46
PHS
L # 17
L # 16
L # 34
Jamtara (JBVNL)
L # 35, 36
L # 64, 65
L # 70
L # 20, 21
DTPS
210 MW
DSTPS
L # 233, 234
CTPS
130 MW
L # 60
Kumardhubi
L # 90
DTPS
Panagarh
Burdwan
CTPS
L # 61
L # 100
L # 109, 110
N Karanpura
BIADA
L # 6, 7
L # 58, 59
Jamuria
ASP
L # 51, 52
L # 75, 76
Burdwan
2 x 500 MW
L # 81, 82
Purulia
L # 22, 23
Patratu
L # 77, 78
L # 39, 40
Jamshedpur
Belmuri
L # 24, 25
RTPS
2 x 600 MW
L # 401, 402
L # 84, 85
L # 55, 56
L # 5, 106
L # 1, 105
L # 2, 3
L # 71, 72
L # 73, 74
L # 26, 27
Ramgarh
Gola
Chandil
Mosabani
Kharagpur
Kolaghat
Howrah
PTPS
(JUVNL)
KTPS
(PDCL)
Ranchi PG
L # 407, 408
L # 406
Ramgarh
Jamshedpur
L # 213, 214
L # 215
Joda (GRIDCO)
Ranchi PG

Load Flow (indicating relevant Bus)

```
    PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(R)E     SUN, APR 21 2019   9:35
 ALL INDIA PEAK WR FEB 2019 25 OCT 2018                                RATING   %MVA FOR TRANSFORMERS
                                                                        SET B   % I  FOR NON-TRANSFORMER BRANCHES

 BUS 232000 DTPS2       220.00 CKT     MW     MVAR     MVA    % 1.0099PU    9.68  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 232000
                                                                 222.17KV              MW     MVAR 2003 DVC          2031 DVC
  TO 231000 DTPS1       132.00  1    112.8    17.3   114.2   60 0.9540RG              0.20   11.91 2003 DVC          2031 DVC
  TO 231000 DTPS1       132.00  2    112.8    17.3   114.2   60 0.9540RG              0.20   11.91 2003 DVC          2031 DVC
  TO 231000 DTPS1       132.00  3    112.8    17.3   114.2   60 0.9540RG              0.20   11.91 2003 DVC          2031 DVC
  TO 232001 MTPS2       220.00  1    -61.4   -49.3    78.8   37                       0.35    2.07 2003 DVC          2031 DVC
  TO 232001 MTPS2       220.00  2    -61.4   -49.3    78.8   37                       0.35    2.07 2003 DVC          2031 DVC
  TO 232014 DSTPS2      220.00  1   -223.9    27.1   225.5  107                       0.61    3.49 2003 DVC          2031 DVC
  TO 232014 DSTPS2      220.00  2   -223.9    27.1   225.5  107                       0.61    3.49 2003 DVC          2031 DVC
  TO 262005 BDNNGR2     220.00  1    116.0    -3.7   116.1   48                       0.20    0.95 2005 WB           2052 S_BNG
  TO 262005 BDNNGR2     220.00  2    116.0    -3.7   116.1   48                       0.20    0.95 2005 WB           2052 S_BNG

 BUS 232001 MTPS2       220.00 CKT     MW     MVAR     MVA    % 1.0300PU   10.73  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 232001
  FROM GENERATION                   798.0   232.6R  831.2   78 226.60KV              MW     MVAR 2003 DVC          2031 DVC
  TO LOAD-PQ                         58.4    14.6    60.2
  TO 232000 DTPS2       220.00  1     61.7    45.2    76.5   36                       0.35    2.07 2003 DVC          2031 DVC
  TO 232000 DTPS2       220.00  2     61.7    45.2    76.5   36                       0.35    2.07 2003 DVC          2031 DVC
  TO 232003 BARJORA2    220.00  1     78.6    18.9    80.8   38                       0.15    0.85 2003 DVC          2031 DVC
  TO 232003 BARJORA2    220.00  2     78.6    18.9    80.8   38                       0.15    0.85 2003 DVC          2031 DVC
  TO 232004 BURNPUR2    220.00  1    111.3    10.6   111.8   52                       1.07    5.71 2003 DVC          2031 DVC
  TO 232005 DURGAPUR2   220.00  1     53.4    37.9    65.5   31                       0.21    1.10 2003 DVC          2031 DVC
  TO 232005 DURGAPUR2   220.00  2     53.4    37.9    65.5   31                       0.21    1.10 2003 DVC          2031 DVC
  TO 242003 KLYN2       220.00  1     80.3     1.1    80.3   37                       0.75    4.00 2003 DVC          2031 DVC
  TO 242003 KLYN2       220.00  2     80.3     1.1    80.3   37                       0.75    4.00 2003 DVC          2031 DVC
  TO 242003 KLYN2       220.00  3     80.3     1.1    80.3   37                       0.75    4.00 2003 DVC          2031 DVC

 BUS 232002 PARULIA2    220.00 CKT     MW     MVAR     MVA    % 1.0143PU   10.22  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 232002
                                                                 223.14KV              MW     MVAR 2003 DVC          2031 DVC
  TO LOAD-PQ                        153.7    38.5   158.4
  TO 232005 DURGAPUR2   220.00  1     14.0   -27.0    30.4   14                       0.02    0.11 2003 DVC          2031 DVC
  TO 232005 DURGAPUR2   220.00  2     14.0   -27.0    30.4   14                       0.02    0.11 2003 DVC          2031 DVC
  TO 232014 DSTPS2      220.00  1    -40.9    32.3    52.1   25                       0.06    0.37 2003 DVC          2031 DVC
  TO 232014 DSTPS2      220.00  2    -40.9    32.3    52.1   25                       0.06    0.37 2003 DVC          2031 DVC
  TO 232017 BURDWAN2    220.00  1     78.7     1.6    78.7   37                       0.82    4.71 2003 DVC          2031 DVC
  TO 232017 BURDWAN2    220.00  2     78.7     1.6    78.7   37                       0.82    4.71 2003 DVC          2031 DVC
  TO 232098 TAMLA_DSP   220.00  1      0.0    -0.9     0.9    0                       0.00    0.00 2003 DVC          2031 DVC
  TO 232098 TAMLA_DSP   220.00  2      0.0    -0.9     0.9    0                       0.00    0.00 2003 DVC          2031 DVC
  TO 232098 TAMLA_DSP   220.00  3      0.0    -0.9     0.9    0                       0.00    0.00 2003 DVC          2031 DVC
  TO 262028 PARULIA     220.00  1   -128.7   -24.9   131.1   62                       0.03    0.13 2055 ER_ISTS_WB   2052 S_BNG
  TO 262028 PARULIA     220.00  2   -128.7   -24.9   131.1   62                       0.03    0.13 2055 ER_ISTS_WB   2052 S_BNG

 BUS 232005 DURGAPUR2   220.00 CKT     MW     MVAR     MVA    % 1.0174PU   10.08  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 232005
                                                                 223.83KV              MW     MVAR 2003 DVC          2031 DVC
  TO LOAD-PQ                        134.4    33.7   138.6
  TO 232001 MTPS2       220.00  1    -53.2   -41.5    67.5   32                       0.21    1.10 2003 DVC          2031 DVC
  TO 232001 MTPS2       220.00  2    -53.2   -41.5    67.5   32                       0.21    1.10 2003 DVC          2031 DVC
  TO 232002 PARULIA2    220.00  1    -14.0    24.7    28.4   13                       0.02    0.11 2003 DVC          2031 DVC
  TO 232002 PARULIA2    220.00  2    -14.0    24.7    28.4   13                       0.02    0.11 2003 DVC          2031 DVC
```

BUS 232014 DSTPS2	220.00	CKT	MW	MVAR	MVA	%	1.0108PU	10.58	X--- LOSSES ---X	X---- AREA -----X	X---- ZONE -----X	232014
							222.37KV		MW	MVAR	2003 DVC	2031 DVC	
TO 232000 DTPS2	220.00	1	224.5	-24.9	225.9	107			0.61	3.49	2003 DVC	2031 DVC	
TO 232000 DTPS2	220.00	2	224.5	-24.9	225.9	107			0.61	3.49	2003 DVC	2031 DVC	
TO 232002 PARULIA2	220.00	1	41.0	-34.3	53.4	25			0.06	0.37	2003 DVC	2031 DVC	
TO 232002 PARULIA2	220.00	2	41.0	-34.3	53.4	25			0.06	0.37	2003 DVC	2031 DVC	
TO 234001 DSTPS4	400.00	1	-265.5	59.2	272.0		1.0000UN		1.88	28.67	2003 DVC	2031 DVC	
TO 234001 DSTPS4	400.00	2	-265.5	59.2	272.0		1.0000UN		1.88	28.67	2003 DVC	2031 DVC	
BUS 242001 CTPS2	220.00	CKT	MW	MVAR	MVA	%	1.0000PU	4.11	X--- LOSSES ---X	X---- AREA -----X	X---- ZONE -----X	242001
FROM GENERATION			456.0	10.1R	456.1	78	220.00KV		MW	MVAR	2003 DVC	2031 DVC	
TO LOAD-PQ			160.1	40.1	165.0								
TO 241002 CTPS1	132.00	1	118.4	43.3	126.1	70	0.9409LO		0.54	13.36	2003 DVC	2031 DVC	
TO 241002 CTPS1	132.00	2	118.4	43.3	126.1	70	0.9409LO		0.54	13.36	2003 DVC	2031 DVC	
TO 241002 CTPS1	132.00	3	118.4	43.3	126.1	70	0.9409LO		0.54	13.36	2003 DVC	2031 DVC	
TO 242000 BTPS2	220.00	1	9.3	-55.9	56.7	27			0.14	0.78	2003 DVC	2031 DVC	
TO 242000 BTPS2	220.00	2	9.3	-55.9	56.7	27			0.14	0.78	2003 DVC	2031 DVC	
TO 242004 DHANBAD2	220.00	1	-39.0	-24.0	45.8	22			0.14	0.73	2003 DVC	2031 DVC	
TO 242004 DHANBAD2	220.00	2	-39.0	-24.0	45.8	22			0.14	0.73	2003 DVC	2031 DVC	
BUS 242003 KLYN2	220.00	CKT	MW	MVAR	MVA	%	1.0172PU	7.91	X--- LOSSES ---X	X---- AREA -----X	X---- ZONE -----X	242003
							223.79KV		MW	MVAR	2003 DVC	2031 DVC	
TO 232001 MTPS2	220.00	1	-79.5	-8.9	80.0	38			0.75	4.00	2003 DVC	2031 DVC	
TO 232001 MTPS2	220.00	2	-79.5	-8.9	80.0	38			0.75	4.00	2003 DVC	2031 DVC	
TO 232001 MTPS2	220.00	3	-79.5	-8.9	80.0	38			0.75	4.00	2003 DVC	2031 DVC	
TO 232004 BURNPUR2	220.00	2	6.2	12.1	13.6	6			0.01	0.04	2003 DVC	2031 DVC	
TO 241009 KLYNS1	132.00	1	149.2	56.2	159.4	100	0.9409LO		1.04	19.88	2003 DVC	2031 DVC	
TO 241009 KLYNS1	132.00	2	149.2	56.2	159.4	100	0.9409LO		1.04	19.88	2003 DVC	2031 DVC	
TO 241009 KLYNS1	132.00	3	145.2	54.9	155.3	97	0.9409LO		0.99	19.36	2003 DVC	2031 DVC	
TO 242009 MAITHON PG2	220.00	1	-105.6	-76.5	130.4	62			0.19	1.02	2053 ER_ISTS_DVC	2031 DVC	
TO 242009 MAITHON PG2	220.00	2	-105.6	-76.5	130.4	62			0.19	1.02	2053 ER_ISTS_DVC	2031 DVC	
BUS 242004 DHANBAD2	220.00	CKT	MW	MVAR	MVA	%	1.0106PU	4.86	X--- LOSSES ---X	X---- AREA -----X	X---- ZONE -----X	242004
							222.34KV		MW	MVAR	2003 DVC	2031 DVC	
TO LOAD-PQ			88.3	22.1	91.1								
TO 232089 ELECTRO STL	220.00	1	0.0	-11.9	11.9	6			0.00	0.01	2003 DVC	2031 DVC	
TO 232089 ELECTRO STL	220.00	2	0.0	-11.9	11.9	6			0.00	0.01	2003 DVC	2031 DVC	
TO 241030 DHNABD_1	132.00	1	0.0	-0.0	0.0	0	0.9409RG		0.00	0.00	2003 DVC	2031 DVC	
TO 241030 DHNABD_1	132.00	2	0.0	-0.0	0.0	0	0.9409RG		0.00	0.00	2003 DVC	2031 DVC	
TO 242001 CTPS2	220.00	1	39.2	18.2	43.2	21			0.14	0.73	2003 DVC	2031 DVC	
TO 242001 CTPS2	220.00	2	39.2	18.2	43.2	21			0.14	0.73	2003 DVC	2031 DVC	
TO 242005 GIRDHI2	220.00	1	58.7	-14.9	60.6	29			0.24	1.30	2003 DVC	2031 DVC	
TO 242005 GIRDHI2	220.00	2	58.7	-14.9	60.6	29			0.24	1.30	2003 DVC	2031 DVC	
TO 242009 MAITHON PG2	220.00	1	-142.1	-2.5	142.1	68			1.58	8.45	2053 ER_ISTS_DVC	2031 DVC	
TO 242009 MAITHON PG2	220.00	2	-142.1	-2.5	142.1	68			1.58	8.45	2053 ER_ISTS_DVC	2031 DVC	
BUS 242009 MAITHON PG2	220.00	CKT	MW	MVAR	MVA	%	1.0231PU	8.23	X--- LOSSES ---X	X---- AREA -----X	X---- ZONE -----X	242009
							225.09KV		MW	MVAR	2053 ER_ISTS_DVC	2031 DVC	
TO 222008 DUMKA NEW	220.00	1	55.1	13.6	56.8	26			0.34	1.95	2002 JHARKHAND	2021 JHARKHAND	
TO 222008 DUMKA NEW	220.00	2	55.1	13.6	56.8	26			0.34	1.95	2002 JHARKHAND	2021 JHARKHAND	
TO 242003 KLYN2	220.00	1	105.8	76.4	130.5	61			0.19	1.02	2003 DVC	2031 DVC	
TO 242003 KLYN2	220.00	2	105.8	76.4	130.5	61			0.19	1.02	2003 DVC	2031 DVC	
TO 242004 DHANBAD2	220.00	1	143.7	3.3	143.7	68			1.58	8.45	2003 DVC	2031 DVC	
TO 242004 DHANBAD2	220.00	2	143.7	3.3	143.7	68			1.58	8.45	2003 DVC	2031 DVC	
TO 244003 MAITHON PG4	400.00	1	-304.6	-93.3	318.6	64	1.0000UN		1.21	24.23	2053 ER_ISTS_DVC	2031 DVC	

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 TO 244003 MAITHON PG4 400.00  3   -304.6   -93.3   318.6  64 1.0000UN             1.21   24.23 2053 ER_ISTS_DVC  2031 DVC

BUS 244003 MAITHON PG4 400.00 CKT     MW     MVAR     MVA   % 0.9900PU   12.22  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 244003
                                                              396.01KV              MW     MVAR 2053 ER_ISTS_DVC  2031 DVC
 TO SWITCHED SHUNT                    0.0   155.6   155.6
 TO 214001 KHALGAON_B  400.00  T1   -57.1   -30.6    64.8   7                      0.12    1.30 2102 KHSTPP       2012 BIHAR_S
 TO 214005 GAYA4       400.00  Q1   196.6  -100.9   221.0  13                      1.06   18.24 2051 ER_ISTS_BIH  2001 ER_BOUNDARY
 TO 214005 GAYA4       400.00  Q2   196.6  -100.9   221.0  13                      1.06   18.24 2051 ER_ISTS_BIH  2001 ER_BOUNDARY
 TO 234002 MTPS_B4     400.00  T2  -457.4   -41.5   459.3  55                      2.39   26.65 2003 DVC          2031 DVC
 TO 234002 MTPS_B4     400.00  T3  -457.4   -41.4   459.3  55                      2.40   26.65 2003 DVC          2031 DVC
 TO 242009 MAITHON PG2 220.00  1    305.8   117.6   327.6  66 0.9409RG             1.21   24.23 2053 ER_ISTS_DVC  2031 DVC
 TO 242009 MAITHON PG2 220.00  3    305.8   117.6   327.6  66 0.9409RG             1.21   24.23 2053 ER_ISTS_DVC  2031 DVC
 TO 244004 JAMSHEDPUR4 400.00  T1   -32.9   -75.5    82.3  10                      0.06    0.60 2053 ER_ISTS_DVC  2031 DVC

BUS 262028 PARULIA    220.00 CKT     MW     MVAR     MVA   % 1.0147PU   10.28  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 262028
                                                              223.24KV              MW     MVAR 2055 ER_ISTS_WB   2052 S_BNG
 TO 232002 PARULIA2    220.00  1    128.7    24.9   131.1  62                     0.03    0.13 2003 DVC          2031 DVC
 TO 232002 PARULIA2    220.00  2    128.7    24.9   131.1  62                     0.03    0.13 2003 DVC          2031 DVC
 TO 264009 PARULIA_B   400.00  1    -29.8   -62.3    69.1  22 1.0000UN            0.09    1.81 2055 ER_ISTS_WB   2052 S_BNG
 TO 264032 PARULIA_A   400.00  3   -227.6    12.5   227.9  72 1.0000UN            1.01   19.66 2055 ER_ISTS_WB   2052 S_BNG

BUS 264009 PARULIA_B  400.00 CKT     MW     MVAR     MVA   % 1.0133PU   10.84  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 264009
                                                              405.32KV              MW     MVAR 2055 ER_ISTS_WB   2052 S_BNG
 TO SWITCHED SHUNT                    0.0   232.8   232.8
 TO 244004 JAMSHEDPUR4 400.00  T1   -93.7    -4.7    93.8  11                     0.35    3.74 2053 ER_ISTS_DVC  2031 DVC
 TO 262028 PARULIA     220.00  1     29.9    64.1    70.8  22 0.9750RG            0.09    1.81 2055 ER_ISTS_WB   2052 S_BNG
 TO 264003 SAGAR4      400.00  T1   -46.2   -55.8    72.4   8                     0.05    0.57 2005 WB           2052 S_BNG
 TO 264003 SAGAR4      400.00  T2   -46.2   -55.8    72.4   8                     0.05    0.57 2005 WB           2052 S_BNG
 TO 264006 BDNNGR4     400.00  T1   146.0   -98.9   176.4  20                     0.06    0.63 2005 WB           2052 S_BNG
 TO 264006 BDNNGR4     400.00  T2   146.0   -98.9   176.4  20                     0.06    0.63 2005 WB           2052 S_BNG
 TO 264008 FARAKKA     400.00  T1  -135.8    17.2   136.9  15                     0.57    6.11 2101 FSTPP        2052 S_BNG

BUS 264032 PARULIA_A  400.00 CKT     MW     MVAR     MVA   % 0.9927PU   15.22  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 264032
                                                              397.09KV              MW     MVAR 2055 ER_ISTS_WB   2052 S_BNG
 TO SWITCHED SHUNT                    0.0   156.4   156.4
 TO 244006 MAITHON B   400.00  T1  -176.5   -41.8   181.4  21                     0.42    4.72 2053 ER_ISTS_DVC  2031 DVC
 TO 244006 MAITHON B   400.00  T2  -176.5   -41.8   181.4  21                     0.42    4.72 2053 ER_ISTS_DVC  2031 DVC
 TO 262028 PARULIA     220.00  3    228.6     7.1   228.7  73 0.9750RG            1.01   19.66 2055 ER_ISTS_WB   2052 S_BNG
 TO 264008 FARAKKA     400.00  T2   124.4   -80.0   147.9  17                     0.46    4.90 2101 FSTPP        2052 S_BNG
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Load Flow (Full DVC portion)

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    PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(R)E     SUN, APR 21 2019   9:45
ALL INDIA PEAK WR FEB 2019 25 OCT 2018                                  RATING   %MVA FOR TRANSFORMERS
                                                                         SET B   % I  FOR NON-TRANSFORMER BRANCHES
                      OUTPUT FOR ZONE 2031 [DVC         ]

BUS 231000 DTPS1       132.00 CKT     MW     MVAR     MVA    % 1.0458PU    3.70  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 231000
                                                               138.04KV              MW     MVAR 2003 DVC          2031 DVC
 TO LOAD-PQ                           46.2    11.6    47.6
 TO 231006 BURDWAN1    132.00  1       9.8    -1.3     9.9  11                      0.06    0.14 2003 DVC          2031 DVC
 TO 231006 BURDWAN1    132.00  2       9.8    -1.3     9.9  11                      0.06    0.14 2003 DVC          2031 DVC
 TO 231008 KALIPAHARI1 132.00  1      45.6    -2.4    45.7  52                      0.70    1.68 2003 DVC          2031 DVC
 TO 231008 KALIPAHARI1 132.00  2      45.6    -2.4    45.7  52                      0.70    1.68 2003 DVC          2031 DVC
 TO 231009 ASP1        132.00  1      15.1     3.5    15.5  18                      0.01    0.02 2003 DVC          2031 DVC
 TO 231009 ASP1        132.00  2      15.1     3.5    15.5  18                      0.01    0.02 2003 DVC          2031 DVC
 TO 231081 JAMURIA1    132.00  1     104.1     7.9   104.4 119                      3.06    7.93 2003 DVC          2031 DVC
 TO 232000 DTPS2       220.00  1    -112.6    -5.3   112.7  59 1.0000UN             0.20   11.91 2003 DVC          2031 DVC
 TO 232000 DTPS2       220.00  2    -112.6    -5.3   112.7  59 1.0000UN             0.20   11.91 2003 DVC          2031 DVC
 TO 232000 DTPS2       220.00  3    -112.6    -5.3   112.7  59 1.0000UN             0.20   11.91 2003 DVC          2031 DVC
 TO 241012 RAMKANALI1  132.00  2      46.4    -3.1    46.5  53                      1.21    2.88 2003 DVC          2031 DVC

BUS 231001 PURULIA1    132.00 CKT     MW     MVAR     MVA    % 1.0194PU   -3.23  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 231001
                                                               134.56KV              MW     MVAR 2003 DVC          2031 DVC
 TO LOAD-PQ                           13.9     3.5    14.3
 TO 241002 CTPS1       132.00  1     -18.7     2.2    18.8  22                      0.20    0.47 2003 DVC          2031 DVC
 TO 241002 CTPS1       132.00  2     -18.7     2.2    18.8  22                      0.20    0.47 2003 DVC          2031 DVC
 TO 241005 JAMSHEDPUR1 132.00  1      11.8    -3.9    12.4  14                      0.11    0.25 2003 DVC          2031 DVC
 TO 241005 JAMSHEDPUR1 132.00  2      11.8    -3.9    12.4  14                      0.11    0.25 2003 DVC          2031 DVC

BUS 231002 KHARGPUR1   132.00 CKT     MW     MVAR     MVA    % 1.0120PU   -4.25  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 231002
                                                               133.59KV              MW     MVAR 2003 DVC          2031 DVC
 TO 231003 KOLAGHAT1   132.00  1     -14.2     0.9    14.3  17                      0.14    0.34 2003 DVC          2031 DVC
 TO 231003 KOLAGHAT1   132.00  2     -14.2     0.9    14.3  17                      0.14    0.34 2003 DVC          2031 DVC
 TO 241011 MOSABANI1   132.00  1      14.2    -0.9    14.3  17                      0.18    0.42 2003 DVC          2031 DVC
 TO 241011 MOSABANI1   132.00  2      14.2    -0.9    14.3  17                      0.18    0.42 2003 DVC          2031 DVC

BUS 231003 KOLAGHAT1   132.00 CKT     MW     MVAR     MVA    % 1.0175PU   -2.84  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 231003
                                                               134.30KV              MW     MVAR 2003 DVC          2031 DVC
 TO LOAD-PQ                           4.7     1.2     4.9
 TO 231002 KHARGPUR1   132.00  1      14.4    -4.5    15.0  18                      0.14    0.34 2003 DVC          2031 DVC
 TO 231002 KHARGPUR1   132.00  2      14.4    -4.5    15.0  18                      0.14    0.34 2003 DVC          2031 DVC
 TO 231004 HOWRAH1     132.00  1     -16.7     3.9    17.2  20                      0.17    0.41 2003 DVC          2031 DVC
 TO 231004 HOWRAH1     132.00  2     -16.7     3.9    17.2  20                      0.17    0.41 2003 DVC          2031 DVC

BUS 231004 HOWRAH1     132.00 CKT     MW     MVAR     MVA    % 1.0199PU   -1.38  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 231004
                                                               134.62KV              MW     MVAR 2003 DVC          2031 DVC
 TO LOAD-PQ                           21.8     5.5    22.5
 TO 231003 KOLAGHAT1   132.00  1      16.9    -6.7    18.2  21                      0.17    0.41 2003 DVC          2031 DVC
 TO 231003 KOLAGHAT1   132.00  2      16.9    -6.7    18.2  21                      0.17    0.41 2003 DVC          2031 DVC
 TO 231005 BELMURI1    132.00  1     -27.8     4.0    28.1  33                      0.37    0.88 2003 DVC          2031 DVC
 TO 231005 BELMURI1    132.00  2     -27.8     4.0    28.1  33                      0.37    0.88 2003 DVC          2031 DVC

BUS 231005 BELMURI1    132.00 CKT     MW     MVAR     MVA    % 1.0275PU    0.50  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 231005
                                                               135.63KV              MW     MVAR 2003 DVC          2031 DVC
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 TO LOAD-PQ                          13.1     3.3    13.5
 TO 231004 HOWRAH1     132.00  1     28.2    -5.9    28.8  33                    0.37    0.88 2003 DVC          2031 DVC
 TO 231004 HOWRAH1     132.00  2     28.2    -5.9    28.8  33                    0.37    0.88 2003 DVC          2031 DVC
 TO 231006 BURDWAN1    132.00  1    -34.7     4.3    35.0  41                    0.60    1.43 2003 DVC          2031 DVC
 TO 231006 BURDWAN1    132.00  2    -34.7     4.3    35.0  41                    0.60    1.43 2003 DVC          2031 DVC

BUS 231006 BURDWAN1    132.00 CKT     MW     MVAR     MVA   % 1.0390PU    2.93  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 231006
                                                              137.14KV              MW     MVAR 2003 DVC          2031 DVC
 TO LOAD-PQ                         104.4    26.2   107.6
 TO 231000 DTPS1       132.00  1     -9.8    -2.4    10.1  12                    0.06    0.14 2003 DVC          2031 DVC
 TO 231000 DTPS1       132.00  2     -9.8    -2.4    10.1  12                    0.06    0.14 2003 DVC          2031 DVC
 TO 231005 BELMURI1    132.00  1     35.3    -5.8    35.8  41                    0.60    1.43 2003 DVC          2031 DVC
 TO 231005 BELMURI1    132.00  2     35.3    -5.8    35.8  41                    0.60    1.43 2003 DVC          2031 DVC
 TO 232017 BURDWAN2    220.00  1    -77.8    -4.9    77.9  41 1.0000UN           0.10    5.39 2003 DVC          2031 DVC
 TO 232017 BURDWAN2    220.00  2    -77.8    -4.9    77.9  41 1.0000UN           0.10    5.39 2003 DVC          2031 DVC

BUS 231007 PANCHET1    132.00 CKT     MW     MVAR     MVA   % 1.0244PU    0.22  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 231007
                                                              135.23KV              MW     MVAR 2003 DVC          2031 DVC
 TO LOAD-PQ                          15.7     3.9    16.2
 TO 241006 MHS1        132.00  1    -34.6    -7.2    35.3  41                    0.18    0.42 2003 DVC          2031 DVC
 TO 241010 KUMARDHUBI1 132.00  1     -3.8     0.5     3.8   4                    0.00    0.00 2003 DVC          2031 DVC
 TO 241012 RAMKANALI1  132.00  1     11.3     1.4    11.4  13                    0.02    0.04 2003 DVC          2031 DVC
 TO 241012 RAMKANALI1  132.00  2     11.3     1.4    11.4  13                    0.02    0.04 2003 DVC          2031 DVC

BUS 231008 KALIPAHARI1 132.00 CKT     MW     MVAR     MVA   % 1.0315PU    1.54  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 231008
                                                              136.16KV              MW     MVAR 2003 DVC          2031 DVC
 TO LOAD-PQ                          67.4    16.9    69.5
 TO 231000 DTPS1       132.00  1    -44.9     1.9    45.0  52                    0.70    1.68 2003 DVC          2031 DVC
 TO 231000 DTPS1       132.00  2    -44.9     1.9    45.0  52                    0.70    1.68 2003 DVC          2031 DVC
 TO 241009 KLYNS1      132.00  1     11.2   -10.4    15.3  18                    0.05    0.12 2003 DVC          2031 DVC
 TO 241009 KLYNS1      132.00  2     11.2   -10.4    15.3  18                    0.05    0.12 2003 DVC          2031 DVC

BUS 231009 ASP1        132.00 CKT     MW     MVAR     MVA   % 1.0447PU    3.62  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 231009
                                                              137.90KV              MW     MVAR 2003 DVC          2031 DVC
 TO LOAD-PQ                          30.1     7.6    31.1
 TO 231000 DTPS1       132.00  1    -15.1    -3.8    15.5  18                    0.01    0.02 2003 DVC          2031 DVC
 TO 231000 DTPS1       132.00  2    -15.1    -3.8    15.5  18                    0.01    0.02 2003 DVC          2031 DVC

BUS 231011 BARJORA 1   132.00 CKT     MW     MVAR     MVA   % 1.0379PU    8.58  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 231011
                                                              137.00KV              MW     MVAR 2003 DVC          2031 DVC
 TO LOAD-PQ                          64.0    16.0    66.0
 TO 231080 SONIC THRML 132.00  1     0.0    -0.1     0.1   0                    0.00    0.00 2003 DVC          2031 DVC
 TO 232003 BARJORA2    220.00  1    -32.0    -8.0    33.0  18 1.0000UN           0.03    0.96 2003 DVC          2031 DVC
 TO 232003 BARJORA2    220.00  2    -32.0    -8.0    33.0  18 1.0000UN           0.03    0.96 2003 DVC          2031 DVC

BUS 231080 SONIC THRML 132.00 CKT     MW     MVAR     MVA   % 1.0379PU    8.58  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 231080
                                                              137.00KV              MW     MVAR 2003 DVC          2031 DVC
 TO 231011 BARJORA 1   132.00  1     0.0    -0.0     0.0   0                    0.00    0.00 2003 DVC          2031 DVC

BUS 231081 JAMURIA1    132.00 CKT     MW     MVAR     MVA   % 1.0115PU   -0.63  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 231081
                                                              133.52KV              MW     MVAR 2003 DVC          2031 DVC
 TO LOAD-PQ                          89.1    22.3    91.9
 TO 231000 DTPS1       132.00  1   -101.1    -1.8   101.1 119                    3.06    7.93 2003 DVC          2031 DVC
 TO 241002 CTPS1       132.00  2     12.0   -20.6    23.8  28                    0.20    0.48 2003 DVC          2031 DVC

BUS 232000 DTPS2       220.00 CKT     MW     MVAR     MVA   % 1.0099PU    9.68  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 232000
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							222.17KV			MW	MVAR	2003 DVC		2031 DVC	
TO 231000 DTPS1	132.00	1	112.8	17.3	114.2	60	0.9540RG			0.20	11.91	2003 DVC		2031 DVC	
TO 231000 DTPS1	132.00	2	112.8	17.3	114.2	60	0.9540RG			0.20	11.91	2003 DVC		2031 DVC	
TO 231000 DTPS1	132.00	3	112.8	17.3	114.2	60	0.9540RG			0.20	11.91	2003 DVC		2031 DVC	
TO 232001 MTPS2	220.00	1	-61.4	-49.3	78.8	37				0.35	2.07	2003 DVC		2031 DVC	
TO 232001 MTPS2	220.00	2	-61.4	-49.3	78.8	37				0.35	2.07	2003 DVC		2031 DVC	
TO 232014 DSTPS2	220.00	1	-223.9	27.1	225.5	107				0.61	3.49	2003 DVC		2031 DVC	
TO 232014 DSTPS2	220.00	2	-223.9	27.1	225.5	107				0.61	3.49	2003 DVC		2031 DVC	
TO 262005 BDNNGR2	220.00	1	116.0	-3.7	116.1	48				0.20	0.95	2005 WB		2052 S_BNG	
TO 262005 BDNNGR2	220.00	2	116.0	-3.7	116.1	48				0.20	0.95	2005 WB		2052 S_BNG	
BUS 232001 MTPS2	220.00	CKT	MW	MVAR	MVA	%	1.0300PU	10.73	X--- LOSSES	---X	X---- AREA	-----X	X---- ZONE	-----X	232001
FROM GENERATION			798.0	232.6R	831.2	78	226.60KV			MW	MVAR	2003 DVC		2031 DVC	
TO LOAD-PQ			58.4	14.6	60.2										
TO 232000 DTPS2	220.00	1	61.7	45.2	76.5	36				0.35	2.07	2003 DVC		2031 DVC	
TO 232000 DTPS2	220.00	2	61.7	45.2	76.5	36				0.35	2.07	2003 DVC		2031 DVC	
TO 232003 BARJORA2	220.00	1	78.6	18.9	80.8	38				0.15	0.85	2003 DVC		2031 DVC	
TO 232003 BARJORA2	220.00	2	78.6	18.9	80.8	38				0.15	0.85	2003 DVC		2031 DVC	
TO 232004 BURNPUR2	220.00	1	111.3	10.6	111.8	52				1.07	5.71	2003 DVC		2031 DVC	
TO 232005 DURGAPUR2	220.00	1	53.4	37.9	65.5	31				0.21	1.10	2003 DVC		2031 DVC	
TO 232005 DURGAPUR2	220.00	2	53.4	37.9	65.5	31				0.21	1.10	2003 DVC		2031 DVC	
TO 242003 KLYN2	220.00	1	80.3	1.1	80.3	37				0.75	4.00	2003 DVC		2031 DVC	
TO 242003 KLYN2	220.00	2	80.3	1.1	80.3	37				0.75	4.00	2003 DVC		2031 DVC	
TO 242003 KLYN2	220.00	3	80.3	1.1	80.3	37				0.75	4.00	2003 DVC		2031 DVC	
BUS 232002 PARULIA2	220.00	CKT	MW	MVAR	MVA	%	1.0143PU	10.22	X--- LOSSES	---X	X---- AREA	-----X	X---- ZONE	-----X	232002
							223.14KV			MW	MVAR	2003 DVC		2031 DVC	
TO LOAD-PQ			153.7	38.5	158.4										
TO 232005 DURGAPUR2	220.00	1	14.0	-27.0	30.4	14				0.02	0.11	2003 DVC		2031 DVC	
TO 232005 DURGAPUR2	220.00	2	14.0	-27.0	30.4	14				0.02	0.11	2003 DVC		2031 DVC	
TO 232014 DSTPS2	220.00	1	-40.9	32.3	52.1	25				0.06	0.37	2003 DVC		2031 DVC	
TO 232014 DSTPS2	220.00	2	-40.9	32.3	52.1	25				0.06	0.37	2003 DVC		2031 DVC	
TO 232017 BURDWAN2	220.00	1	78.7	1.6	78.7	37				0.82	4.71	2003 DVC		2031 DVC	
TO 232017 BURDWAN2	220.00	2	78.7	1.6	78.7	37				0.82	4.71	2003 DVC		2031 DVC	
TO 232098 TAMLA_DSP	220.00	1	0.0	-0.9	0.9	0				0.00	0.00	2003 DVC		2031 DVC	
TO 232098 TAMLA_DSP	220.00	2	0.0	-0.9	0.9	0				0.00	0.00	2003 DVC		2031 DVC	
TO 232098 TAMLA_DSP	220.00	3	0.0	-0.9	0.9	0				0.00	0.00	2003 DVC		2031 DVC	
TO 262028 PARULIA	220.00	1	-128.7	-24.9	131.1	62				0.03	0.13	2055 ER_ISTS_WB		2052 S_BNG	
TO 262028 PARULIA	220.00	2	-128.7	-24.9	131.1	62				0.03	0.13	2055 ER_ISTS_WB		2052 S_BNG	
BUS 232003 BARJORA2	220.00	CKT	MW	MVAR	MVA	%	1.0255PU	10.18	X--- LOSSES	---X	X---- AREA	-----X	X---- ZONE	-----X	232003
							225.62KV			MW	MVAR	2003 DVC		2031 DVC	
TO LOAD-PQ			92.8	23.3	95.7										
TO 231011 BARJORA 1	132.00	1	32.0	8.9	33.3	18	0.9801RG			0.03	0.96	2003 DVC		2031 DVC	
TO 231011 BARJORA 1	132.00	2	32.0	8.9	33.3	18	0.9801RG			0.03	0.96	2003 DVC		2031 DVC	
TO 232001 MTPS2	220.00	1	-78.4	-20.6	81.1	38				0.15	0.85	2003 DVC		2031 DVC	
TO 232001 MTPS2	220.00	2	-78.4	-20.6	81.1	38				0.15	0.85	2003 DVC		2031 DVC	
BUS 232004 BURNPUR2	220.00	CKT	MW	MVAR	MVA	%	1.0146PU	7.88	X--- LOSSES	---X	X---- AREA	-----X	X---- ZONE	-----X	232004
							223.20KV			MW	MVAR	2003 DVC		2031 DVC	
TO LOAD-PQ			116.4	29.2	120.0										
TO 232001 MTPS2	220.00	1	-110.2	-13.5	111.0	53				1.07	5.71	2003 DVC		2031 DVC	
TO 232099 IISCO	220.00	1	0.0	-0.2	0.2	0				0.00	0.00	2003 DVC		2031 DVC	
TO 232099 IISCO	220.00	2	0.0	-0.2	0.2	0				0.00	0.00	2003 DVC		2031 DVC	
TO 242003 KLYN2	220.00	2	-6.2	-15.3	16.5	8				0.01	0.04	2003 DVC		2031 DVC	

BUS 232005 DURGAPUR2	220.00	CKT	MW	MVAR	MVA	%	1.0174PU	10.08	X--- LOSSES ---X	X---- AREA -----X		X---- ZONE -----X	232005
							223.83KV		MW	MVAR	2003 DVC	2031 DVC	
TO LOAD-PQ			134.4	33.7	138.6								
TO 232001 MTPS2	220.00	1	-53.2	-41.5	67.5	32			0.21	1.10	2003 DVC	2031 DVC	
TO 232001 MTPS2	220.00	2	-53.2	-41.5	67.5	32			0.21	1.10	2003 DVC	2031 DVC	
TO 232002 PARULIA2	220.00	1	-14.0	24.7	28.4	13			0.02	0.11	2003 DVC	2031 DVC	
TO 232002 PARULIA2	220.00	2	-14.0	24.7	28.4	13			0.02	0.11	2003 DVC	2031 DVC	
BUS 232014 DSTPS2	220.00	CKT	MW	MVAR	MVA	%	1.0108PU	10.58	X--- LOSSES ---X	X---- AREA -----X		X---- ZONE -----X	232014
							222.37KV		MW	MVAR	2003 DVC	2031 DVC	
TO 232000 DTPS2	220.00	1	224.5	-24.9	225.9	107			0.61	3.49	2003 DVC	2031 DVC	
TO 232000 DTPS2	220.00	2	224.5	-24.9	225.9	107			0.61	3.49	2003 DVC	2031 DVC	
TO 232002 PARULIA2	220.00	1	41.0	-34.3	53.4	25			0.06	0.37	2003 DVC	2031 DVC	
TO 232002 PARULIA2	220.00	2	41.0	-34.3	53.4	25			0.06	0.37	2003 DVC	2031 DVC	
TO 234001 DSTPS4	400.00	1	-265.5	59.2	272.0		1.0000UN		1.88	28.67	2003 DVC	2031 DVC	
TO 234001 DSTPS4	400.00	2	-265.5	59.2	272.0		1.0000UN		1.88	28.67	2003 DVC	2031 DVC	
BUS 232017 BURDWAN2	220.00	CKT	MW	MVAR	MVA	%	0.9991PU	6.85	X--- LOSSES ---X	X---- AREA -----X		X---- ZONE -----X	232017
							219.79KV		MW	MVAR	2003 DVC	2031 DVC	
TO 231006 BURDWAN1	132.00	1	77.9	10.4	78.6	41	0.9540RG		0.10	5.39	2003 DVC	2031 DVC	
TO 231006 BURDWAN1	132.00	2	77.9	10.4	78.6	41	0.9540RG		0.10	5.39	2003 DVC	2031 DVC	
TO 232002 PARULIA2	220.00	1	-77.9	-10.4	78.6	38			0.82	4.71	2003 DVC	2031 DVC	
TO 232002 PARULIA2	220.00	2	-77.9	-10.4	78.6	38			0.82	4.71	2003 DVC	2031 DVC	
BUS 232089 ELECTRO STL	220.00	CKT	MW	MVAR	MVA	%	1.0126PU	4.85	X--- LOSSES ---X	X---- AREA -----X		X---- ZONE -----X	232089
							222.78KV		MW	MVAR	2003 DVC	2031 DVC	
TO 242004 DHANBAD2	220.00	1	0.0	-0.0	0.0	0			0.00	0.01	2003 DVC	2031 DVC	
TO 242004 DHANBAD2	220.00	2	0.0	-0.0	0.0	0			0.00	0.01	2003 DVC	2031 DVC	
BUS 232098 TAMLA_DSP	220.00	CKT	MW	MVAR	MVA	%	1.0143PU	10.22	X--- LOSSES ---X	X---- AREA -----X		X---- ZONE -----X	232098
							223.14KV		MW	MVAR	2003 DVC	2031 DVC	
TO 232002 PARULIA2	220.00	1	-0.0	0.0	0.0	0			0.00	0.00	2003 DVC	2031 DVC	
TO 232002 PARULIA2	220.00	2	-0.0	0.0	0.0	0			0.00	0.00	2003 DVC	2031 DVC	
TO 232002 PARULIA2	220.00	3	-0.0	0.0	0.0	0			0.00	0.00	2003 DVC	2031 DVC	
BUS 232099 IISCO	220.00	CKT	MW	MVAR	MVA	%	1.0146PU	7.88	X--- LOSSES ---X	X---- AREA -----X		X---- ZONE -----X	232099
							223.20KV		MW	MVAR	2003 DVC	2031 DVC	
TO 232004 BURNPUR2	220.00	1	0.0	-0.0	0.0	0			0.00	0.00	2003 DVC	2031 DVC	
TO 232004 BURNPUR2	220.00	2	0.0	-0.0	0.0	0			0.00	0.00	2003 DVC	2031 DVC	
BUS 234000 RTPS4	400.00	CKT	MW	MVAR	MVA	%	1.0010PU	16.75	X--- LOSSES ---X	X---- AREA -----X		X---- ZONE -----X	234000
FROM GENERATION			400.0	-180.0L	438.6	57	400.38KV		MW	MVAR	2003 DVC	2031 DVC	
TO SWITCHED SHUNT			0.0	90.9	90.9								
TO 224004 RANCHI_4	400.00	Q2	128.1	-91.9	157.7	9			0.25	4.33	2052 ER_ISTS_JHA	2001 ER_BOUNDARY	
TO 224004 RANCHI_4	400.00	Q3	128.1	-91.9	157.7	9			0.25	4.33	2052 ER_ISTS_JHA	2001 ER_BOUNDARY	
TO 224004 RANCHI_4	400.00	T1	96.6	-72.8	120.9	14			0.30	3.28	2052 ER_ISTS_JHA	2001 ER_BOUNDARY	
TO 234001 DSTPS4	400.00	T1	16.9	-13.1	21.4	2			0.00	0.04	2003 DVC	2031 DVC	
TO 234001 DSTPS4	400.00	T2	16.9	-13.1	21.4	2			0.00	0.04	2003 DVC	2031 DVC	
TO 244006 MAITHON B	400.00	T1	13.4	11.9	17.9	2			0.01	0.07	2053 ER_ISTS_DVC	2031 DVC	
BUS 234001 DSTPS4	400.00	CKT	MW	MVAR	MVA	%	1.0000PU	16.63	X--- LOSSES ---X	X---- AREA -----X		X---- ZONE -----X	234001
FROM GENERATION			950.0	-232.4R	978.0	83	400.00KV		MW	MVAR	2003 DVC	2031 DVC	
TO 232014 DSTPS2	220.00	1	267.4	-30.3	269.1		1.0000RG		1.88	28.67	2003 DVC	2031 DVC	
TO 232014 DSTPS2	220.00	2	267.4	-30.3	269.1		1.0000RG		1.88	28.67	2003 DVC	2031 DVC	
TO 234000 RTPS4	400.00	T1	-16.9	-25.4	30.5	3			0.00	0.04	2003 DVC	2031 DVC	
TO 234000 RTPS4	400.00	T2	-16.9	-25.4	30.5	3			0.00	0.04	2003 DVC	2031 DVC	

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 TO 244004 JAMSHEDPUR4 400.00  T1   224.4   -60.5   232.4  27                    1.43   15.24 2053 ER_ISTS_DVC  2031 DVC
 TO 244004 JAMSHEDPUR4 400.00  T2   224.4   -60.5   232.4  27                    1.43   15.24 2053 ER_ISTS_DVC  2031 DVC

BUS 234002 MTPS_B4     400.00 CKT     MW     MVAR     MVA   % 1.0000PU   15.50  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 234002
 FROM GENERATION                   950.0     5.3R  950.0  81 400.00KV              MW     MVAR 2003 DVC          2031 DVC
 TO 244003 MAITHON PG4 400.00  T2   459.8    35.2   461.1  54                    2.39   26.65 2053 ER_ISTS_DVC  2031 DVC
 TO 244003 MAITHON PG4 400.00  T3   459.8    35.1   461.1  54                    2.40   26.65 2053 ER_ISTS_DVC  2031 DVC
 TO 244004 JAMSHEDPUR4 400.00  T1   148.8   -60.8   160.8  18                    0.67    7.18 2053 ER_ISTS_DVC  2031 DVC
 TO 244006 MAITHON B   400.00  T1  -118.4    -4.2   118.5  14                    0.22    2.49 2053 ER_ISTS_DVC  2031 DVC

BUS 241000 BARHI1      132.00 CKT     MW     MVAR     MVA   % 1.0472PU   -0.35  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 241000
                                                               138.23KV              MW     MVAR 2003 DVC          2031 DVC
 TO LOAD-PQ                         34.9     8.8    36.0
 TO 211093 RAJGIR      132.00  1     16.2     6.8    17.6  20                    0.45    1.07 2001 BIHAR        2012 BIHAR_S
 TO 211217 RAJGIR T    132.00  1     17.7     9.4    20.1  23                    0.49    1.16 2001 BIHAR        2012 BIHAR_S
 TO 241001 BTPS1       132.00  1    -15.6     5.2    16.5  19                    0.21    0.49 2003 DVC          2031 DVC
 TO 241017 KONAR1      132.00  1    -10.4     5.9    11.9  14                    0.09    0.20 2003 DVC          2031 DVC
 TO 241018 KTPP1       132.00  1    -50.6   -24.9    56.4  64                    1.03    2.44 2003 DVC          2031 DVC
 TO 241018 KTPP1       132.00  2    -50.6   -24.9    56.4  64                    1.03    2.44 2003 DVC          2031 DVC
 TO 241019 HAZARIBAGH1 132.00  1     29.2     6.9    30.0  34                    0.08    0.20 2003 DVC          2031 DVC
 TO 241019 HAZARIBAGH1 132.00  2     29.2     6.9    30.0  34                    0.08    0.20 2003 DVC          2031 DVC

BUS 241001 BTPS1       132.00 CKT     MW     MVAR     MVA   % 1.0461PU    1.40  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 241001
                                                               138.09KV              MW     MVAR 2003 DVC          2031 DVC
 TO LOAD-PQ                         51.7    12.9    53.2
 TO 241000 BARHI1      132.00  1     15.8    -9.2    18.3  21                    0.21    0.49 2003 DVC          2031 DVC
 TO 241017 KONAR1      132.00  1     30.3    -6.2    30.9  35                    0.17    0.40 2003 DVC          2031 DVC
 TO 242000 BTPS2       220.00  1    -48.9     1.2    48.9  27 1.0000UN           0.10    2.07 2003 DVC          2031 DVC
 TO 242000 BTPS2       220.00  2    -48.9     1.2    48.9  27 1.0000UN           0.10    2.07 2003 DVC          2031 DVC

BUS 241002 CTPS1       132.00 CKT     MW     MVAR     MVA   % 1.0252PU   -1.72  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 241002
                                                               135.32KV              MW     MVAR 2003 DVC          2031 DVC
 TO LOAD-PQ                        117.1    29.3   120.7
 TO 231001 PURULIA1    132.00  1     18.9    -4.9    19.6  23                    0.20    0.47 2003 DVC          2031 DVC
 TO 231001 PURULIA1    132.00  2     18.9    -4.9    19.6  23                    0.20    0.47 2003 DVC          2031 DVC
 TO 231081 JAMURIA1    132.00  2    -11.8    17.4    21.0  24                    0.20    0.48 2003 DVC          2031 DVC
 TO 241003 GOLA1       132.00  1     33.3    -2.2    33.4  39                    0.53    1.64 2003 DVC          2031 DVC
 TO 241003 GOLA1       132.00  2     33.3    -2.2    33.4  39                    0.53    1.64 2003 DVC          2031 DVC
 TO 241012 RAMKANALI1  132.00  1    -16.7     7.4    18.3  21                    0.23    0.54 2003 DVC          2031 DVC
 TO 241015 PUTKI 1     132.00  1     31.0    10.9    32.8  38                    0.25    0.59 2003 DVC          2031 DVC
 TO 241015 PUTKI 1     132.00  2     31.0    10.9    32.8  38                    0.25    0.59 2003 DVC          2031 DVC
 TO 241015 PUTKI 1     132.00  3     31.0    10.9    32.8  38                    0.25    0.59 2003 DVC          2031 DVC
 TO 241015 PUTKI 1     132.00  4     31.0    10.9    32.8  38                    0.25    0.59 2003 DVC          2031 DVC
 TO 241024 RAJABAR     132.00  1      0.0    -0.2     0.2   0                    0.00    0.00 2003 DVC          2031 DVC
 TO 241024 RAJABAR     132.00  2      0.0    -0.2     0.2   0                    0.00    0.00 2003 DVC          2031 DVC
 TO 241091 BIADA       132.00  1     18.3     3.5    18.6  22                    0.07    0.18 2003 DVC          2031 DVC
 TO 241091 BIADA       132.00  2     18.3     3.5    18.6  22                    0.07    0.18 2003 DVC          2031 DVC
 TO 242001 CTPS2       220.00  1   -117.9   -29.9   121.6  68 1.0000UN           0.54   13.36 2003 DVC          2031 DVC
 TO 242001 CTPS2       220.00  2   -117.9   -29.9   121.6  68 1.0000UN           0.54   13.36 2003 DVC          2031 DVC
 TO 242001 CTPS2       220.00  3   -117.9   -29.9   121.6  68 1.0000UN           0.54   13.36 2003 DVC          2031 DVC

BUS 241003 GOLA1       132.00 CKT     MW     MVAR     MVA   % 1.0111PU   -4.60  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 241003
                                                               133.47KV              MW     MVAR 2003 DVC          2031 DVC
 TO LOAD-PQ                         47.7    12.0    49.2
 TO 241002 CTPS1       132.00  1    -32.8     0.6    32.8  39                    0.53    1.64 2003 DVC          2031 DVC
 TO 241002 CTPS1       132.00  2    -32.8     0.6    32.8  39                    0.53    1.64 2003 DVC          2031 DVC
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TO 241004 CHANDIL1	132.00	1	6.7	-2.8	7.3	9				0.03	0.08	2003 DVC	2031 DVC	
TO 241004 CHANDIL1	132.00	2	18.2	-4.2	18.7	22				0.04	0.23	2003 DVC	2031 DVC	
TO 241013 RAMGARH1	132.00	1	-3.5	-3.1	4.7	6				0.00	0.01	2003 DVC	2031 DVC	
TO 241013 RAMGARH1	132.00	2	-3.5	-3.1	4.7	6				0.00	0.01	2003 DVC	2031 DVC	
BUS 241004 CHANDIL1	132.00	CKT	MW	MVAR	MVA	%	1.0073PU	-5.31	X--- LOSSES	---X	X---- AREA	-----X	X---- ZONE	-----X 241004
							132.97KV		MW	MVAR	2003 DVC		2031 DVC	
TO LOAD-PQ			50.2	12.6	51.8									
TO 241003 GOLA1	132.00	1	-6.7	-1.4	6.8	8				0.03	0.08	2003 DVC	2031 DVC	
TO 241003 GOLA1	132.00	2	-18.2	-8.1	19.9	23				0.04	0.23	2003 DVC	2031 DVC	
TO 241005 JAMSHEDPUR1	132.00	1	-12.7	-1.6	12.8	15				0.08	0.18	2003 DVC	2031 DVC	
TO 241005 JAMSHEDPUR1	132.00	2	-12.7	-1.6	12.8	15				0.08	0.18	2003 DVC	2031 DVC	
BUS 241005 JAMSHEDPUR1	132.00	CKT	MW	MVAR	MVA	%	1.0138PU	-4.50	X--- LOSSES	---X	X---- AREA	-----X	X---- ZONE	-----X 241005
							133.82KV		MW	MVAR	2003 DVC		2031 DVC	
TO LOAD-PQ			120.1	30.1	123.8									
TO 231001 PURULIA1	132.00	1	-11.7	-0.2	11.7	14				0.11	0.25	2003 DVC	2031 DVC	
TO 231001 PURULIA1	132.00	2	-11.7	-0.2	11.7	14				0.11	0.25	2003 DVC	2031 DVC	
TO 241004 CHANDIL1	132.00	1	12.8	-0.9	12.8	15				0.08	0.18	2003 DVC	2031 DVC	
TO 241004 CHANDIL1	132.00	2	12.8	-0.9	12.8	15				0.08	0.18	2003 DVC	2031 DVC	
TO 241011 MOSABANI1	132.00	1	28.7	5.6	29.2	34				0.33	0.80	2003 DVC	2031 DVC	
TO 241011 MOSABANI1	132.00	2	28.7	5.6	29.2	34				0.33	0.80	2003 DVC	2031 DVC	
TO 241031 JOJOBE_1	132.00	1	0.0	-0.0	0.0	0				0.00	0.00	2003 DVC	2031 DVC	
TO 241031 JOJOBE_1	132.00	2	0.0	-0.0	0.0	0				0.00	0.00	2003 DVC	2031 DVC	
TO 242002 JAMSHEDPUR2	220.00	1	-89.8	-19.5	91.9	51	1.0000UN			0.39	7.88	2003 DVC	2031 DVC	
TO 242002 JAMSHEDPUR2	220.00	2	-89.8	-19.5	91.9	51	1.0000UN			0.39	7.88	2003 DVC	2031 DVC	
BUS 241006 MHS1	132.00	CKT	MW	MVAR	MVA	%	1.0319PU	0.84	X--- LOSSES	---X	X---- AREA	-----X	X---- ZONE	-----X 241006
							136.21KV		MW	MVAR	2003 DVC		2031 DVC	
TO LOAD-PQ			50.8	12.7	52.4									
TO 221018 JAMTARA	132.00	1	69.6	30.3	75.9	88				1.27	3.02	2002 JHARKHAND	2021 JHARKHAND	
TO 231007 PANCHET1	132.00	1	34.8	6.8	35.4	41				0.18	0.42	2003 DVC	2031 DVC	
TO 241007 PATHARDIH1	132.00	1	70.7	2.1	70.7	82				1.72	4.08	2003 DVC	2031 DVC	
TO 241007 PATHARDIH1	132.00	2	70.7	2.1	70.7	82				1.72	4.08	2003 DVC	2031 DVC	
TO 241009 KLYNS1	132.00	1	-119.5	-21.3	121.4	140				0.21	0.49	2003 DVC	2031 DVC	
TO 241009 KLYNS1	132.00	2	-119.5	-21.3	121.4	140				0.21	0.49	2003 DVC	2031 DVC	
TO 241009 KLYNS1	132.00	3	-63.8	-11.4	64.8	75				0.11	0.26	2003 DVC	2031 DVC	
TO 241009 KLYNS1	132.00	4	-63.8	-11.4	64.8	75				0.11	0.26	2003 DVC	2031 DVC	
TO 241010 KUMARDHUBI1	132.00	1	70.1	16.0	71.9	83				0.34	0.81	2003 DVC	2031 DVC	
TO 241027 SULTANG	132.00	1	0.0	-4.6	4.6	5				0.01	0.01	2003 DVC	2031 DVC	
BUS 241007 PATHARDIH1	132.00	CKT	MW	MVAR	MVA	%	1.0059PU	-2.49	X--- LOSSES	---X	X---- AREA	-----X	X---- ZONE	-----X 241007
							132.78KV		MW	MVAR	2003 DVC		2031 DVC	
TO LOAD-PQ			125.4	31.4	129.3									
TO 241006 MHS1	132.00	1	-69.0	-0.1	69.0	82				1.72	4.08	2003 DVC	2031 DVC	
TO 241006 MHS1	132.00	2	-69.0	-0.1	69.0	82				1.72	4.08	2003 DVC	2031 DVC	
TO 241015 PUTKI 1	132.00	1	-3.4	-16.0	16.3	19				0.04	0.08	2003 DVC	2031 DVC	
TO 241015 PUTKI 1	132.00	2	-3.4	-16.0	16.3	19				0.04	0.08	2003 DVC	2031 DVC	
TO 241022 SINDRI1	132.00	1	9.7	0.8	9.7	11				0.01	0.03	2003 DVC	2031 DVC	
TO 241022 SINDRI1	132.00	2	9.7	0.8	9.7	11				0.01	0.03	2003 DVC	2031 DVC	
TO 241094 BALIHARI	132.00	1	0.0	-0.8	0.8	1				0.00	0.00	2003 DVC	2031 DVC	
BUS 241009 KLYNS1	132.00	CKT	MW	MVAR	MVA	%	1.0344PU	1.05	X--- LOSSES	---X	X---- AREA	-----X	X---- ZONE	-----X 241009
							136.54KV		MW	MVAR	2003 DVC		2031 DVC	
TO LOAD-PQ			95.6	24.0	98.5									
TO 231008 KALIPAHARI1	132.00	1	-11.2	9.0	14.4	17				0.05	0.12	2003 DVC	2031 DVC	

TO 231008 KALIPAHARI1	132.00	2	-11.2	9.0	14.4	17				0.05	0.12	2003 DVC		2031 DVC		
TO 241006 MHS1	132.00	1	119.8	21.7	121.7	140				0.21	0.49	2003 DVC		2031 DVC		
TO 241006 MHS1	132.00	2	119.8	21.7	121.7	140				0.21	0.49	2003 DVC		2031 DVC		
TO 241006 MHS1	132.00	3	63.9	11.5	64.9	75				0.11	0.26	2003 DVC		2031 DVC		
TO 241006 MHS1	132.00	4	63.9	11.5	64.9	75				0.11	0.26	2003 DVC		2031 DVC		
TO 241090 MAL IMPX	132.00	1	0.0	-0.1	0.1	0				0.00	0.00	2003 DVC		2031 DVC		
TO 242003 KLYN2	220.00	1	-148.1	-36.3	152.5	95	1.0000UN			1.04	19.88	2003 DVC		2031 DVC		
TO 242003 KLYN2	220.00	2	-148.1	-36.3	152.5	95	1.0000UN			1.04	19.88	2003 DVC		2031 DVC		
TO 242003 KLYN2	220.00	3	-144.2	-35.6	148.5	93	1.0000UN			0.99	19.36	2003 DVC		2031 DVC		
BUS 241010 KUMARDHUBI1	132.00	CKT	MW	MVAR	MVA	%	1.0246PU	0.26	X--- LOSSES ---X	X---- AREA -----X			X---- ZONE -----X		241010	
							135.25KV		MW	MVAR	2003 DVC		2031 DVC			
TO LOAD-PQ			66.0	16.5	68.1											
TO 231007 PANCHET1	132.00	1	3.8	-1.0	3.9	5				0.00	0.00	2003 DVC		2031 DVC		
TO 241006 MHS1	132.00	1	-69.8	-15.6	71.5	83				0.34	0.81	2003 DVC		2031 DVC		
BUS 241011 MOSABANI1	132.00	CKT	MW	MVAR	MVA	%	0.9966PU	-5.88	X--- LOSSES ---X	X---- AREA -----X			X---- ZONE -----X		241011	
							131.55KV		MW	MVAR	2003 DVC		2031 DVC			
TO LOAD-PQ			84.8	21.2	87.4											
TO 231002 KHARGPUR1	132.00	1	-14.0	-3.6	14.5	17				0.18	0.42	2003 DVC		2031 DVC		
TO 231002 KHARGPUR1	132.00	2	-14.0	-3.6	14.5	17				0.18	0.42	2003 DVC		2031 DVC		
TO 241005 JAMSHEDPUR1	132.00	1	-28.3	-7.0	29.2	35				0.33	0.80	2003 DVC		2031 DVC		
TO 241005 JAMSHEDPUR1	132.00	2	-28.3	-7.0	29.2	35				0.33	0.80	2003 DVC		2031 DVC		
BUS 241012 RAMKANALI1	132.00	CKT	MW	MVAR	MVA	%	1.0222PU	0.02	X--- LOSSES ---X	X---- AREA -----X			X---- ZONE -----X		241012	
							134.93KV		MW	MVAR	2003 DVC		2031 DVC			
TO LOAD-PQ			50.9	12.8	52.5											
TO 231000 DTPS1	132.00	2	-45.2	2.2	45.3	53				1.21	2.88	2003 DVC		2031 DVC		
TO 231007 PANCHET1	132.00	1	-11.3	-2.2	11.5	13				0.02	0.04	2003 DVC		2031 DVC		
TO 231007 PANCHET1	132.00	2	-11.3	-2.2	11.5	13				0.02	0.04	2003 DVC		2031 DVC		
TO 241002 CTPS1	132.00	1	16.9	-10.6	20.0	23				0.23	0.54	2003 DVC		2031 DVC		
BUS 241013 RAMGARH1	132.00	CKT	MW	MVAR	MVA	%	1.0135PU	-4.51	X--- LOSSES ---X	X---- AREA -----X			X---- ZONE -----X		241013	
							133.78KV		MW	MVAR	2003 DVC		2031 DVC			
TO LOAD-PQ			117.3	29.4	120.9											
TO 241003 GOLA1	132.00	1	3.5	1.6	3.9	5				0.00	0.01	2003 DVC		2031 DVC		
TO 241003 GOLA1	132.00	2	3.5	1.6	3.9	5				0.00	0.01	2003 DVC		2031 DVC		
TO 241097 PATRATU1	132.00	1	40.3	9.4	41.4	49				0.49	1.16	2003 DVC		2031 DVC		
TO 241097 PATRATU1	132.00	2	40.3	9.4	41.4	49				0.49	1.16	2003 DVC		2031 DVC		
TO 242007 RAMGARH2	220.00	1	-102.4	-25.8	105.6	59	1.0000UN			0.43	10.29	2003 DVC		2031 DVC		
TO 242007 RAMGARH2	220.00	2	-102.4	-25.8	105.6	59	1.0000UN			0.43	10.29	2003 DVC		2031 DVC		
BUS 241015 PUTKI 1	132.00	CKT	MW	MVAR	MVA	%	1.0116PU	-2.55	X--- LOSSES ---X	X---- AREA -----X			X---- ZONE -----X		241015	
							133.53KV		MW	MVAR	2003 DVC		2031 DVC			
TO LOAD-PQ			133.6	33.5	137.8											
TO 241002 CTPS1	132.00	1	-30.7	-11.6	32.9	39				0.25	0.59	2003 DVC		2031 DVC		
TO 241002 CTPS1	132.00	2	-30.7	-11.6	32.9	39				0.25	0.59	2003 DVC		2031 DVC		
TO 241002 CTPS1	132.00	3	-30.7	-11.6	32.9	39				0.25	0.59	2003 DVC		2031 DVC		
TO 241002 CTPS1	132.00	4	-30.7	-11.6	32.9	39				0.25	0.59	2003 DVC		2031 DVC		
TO 241007 PATHARDIH1	132.00	1	3.4	15.3	15.7	18				0.04	0.08	2003 DVC		2031 DVC		
TO 241007 PATHARDIH1	132.00	2	3.4	15.3	15.7	18				0.04	0.08	2003 DVC		2031 DVC		
TO 241021 NIMIAGHAT1	132.00	1	-8.8	-8.7	12.4	15				0.05	0.13	2003 DVC		2031 DVC		
TO 241021 NIMIAGHAT1	132.00	2	-8.8	-8.7	12.4	15				0.05	0.13	2003 DVC		2031 DVC		
BUS 241016 JAM_DV2	132.00	CKT	MW	MVAR	MVA	%	1.0027PU	12.01	X--- LOSSES ---X	X---- AREA -----X			X---- ZONE -----X		241016	
							132.35KV		MW	MVAR	2003 DVC		2031 DVC			

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 TO 244000 TISCO_BRPS4 400.00  1     -0.0    -0.0     0.0   0 1.0000UN              0.00    0.00 2003 DVC          2031 DVC

BUS 241017 KONAR1      132.00 CKT     MW     MVAR     MVA    % 1.0431PU    0.61  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 241017
                                                               137.69KV              MW     MVAR 2003 DVC          2031 DVC
 TO LOAD-PQ                          19.6     4.9    20.2
 TO 241000 BARHI1       132.00  1     10.4    -9.1    13.9  16                      0.09    0.20 2003 DVC          2031 DVC
 TO 241001 BTPS1        132.00  1    -30.1     5.4    30.6  35                      0.17    0.40 2003 DVC          2031 DVC
 TO 241099 HAZARIBABRD  132.00  1      0.0    -0.6     0.6   1                      0.00    0.00 2003 DVC          2031 DVC
 TO 241099 HAZARIBABRD  132.00  2      0.0    -0.6     0.6   1                      0.00    0.00 2003 DVC          2031 DVC

BUS 241018 KTPP1       132.00 CKT     MW     MVAR     MVA    % 1.0845PU    1.40  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 241018
                                                               143.16KV              MW     MVAR 2003 DVC          2031 DVC
 TO LOAD-PQ                          18.2     4.6    18.8
 TO 241000 BARHI1       132.00  1     51.7    25.1    57.4  63                      1.03    2.44 2003 DVC          2031 DVC
 TO 241000 BARHI1       132.00  2     51.7    25.1    57.4  63                      1.03    2.44 2003 DVC          2031 DVC
 TO 241032 KODERMA _OLD132.00  1     31.4     7.1    32.2  35                      0.15    0.36 2003 DVC          2031 DVC
 TO 241032 KODERMA _OLD132.00  2     31.4     7.1    32.2  35                      0.15    0.36 2003 DVC          2031 DVC
 TO 242006 KODERMA2     220.00  1    -92.1   -34.5    98.4  55 1.0000UN             0.21    7.81 2003 DVC          2031 DVC
 TO 242006 KODERMA2     220.00  2    -92.1   -34.5    98.4  55 1.0000UN             0.21    7.81 2003 DVC          2031 DVC

BUS 241019 HAZARIBAGH1 132.00 CKT     MW     MVAR     MVA    % 1.0427PU   -0.69  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 241019
                                                               137.63KV              MW     MVAR 2003 DVC          2031 DVC
 TO LOAD-PQ                          58.2    14.6    60.0
 TO 241000 BARHI1       132.00  1    -29.1    -7.3    30.0  34                      0.08    0.20 2003 DVC          2031 DVC
 TO 241000 BARHI1       132.00  2    -29.1    -7.3    30.0  34                      0.08    0.20 2003 DVC          2031 DVC

BUS 241020 N KARANPURA1132.00 CKT     MW     MVAR     MVA    % 0.9858PU   -6.67  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 241020
                                                               130.12KV              MW     MVAR 2003 DVC          2031 DVC
 TO LOAD-PQ                          40.4    10.1    41.6
 TO 241095 ECR_RLY      132.00  1      0.0    -0.2     0.2   0                      0.00    0.00 2003 DVC          2031 DVC
 TO 241095 ECR_RLY      132.00  2      0.0    -0.2     0.2   0                      0.00    0.00 2003 DVC          2031 DVC
 TO 241097 PATRATU1     132.00  1    -20.2    -4.8    20.8  25                      0.13    0.31 2003 DVC          2031 DVC
 TO 241097 PATRATU1     132.00  2    -20.2    -4.8    20.8  25                      0.13    0.31 2003 DVC          2031 DVC

BUS 241021 NIMIAGHAT1  132.00 CKT     MW     MVAR     MVA    % 1.0227PU   -2.24  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 241021
                                                               134.99KV              MW     MVAR 2003 DVC          2031 DVC
 TO LOAD-PQ                          43.7    10.9    45.0
 TO 241015 PUTKI 1      132.00  1      8.8     6.5    10.9  13                      0.05    0.13 2003 DVC          2031 DVC
 TO 241015 PUTKI 1      132.00  2      8.8     6.5    10.9  13                      0.05    0.13 2003 DVC          2031 DVC
 TO 241023 GIRIDIH1     132.00  1    -30.6   -12.0    32.9  38                      0.41    0.97 2003 DVC          2031 DVC
 TO 241023 GIRIDIH1     132.00  2    -30.6   -12.0    32.9  38                      0.41    0.97 2003 DVC          2031 DVC

BUS 241022 SINDRI1     132.00 CKT     MW     MVAR     MVA    % 1.0040PU   -2.68  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 241022
                                                               132.53KV              MW     MVAR 2003 DVC          2031 DVC
 TO LOAD-PQ                          19.3     4.8    19.9
 TO 241007 PATHARDIH1   132.00  1     -9.6    -1.6     9.8  12                      0.01    0.03 2003 DVC          2031 DVC
 TO 241007 PATHARDIH1   132.00  2     -9.6    -1.6     9.8  12                      0.01    0.03 2003 DVC          2031 DVC
 TO 241028 PRADHAN      132.00  1      0.0    -0.8     0.8   1                      0.00    0.00 2003 DVC          2031 DVC
 TO 241028 PRADHAN      132.00  2      0.0    -0.8     0.8   1                      0.00    0.00 2003 DVC          2031 DVC

BUS 241023 GIRIDIH1    132.00 CKT     MW     MVAR     MVA    % 1.0453PU   -0.89  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 241023
                                                               137.99KV              MW     MVAR 2003 DVC          2031 DVC
 TO LOAD-PQ                         124.4    31.2   128.2
 TO 241021 NIMIAGHAT1   132.00  1     31.0    10.6    32.8  37                      0.41    0.97 2003 DVC          2031 DVC
 TO 241021 NIMIAGHAT1   132.00  2     31.0    10.6    32.8  37                      0.41    0.97 2003 DVC          2031 DVC
 TO 242005 GIRDHI2      220.00  1    -93.2   -26.2    96.8  54 1.0000UN             0.21    8.14 2003 DVC          2031 DVC
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 TO 242005 GIRDHI2     220.00  2    -93.2   -26.2    96.8  54 1.0000UN             0.21    8.14 2003 DVC          2031 DVC

BUS 241024 RAJABAR     132.00 CKT     MW     MVAR     MVA   % 1.0252PU   -1.72  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 241024
                                                               135.32KV              MW     MVAR 2003 DVC          2031 DVC
 TO 241002 CTPS1       132.00  1      0.0     0.0     0.0   0                      0.00    0.00 2003 DVC          2031 DVC
 TO 241002 CTPS1       132.00  2      0.0     0.0     0.0   0                      0.00    0.00 2003 DVC          2031 DVC

BUS 241027 SULTANG     132.00 CKT     MW     MVAR     MVA   % 1.0377PU    0.69  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 241027
                                                               136.98KV              MW     MVAR 2003 DVC          2031 DVC
 TO 241006 MHS1        132.00  1     -0.0     0.0     0.0   0                      0.01    0.01 2003 DVC          2031 DVC

BUS 241028 PRADHAN     132.00 CKT     MW     MVAR     MVA   % 1.0042PU   -2.68  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 241028
                                                               132.56KV              MW     MVAR 2003 DVC          2031 DVC
 TO 241022 SINDRI1     132.00  1      0.0    -0.0     0.0   0                      0.00    0.00 2003 DVC          2031 DVC
 TO 241022 SINDRI1     132.00  2      0.0    -0.0     0.0   0                      0.00    0.00 2003 DVC          2031 DVC

BUS 241030 DHNABD_1    132.00 CKT     MW     MVAR     MVA   % 1.0741PU    4.86  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 241030
                                                               141.78KV              MW     MVAR 2003 DVC          2031 DVC
 TO 242004 DHANBAD2    220.00  1     -0.0     0.0     0.0   0 1.0000UN             0.00    0.00 2003 DVC          2031 DVC
 TO 242004 DHANBAD2    220.00  2     -0.0     0.0     0.0   0 1.0000UN             0.00    0.00 2003 DVC          2031 DVC

BUS 241031 JOJOBE_1    132.00 CKT     MW     MVAR     MVA   % 1.0138PU   -4.50  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 241031
                                                               133.82KV              MW     MVAR 2003 DVC          2031 DVC
 TO 241005 JAMSHEDPUR1 132.00  1      0.0     0.0     0.0   0                      0.00    0.00 2003 DVC          2031 DVC
 TO 241005 JAMSHEDPUR1 132.00  2      0.0     0.0     0.0   0                      0.00    0.00 2003 DVC          2031 DVC

BUS 241032 KODERMA _OLD132.00 CKT     MW     MVAR     MVA   % 1.0768PU    0.84  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 241032
                                                               142.14KV              MW     MVAR 2003 DVC          2031 DVC
 TO LOAD-PQ                           62.5    15.7    64.4
 TO 241018 KTPP1       132.00  1    -31.2    -7.8    32.2  36                      0.15    0.36 2003 DVC          2031 DVC
 TO 241018 KTPP1       132.00  2    -31.2    -7.8    32.2  36                      0.15    0.36 2003 DVC          2031 DVC

BUS 241090 MAL IMPX    132.00 CKT     MW     MVAR     MVA   % 1.0344PU    1.05  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 241090
                                                               136.54KV              MW     MVAR 2003 DVC          2031 DVC
 TO 241009 KLYNS1      132.00  1      0.0     0.0     0.0   0                      0.00    0.00 2003 DVC          2031 DVC

BUS 241091 BIADA       132.00 CKT     MW     MVAR     MVA   % 1.0191PU   -2.21  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 241091
                                                               134.52KV              MW     MVAR 2003 DVC          2031 DVC
 TO LOAD-PQ                           36.5     9.1    37.6
 TO 241002 CTPS1       132.00  1    -18.2    -4.6    18.8  22                      0.07    0.18 2003 DVC          2031 DVC
 TO 241002 CTPS1       132.00  2    -18.2    -4.6    18.8  22                      0.07    0.18 2003 DVC          2031 DVC

BUS 241094 BALIHARI    132.00 CKT     MW     MVAR     MVA   % 1.0061PU   -2.49  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 241094
                                                               132.80KV              MW     MVAR 2003 DVC          2031 DVC
 TO 241007 PATHARDIH1  132.00  1      0.0    -0.0     0.0   0                      0.00    0.00 2003 DVC          2031 DVC

BUS 241095 ECR_RLY     132.00 CKT     MW     MVAR     MVA   % 0.9858PU   -6.67  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 241095
                                                               130.12KV              MW     MVAR 2003 DVC          2031 DVC
 TO 241020 N KARANPURA1132.00  1      0.0     0.0     0.0   0                      0.00    0.00 2003 DVC          2031 DVC
 TO 241020 N KARANPURA1132.00  2      0.0     0.0     0.0   0                      0.00    0.00 2003 DVC          2031 DVC

BUS 241097 PATRATU1    132.00 CKT     MW     MVAR     MVA   % 0.9954PU   -5.91  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 241097
                                                               131.39KV              MW     MVAR 2003 DVC          2031 DVC
 TO LOAD-PQ                           38.9     9.8    40.1
 TO 241013 RAMGARH1    132.00  1    -39.8    -9.9    41.0  49                      0.49    1.16 2003 DVC          2031 DVC
 TO 241013 RAMGARH1    132.00  2    -39.8    -9.9    41.0  49                      0.49    1.16 2003 DVC          2031 DVC
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 TO 241020 N KARANPURA1132.00  1     20.3     5.0    20.9  25                    0.13    0.31 2003 DVC          2031 DVC
 TO 241020 N KARANPURA1132.00  2     20.3     5.0    20.9  25                    0.13    0.31 2003 DVC          2031 DVC

BUS 241099 HAZARIBABRD 132.00 CKT     MW     MVAR     MVA    % 1.0432PU    0.61  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 241099
                                                               137.70KV              MW     MVAR 2003 DVC          2031 DVC
 TO 241017 KONAR1       132.00  1      0.0    -0.0     0.0   0                     0.00    0.00 2003 DVC          2031 DVC
 TO 241017 KONAR1       132.00  2      0.0    -0.0     0.0   0                     0.00    0.00 2003 DVC          2031 DVC

BUS 242000 BTPS2       220.00 CKT     MW     MVAR     MVA    % 1.0136PU    3.83  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 242000
                                                               223.00KV              MW     MVAR 2003 DVC          2031 DVC
 TO 241001 BTPS1        132.00  1     49.0     0.8    49.0  27 0.9670RG            0.10    2.07 2003 DVC          2031 DVC
 TO 241001 BTPS1        132.00  2     49.0     0.8    49.0  27 0.9670RG            0.10    2.07 2003 DVC          2031 DVC
 TO 242001 CTPS2        220.00  1     -9.2    52.2    53.0  25                     0.14    0.78 2003 DVC          2031 DVC
 TO 242001 CTPS2        220.00  2     -9.2    52.2    53.0  25                     0.14    0.78 2003 DVC          2031 DVC
 TO 242002 JAMSHEDPUR2  220.00  1     54.3     9.4    55.1  26                     0.72    4.14 2003 DVC          2031 DVC
 TO 242002 JAMSHEDPUR2  220.00  2     54.3     9.4    55.1  26                     0.72    4.14 2003 DVC          2031 DVC
 TO 242007 RAMGARH2     220.00  1    130.1    43.2   137.1  65                     1.47    8.37 2003 DVC          2031 DVC
 TO 242007 RAMGARH2     220.00  2    130.1    43.2   137.1  65                     1.47    8.37 2003 DVC          2031 DVC
 TO 244001 BTPS - A4    400.00  1   -224.2  -105.6   247.8  79 1.0000UN            1.18   23.72 2003 DVC          2031 DVC
 TO 244001 BTPS - A4    400.00  2   -224.2  -105.6   247.8  79 1.0000UN            1.18   23.72 2003 DVC          2031 DVC

BUS 242001 CTPS2       220.00 CKT     MW     MVAR     MVA    % 1.0000PU    4.11  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 242001
 FROM GENERATION                    456.0    10.1R   456.1  78 220.00KV              MW     MVAR 2003 DVC          2031 DVC
 TO LOAD-PQ                         160.1     40.1   165.0
 TO 241002 CTPS1        132.00  1    118.4     43.3   126.1  70 0.9409LO            0.54   13.36 2003 DVC          2031 DVC
 TO 241002 CTPS1        132.00  2    118.4     43.3   126.1  70 0.9409LO            0.54   13.36 2003 DVC          2031 DVC
 TO 241002 CTPS1        132.00  3    118.4     43.3   126.1  70 0.9409LO            0.54   13.36 2003 DVC          2031 DVC
 TO 242000 BTPS2        220.00  1      9.3    -55.9    56.7  27                     0.14    0.78 2003 DVC          2031 DVC
 TO 242000 BTPS2        220.00  2      9.3    -55.9    56.7  27                     0.14    0.78 2003 DVC          2031 DVC
 TO 242004 DHANBAD2     220.00  1    -39.0    -24.0    45.8  22                     0.14    0.73 2003 DVC          2031 DVC
 TO 242004 DHANBAD2     220.00  2    -39.0    -24.0    45.8  22                     0.14    0.73 2003 DVC          2031 DVC

BUS 242002 JAMSHEDPUR2 220.00 CKT     MW     MVAR     MVA    % 0.9783PU    0.13  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 242002
                                                               215.23KV              MW     MVAR 2003 DVC          2031 DVC
 TO 241005 JAMSHEDPUR1  132.00  1     90.2     27.4    94.3  52 0.9409LO            0.39    7.88 2003 DVC          2031 DVC
 TO 241005 JAMSHEDPUR1  132.00  2     90.2     27.4    94.3  52 0.9409LO            0.39    7.88 2003 DVC          2031 DVC
 TO 242000 BTPS2        220.00  1    -53.6    -26.7    59.9  29                     0.72    4.14 2003 DVC          2031 DVC
 TO 242000 BTPS2        220.00  2    -53.6    -26.7    59.9  29                     0.72    4.14 2003 DVC          2031 DVC
 TO 252029 JINDAL       220.00  1    -73.2     -1.3    73.2  36                     1.10    6.29 2004 ODISHA       2043 ODISHA_N

BUS 242003 KLYN2       220.00 CKT     MW     MVAR     MVA    % 1.0172PU    7.91  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 242003
                                                               223.79KV              MW     MVAR 2003 DVC          2031 DVC
 TO 232001 MTPS2        220.00  1    -79.5     -8.9    80.0  38                     0.75    4.00 2003 DVC          2031 DVC
 TO 232001 MTPS2        220.00  2    -79.5     -8.9    80.0  38                     0.75    4.00 2003 DVC          2031 DVC
 TO 232001 MTPS2        220.00  3    -79.5     -8.9    80.0  38                     0.75    4.00 2003 DVC          2031 DVC
 TO 232004 BURNPUR2     220.00  2      6.2     12.1    13.6   6                     0.01    0.04 2003 DVC          2031 DVC
 TO 241009 KLYNS1       132.00  1    149.2     56.2   159.4 100 0.9409LO            1.04   19.88 2003 DVC          2031 DVC
 TO 241009 KLYNS1       132.00  2    149.2     56.2   159.4 100 0.9409LO            1.04   19.88 2003 DVC          2031 DVC
 TO 241009 KLYNS1       132.00  3    145.2     54.9   155.3  97 0.9409LO            0.99   19.36 2003 DVC          2031 DVC
 TO 242009 MAITHON PG2  220.00  1   -105.6    -76.5   130.4  62                     0.19    1.02 2053 ER_ISTS_DVC  2031 DVC
 TO 242009 MAITHON PG2  220.00  2   -105.6    -76.5   130.4  62                     0.19    1.02 2053 ER_ISTS_DVC  2031 DVC

BUS 242004 DHANBAD2    220.00 CKT     MW     MVAR     MVA    % 1.0106PU    4.86  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 242004
                                                               222.34KV              MW     MVAR 2003 DVC          2031 DVC
 TO LOAD-PQ                          88.3     22.1    91.1
 TO 232089 ELECTRO STL  220.00  1      0.0    -11.9    11.9   6                     0.00    0.01 2003 DVC          2031 DVC
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 TO 232089 ELECTRO STL 220.00  2      0.0   -11.9    11.9   6                      0.00    0.01 2003 DVC          2031 DVC
 TO 241030 DHNABD_1    132.00  1      0.0    -0.0     0.0   0 0.9409RG             0.00    0.00 2003 DVC          2031 DVC
 TO 241030 DHNABD_1    132.00  2      0.0    -0.0     0.0   0 0.9409RG             0.00    0.00 2003 DVC          2031 DVC
 TO 242001 CTPS2       220.00  1     39.2    18.2    43.2  21                      0.14    0.73 2003 DVC          2031 DVC
 TO 242001 CTPS2       220.00  2     39.2    18.2    43.2  21                      0.14    0.73 2003 DVC          2031 DVC
 TO 242005 GIRDHI2     220.00  1     58.7   -14.9    60.6  29                      0.24    1.30 2003 DVC          2031 DVC
 TO 242005 GIRDHI2     220.00  2     58.7   -14.9    60.6  29                      0.24    1.30 2003 DVC          2031 DVC
 TO 242009 MAITHON PG2 220.00  1   -142.1    -2.5   142.1  68                      1.58    8.45 2053 ER_ISTS_DVC  2031 DVC
 TO 242009 MAITHON PG2 220.00  2   -142.1    -2.5   142.1  68                      1.58    8.45 2053 ER_ISTS_DVC  2031 DVC

BUS 242005 GIRDHI2     220.00 CKT     MW     MVAR     MVA    % 1.0111PU    3.59  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 242005
                                                                222.44KV             MW     MVAR 2003 DVC          2031 DVC
 TO LOAD-PQ                          25.5     6.4    26.2
 TO 241023 GIRIDIH1    132.00  1     93.4    34.3    99.5  55 0.9409RG             0.21    8.14 2003 DVC          2031 DVC
 TO 241023 GIRIDIH1    132.00  2     93.4    34.3    99.5  55 0.9409RG             0.21    8.14 2003 DVC          2031 DVC
 TO 242004 DHANBAD2    220.00  1    -58.5     9.7    59.3  28                      0.24    1.30 2003 DVC          2031 DVC
 TO 242004 DHANBAD2    220.00  2    -58.5     9.7    59.3  28                      0.24    1.30 2003 DVC          2031 DVC
 TO 242006 KODERMA2    220.00  1    -47.7   -47.1    67.0  32                      0.61    3.27 2003 DVC          2031 DVC
 TO 242006 KODERMA2    220.00  2    -47.7   -47.1    67.0  32                      0.61    3.27 2003 DVC          2031 DVC

BUS 242006 KODERMA2    220.00 CKT     MW     MVAR     MVA    % 1.0535PU    5.49  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 242006
                                                                231.78KV             MW     MVAR 2003 DVC          2031 DVC
 TO 241018 KTPP1       132.00  1     92.3    42.3   101.6  56 0.9409RG             0.21    7.81 2003 DVC          2031 DVC
 TO 241018 KTPP1       132.00  2     92.3    42.3   101.6  56 0.9409RG             0.21    7.81 2003 DVC          2031 DVC
 TO 242005 GIRDHI2     220.00  1     48.3    34.4    59.3  27                      0.61    3.27 2003 DVC          2031 DVC
 TO 242005 GIRDHI2     220.00  2     48.3    34.4    59.3  27                      0.61    3.27 2003 DVC          2031 DVC
 TO 244002 KTPS4       400.00  1   -140.6   -76.7   160.2  51 1.0000UN             0.46    9.17 2003 DVC          2031 DVC
 TO 244002 KTPS4       400.00  2   -140.6   -76.7   160.2  51 1.0000UN             0.46    9.17 2003 DVC          2031 DVC

BUS 242007 RAMGARH2    220.00 CKT     MW     MVAR     MVA    % 0.9841PU    0.69  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 242007
                                                                216.51KV             MW     MVAR 2003 DVC          2031 DVC
 TO LOAD-PQ                          51.5    12.9    53.1
 TO 241013 RAMGARH1    132.00  1    102.9    36.1   109.0  61 0.9409LO             0.43   10.29 2003 DVC          2031 DVC
 TO 241013 RAMGARH1    132.00  2    102.9    36.1   109.0  61 0.9409LO             0.43   10.29 2003 DVC          2031 DVC
 TO 242000 BTPS2       220.00  1   -128.6   -42.5   135.5  66                      1.47    8.37 2003 DVC          2031 DVC
 TO 242000 BTPS2       220.00  2   -128.6   -42.5   135.5  66                      1.47    8.37 2003 DVC          2031 DVC

BUS 242009 MAITHON PG2 220.00 CKT     MW     MVAR     MVA    % 1.0231PU    8.23  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 242009
                                                                225.09KV             MW     MVAR 2053 ER_ISTS_DVC  2031 DVC
 TO 222008 DUMKA NEW   220.00  1     55.1    13.6    56.8  26                      0.34    1.95 2002 JHARKHAND    2021 JHARKHAND
 TO 222008 DUMKA NEW   220.00  2     55.1    13.6    56.8  26                      0.34    1.95 2002 JHARKHAND    2021 JHARKHAND
 TO 242003 KLYN2       220.00  1    105.8    76.4   130.5  61                      0.19    1.02 2003 DVC          2031 DVC
 TO 242003 KLYN2       220.00  2    105.8    76.4   130.5  61                      0.19    1.02 2003 DVC          2031 DVC
 TO 242004 DHANBAD2    220.00  1    143.7     3.3   143.7  68                      1.58    8.45 2003 DVC          2031 DVC
 TO 242004 DHANBAD2    220.00  2    143.7     3.3   143.7  68                      1.58    8.45 2003 DVC          2031 DVC
 TO 244003 MAITHON PG4 400.00  1   -304.6   -93.3   318.6  64 1.0000UN             1.21   24.23 2053 ER_ISTS_DVC  2031 DVC
 TO 244003 MAITHON PG4 400.00  3   -304.6   -93.3   318.6  64 1.0000UN             1.21   24.23 2053 ER_ISTS_DVC  2031 DVC

BUS 244000 TISCO_BRPS4 400.00 CKT     MW     MVAR     MVA    % 1.0027PU   12.01  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 244000
                                                                401.06KV             MW     MVAR 2003 DVC          2031 DVC
 TO 241016 JAM_DV2     132.00  1      0.0     0.0     0.0   0 1.0000LK             0.00    0.00 2003 DVC          2031 DVC
 TO 244004 JAMSHEDPUR4 400.00  Q1  -185.8    49.1   192.2  22                      0.22    2.50 2053 ER_ISTS_DVC  2031 DVC
 TO 254012 BARIPADA4   400.00  Q1   185.8   -49.1   192.2  22                      0.67    7.21 2054 ER_ISTS_ODIS 2043 ODISHA_N

BUS 244001 BTPS - A4   400.00 CKT     MW     MVAR     MVA    % 1.0000PU    8.46  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 244001
 FROM GENERATION                   475.0   -13.3R   475.2  73 400.00KV             MW     MVAR 2003 DVC          2031 DVC
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 TO 242000 BTPS2       220.00  1    225.4   129.3   259.8  82 0.9409RG              1.18   23.72 2003 DVC          2031 DVC
 TO 242000 BTPS2       220.00  2    225.4   129.3   259.8  82 0.9409RG              1.18   23.72 2003 DVC          2031 DVC
 TO 244002 KTPS4       400.00  T1    12.1  -136.0   136.6  16                       0.22    2.45 2003 DVC          2031 DVC
 TO 244002 KTPS4       400.00  T2    12.1  -136.0   136.6  16                       0.22    2.45 2003 DVC          2031 DVC

BUS 244002 KTPS4       400.00 CKT     MW     MVAR     MVA   % 1.0221PU    8.20  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 244002
 FROM GENERATION                    950.0   600.0H 1123.6  96 408.83KV              MW     MVAR 2003 DVC          2031 DVC
 TO SWITCHED SHUNT                    0.0    94.8    94.8
 TO 214000 BIHARSHARIF 400.00  Q1   202.3    23.0   203.6  11                       0.44    7.57 2051 ER_ISTS_BIH  2001 ER_BOUNDARY
 TO 214000 BIHARSHARIF 400.00  Q2   202.3    23.0   203.6  11                       0.44    7.57 2051 ER_ISTS_BIH  2001 ER_BOUNDARY
 TO 214005 GAYA4       400.00  Q1   143.6    61.5   156.2   9                       0.21    3.63 2051 ER_ISTS_BIH  2001 ER_BOUNDARY
 TO 214005 GAYA4       400.00  Q2   143.6    61.5   156.2   9                       0.21    3.63 2051 ER_ISTS_BIH  2001 ER_BOUNDARY
 TO 242006 KODERMA2    220.00  1    141.1    85.9   165.2  52 0.9409RG              0.46    9.17 2003 DVC          2031 DVC
 TO 242006 KODERMA2    220.00  2    141.1    85.9   165.2  52 0.9409RG              0.46    9.17 2003 DVC          2031 DVC
 TO 244001 BTPS - A4   400.00  T1   -11.9    82.3    83.2   9                       0.22    2.45 2003 DVC          2031 DVC
 TO 244001 BTPS - A4   400.00  T2   -11.9    82.3    83.2   9                       0.22    2.45 2003 DVC          2031 DVC

BUS 244003 MAITHON PG4 400.00 CKT     MW     MVAR     MVA   % 0.9900PU   12.22  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 244003
                                                              396.01KV              MW     MVAR 2053 ER_ISTS_DVC  2031 DVC
 TO SWITCHED SHUNT                    0.0   155.6   155.6
 TO 214001 KHALGAON_B  400.00  T1   -57.1   -30.6    64.8   7                       0.12    1.30 2102 KHSTPP       2012 BIHAR_S
 TO 214005 GAYA4       400.00  Q1   196.6  -100.9   221.0  13                       1.06   18.24 2051 ER_ISTS_BIH  2001 ER_BOUNDARY
 TO 214005 GAYA4       400.00  Q2   196.6  -100.9   221.0  13                       1.06   18.24 2051 ER_ISTS_BIH  2001 ER_BOUNDARY
 TO 234002 MTPS_B4     400.00  T2  -457.4   -41.5   459.3  55                       2.39   26.65 2003 DVC          2031 DVC
 TO 234002 MTPS_B4     400.00  T3  -457.4   -41.4   459.3  55                       2.40   26.65 2003 DVC          2031 DVC
 TO 242009 MAITHON PG2 220.00  1    305.8   117.6   327.6  66 0.9409RG              1.21   24.23 2053 ER_ISTS_DVC  2031 DVC
 TO 242009 MAITHON PG2 220.00  3    305.8   117.6   327.6  66 0.9409RG              1.21   24.23 2053 ER_ISTS_DVC  2031 DVC
 TO 244004 JAMSHEDPUR4 400.00  T1   -32.9   -75.5    82.3  10                       0.06    0.60 2053 ER_ISTS_DVC  2031 DVC

BUS 244004 JAMSHEDPUR4 400.00 CKT     MW     MVAR     MVA   % 1.0000PU   12.73  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 244004
                                                              400.00KV              MW     MVAR 2053 ER_ISTS_DVC  2031 DVC
 TO SWITCHED SHUNT                    0.0   158.7   158.7
 TO 222002 RAMCHAND PG 220.00  1    107.9   109.3   153.6  39 0.9409LK              0.42    8.26 2052 ER_ISTS_JHA  2021 JHARKHAND
 TO 222002 RAMCHAND PG 220.00  2    107.9   109.3   153.6  39 0.9409LK              0.42    8.26 2052 ER_ISTS_JHA  2021 JHARKHAND
 TO 222002 RAMCHAND PG 220.00  3    107.9   109.3   153.6  39 0.9409LK              0.42    8.26 2052 ER_ISTS_JHA  2021 JHARKHAND
 TO 224002 ADUNIK      400.00  Q1  -236.4    17.3   237.0  27                       0.00    0.03 2301 ADHUNIK      2021 JHARKHAND
 TO 224002 ADUNIK      400.00  Q2  -236.4    17.3   237.0  27                       0.00    0.03 2301 ADHUNIK      2021 JHARKHAND
 TO 234001 DSTPS4      400.00  T1  -223.0   -18.6   223.8  26                       1.43   15.24 2003 DVC          2031 DVC
 TO 234001 DSTPS4      400.00  T2  -223.0   -18.6   223.8  26                       1.43   15.24 2003 DVC          2031 DVC
 TO 234002 MTPS_B4     400.00  T1  -148.2   -33.0   151.8  17                       0.67    7.18 2003 DVC          2031 DVC
 TO 244000 TISCO_BRPS4 400.00  Q1   186.1   -64.4   196.9  23                       0.22    2.50 2003 DVC          2031 DVC
 TO 244003 MAITHON PG4 400.00  T1    32.9   -15.1    36.2   4                       0.06    0.60 2053 ER_ISTS_DVC  2031 DVC
 TO 244005 CHAIBASA PG4400.00  T1   120.6  -102.5   158.3  18                       0.30    3.25 2053 ER_ISTS_DVC  2031 DVC
 TO 244005 CHAIBASA PG4400.00  T2   120.6  -102.5   158.3  18                       0.30    3.25 2053 ER_ISTS_DVC  2031 DVC
 TO 254012 BARIPADA4   400.00  T2   189.0   -66.9   200.4  23                       0.92    9.80 2054 ER_ISTS_ODIS 2043 ODISHA_N
 TO 264009 PARULIA_B   400.00  T1    94.0   -99.6   136.9  16                       0.35    3.74 2055 ER_ISTS_WB   2052 S_BNG

BUS 244005 CHAIBASA PG4400.00 CKT     MW     MVAR     MVA   % 1.0107PU   11.59  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X 244005
                                                              404.28KV              MW     MVAR 2053 ER_ISTS_DVC  2031 DVC
 TO SWITCHED SHUNT                    0.0    74.1    74.1
 TO 222010 CHAIBASA    220.00  1     29.4  -105.0   109.0  35 1.0000UN              0.23    4.60 2052 ER_ISTS_JHA  2021 JHARKHAND
 TO 222010 CHAIBASA    220.00  2     29.4  -105.0   109.0  35 1.0000UN              0.23    4.60 2052 ER_ISTS_JHA  2021 JHARKHAND
 TO 244004 JAMSHEDPUR4 400.00  T1  -120.3   101.8   157.6  18                       0.30    3.25 2053 ER_ISTS_DVC  2031 DVC
 TO 244004 JAMSHEDPUR4 400.00  T2  -120.3   101.8   157.6  18                       0.30    3.25 2053 ER_ISTS_DVC  2031 DVC
 TO 254007 ROURKELLA4  400.00  T1  -227.7    37.5   230.7  26                       1.21   12.96 2054 ER_ISTS_ODIS 2001 ER_BOUNDARY
 TO 254007 ROURKELLA4  400.00  T2  -227.7    37.5   230.7  26                       1.21   12.96 2054 ER_ISTS_ODIS 2001 ER_BOUNDARY
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TO 264001 KHARAGP	400.00	T1	318.6	-71.4	326.5	37			2.90	31.02	2005	WB	2052	S_BNG	
TO 264001 KHARAGP	400.00	T2	318.6	-71.4	326.5	37			2.90	31.02	2005	WB	2052	S_BNG	
BUS 244006 MAITHON B	400.00	CKT	MW	MVAR	MVA	%	0.9987PU	16.70	X--- LOSSES ---X		X---- AREA -----X		X---- ZONE -----X		244006
							399.49KV		MW	MVAR	2053	ER_ISTS_DVC	2031	DVC	
TO SWITCHED SHUNT			0.0	116.7	116.7										
TO 214032 KHALGAON_A	400.00	T1	178.8	-21.9	180.2	21			1.00	10.68	2102	KHSTPP	2012	BIHAR_S	
TO 224001 MPL	400.00	T1	-357.8	6.9	357.9	41			0.73	7.79	2304	MPL	2021	JHARKHAND	
TO 224001 MPL	400.00	T2	-357.8	6.9	357.9	41			0.73	7.79	2304	MPL	2021	JHARKHAND	
TO 224004 RANCHI_4	400.00	T1	77.8	-45.7	90.3	10			0.25	2.69	2052	ER_ISTS_JHA	2001	ER_BOUNDARY	
TO 234000 RTPS4	400.00	T1	-13.4	-38.3	40.6	5			0.01	0.07	2003	DVC	2031	DVC	
TO 234002 MTPS_B4	400.00	T1	118.6	-39.5	125.0	14			0.22	2.49	2003	DVC	2031	DVC	
TO 264032 PARULIA_A	400.00	T1	176.9	7.6	177.1	21			0.42	4.72	2055	ER_ISTS_WB	2052	S_BNG	
TO 264032 PARULIA_A	400.00	T2	176.9	7.6	177.1	21			0.42	4.72	2055	ER_ISTS_WB	2052	S_BNG	

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

To

As per List Enclosed.

Subject: Minutes of Meeting regarding review of Connectivity/ LTA/ evacuation system for OPGC IBTPS (2x660MW) thermal power project in Odisha.

Sir,

A meeting regarding review of Connectivity/ LTA/ evacuation system for OPGC IBTPS (2x660MW) thermal power project in Odisha was held on 26.03.2019 at CEA, New Delhi. Minutes of the Meeting are enclosed herewith.

Yours faithfully,

12/04/2019

(Pardeep Jindal)

Chief Engineer (PSP&A-II)

सेवा भवन, आर. के. पुरम-I, नई दिल्ली-110066 **टेलीफोन**: 011-26198092 **ईमेल**: cea-pspa2@gov.in वेबसाइट: www.cea.nic.in
Sewa Bhawan, R.K Puram-I, New Delhi-110066 **Telephone**: 011-26198092 **Email**: cea-pspa2@gov.in **Website**: www.cea.nic.in

List of addressee:

1. Member Secretary, Eastern Regional Power Committee, 14, Golf Club Road, Tollygange, Kolkata-700033. Tel. No. 033-24235199 Fax No.033-24171358	2. Managing Director, Bihar State Power Transmission Company, Vidyut Bhavan (4th floor), Baily Road, Patna-800021. Tel. 0612-2504442
3. Chairman-cum-Managing Director, Jharkhand Urja Sancharan Nigam Limited Engineering Building, H.E.C., Dhurwa, Ranchi-834004.	4. Chairman-cum-Managing Director, Orissa Power Transmission Corporation Ltd, Jan path, Bhubaneshwar-751022. Tel. No. 0674-2540098 Fax No.0674-2541904
5. Managing Director, West Bengal State Electricity Transmission Company Ltd, Vidyut Bhavan (8th Floor), A-block, Salt Lake City, Kolkata-700091.	6. Principal Chief Engineer cum Secretary, Power Department Government of Sikkim, Sikkim. Tel. No. 03592-2022440 Fax No.03592-202927
7. Chief Operating Officer, Central Transmission Utility (CTU), Power Grid Corporation of India "Saudamini" Plot No. 2, Sector-29, Gurugram-122001	8. Managing Director, Odisha Power Generation Corporation Ltd.(OPGC), Zone-A, 7th Floor, Fortune Towers, Chandrashekarpur, Bhubaneswar-751023,Odisha.

Minutes of Meeting regarding review of Connectivity/ LTA/ evacuation system for OPGC IBTPS (2x660MW) thermal power project in Odisha held on 26.03.2019 at CEA, New Delhi.

List of participants are enclosed at Annexure-I.

1. Chairperson, CEA welcomed the participants and requested Chief Engineer (PSP&A-II) to appraise the issue.
2. Chief Engineer (PSP&A-II), CEA informed that Odisha Power Generation Corporation (OPGC) is constructing power project of 2x660MW (Ib Valley U-3 & 4), out of which Unit-3 would be connected to STU system through OPGC-Lapanga 400kV D/c line (with twin moose conductor of 85 deg. C rating) and Unit-4 would be connected to ISTS through OPGC-Sundargarh 400kV D/c ISTS line (with triple snowbird conductor, under TBCB route). As the connectivities are separate for the two units, i.e. U-3 with STU and U-4 with ISTS, the system has been planned with a bus sectionaliser in generation switchyard, which would be normally kept open.
3. Representative of OPGC informed that Unit 3 and Unit 4 would be commissioned by the end of April, 2019 and May, 2019 respectively. He said that OPGC had taken connectivity and LTA for 660 MW (Unit-4) based on target region (200 MW for Northern Region, 200 MW for Western Region and 200 MW for Southern region). Subsequently, the coal linkage was cancelled due to coal blocks deallocation. Therefore, OPGC was compelled to purchase the coal from the state owned mining company (OCPL- Odisha Coal Private Limited). Odisha government while providing coal linkage from OCPL, allocated total power of Unit 3 & 4 (1320MW) to GRIDCO, Odisha for a period of 25 years. As per PPA, OPGC has to deliver this power to GRIDCO at their switchyard, therefore, they have requested CEA to approve the proposal of operating the system under common bus mode i.e. by closing the bus sectionaliser between Unit-3 (connected to STU) and Unit-4 (connected to ISTS).
4. Chief Engineer (PSPA-II) stated that in the PPA, if delivery point is OPGC switchyard, the requisite transmission access and charges are to be arranged/paid by GRIDCO. And under the present configuration, there is no constraint in transmitting power to Odisha as per the PPA. However, OPGC has voluntarily relinquished the LTA granted to them but connectivity agreement with CTU still exists. OPGC would need transmission access to ISTS for scheduling & dispatch of their power from U-4. For this, one of the options is that OPGC may again apply for LTA, or alternatively, OPGC may seek Short Term Open Access (STOA). As complete transmission system has already been built as per request of OPGC's LTA application, any constraint in scheduling of power even under STOA, is unlikely.
5. Member Secretary, ERPC stated that, after closing the bus sectionaliser, the scheduling of the Unit 4 would come under jurisdiction of SLDC, Odisha.

6. Representative of GRIDCO, Odisha, stated that GRIDCO wanted to evacuate the entire power through their STU network and requested to examine the technical feasibility of the system under common bus mode. This way, they can also avoid any transmission charges (and losses) of the ISTS for drawing power from U-4 of OPGC. GRIDCO, however, would abide by all the commercial terms and conditions, as per CERC regulations/order.

7. Representative of CTU stated that by closing the bus sectionaliser, the entire power (1320 MW) may not flow towards Odisha system through the STU network (OPGC-Lapanga 400 kV D/c line), as some power would also flow through the ISTS network (OPGC-Sundargarh 400kV D/c line). Also, if there is N-1 contingency on OPGC-Lapanga400kV D/c line, the power flow on the other circuit may be on the higher side (near thermal limits) in some conditions. However, in case of outage of both circuits of OPGC-Lapanga (twin moose) line, entire power will have to be evacuated through OPGC-Sundargarh ISTS line, which is of higher capacity (triple snowbird).

8. Chief Engineer (PSPA-II) added that under separate bus mode, the reliability is better than that under common bus mode due to insufficient transmission capacity of the OPGC-Lapanga 400kV D/c line under N-1 conditions.

9. Representative of CTU further stated that OPGC-Sundargarh 400kV D/c ISTS line has been built under TBCB and executed by Odisha Generation Power Transmission Company Ltd (OGPTL, a subsidiary of Sterlite). The line has been exclusively built for evacuation of power from OPGC (Ib Valley) U 4 (660 MW) power. As the LTA has been relinquished, the additional burden of OPGC-Sudargarh ISTS line would lie on all the other DICs/states. Therefore OPGC may consider sharing the entire transmission charges of the OPGC-Sundargarh ISTS line as it would be used primarily by them.

10. Regarding avoidance of ISTS charges (and losses), Chief Engineer (PSP&A-II) said that investment in the ISTS for evacuation of power from OPGC has already been carried out. If sectionaliser is closed, these assets would be used by OPGC but the charges for the same would not be shared by them. Such scenario would be unfair to other states/DICs. He opined that, the other states may also follow example of OPGC/GRIDCO and also take cue from some of the CERC orders (e.g. dated 09.03.2018 on Petition No. 20/MP/2017 and dated 04.05.2018 on Petition No. 126/MP/2017).

11. Representative of the BSPTCL stated that the matter would be examined in detail and their opinion would be conveyed in due course.

12. In view the above, the following was concluded:

    (a) The proposal of OPGC/GRIDCO regarding closing of bus sectionaliser between U-3 (connected to STU) and U-4 (connected to ISTS) is feasible, but with compromise in N-1 reliability, as explained in above discussion.

    (b) There is no constraint in evacuation of power from U-4 in the planned arrangement i.e. with sectionaliser kept as open.

(c) OPGC U-4 is connected with ISTS and they may seek Long term/Short term open access in the ISTS for scheduling their power to Odisha, as per their PPA.

(d) OPGC may approach CERC, if desired, for resolution of above technical/commercial matters.

Meeting ended with vote of thanks to chair.

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I/4610/2019

Annexure-1

List of participants of Meeting regarding review of Connectivity/ LTA/ evacuation system for OPGC IBTPS (2x660MW) thermal power project in Odisha.

Sl. No.	Name	Designation	Organization
1	P.S. Mhaske (in chair)	Member(PS) & Chairperson	CEA
2	Pardeep Jindal	CE (PSP&A-II)	CEA
3	Ishan Sharan	Director (PSP&A-II)	CEA
4	U M Rao	Dy. Director (PSP&A-II)	CEA
5	J. Bandopadhay	Member Secretary	ERPC
6	Ashok Pal	CGM (CTU-Plg)	POWERGRID
7	Manish Ranjan Keshari	Dy. Manager(CTU-Plg)	POWERGRID
8	Ravi S Prasad	ESE	BSPTCL
9	Abhishek Kumar	EEE/P&E	BSPTCL
10	Manas Kumar Das	Director (Commercial)	GRIDCO
11	P. K. Mishra	CGM	OPTCL
12	C.R. Mishra	DGM	OPTCL
13	A K Benarajee	AGM	OPTCL
14	Ritwik Mishra	GM	OPGC
15	K C Samantray	AGM	OPGC

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भारत सरकार

Government of India

विद्युत मंत्रालय

Ministry of Power

केंद्रीय विद्युत प्राधिकरण

Central Electricity Authority

विद्युत प्रणाली योजना एवं मूल्यांकन प्रभाग-II

Power System Planning & Appraisal Division-II

सेवामें/To

1 Chief Operating Officer,
Central Transmission Utility (CTU),
Power Grid Corporation of India Ltd.(PGCIL)
"Saudamini" Plot No. 2,
Sector-29,
Gurugram-122001

2. Director (Technical),
NTPC Ltd,
Engineering Office Complex,
A-8, Sector-24,
Noida (U.P.)-201301

3. Vivek Singla,
NKTL, Sambhav House,
Judges Bungalow Road,
Bodakdev,Ahmedabad-380015

Subject: Minutes of Meeting regarding evacuation system for North Karanpura (3x660MW) generation project of NTPC w.r.t. Petition no. 194/MP/2017 of NKTL in CERC held on 23.04.2019 at CEA, New Delhi.

Sir/Madam,

A meeting regarding evacuation system for North Karanpura (3x660MW) generation project of NTPC w.r.t. Petition no. 194/MP/2017 of NKTL in CERC held on 23.04.2019 at CEA, New Delhi. Minutes of the meeting are enclosed herewith.

भवदीय/yours faithfully,

15.5.2019

(बी.एस.बैरवा/B.S. Bairwa)

निदेशक/Director

Minutes of Meeting regarding evacuation system for North Karanpura (3x660MW) generation project of NTPC w.r.t. Petition no. 194/MP/2017 of NKTL in CERC held on 23.04.2019 at CEA, New Delhi.

List of participants are enclosed at **Annexure-I.**

1. Member (Power System), CEA welcomed the participants and asked Chief Engineer (PSPA-II) to take up the issue.
2. Chief Engineer (PSPA-II), CEA informed that CERC, in its order dated 20.03.2019 in Petition no. 194/MP/2017 has directed CEA to decide revised Scheduled Commercial Date of Operation(SCoD) for execution of the transmission system in consultation with NTPC and the Petitioner. An extract of the decision, in this order is enclosed at **Annexure-II**.
3. He enquired about the status of NoC from Ministry of Coal(MoC) /CCL to NKTL. Representative of NKTL stated that NKTL has received a letter from CCL regarding NoC, however NoC is yet to be received. NKTL furnished the letter dated 18.04.2019 in the meeting. The same is enclosed at **Annexure-III**.
4. Chief Engineer (PSPA-II), CEA enquired about the status of North Karanpura (3x660MW) generation project of NTPC. Representative of NTPC stated that the Unit -1 of the NKSTPP is scheduled for CoD in April, 2020. However, Startup power is required as soon as possible.
5. Chief Engineer (PSPA-II), CEA asked NKTL regarding compressed time schedule for the implementation of the transmission system.
6. Representative of NKTL presented the scope of project (schematic is at **Annexure-IV**). NKSTPP- Common point(AP/19) would be 13 km multi-circuit line and Common point – Gaya would be 98 km and Common point – Chandwa would be 25 km. New 400kV Dhanbad S/s would be established with 1.2 km D/c LILO of Ranchi-Maithon 400kV D/c line. He requested to approve the construction of multi-circuit portion of about 13km for NKSTPP – Gaya and NKSTPP – Chandwa lines.
7. Participants deliberated and “in principally” agreed for the modification in the scope of works. Chief Engineer (PSPA-II), CEA stated that this modification in the scope would be ratified in the forthcoming meeting of Eastern Region Standing Committee on Transmission(ERSCT).
8. Representative of NKTL stated that financial tie-up with revised time line and cost is under progress and financial tie-up is expected to be completed by Aug 2019. He stated that May,2019 is assumed as revised zero date(i.e. Date of receipt of NOC). He explained about various activities and their timelines (Details are at **Annexure-V**) to implement the transmission system. He stated that Authorization under section 164 of Electricity Act 2003 would require about 130 days and forest clearance would take about 12 months time.
9. Further, he stated that NKSTPP-Chandwa 400kV D/c line could be completed in 17 months, i.e. by September 2020. NKSTPP- Gaya 400kV D/c line could be

completed in 26 months, i.e. by June 2021. He mentioned that forest area is more in NKSTPP- Gaya 400kV D/c line, therefore forest clearance process would take more time. New 400kV Dhanbad S/s with 1.2KM D/c LILO of Ranchi-Maithon 400kV D/c line would be completed in about 18 months, i.e. by October 2020.

10. Regarding authorization under Section 164 of Electricity Act 2003, it was stated that CEA may expedite the matter

11. Representative of NKTL agreed for the above time lines are subject to getting the forest clearance for NKSTPP-Chandwa 400kV D/c line within 200 days and for NKSTPP-Gaya 400kV D/c line within 300 days.

12. After the deliberations, following were decided:

    i. Revised scope of the project:

        a. NKSTPP- Common point would be 13 km multi circuit 400kV line (quad moose conductor).

        b. Common point – Chandwa would be 25 km 400kV D/c line(quad moose conductor)..

        c. Common point – Gaya would be 98 km 400kV D/c line(quad moose conductor).

        d. New 400kV Dhanbad Substation.

        e. 1.2 km D/c LILO of Ranchi-Maithon 400kV D/c line.

    ii. NKSTPP-Chandwa 400kV D/c line would be completed in 14 months, i.e. by June 2020 and NKSTPP-Gaya 400kV D/c line would be completed in 23 months, i.e. by March 2021. New 400kV Dhanbad S/s with 1.2 km D/c LILO of Ranchi-Maithon 400kV D/c line would be completed in about 18 months, i.e. by October 2020.

    iii. Representative of NKTL agreed for the above time lines subject to getting forest clearance for NKSTPP-Chandwa 400kV D/c line within 200 days and for NKSTPP-Gaya 400kV D/c line within 300 days. .

Meeting ended with vote of thanks to chair.

***

Annexure-I

List of the participants of Meeting regarding evacuation system for North Karanpura (3x660MW) generation project of NTPC w.r.t. Petition no. 194/MP/2017 of NKTL in CERC held on 23.04.2019 at CEA, New Delhi.

S. No.	Name	Designation	Organisation
1.	P.S. Mhaske (In –chair)	Chairperson & Member(PS)	CEA
2.	Pardeep Jindal	Chief Engineer(PSP&A-II)	CEA
3.	Ishan Sharan	Director (PSP&A-II)	CEA
4.	B. S. Bairwa	Director(PSP&A-II)	CEA
5.	U. M. Rao	Dy. Director(PSP&A-II)	CEA
6.	Ashok Pal	CGM (CTU-Plg)	POWERGRID
7.	Deepak Trehan	GM	NTPC
8.	Subhash Thakur	AGM	NTPC
9.	V S Dubey	AGM	NTPC
10.	L. N. Mishra	Sr. V.P.	NKTL
11.	Vivek Singla	Joint President	NKTL
12.	Sameer Ganju	AVP	NKTL
13.	Praveen Tamak	Manager	NKTL