I/1960/2018/985-994

सत्यमेव जयते

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

-As per list enclosed

विषय: पश्चिमी क्षेत्र की ट्रांसमिशन पर स्थायी समिति की पहली बैठक के लिए कार्यसूची

Sub: 1st Meeting of Western Region Standing Committee on Transmission (WRSCT) – Agenda note

Sir/ Madam,

In continuation to our letter of even no. dated 24.08.2018, it is intimated that agenda notes for the 1st meeting of **Western Region Standing Committee on Transmission (WRSCT)** is available CEA at website (www.cea.nic.in) at the following link: http://cea.nic.in/compsplanningwr.html i.e. Home page - Wings – Power Systems -PSP&PA-I - Standing Committee on Power System Planning-Western Region.

Kindly make it convenient to attend the meeting.

Yours faithfully,

रवीन्द्र गुप्ता

(Ravinder Gupta)
Chief Engineer

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1.	Member Secretary, WRPC, F-3, MIDC Area, Andheri (East), Mumbai – 400093 Fax – 022-28370193	2.	#Managing Director, CSPTCL, Dangania, Raipur (CG)-492013 Fax - 0771 - 2574246/ 4066566	3.	#Executive Engineer, Administration of Daman & Diu (U.T.), Department of Electricity, Moti Daman-396220
4.	#Executive Engineer (Projects), UT of Dadra & Nagar Haveli, Department of Electricity , Vidyut Bhavan, Amli, Silvassa - 396230	5.	#Chief Engineer, Electricity Department, Government of Goa, Vidyut Bhavan, 3rd Floor, Panaji - 403001 Fax – 0832-2222354	6.	Managing Director, GETCO, 9th Floor, Sardar Patel Vidyut Bhawan, Race Course, Vadodara-390007 Fax - 0265-2338152
7.	#Chairman and Managing Director, MPPTCL, Shakti Bhawan, Rampur, Jabalpur-482008 Fax – 0761-2664141	8.	#Director (Operation), MAHATRANSCO, Plot No.C-19, E-Block, Bandra-Kurla Complex, Bandra (E), Mumbai - 400051 Fax : 022-26591254	9.	CEO, POSOCO B-9, Qutub Institutional Area, Katwaria Sarai New Delhi – 110010 Fax – 011-2682747
10.	COO (CTU) POWERGRID, Saudamini, Plot no. 2, Sector -29, Gurgaon-122 001 Fax-0124-2571809				

- State Transmission Utilities (STUs) which have not intimated the details of their WRSCT member in line with the MoP order no. 15/3/2017–Trans dated 13.4.2018

Agenda note of 1st meeting of Western Region Standing Committee on Transmission (WRSCT) to be held on 05.09.2018 at NRPC, Katwaria Sarai, New Delhi

1. Confirmation of Minutes of 43rd meeting of Standing Committee on Power System Planning of Western Region (SCPSPWR)

1.1. The minutes of the 43rd meeting of SCPSPWR were issued vide CEA letter No.CEA-PS-11-23(19)/1/2018-PSPA-I Division I/1241/2018 dated 21.06.2018.

1.2. MPPTCL vide their letter no. 04-02/N-171/1822 dated 08.08.2018 has requested for the following corrigendum in the para 4.3 (ii) of the minutes:

Para 4.3(ii): Morena (TBCB)–Bhind 220 kV D/C along with 2 no. 220 kV line bays at both ends of this line would be implemented by MPPTCL at its own cost.

May be corrected as

Para 4.3(ii): Morena (TBCB)–Bhind 220 kV D/C along with 2 no. 220 kV line bays at both ends of this line would be implemented by selected Project developer at its own cost.

1.3. It is clarified that the two nos. 220 kV bays at Morena TBCB 400/220 kV for termination of 220 kV D/C line to Bhind would be owned by MPPTCL (STU system) and MPPTCL has proposed its implementation through tariff based competitive bidding process by intra-state transmission licensee.

1.4. Accordingly, no modification is required in the minutes of the meeting. Members may confirm the minutes of the meeting.

2. Transmission System plan for potential wind energy zones (WEZs) in Western Region

2.1. SECI has conducted bidding process for 6050MW wind projects on pan India basis, but majority of bids have been received in Kutch district of Gujarat (3900MW at Bhuj and 600MW at Bhachau) and balance in Tamil Nadu (950MW at Tirunelveli, 300MW at Pugalur and 300MW at Palakkad). In the 43rd meeting of SCPSPWR held on 11.05.2018, the following transmission system was proposed at Bhuj PS for evacuation of about 4000MW power from the various RE generation projects in the vicinity of Bhuj:

i) 7x500MVA 400/220kV (addl) ICTs at Bhuj PS*
ii) 2x1500MVA 765/400kV (addl) ICT at Bhuj PS
iii) Bhachau – Halwad (GETCO) 400kV D/c (triple) line (through LILO of EPGL – Bhachau line at Halwad)
iv) LILO of Zerda – Ranchhodpura 400kV S/c at Banaskantha (approved in 42nd WR SCM) to be expedited

*On account of space constraints at Bhuj PS, all future 220kV as well as 400kV line / ICT bays at Bhuj PS need to be implemented as GIS

2.2. In addition to above the, the transmission system for evacuation of power from other potential areas in Western Region {2000 MW (additional) in Bhuj ,

2000MW near Bhachau/Lakadia area, 2000 MW in Devbhumi Dwarka region of Gujarat and 2000 MW in Osmanabad region of Maharashtra} were also proposed and discussed in the 43rd meeting of SCPSPWR. The transmission system for evacuation of power from Bhuj and other potential areas in Western Region was broadly agreed by the members. During the meeting, Members advised to hold a joint study meeting amongst CEA, CTU, POSOCO, GETCO and MSETCL for further deliberations and finalization of the transmission system.

2.3. In line with the decision of the 43rd meeting of SCPSPWR, a joint study meeting with CTU, POSOCO, MSETCL and GETCO was convened by CEA on 05.06.18 & 06.06.18 at POWERGRID Office, Gurgaon. The minutes of the meeting is enclosed at Annexure – 2(i). Based on the joint studies (Exhibits are attached as Annexure – 2A & Annexure – 2B) for Gujarat WEZs, the following schemes were technically agreed:

PHASE-I:

A. **Injection from 4000MW RE projects under SECI bids (Tranche I to IV) at Bhuj PS (by April 2020):**

i) In addition to existing 2x500MVA 400/220 kV & 2x1500MVA 765/400 kV ICTs at Bhuj, the following augmentation in transformation capacity would be required for evacuation of 4000MW RE projects under SECI bids (Tranche-I to IV)

- 6x500MVA 400/220kV ICTs (addl)*
- 2x1500MVA 765/400kV (addl)

ii) For injection from any addl RE project (other than the above 4000MW) in existing Bhuj PS, 1x500MVA 400/220kV (9th) ICT is required.

iii) Bhachau – Varsana 400kV D/c line remains critically loaded. It was observed that the line remains loaded even without the RE injection at Bhuj PS. Further, the short circuit levels at Bhachau and Varsana exceed 40kA design rating as they contribute heavily to each other.

*On account of space constraints at Bhuj PS, all future 220kV as well as 400kV line / ICT bays at Bhuj PS need to be implemented as GIS

B. **Transmission System strengthening for relieving over loadings observed in Gujarat Intra-state system:**

i) 3x1500MVA, 765/400kV Lakadia PS#

ii) Lakadia – Vadodara 765kV D/c line (~350km) along-with 330MVAr switchable line reactors at both ends

iii) LILO of Bhachau – EPGL 400kV D/c (triple) line at Lakadia PS

iv) 1x330MVAr, 765kV Bus reactor & 1x125MVAr, 420kV Bus reactor at Lakadia PS

 # with provision for creation of 220 kV level

With the above proposed transmission system, loading on Bhachau – Varsana 400kV D/c line eases out significantly. However, the fault levels at both Bhachau & Varsana substations further increase to over 50kA. Accordingly, it was decided that the line may be kept normally open and may be utilized under contingency conditions. GETCO may make proposal of bus splitting at Versana to keep Bhachau–Varsana 400kV D/c line normally in service.

PHASE-II

C. **Transmission System Plan for RE generations at Potential wind energy zones in Gujarat [Bhuj-II (2000MW), Lakadia (2000MW) & Dwarka (2000MW)]:**

i) Establishment of 2x1500MVA (765/400kV), 4x500MVA (400/220kV) Bhuj-II PS (GIS) along-with space for 8 nos. 220kV bays for wind farms' integration

ii) Establishment of 4x500MVA, 400/220kV ICTs at Lakadia PS (GIS) along-with space for 8 nos. 220kV bays for wind farms' integration

iii) Establishment of 4x500MVA, 400/220kV Jam Khambhaliya PS (GIS) along-with space for 8 nos. 220kV line bays

iv) Extension of Essar–Lakadia/Bhachau 400kV D/c (triple) line upto Jam Khambhaliya PS along-with 63MVAr Line Reactor at both ends (i.e. Lakadia & Jam Khambhaliya ends). Further, the existing line reactor (63MVAr) on Bhachau end of EPGL – Bhachau line shall be converted into switchable Line Reactor.

v) Interconnection of 765kV Bhuj S/s with the proposed Bhuj-II (GIS) S/s through bus extension or 765kV D/c line

vi) Bhuj-II PS – Lakadia PS 765kV D/c line (~120km)

vii) Lakadia PS – Banaskantha PS 765kV D/c line along-with 240MVAr switchable LR at Lakadia PS (~150km)

viii) 1x330MVAr, 765kV Bus reactor at Bhuj-II PS & 1x125MVAr, 420kV Bus reactor each at Bhuj-II PS & Jam Khabhaliya PS

The above system for Jam Khambhaliya PS shall be able to cater RE injection to the tune of 1500MW in Dwarka area. For any additional RE injection, additional system would need to be planned subsequently. Further, it is observed that loading on *Ranchhodpura – Dehgam 400kV D/c line is beyond 850MW thermal limit*. Accordingly, it was decided to study the same separately.

2.4. The following scheme was technically agreed for evacuation of power from about 2000MW RE expected to come up in the Osmanabad area in Maharashtra:

i) Establishment of 4x500MVA, 400/220kV near Kallam PS along-with 8 nos. 220kV line bays

ii) 1x125MVAr bus reactor at Kallam PS

iii) LILO of both circuits of Parli(PG) – Pune(GIS) 400kV D/c line at Kallam PS along-with:

a. Conversion of 50MVAr fixed Line Reactors on each ckt of Parli (PG) – Pune(GIS) 400kV D/c line at Parli(PG) end into switchable.

b. Provision of new 50MVAr switchable line reactor at Kallam PS end of Kallam – Pune(GIS) 400kV D/c line

2.5. National Committee on Transmission (NCT) in its 1st meeting held on 27.07.2018 has recommended the following scheme for implementation through RTM by POWERGRID under compressed time schedule:

Transmission system for injection of power from 4000MW RE projects under SECI bids (Tranche I to IV) at Bhuj PS

Sl. No.	Scope of the Transmission Scheme	Capacity (MVA)	Estimated Cost (Rs.) Cr.
1	Installation of additional 3x500MVA, 400/220kV ICTs along with 400kV AIS & 220kV AIS bays	3x500MVA 400/220kV	102
2	Installation of additional 3x500MVA, 400/220kV ICTs along with 400kV GIS & 220kV AIS bays	3x500MVA 400/220kV	107
3	Installation of additional 2x1500MVA, 765/400kV ICTs along with 765kV AIS & 400kV GIS bays	2x1500MVA, 765/400kV	147
		Total Rs (in Crore)	356

The above scheme is required urgently for evacuation of power from 4000MW RE projects at Bhuj PS as the wind power generation projects, which have been successful in SECI bids of tranche 1, 2, 3 & 4 are scheduled to be commissioned by Oct, 2018, May, 2019, Nov, 2019 and April 2020 respectively.

2.6. Empowered Committee on Transmission (ECT) in its 2nd meeting held on 06.08.2018 has also recommended the implementation of scheme "Transmission system for injection of power from 4000MW RE projects under SECI bids (Tranche I to IV) at Bhuj PS" through RTM by POWERGRID under works to cater to urgency.

2.7. Members may kindly note the recommendation made by NCT & ECT and may kindly approve the transmission system planned for potential wind energy zones in Gujarat and Maharashtra.

3. **Intra state transmission system strengthening in Maharashtra for evacuation of power beyond Warora, transmission line overloading and ICT overloading.**

3.1. In the 42nd and 43rd meetings of SCPSPWR, it was agreed to carry out joint studies for the following issues in Maharashtra:

(i) Evacuation of power beyond Warora – 42nd SCM

(ii) Overloading of 2x315 ICTs at Wardha (PG) – 43rd SCM

(iii) Overloading of 400 kV Chandrapur-I – Chandrapur-II D/c line during less/nil generation at Chandrapur-I complex – 43rd SCM

3.2. To carry out joint study on above issues, a meeting was held among CEA, CTU, POSOCO and MSETCL on 18.06.2018 & 19.06.2018 at CEA, New Delhi. The minutes of the meeting is enclosed as Annexure – 3(i). In the meeting following intra state – transmission system strengthening in Maharashtra was agreed (Exhibits of the studies are attached as Annexure – 3A):

I. Evacuation of power beyond Warora:

(i) LILO of Chandrapur-I – Parli 400 kV S/c line at Warora(M)

(ii) LILO of one circuit of Warora Pool – Parli(PG) D/c line at Warora(M) or Warora (M) – Warora Pool 400 kV D/c line

(iii) Wardha – Warora Pool 400 kV D/c line to be kept normally open

The above proposal would be put up in Standing Committee on Transmission for further deliberations.

II. Overloading of 2x315 ICTs at Wardha (PG):

Overloading is not observed after the implementation of 400 kV bus splitting arrangement as agreed in the 41st meeting of SCPSPWR to control the fault level at 400 kV bus at Wardha (PG). Loading on 400/220 kV ICTs at Wardha S/s would further reduce in case of drawl of MSEDCL's share of power from M/s GWEL (2x300 MW) through 220 kV D/c line from M/s GWEL to Maharashtra system.

At present there is no need of any augmentation of 400/220 kV ICT at Wardha (PG) S/s and any future requirement of augmentation of 400/220 kV ICTs at Wardha (PG) would be taken up when required.

III. Overloading of 400 kV Chandrapur-I – Chandrapur-II D/c line during less/nil generation at Chandrapur-I complex

The loading on the Chandrapur-II – Chandrapur-I 400 kV D/c line gets reduced after implementation LILO of Chandrapur-I – Parli 400 kV S/c line at Warora (M). Its implementation will take time. Chandrapur-I – Bhadravati 400 kV 2xD/c line passes nearby Chandrapur-II S/s and implementation of its LILO will take less time. Accordingly, the following proposal of MSETCL was agreed to reduce the loading of Chandrapur-II – Chandrapur-I 400 kV D/c line and make it n-1 compliant:

(i) LILO of one circuit of Chandrapur-I – Bhadravati 400 kV 2xD/c line at Chandrapur-II

3.3. Members may deliberate and concur the above proposals as intra-state system strengthening in Maharashtra. MSETCL may intimate the implementation schedule of the above schemes.

4. MSETCL proposal for STU connectivity of M/s GWEL generation plant situated at Warora:

4.1. M/s GWEL, which is an ISGS with 2x300 MW of installed capacity has total PPA of 550 MW (200 MW to MSEDCL, 200 MW to Dadra & Nagar Haveli and 150 MW to TANGEDCO). Currently, M/s GWEL is connected with ISTS network through dedicated GWEL-Bhadravati 400 kV D/c line and all the beneficiaries are drawing their share of power through ISTS network and paying the respective ISTS charges. Now, Maharashtra wants to draw their

share of power through STU network to avoid the ISTS charges. As per CERC order dated 09.03.2018, an ISGS can be connected to both STU network and ISTS network for supply of powers to the beneficiaries within and outside the home state respectively. In such cases, the ISTS charges shall not be applicable on the conveyance of power on the State network.

4.2. To provide the STU connectivity to M/s GWEL (ISGS generation) as per the CERC order dated 27.03.2018 on the petition no. 245/MP/2016, MSETCL has proposed LILO of one circuit of GWEL – Bhadravati 400 kV D/c line at Warora(M).

4.3. Various options for providing connectivity with GWEL switchyard to MSETCL for drawl of MSEDCL share was jointly studied (with CTU, CEA, POSOCO and MSETCL on 18.07.2018). In the meeting the following options were studied:

Case A: LILO of one circuit of GWEL – Bhadravati 400 kV D/c line at Warora (M)

Case B: GWEL – Warora (M) 400 kV D/c line

Case C: Creation of 220 kV level at M/s GWEL through 400/220, 2x315 MVA ICTs and interconnection it with 220 kV Warora S/s through 220 kV D/c line

Case D: Case A + LILO of Chandrapur-I – Parli 400 kV S/c line at Warora (M)

Case E: Case B + LILO of Chandrapur-I – Parli 400 kV S/c line at Warora (M)

Case F: Case C + LILO of Chandrapur-I – Parli 400 kV S/c line at Warora (M)

As per the studies the following system was proposed for providing connectivity to MSETCL for drawing MSEDCL share of power from M/s GWEL:

(i) Installation of 400/220, 2x315 or 500 MVA ICTs at GWEL generation switchyard along with associated ICT bays

(ii) 2 nos. 220 kV line bays.

(iii) GWEL – Warora (M) 220 kV D/c line

4.4. A meeting to discuss the connectivity proposal was held in CEA on 19.07.2018 with participation from MSEDCL, MSETCL, M/s GWEL, CTU and POSOCO. The minutes of the meeting is enclosed as Annexure – 4(i). In the meeting the following was agreed (Exhibits of the studies as Annexure – 4A):

(i) MSETCL to convey their views regarding the proposal for installation of 400/220, 1x315 or 500 MVA ICT at GWEL generation switchyard along with associated ICT bays for drawl of MSEDCL share from GWEL through 220 kV lines.

(ii) M/s GWEL and MSETCL to jointly explore the availability of space for creation of 220 kV level in GWEL generation switchyard.

4.5. MSETCL may update the progress made. Members may deliberate.

5. Creation of 400/220 kV intra-state S/s at Guna (Distt-Guna) through TBCB process

5.1. MPPTCL vide their letter no. 04-02/N-171/1880 dated 16.08.2018 has intimated that Madhya Pradesh demand has reached to 12,240 MW in FY 2017-18 and expected to grow up to 15,000 MW by FY 2021-22. Currently, 400 kV Bina (MP) S/s is having transformation capability of 3x315 MVA, which feeds the

load of Bina, Vidisha, Ganjbasoda, Datiya and Gwalior areas. The maximum load recorded at 400 kV Bina (MP) S/s in the FY 2017-18 is 782 MVA (82% of the full capacity). MPPTCL has proposed a 400/220 kV intra-state sub-station at Guna to meet the load demand of nearby areas and reduce the loading of 400/220 kV ICTs at 400 kV Bina (MP) S/s. The proposed scope of work is given below:

i. Establishment of Guna 400/220 kV S/s with 2x500 MVA, 400/220 kV transformer and 1x125 MVAR bus reactor
ii. 400 kV DCDS (Quad Moose) line from Bina (MP) 400 to Guna 400 alongwith associated feeder bays (120 km) with 2x80 MVAR, 400 kV line reactor at Bina (MP) 400 kV end
iii. 220 kV DCDS line from Guna 400 to Guna 220 alongwith associated feeder bays (15 km)
iv. 220 kV DCDS line from Guna400 to Shivpuri220 alongwith associated feeder bays (100 km)

5.2. MPPTCL has also intimated that 400/220 kV Guna S/s as an intra-state network is to be developed through intra-state TBCB process.

5.3. MPPTCL may present the relevant studies and members may deliberate.

6. Establishment of 132/33 kV Sironcha Substation, Tal. – Sironcha, District – Gadchiroli – Agenda by MSETCL

6.1. MSETCL vide their letter no. MSETCL/CO/STU/6663 dated 13.06.2018 has intimated that presently 66/33/11 kV Sironcha S/s, which is having load of 17 MW is feed through 132 kV Ashti S/s, which is 132 km away via 66 kV Allapalli S/s. The entire 66 kV line from Ashti to Sironcha is passing through dense forest area. Also there is no redundant supply is available and voltage profile is very low.

6.2. MSETCL has planned 132/33 kV Sironcha S/s at existing 66 kV Sirocha S/s to increase the redundancy of supply and improve the voltage profile and quality of power supply. However, it is not feasible to connect 132 kV Sironcha S/s from 132 kV Allapalli S/s (under construction) due to involvement of dense forest.

6.3. MSETCL has proposed to connect 132 kV Sironcha S/s through 132 kV Kistampeth S/s of Telangana State Transmission Company Limited as proposed Sironcha S/s is 32 km away and forest free terrain. The scope of work for establishment of 132 kV Sironcha S/s is given below:

i. 132 kV SCDC line from Kistampeth (Telangana State) with end bays each at Kistampeth and Sironcha S/s – 32 km
ii. 2x25 MVA, 132/33 kV ICT with bays
iii. 33 kV outlets – 4 nos.

6.4. The above proposal was also discussed in the 33rd meeting of SCPSPWR held on 21.10.2011 and 33rd meeting of SCPSPSR held on 20.10.2011, where APTRANSCO refused to agree with the above proposal.

6.5. MSETCL may present the deliberations held with Telangana i.e. TSTCL and members may deliberate.

7. Installation of 400/220 kV ICT along with associated bays at M/s CGPL Switchyard

7.1. In the 43rd meeting of SCPSPWR held on 11.05.2018, members agreed to install 1x500 MVA 400/220 kV ICT at M/s CGPL switchyard to provide the startup power during the black start. The startup power would be provided through Nanikhakhar-CGPL 220 kV S/C line. The line would remain open from CGPL end. The scope of work to be implemented under ISTS is:

- 1x500 MVA, 400/220 kV ICT at CGPL Mundra to be installed at CGPL Switchyard along with one no. of 400 kV bay and one no. of 220 kV bay at CGPL Mundra.

7.2. The matter was discussed in the 1st meeting of National Committee on Transmission (NCT) held on 27th July, 2018, wherein, it was deliberated that already the CGPL generation is connected to the grid and the utility of the transformer is only to provide the startup power during black start. Accordingly, it was decided to review the scheme again in the next meeting of WRSCT.

7.3. **Members may discuss**.

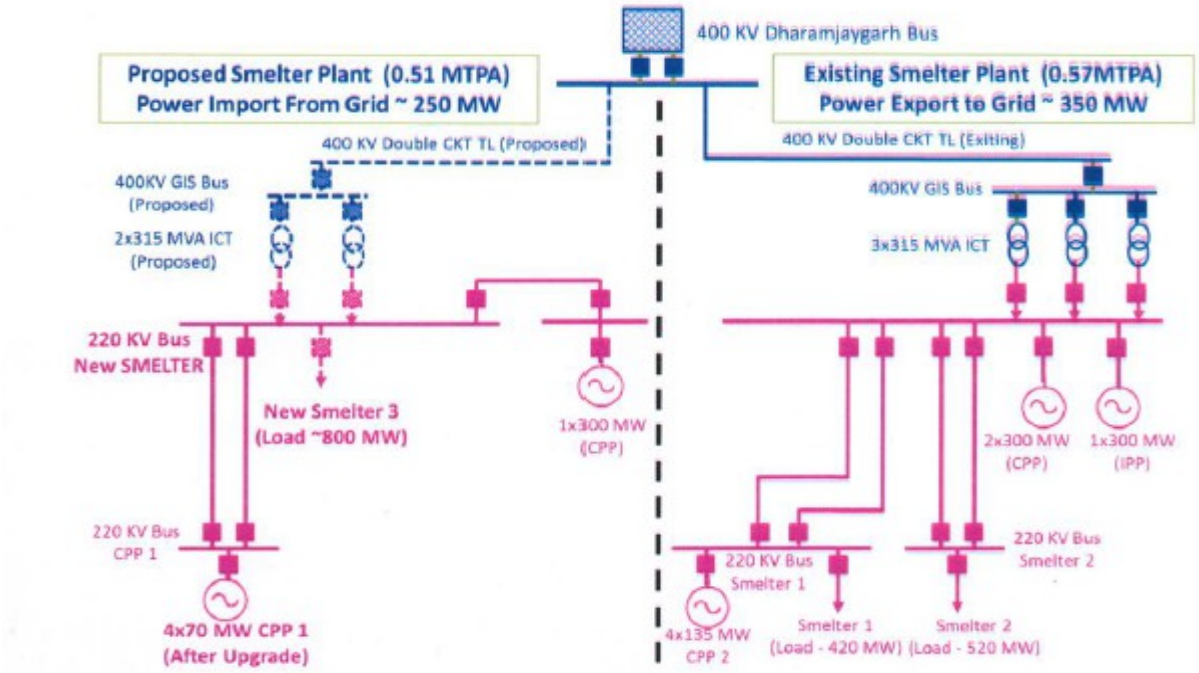
8. Connectivity application of 250 MW as Bulk Consumer for BALCO TPS (4x300+4x67.5+4x135MW)

8.1. M/s BALCO has been already granted connectivity of 2010MW [1200MW (4x300) as IPP and 810MW (4x67.5+4x135) as CPP] through BALCO – Dharamjaygarh 400kV D/c line. Further, the total LTA granted to M/s BALCO is 350MW [200(TN) + 95(KSEB) +55(CSPTrCL)].

8.2. BALCO had submitted application for 250MW connectivity as a bulk consumer with following arrangement through segregation of units as under:

- 580MW [1x300MW (CPP) + 4x70MW (up gradation of 4x67.5MW) (CPP)] units on one bus with New Smelter Load of 800MW] for which BALCO now seeks connectivity to the tune of 250MW for meeting the average demand of the smelter load
- 1440MW [1x300 (IPP) + 2x300MW (CPP) + 4x135MW (CPP)] units on the other bus with existing smelter load of 940MW. Accordingly, the exportable capacity on this bus shall be about 385MW out of which LTA of 350MW is already granted.

8.3. Details regarding proposed connectivity arrangement sought for 250 MW as Bulk Consumer are given below:



Installed capacity	**-**	**580 MW**	**Installed capacity**	**-**	**1440 MW**
Aux. Consumption (Considering max. 8%)	-	45 MW	Aux. Consumption (Considering max. 8%)	-	115 MW
Ex- bus capacity	-	535 MW	Ex- bus capacity	-	1325 MW
Load	-	800 MW	Load	-	940 MW
Deficit	**-**	**265 MW**	**Exportable Capacity**	**-**	**385 MW**

8.4. The application was discussed in the 43rd meeting of SCPSPWR as well as in the 26th WR Connectivity/LTA meeting held on 11.05.2018, wherein the following was decided:

- Grant of connectivity to BALCO for 250 MW, as a bulk consumer, subject to submission of supporting documents with regard to status of IPP/CPP units (conversion of 3x300MW units from IPP to CPP).
- The connectivity was agreed through BALCO-Dharamjaygarh 400kV (2nd) D/c line (new) along with associated 400kV bays at both ends to be implemented by M/s BALCO at its own cost. M/s BALCO, being a bulk consumer, may approach CERC regarding construction modalities for the 400kV D/c line.

8.5. M/s BALCO vide e-mail dated 20.07.2018 has submitted a letter from Chief Electrical Inspector to Govt. (CEIG) of Chhattisgarh dated 17.07.2018 in which CEIG has acknowledged that M/s BALCO has submitted the status of its 3x300MW units as CPP for FY 2017-18.

8.6. CEIG has further stated in the letter that the captive status as reported above has been forwarded to Chhattisgarh SERC vide CEIG letter dated 05.07.2018 and that the status of units shall be finalized only after concurrence of the SERC.

8.7. Members may discuss and deliberate future course of action.

9. **Optimization of bay requirement at 400/220 kV Banaskantha (Radhanesda) S/s**

9.1. GPCL vide letter dated 04.07.2018 has intimated that evacuation infrastructure for transmission of power from upcoming Radhanesda and Harshad Solar Park has been optimized. The original agreed scheme for evacuation of power from 700 MW Radhanesda and 500 MW Harshad Solar Park is given below:

i. Establishment of 2x500MVA, 400/220kV pooling station at Banaskantha (Radhanesda) [GIS] along with 1x125MVAr bus reactor

ii. 2 nos. 400 kV line bays at 400/220 kV at Banaskantha (Radhanesda) Pooling Station for termination of Banaskantha (Radhanesda) Pooling Station - Banaskantha (POWERGRID) 400 kV D/C line

iii. 4 nos. 220kV line bays at 400/220kV at Banaskantha (Radhanesda) pooling station for Solar Park Interconnection

iv. Provision of space for 8 nos. 220 kV bays (4 nos. for solar injection and 4 nos. of GETCO drawal)

v. Provision of space for future 400/220kV, 1X500 MVA ICT along with bays

9.2. As per above, total 8 nos. of 220 kV feeder bays are planned (4 nos. each for Radhanesda & Harshad solar parks). Out of which 4 nos. of 220 kV feeder bays will be implemented immediately and space will be reserved for additional 4 nos. of 220 kV feeder bays for Harshad solar park.

9.3. Now, GPCL has proposed to construct only one 220 kV D/C line (with AL-59 conductor) from each solar park i.e. Radhanesda & Harshad solar parks. Therefore, only 4 nos. of 220 kV feeder bays for both solar parks (2 nos. each for Radhanesda & Harshad solar parks) are required instead of 8 nos. of 220 kV feeder bays at 400/220 kV Banaskantha (Radhanesda) S/s are required.

9.4. POWERGRID may present the status of implementation of the scheme and members may deliberate.

10. **Finalization of switching Scheme for GIS substations**

10.1. Generally double circuit lines are terminated in separate diameter to avoid tripping of both lines under tie breaker stuck condition (if terminated in the same diameter). This guideline is also being specified in RFP documents for Inter State transmission system under TBCB projects. In line with above, for 765 & 400kV substations, one & half CB switching scheme is followed by POWERGRID.

10.2. In the 42nd meeting of SCPSPWR held on 17.11.2017, members had decided that in view of the complexities involved in the interfacing of GIS modules of different manufacturers, the complete diameter (with 3 CB bays) shall be installed in the beginning itself even though the third CB would be used for an upcoming feeder in future. This would not only facilitate ease of integration of future transmission elements as and when they are planned, but would also enhance system reliability.

10.3. POWERGRID has informed that recently in Nagapattinam 400kV GIS substation case, CERC has not allowed the capitalization of unutilized (future) GIS bays. Matter was again taken up with CERC to allow capitalization considering complexities involved in GIS substations. In this respect, on

18.01.2018, a meeting was held with CERC team headed by their Chief (Engg) at POWERGRID Gurgaon GIS S/s followed by visit to GIS installation so as to understand the complexities involved in any GIS installations. During the visit CERC team was explained about non-feasibility of constructing future bay at later date in the same diameter due to interfacing complexities and manufacturer specific proprietary design issues involved. CERC appreciated the complexities involved in GIS interfacing. Finally, CERC team suggested for construction of full diameter (Present-Tie-Future bay), only if there is concrete plan for utilization of future bay.

10.4. In view of the above, POWERGRID has proposed use of Double CB switching scheme for 400kV & 765kV GIS substations in all such cases where there is no plan in near future to utilize the bays.

10.5. The clause 15.7 of CEA Manual on Transmission Planning Criteria recommends 'One and half breaker' scheme for 400kV and 765kV sub-stations.

10.6. Members may deliberate.

11. Stage-II connectivity granted to RE applicants in WR in the 28th and 29th WR Connectivity/LTA meetings held on 12.07.18 & 17.08.18 respectively

11.1. Hon'ble CERC had notified on 15.05.2018, the detailed Procedure for Grant of connectivity to projects based on renewable sources to ISTS as per which all connectivity applications based on renewable energy sources are to be processed through a two stage connectivity process viz. Stage-I & II. As per the procedure, the new substation/location for connectivity, if needed is to be established, shall be planned in consultation with CEA, MNRE and other stakeholders.

11.2. The following applicants were granted Stage-II connectivity in the 28th and 29th WR Connectivity/LTA meetings held on 12.07.18 & 17.08.18 respectively:

Sl	Name of Applicant (Organization)	Stage-II Application No	Stage-II Conn Quantum (MW)	Date: Stage-II connectivity required	LOA details (as applicable)	Proposed location for Grant of Stage-II Connectivity	Tr System for Stage-II connectivity (under scope of applicant)
1.	Green Infra Wind Energy Ltd. (GIWEL-Bhuj)	1200001268	250	31/10/18	SECI Tr-II	Bhuj PS (Under Implementation)	• Green Infra Wind Energy Ltd. (GIWEL-Bhuj) - Bhuj PS 220kV S/c line along-with associated bays at both ends
2.	Adani Green Energy MP Ltd. (AGEMPL-Dayapar)	1200001362	100	01/10/18	SECI Tr-I: 50MW; SECI Tr-II: 50MW;		**Common Transmission System for applications at Sl. 2, 3 and 14** • Establishment of 220kV Pooling Station near Dayapar • Adani Green Energy (MP) Ltd. Dayapar Pooling Station - Bhuj PS 220kV D/c line (with ampacity of at least 725MW at nominal voltage) along-with associated bays at both ends • Adani Green Energy (MP) Ltd. would take care of operational and commercial issues in regard to power transfer from the projects at Sl. 2, 3 and 14
3.	Adani Green Energy MP Ltd. (AGEML-Dayapar/Ratadiya)	1200001363	250	01/11/19	SECI Tr-III		
4.	Torrent Power Ltd.(TPL-	1200001358	300	30/06/19	SECI Tr-III		• Torrent Power Ltd.(TPL-Lakhpat Bhuj) - Bhuj PS 220kV S/c

Sl	Name of Applicant (Organization)	Stage-II Application No	Stage-II Conn Quantum (MW)	Date: Stage-II connectivity required	LOA details (as applicable)	Proposed location for Grant of Stage-II Connectivity	Tr System for Stage-II connectivity (under scope of applicant)
	Lakhpat Bhuj)					Bhuj PS (Under Implementation)	line along-with associated bays at both ends
5.	Torrent Power Ltd.(TPL-Junachay Bhuj)	1200001369	199.5	30/06/19	SECI Tr-III		**Common Transmission System for Junachay (199.5MW) & Nakhatrana (115MW) wind farms** • Establishment of 220kV Pooling Station near Bhuj for pooling of power from Junachay (199.5MW) & Nakhatrana (115MW) wind farms. • TPL Bhuj PS – Bhuj PS 220kV S/c line (with minimum capacity of 315MW) alongwith associated bays at both ends • TPL would take care of operational and commercial issues in regard to power transfer from both Nakhatrana & Junachay wind projects
6.	Alfanar Energy Private Limited (AEPL- Kotda Madh)	1200001357	300	30/06/19	SECI Tr-III		• Alfanar Energy Private Limited (AEPL- Kotda Madh) - Bhuj PS 220kV S/c line along-with associated bays at both ends
7.	Green Infra Wind Energy Ltd. (GIWEL-Roha)	1200001359	300	30/04/19	SECI Tr-III		• Green Infra Wind Energy Ltd. (GIWEL-Roha) - Bhuj PS 220kV S/c line along-with associated bays at both ends
8.	Vaayu Renewable Energy (Kaveri) Private Limited	1200001371	250	01/01/20	NA		• Vaayu Renewable Energy (Kaveri) Private Limited - Bhuj PS 220kV S/c line along-with associated bays at generation end
9.	Vaayu Renewable Energy (Krishna) Pvt. Ltd.	1200001372	300	01/04/20	NA		• Vaayu Renewable Energy (Krishna) Pvt. Ltd. - Bhuj PS 220kV S/c line along-with associated bays at generation end
10.	ReNew Wind Energy (TN) Private Limited	1200001426	265	15/01/20	SECI Tr-IV		• ReNew Wind Energy (TN) Private Limited - Bhuj PS 220kV S/c line along-with associated bays at both ends
11.	ReNew Wind Energy (AP2) Private Limited	1200001427	300	15/06/19	SECI Tr-III		• ReNew Wind Energy (AP2) Private Limited - Bhuj PS 220kV S/c line along-with associated bays at both ends
12.1	Avikiran Solar India Private Limited	1200001423	285	29/02/20	SECI Tr-IV		• Avikiran Solar India Private Limited - Bhuj PS 220kV S/c line along-with associated bays at both ends
13.1	Vaayu Renewable Energy (Sironj) Private Limited	1200001433	300	01/04/20	NA		• Vaayu Renewable Energy (Sironj) Private Limited - Bhuj PS 220kV S/c line along-with associated bays at generation end
14.	Adani Green Energy (MP) Limited	1200001484	300	01.02.20	SECI Tr-IV		**Common Transmission System for applications at Sl. 2, 3 and 14** • Establishment of 220kV Pooling Station near Dayapar

Sl	Name of Applicant (Organization)	Stage-II Application No	Stage-II Conn Quantum (MW)	Date: Stage-II connectivity required	LOA details (as applicable)	Proposed location for Grant of Stage-II Connectivity	Tr System for Stage-II connectivity (under scope of applicant)
							• Adani Green Energy (MP) Ltd. Dayapar Pooling Station - Bhuj PS 220kV D/c line (with ampacity of at least 725MW at nominal voltage) along-with associated bays at both ends • Adani Green Energy (MP) Ltd. would take care of operational and commercial issues in regard to power transfer from the projects at Sl. 2, 3 and 14
15.	Torrent Power Limited	1200001569	115	01.07.2019	NA		**Common Transmission System for Junachay (199.5MW) & Nakhatrana (115MW) wind farms** • Establishment of 220kV Pooling Station near Bhuj for pooling of power from Junachay (199.5MW) & Nakhatrana (115MW) wind farms. • TPL Bhuj PS – Bhuj PS 220kV S/c line (with minimum capacity of 315MW) alongwith associated bays at both ends • TPL would take care of operational and commercial issues in regard to power transfer from both Nakhatrana & Junachay projects
		Subtotal	**3814.5**				
16.1	Vaayu Renewable Energy (Mevasa) Private Limited	1200001414	300	31/12/19	NA	Jam Khambhaliya PS (GIS) (New) • Establishment of Jam Khambhaliya 400/220kV PS (GIS) along with 1x500 MVA, 400/220kV ICT • Extension of Essar – Lakadia/Bhachau 400kV D/c (triple) line upto Jam Khambhaliya PS • 1X125MVAR, 420kV Bus Reactor at Jam Khambhaliya GIS PS	• Vaayu Renewable Energy (Mevasa) Private Limited - Jam Khambhaliya PS (GIS) 400kV S/c line (with ampacity equivalent to 1000MW at nominal voltage) along-with associated bays at generation end
17.	Airpower Windfarms Pvt Ltd	1200001554	250	01/12/19	NA		• Airpower Windfarms Pvt. Ltd. (AWPL-Jam Khambhaliya) - Jam Khambhaliya PS 220kV S/c line alongwith bays at generation end
		Subtotal	**550**				
18.	Toramba Renewable Energy Pvt Ltd	1200001555	300	24.12.19	NA	765/400/220kV Solapur (PG) (existing S/s)	• Toramba Renewable Energy Private Limited – Solapur (PG) 400kV S/c line (with minimum capacity of at least 900MW at nominal voltage) alongwith associated bays at generation end
		Subtotal	**300**				
		Total	**4665**				

11.3. From the above, it is observed that applicants from Sl. 1 to 15 have been granted Stage-II connectivity at the under implementation Bhuj PS while

applicant at Sl. 18 has been granted Stage-II connectivity at the existing Solapur substation. However, for applicants at Sl. 16 & 17 (550MW), a new pooling station near Jam Khambhaliya has been proposed with following transmission system:

- Establishment of Jam Khambhaliya 400/220kV PS (GIS) along with 1x500 MVA, 400/220kV ICT
- Extension of Essar – Lakadia/Bhachau 400kV D/c (triple) line upto Jam Khambhaliya PS along with 63MVAr Line reactors on each ckt at Jam Khambhaliya end
- 1X125MVAR, 420kV Bus Reactor at Jam Khambhaliya GIS PS

11.4. As per para 5.3.1 of the detailed procedure for RE, the bays at ISTS substation for termination of dedicated lines from applicants at Sl. 8, 9, 13 at Bhuj PS, 16, 17 at Jam Khambhaliya PS and 18 at Solapur S/s are to be implemented by the ISTS transmission licensee owning the substation subject to compliance of the relevant provisions of tariff policy. Accordingly, the following bays are to be implemented under ISTS by the transmission licensee owning the substation:

- 3 nos. 220kV line bays at Bhuj PS
- 1 no. 400kV line bay and 1 no. 220kV line bay at Jam Khambhaliya PS
- 1 no. 400kV line bay at Solapur S/s

11.5. Members may deliberate**.**

12. LTA granted to RE applicants in WR in the 28th and 29th WR Connectivity/LTA meetings held on 12.07.18 & 17.08.18 respectively

12.1. Following applications have been granted LTA with injection at Bhuj PS and with NR, ER, NER & WR as target regions:

Sl.	Name of Applicant (Organization)	Stage-II Connectivity Quantum (in MW)	LOA Quantum	Seeking LTA for (MW)	Date from which LTA required	Date upto which LTA required	LTA Application No	LTA processed for (MW)
2	Green Infra Wind Energy Ltd. (GIWEL-Bhuj)	250	250 (SECI Tr-II)	250 (200: ER; 50: NER)	03/11/18	02/11/43	1200001086	250 (200: ER; 50: NER)
3	Green Infra Wind Energy Ltd. (GIWEL-Roha)	300	300 (SECI Tr-III)	300 (200: NR; 100: ER)	30/04/19	29/04/44	1200001116	300 (200: NR; 100: ER)
4	Adani Green Energy MP Ltd. (AGEMPL-Dayapar)	100	SECI Tr-I: 50MW; SECI Tr-II: 50MW;	300 (300: NR)	01/09/18	01/09/43	1200000783	100 (100: NR(Firm))
5	Torrent Power Ltd. (TPL- Lakhpat Bhuj)	300	300.3 (SECI Tr-III)	300.3 (300.3: WR)	30/06/19	01/09/44	1200001085	300 (300: WR)
6	ALFANAR ENERGY PRIVATE LIMITED (AEPL- Kotda Madh)	300	300 (SECI Tr-III)	300 (250: NR; 50: ER)	30/06/19	29/06/44	1200001149	300 (250: NR; 50: ER)
7	Torrent Power Ltd. (TPL- Junachay Bhuj)	200	199.5 (SECI Tr-III)	199.5 (149.7: WR; 49.8: ER)	31/07/19	01/09/44	1200001118	199.5 (149.7:WR 49.8: ER)
8	Renew Wind Energy (AP2) Pvt. Ltd. [RWE(AP2)PL]	300	300 (SECI Tr-III)	300 (300: NR)	24/11/19	24/11/44	120000 1450	300 (300:NR)
9	Renew Wind	265	SECI	265	28/02/20	28/02/	1200001510	265

Sl.	Name of Applicant (Organization)	Stage-II Connectivity Quantum (in MW)	LOA Quantum	Seeking LTA for (MW)	Date from which LTA required	Date upto which LTA required	LTA Application No	LTA processed for (MW)
	Energy(TN) Pvt Ltd		Tr-IV : 265	(NR: 150MW WR: 115MW)		45		(NR: 150MW WR: 115MW)
	Total	**2015**						**2014.5**

12.2. It was agreed to grant the LTA to Renew Power Ltd with the following transmission system:

Green Energy Corridor – ISTS (Part system):

- Bhuj PS – Banaskantha 765kV D/c line
- Banaskantha – Sankhari 400kV D/c line
- Banaskantha PS – Chittorgarh 765kV D/c line
- Chittorgarh – Chittorgarh (RVPN) 400kV D/c (quad) line

Transmission System Strengthening associated with Mundra UMPP (Part B):

- Mundra UMPP – Bhuj PS 400kV D/c (Triple) line

12.3. Members may deliberate and concur the above.

13. **Evolution of transmission scheme for integration of envisaged RE generation capacity in Solar & Wind Energy Zones:**

13.1. Govt. of India had set a target for establishing 175 GW renewable capacity by 2022 which includes 100 GW Solar, 60 GW Wind generation capacity. Recently Govt. of India scaled up its renewable target to 227GW by 2022 comprising 113.5GW Solar, 66.6 GW Wind, 31GW from floating solar & off shore wind and balance is from SHP & Biomass (Out of which, 49.5GW solar & 46.6GW wind is already commissioned/pipeline in different stages).

13.2. MNRE vide its order dated 08.06.2018 had constituted a Sub-Committee for Review of ISTS Connectivity for Renewable Energy power plants (enclosed as Annexure – 13A). Accordingly, based on the inputs regarding potential Solar Energy Zones (50 GW) by SECI/MNRE as well as Wind Energy Zones (16.5 GW) by MNRE, tentative transmission scheme for envisaged total RE capacity (66.5 GW) has been evolved. The report of subcommittee is enclosed as Annexure – 13B**.** Further, it has been proposed to bifurcate these requirements in two phases to ease the implementation of transmission infrastructure. A total of 20GW solar & 9 GW wind projects are planned in Phase-I (upto Dec2020) and 30 GW solar & 7.5 GW wind are to be planned for Phase-II (December 2021).

13.3. **The salient features of the report are as given below:**

13.3.1. The state wise and phase details of SEZ and WEZ are as given below:

Solar Energy Zone (SEZ)						Wind Energy Zone (WEZ)				
State/ District	**Taluk/ Tehsil**	**Ph-1**	**Ph-2**	**Total**		**State/ District**		**Ph-1**	**Ph-2**	**Total**
		2020	**2021**					**2020**	**2021**	
		GW	**GW**	**GW**				**GW**	**GW**	**GW**
Rajasthan						**Tamil Nadu**				
Jaisalmer	Ramgarh	2.5	1.5	4		Karur		1.5	1	2.5
	Fatehgarh	2.5	1.5	4		Tirunelveli		0	0.5	0.5
Jodhpur	Phalodi	2	1	3						
Bikaner	Koyalat/ Pugal	3	1	4						
Barmer	Barmer	0	5	5						
Subtotal		10	10	20		**Subtotal**		**1.5**	**1.5**	**3**
Andhra Pradesh						**Andhra Pradesh**				
Kurnool	Gooty	2.5	0	2.5		kurnool		2	1	3
Ananthpuram	Urvakonda	0	2.5	2.5						
Subtotal		2.5	2.5	5		**Subtotal**		2	1	3
Karnataka						**Karnataka**				
Gadag		0	2.5	2.5		Koppal		2.5	0	2.5
Bidar		0	2.5	2.5						
Subtotal		0	5	5		**Subtotal**		2.5	0	2.5
Gujarat						**Gujarat**				
Kutch	Rapar	3	2	5		Kutch	Bhuj	0	2	2
Banaskantha	Vav/ Tharad	0	2.5	2.5			Laka-diya	2	0	2
Jamnagar	Lalpur	1	1.5	2.5		Dwarka		1	1	2
Subtotal		4	6	10		**Subtotal**		3	3	6
Maharashtra						**Maharashtra**				
Solapur		1	1.5	2.5		Osmanabad		0	2	2
Wardha		0	2.5	2.5						
Subtotal		1	4	5		**Subtotal**		0	2	2
Madhya Pradesh										
Raigarh		2.5	0	2.5						
Khandwa		0	2.5	2.5						
Subtotal		2.5	2.5	5						
Total		**20**	**30**	**50**		**Total**		**9**	**7.5**	**16.5**

13.3.2. The estimates cost of the transmission scheme for 66.5 GW RE generations projects is about □ 43,235 Cr. The summary of the cost estimate is as given below:

S. No	Region	Capacity (GW)	Ph-1	Ph-2	Total (Ph-1 +Ph-2)

.			Cost (Cr.)	Capacity (GW)	Cost (Cr.)	Capacity (GW)	Cost (Cr.)	Capacity (GW)
1	Western Region							
A	Gujarat	16	4945	7	10585	9	15530	16
B	Maharashtra	7	335	1	1285	6	1620	7
C	Madhya Pradesh	5	790	2.5	620	2.5	1065	5
	Sub Total (WR)	28	6070	10.5	12490	17.5	18560	28
2	Northern Region							
A	Rajasthan	20	9180	10	8265	10	17445	20
3	Southern Region							
A	Tamil Nadu	3	450	1.5	150	1.5	600	3
B	Andhra Pradesh	8	2730	4.5	1540	3.5	4270	8
C	Karnataka	7.5	730	2.5	1630	5	2360	7.5
	Sub Total (SR)	18.5	3910	8.5	3320	10	7230	18.5
	Total	**66.5**	**19160**	**29**	**24075**	**37.5**	**43235**	**66.5**

13.3.3. The total normative transmission charges for Ph-1 & Ph-2 are estimated as under:

Envisaged solar (50 GW) & wind (16.5 GW) generation capacity is expected to generate about 115 billion units of renewable energy per annum. The implication in terms transmission charges for different options has been considered. Option 1 is without any grant / upfront payment from RE generation developers for development of transmission system. Option 2, 3, 4 is with upfront payment of Rs 25 lakh/MW, 35 lakh/MW, 50 lakh/MW from RE generation developers respectively.With option 1, considering estimated cost of Rs 43,235 Cr for proposed transmission scheme, annual transmission charges are expected to be about Rs 7782 Cr.

S.No	Attribute	Option 1	Option 2 (25 lakh/MW Bid incl.)	Option 3 (35 lakh/MW Bid incl.)	Option 4 (50 lakh/MW Bid incl.)
1	Envisaged RE Capacity	**66500 MW**			
2	Units Generated (Wind CUF@25%, Solar CUF @18%)	115 Billion units/Year			
3	Transmission Cost	Rs 43,235 Cr	Rs 26,610 Cr	Rs 19,960 Cr	Rs 9,985 Cr
4	Annual transmission charges (@18%)	Rs 7782 Cr	Rs 4790 Cr	Rs 3593 Cr	Rs 1797 Cr

S.No	Attribute	Option 1	Option 2 (25 lakh/MW Bid incl.)	Option 3 (35 lakh/MW Bid incl.)	Option 4 (50 lakh/MW Bid incl.)
5	Tentative Transmission Tariff	Rs 0.67/Unit	Rs 0.42/Unit@	Rs 0.31/Unit	Rs 0.16/Unit

*** D: E- 70:30*
@ Generation tariff increase by 14-18 (25 lakh/MW Bid incl.) , 21-25 paise/unit (35 lakh/MW Bid incl.) & 32-36 paise/unit (50 lakh/MW Bid incl.)

13.3.4. The normative transmission charges for Ph-1 & Ph-2 separately are estimated as under:

Phase-I

S.No	Attribute	Option 1	Option 2 (25 lakh/MW Bid incl.)	Option 3 (35 lakh/MW Bid incl.)	Option 4 (50 lakh/MW Bid incl.)
1	Envisaged RE Capacity (in MW)	**29000**			
2	Units Generated (Wind CUF@25%, Solar CUF @18%)(in BU/year)	51 BU/annum			
3	Transmission Cost (Rs. Cr)	19,160	11,910	9,010	4,660
4	Annual transmission charges (@18%)	3449	2144	1622	839
5	Tentative Transmission Tariff (Rs/Unit)	0.68	0.42	0.32	0.16

*** D: E- 70:30*
@ Generation tariff increase by 14-18 (25 lakh/MW Bid incl.) , 21-25 paise/unit (35 lakh/MW Bid incl.) & 32-36 paise/unit (50 lakh/MW Bid incl.)

Phase-2

S.No	Attribute	Option 1	Option 2 (25 lakh/MW Bid incl.)	Option 3 (35 lakh/MW Bid incl.)	Option 4 (50 lakh/MW Bid incl.)
1	Envisaged RE Capacity (in MW)	**37500**			
2	Units Generated (Wind CUF@25%, Solar CUF	64 BU/annum			

	@18%)(in BU/year)				
3	Transmission Cost (Rs. Cr)	24,075	14,700	10,950	5,325
4	Annual transmission charges (@18%)	4334	2646	1971	959
5	Tentative Transmission Tariff (Rs/Unit)	0.68	0.41	0.31	0.15

*** D: E- 70:30*
@ Generation tariff increase by 14-18 (25 lakh/MW Bid incl.), 21-25 paise/unit (35 lakh / MW Bid incl.) & 32-36 paise/unit (50 lakh/MW Bid incl.)

13.3.5. The sub-committee, in its meeting held on 18.07.2018, to facilitate development of the transmission system had solicited decisions on the following aspects from the competent authority:

i) Amount of upfront payment from RE generation developers at the time of bidding and grant from Government.

ii) Finalization of transmission system implementation mode and transmission implementing agency i.e. TBCB or RTM.

iii) Site specific bidding for RE generation addition in accordance to the transmission plan.

iv) CERC to expedite enabling provision in connectivity regulation so that SECI can apply for Connectivity & LTA.

13.3.6. MNRE vide its letter dated 3.8.2018 has forwarded the proposal to MoP to undertake the planning and implementation including financing of transmission system for evacuation of renewable energy and its grid connectivity.

13.3.7. Based on prioritised renewable potential zones approach, CTU has proposed that transmission scheme may be further phased out for about 10-12 GW capacity. Accordingly, transmission schemes have been phased out with two RE capacity scenarios namely, **Scenario 1 (10GW):** Rajasthan (7 GW) & Gujarat (3 GW) with estimated cost of Rs. 9150 cr. and **Scenario 2 (12.5 GW):** Rajasthan (7 GW), Gujarat (3 GW) and Andhra Pradesh (2.5 GW) with estimated cost: Rs. 10350 cr.

13.3.8. **Scenario 1: Rajasthan (7GW) & Gujarat (3GW), 10 GW**

A. Transmission scheme for Solar Energy Zone in Rajasthan (7000 MW) : Jaisalmer 5GW (Ramgarh 2.5GW, Fatehgarh 2.5GW), Jodhpur (2GW)

i) Establishment of 400/220kV 5x500 MVA pooling station (RE PP1) at suitable location in Jaisalmer Distt (near Ramgarh/Kuchheri)
ii) Establishment of 765/400/220kV 3x1500 MVA, 5x500 MVA pooling station (RE PP2) at suitable location in Jaisalmer Distt (near Fatehgarh)
iii) Establishment of 765/400/220kV 2x1500 MVA, 4x500 MVA pooling station (RE PP3) at suitable location in Jodhpur Distt (between Phalodi & Osian)
iv) RE PP1 (near Ramgarh) – RE PP2 (near Fatehgarh) 400 kV D/c Line (Twin HTLS on M/c tower)

v) LILO of both ckts of 765 kV Fatehgarh (TBCB) – Bhadla (PG) D/c line at RE PP2 (near Fatehgarh) (Charged at 400kV)
vi) RE PP1 (near Ramgarh) – Jaisalmer -2 (RVPN) 400 kV D/c Line (Twin HTLS)
vii) RE PP2 (near Fatehgarh) – RE PP3 (between Phalodi &Osian) 765 kV D/c Line
viii) RE PP3 (between Phalodi &Osian) – Ajmer (PG) 765 kV D/c Line
ix) RE PP3 (between Phalodi &Osian) –Jodhpur (new) [RVPN] 400 kV D/c Line (Twin HTLS)
x) Ajmer – Bhiwani 765kV D/c line
xi) 220kV line bays for interconnection of solar projects (25 nos)
xii) Augmentation of 400/220kV Transformation capacity at various substations
xiii) Associated Reactive compensation

Estimated Cost : Rs 6000 Cr.

B. Transmission scheme for Solar Energy Zone in Gujarat (3000 MW) : Kutch (Rapar) SEZ 2000 MW & Jamnagar SEZ 1000 MW

Kutch (Rapar) SEZ 2000 MW

i) Establishment of 2x1500MVA & 4x500MVA, 765/400kV/220kV at Rapar/Lakadia PS
ii) Rapar/Lakadia PS– Vadodara 765kV D/c line
iii) LILO of Bhachau – EPGL 400kV D/c (triple) line (both ckt) at Lakadia/Rapar PS
iv) 220kV line bays for interconnection of wind & solar projects (7 nos)
v) 1x330MVAr, 765kV Bus reactor & 1x125MVAr, 420kV Bus reactor at Lakadia/Rapar PS & line reactive compensation

Estimated Cost: Rs 2800 Cr

Jamnagar SEZ 1000 MW

i) Establishment of 2x500MVA, 400/220kV Jam Khambhaliya PS (GIS) (near Jamnagar and Dwarka district border)
ii) Extension of Essar – Lakadia/Bhachau 400kV D/c (triple) line upto Jam Khambhaliya PS
iii) 220kV line bays for interconnection of RE projects - 3 nos
iv) 1X125 MVAR, 420 kV Bus Reactor at Jam Khambhaliya PS (GIS) & line reactive compensation

Estimated *Cost: Rs 350 Cr*

C. Summary of Abstract Cost Estimate

S.No.	State	Solar Capacity (GW)	Estimated Cost (Rs Cr.)
1	Rajasthan	7	6000
2	Gujarat	3	3150
	Total	10	9150

13.3.9. **Scenario 2: Scenario 1 + Andhra Pradesh (2.5GW), 12.5 GW**

A. Transmission scheme for Solar Energy Zone in AP (2500 MW) Kurnool SEZ (2500 MW), AP

i) Establishment of 765/400/220kV 3x1500 MVA, 5x500 MVA Pooling station at suitable location in Kurnool Distt
ii) Kurnool PS - Kurnool(new) 765 kV D/c Line
iii) 220kV line bays for interconnection of wind projects (8 nos)
iv) 1x330 MVAr (765kV) & 1x125MVAr (400kV) bus reactor at Kurnool PS

Estimated Cost: Rs 1200 Cr

B. Summary of Abstract Cost Estimate

S.No.	State	Solar Capacity (GW)	Estimated Cost (Rs Cr.)
1	Rajasthan	7	6000
2	Gujarat	3	3150
3	Andhra Pradesh	2.5	1200
	Total	**12.5**	**10350**

13.3.10. Members may deliberate.

File No.CEA-PS-11-23(19)/1/2018-PSPA-I Division

1/1284/2018

भारत सरकार

Government of India

विद्युत मंत्रालय

Ministry of Power

केन्द्रीय विद्युत प्राधिकरण

Central Electricity Authority

विद्युत प्रणाली योजना एवं मूल्यांकन-I प्रभाग

Power System Planning & Appraisal-I Division

File No.: CEA-PS-11-23(19)/1/2018-PSPA-I Division Date: 28.06.2018

सेवा में / To,

1. COO, CTU, PGCIL, Saudamini, Plot No. 2, Sector - 29, Gurgaon – 122001
2. CEO, POSOCO, B-9, Qutab Institutinal Area, Katwaria Sarai, New Delhi-110016, Fax 011-26852747.
3. The Managing Director, GETCO, Sardar Patel Vidyut Bhawan, Race Course, Vadodara, 390007, Fax 0265-2338164.
4. Director (Operation), MAHATRANSCO, 'Prakashganga', Plot No.G-9, Bandra-East, Mumbai-400051, Fax 022-26390383/26595258.

विषय: पश्चिमी क्षेत्र – भुज, भचाऊ, द्वारका (गुजरात) और उस्मानाबाद् (महाराष्ट्र) में संभावित पवन ऊर्जा क्षेत्र (WEZs) के लिए ट्रांसिमशन सिस्टम योजना पर चर्चा करने के लिए हुई बैठक का कार्यवृत्त।

Subject: Minutes of the Joint Study Meeting to discuss the Transmission System plan for potential wind energy zones (WEZs) in Western Region – Bhuj, Bhachau, Dwarka (in Gujarat) and Osmanabad (in Maharashtra) – reg.

Madam / Sir / महोदय / महोदया,

Please find enclosed minutes of the joint study meeting held on 05.06.2018 & 06.06.2018 at Powergrid Office, Gurugram to discuss the Transmission System plan for potential wind energy zones (WEZs) in Western Region – Bhuj, Bhachau, Dwarka (in Gujarat) and Osmanabad (in Maharashtra).

Yours faithfully,

(अवधेश कुमार यादव / Awdhesh Kr. Yadav)

निदेशक / Director

सेवा भवन, आर. के. पुरम-I, नई दिल्ली-110066 टेलीफैक्स: 011-26102045 ईमेल: cea-pspa1@gov.in वेबसाइट: www.cea.nic.in

Sewa Bhawan, R.K Puram-I, New Delhi-110066 Telefax: 011-26102045 email: cea-pspa1@gov.in Website: www.cea.nic.in

Minutes of the Joint Study meeting regarding Transmission System plan for potential wind energy zones (WEZs) in Western Region held on 05.06.18 & 06.06.18 at POWERGRID Office, Gurgaon

The list of participants is enclosed as **Annexure – I.**

Background

SECI has conducted bidding process for 6050MW wind projects, out of which 4050MW has already been awarded under Tranches I, II & III and 2000MW under Tranche IV is pending for award. Though the bidding was carried out on pan India basis, a majority of bids have been received in Kutch district of Gujarat (3900MW at Bhuj and 600MW at Bhachau) and balance in Tamil Nadu (950MW at Tirunelveli, 300MW at Pugalur and 300MW at Palakkad).

In the 43rd WR SCM held on 11.05.2018, the following transmission system was proposed at Bhuj PS for evacuation of about 4000MW power from the various RE generation projects in the vicinity of Bhuj:

i) 7x500MVA 400/220kV (addl) ICTs at Bhuj PS*

ii) 2x1500MVA 765/400kV (addl) ICT at Bhuj PS

iii) Bhachau – Halwad (GETCO) 400kV D/c (triple) line (through LILO of EPGL – Bhachau line at Halwad)

iv) LILO of Zerda – Ranchhodpura 400kV S/c at Banaskantha (approved in 42nd WR SCM) to be expedited

*On account of space constraints at Bhuj PS, all future 220kV as well as 400kV line / ICT bays at Bhuj PS need to be implemented as GIS

In addition to above the, the transmission system for evacuation of power from other potential areas in Western region (2000 MW in Bhuj, 2000MW near Bhachau/Lakadia area, 2000 MW in Devbhumi Dwarka region of Gujarat and 2000 MW in Osmanabad region of Maharashtra were also proposed and discussed. The transmission system for evacuation of power from Bhuj and other potential areas in Western Region was broadly agreed by the members. For further deliberations and finalization of the transmission system taking into consideration the suggestions made by the members during the meeting, it was agreed to hold a joint study meeting amongst CEA, CTU, POSOCO, GETCO & MSETCL.

With the above background, Director (PSPA-I), CEA welcomed the participants and stated that that the joint study meeting has been convened in line with the decision of the 43rd Standing Committee meeting on Power System Planning in WR.

CTU informed that Hon'ble CERC vide its order dated 15.05.2018 has notified the Detailed Procedure for "Grant of Connectivity to projects based on Renewable Sources" wherein it is stated that new substations for harnessing RE potential shall be planned by CTU in consultation with CEA/MNRE keeping in view the exploitable wind or solar potential in the area based on information made available by MNRE.

Accordingly, planning of the new substation(s) in RE rich areas is being taken up in advance for the potential WEZs in Western Region.

Thereafter, studies pertaining to WEZs in Gujarat and Maharashtra were taken up separately and the gist of discussions / deliberations is given below:

1. **Gujarat (Kutchh & Dwarka)**

Short Circuit Ratio / SC MVA at Bhuj PS

- POSOCO representative stated that in order to integrate the huge RE potential of about 4000MW at Bhuj PS, the Short circuit ratio at Bhuj PS must be at least 3. Accordingly, the SC MVA at Bhuj PS must be greater than **12000MVA**.

- Load flow and short circuit studies were carried out for Dec'18 time frame both with and without CGPL – Bhuj 400kV D/c line. Only Inox (500MW) & Srijan (300MW) wind generation projects, which are deemed Stage-II grantees, have been considered in the studies.

- The following 3 phase short circuit levels at Bhuj PS are observed:

	Without CGPL-Bhuj line		**With CGPL-Bhuj line**	
	SC MVA	**SC Current (A)**	**SC MVA**	**SC Current (A)**
Bhuj 400kV bus	5730	8270	19068	27522
Bhuj 765kV bus	7067	5333	14995	11317

Accordingly, assuming that **800MW** RE gets integrated at Bhuj PS prior to commissioning of CGPL-Bhuj line, the SCR at Bhuj PS is much more than the required value. Further, with the expected integration of **4000MW** RE by Apr'2020 , the SC MVA is observed to be much higher than the minimum SC MVA of 12000MVA as stated above.

- Load flow study was also carried out to study feasibility of charging Bhuj PS from Banaskantha PS end in the absence of CGPL – Bhuj PS 400kV D/c line. It was observed that the line may be charged from Banaskantha end provided that all the reactive compensation devices (both bus reactors & line reactors) are available at Bhuj PS as well as Banaskantha PS.

- 765/400/220 kV Bhuj pooling station, Bhuj pool- Banaskantha 765 kV D/c line are expected to be commissioned by September 2018 and CGPL – Bhuj 400kV D/c line is expected to be commissioned by December 2018. POWERGRID was requested to expedite the implementation of CGPL- Bhuj 400 kV D/C line.

RE Despatch in Kutch region of Gujarat

- The installed capacity of RE power (wind and solar) in Gujarat is around 7000 MW. And as per the data available with the Gujarat, the maximum wind RE power generated is 3763 MW (July 2017 in the year 2017-18) as against installed capacity of 5531 MW (as on March 2018). The maximum solar RE power generated is 1072 MW (March 2018 in the year 2017-18) as against installed capacity of 1493 MW (as on March 2018).The maximum dispatch from wind projects is around 70 % and that of solar projects is 72 % of the installed capacity at state level. Accordingly, based on the available data as well as guidelines of the planning criteria, it was decided that 80% peak dispatch from wind projects may be considered for RE projects in Gujarat.

Transmission System Requirement

- It was decided that phase-wise transmission system augmentation requirement may be planned depending upon quantum of RE injection at Bhuj PS as well as for the other wind energy zones in Gujarat (Bhuj-II, Lakadia & Dwarka).
- For carrying out studies for April 2020 time frame , the following transmission systems under implementation by GETCO have not considered on account of delay in implementation beyond Apr'2020:
    - Adani – Zerda 400kV D/c (line 3 and line 4)
    - Varsana – Halvad 400kV D/c (quad) line
    - Halvad – Ranchhodpura 400kV D/c line (one ckt via Sanand)
- Based on the joint studies for Gujarat WEZs, the following schemes were technically agreed:

PHASE-I:

A. **Injection from 4000MW RE projects under SECI bids (Tranche I to IV) at Bhuj PS (by Apr'2020):**

i) In addition to existing 2x500MVA & 2x1500MVA ICTs at Bhuj, the following augmentation in transformation capacity would be required for evacuation of ~4000MW RE projects under SECI bids (Tr-I to IV)

- 6x500MVA 400/220kV ICTs (addl)*
- 2x1500MVA 765/400kV (addl)

ii) For injection of any addl RE projects (other than the above 4000MW) in existing Bhuj PS, 1x500MVA 400/220kV (9^{th}) ICT is required.

iii) Bhachau – Varsana 400kV D/c line remains critically loaded. It was observed that the line remains loaded even without the RE injection at

Bhuj PS. Further, the SC levels at Bhachau and Varsana exceed 40kA design rating as they contribute heavily to each other.

*On account of space constraints at Bhuj PS, all future 220kV as well as 400kV line / ICT bays at Bhuj PS need to be implemented as GIS

B. **Transmission System strengthening for relieving overloadings observed in Gujarat Intra-state system:**

i) 3x1500MVA, 765/400kV(/220kV) Lakadia PS
ii) Lakadia – Vadodara 765kV D/c line (~350km) along-with 330MVAr switchable line reactors at both ends
iii) LILO of Bhachau – EPGL 400kV D/c (triple) line at Lakadia PS
iv) 1x330MVAr, 765kV Bus reactor & 1x125MVAr, 420kV Bus reactor at Lakadia PS

- With the above proposed transmission system, loading on Bhachau – Varsana 400kV D/c line eases out significantly. However, the fault levels at both Bhachau & Varsana substations further increase to over 50kA. Accordingly,it was decided that the line may be kept normally open and may be utilized under contingency conditions. GETCO may make proposal of bus splitting at Versana to keep Bhachau – Varsana 400kV D/c line normally in service.

PHASE-II

Transmission System Plan for RE generations at Potential wind energy zones in Gujarat [Bhuj-II (2000MW), Lakadia (2000MW) & Dwarka (2000MW)]:

i) Establishment of 2x1500MVA (765/400kV), 4x500MVA (400/220kV) Bhuj-II PS (GIS) along-with space for 8 nos. 220kV bays for wind farms' integration
ii) Installation of 4x500MVA, 400/220kV ICTs at Lakadia PS (GIS) along-with space for 8 nos. 220kV bays for wind farms' integration
iii) Establishment of 4x500MVA, 400/220kV Jam Khambhaliya PS (GIS) along-with space for 8 nos. 220kV line bays
iv) Extension of Essar – Lakadia/Bhachau 400kV D/c (triple) line upto Jam Khambhaliya PS along-with 63MVAr Line Reactor at both ends (i.e. Lakadia & Jam Khambhaliya ends). Further, the existing line reactor (63MVAr) on Bhachau end of EPGL – Bhachau line shall be converted into switchable Line Reactor.
v) Interconnection of 765kV Bhuj S/s with the proposed Bhuj-II (GIS) S/s through bus extension or 765kV D/c line
vi) Bhuj-II PS – Lakadia PS 765kV D/c line (~120km)
vii) Lakadia PS – Banaskantha PS 765kV D/c line along-with 240MVAr switchable LR at Lakadia PS (~150km)
viii) 1x330MVAr, 765kV Bus reactor at Bhuj-II PS & 1x125MVAr, 420kV Bus reactor each at Bhuj-II PS & Jam Khabhaliya PS

- The above system for Jam Khambhaliya PS shall be able to cater RE injection to the tune of 1500MW in Dwarka area. For any additional RE injection, additional system would need to be planned subsequently. Further, it is observed that loading on *Ranchhodpura – Dehgam 400kV D/c line is beyond 850MW thermal limit*. Accordingly, it was decided to study the same separately.

2. **Maharashtra (Osmanabad)**

- Osmanabad WEZ potential: 2000MW

RE Despatch in Osmanabad region of Maharashtra

- MSETCL stated that they have observed about 60% Peak Wind Dispatch integrated in their system (i.e. about 2800MW out of 4769MW). Further, the maximum injection observed in an individual wind farm on stand-alone basis does not exceed 80% of the Installed Capacity.

- Accordingly, based on the available data as well as guidelines of the planning criteria, it was decided that 80% peak dispatch from wind projects in Osmanabad area may be considered for RE projects in the region.

Transmission System Requirement

- Based on the joint studies, the following scheme was technically agreed for evacuation of power from about 2000MW RE expected to come up in the Osmanabad area:

i) Establishment of 4x500MVA, 400/220kV near Kallam PS along-with 8 nos. 220kV line bays
ii) 1x125MVAr bus reactor at Kallam PS
iii) LILO of both circuits of Parli(PG) – Pune(GIS) 400kV D/c line at Kallam PS along-with:
   a. Conversion of 50MVAr fixed Line Reactors on each ckt of Parli(PG) – Pune(GIS) 400kV D/c line at Parli(PG) end into switchable.
   b. Provision of new 50MVAr switchable line reactor at Kallam PS end of Kallam – Pune(GIS) 400kV D/c line

The meeting ended with a vote of thanks.

---x------x---

Annexure - I

Joint Study Meeting among CTU, CEA, POSOCO, GETCO & MSETCL
Date 05.06.2018 & 06.06.2018, Venue - CC Powergirid, Gurgaon

S. No.	Name S/Shri	Designation	Mob. No.	Email Id.
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	CTU, Powergrid			
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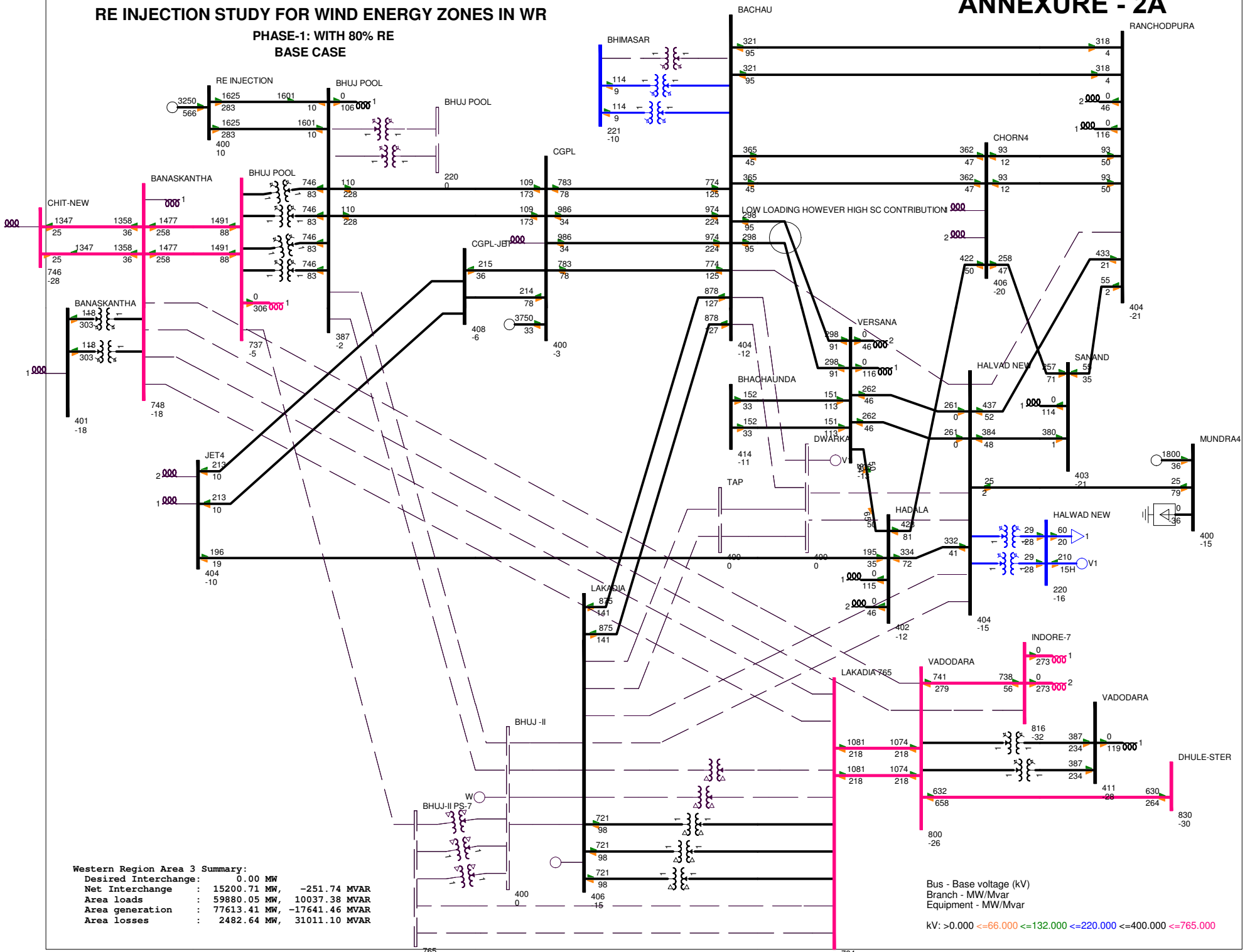
7	S.M. Fahad	Engineer		smfahad@powergridindia.com
	NLDC, POSOCO			
8	Rahul Chakrabarti	Dy. Manager	9599449975	rahulchakrabarti@posoco.in
9	Prabhankar Parwal	Engineer	9970702157	pparwal@posoco.in
	WRLDC,POSOCO			
10	Pradeep Kr. Sanodiya	Sr. Engineer	8452045338	psanodiya@posoco.in
	MSETCL			
11	Deepak Rokade	SE(STU)	9167831551	dkrokade@gmail.com
	GETCO			
12	Dipak H Patel	Dy. Engineer	9925213273	desystem@gmail.com

ANNEXURE - 2A

RE INJECTION STUDY FOR WIND ENERGY ZONES IN WR

PHASE-1: WITH 80% RE
BASE CASE

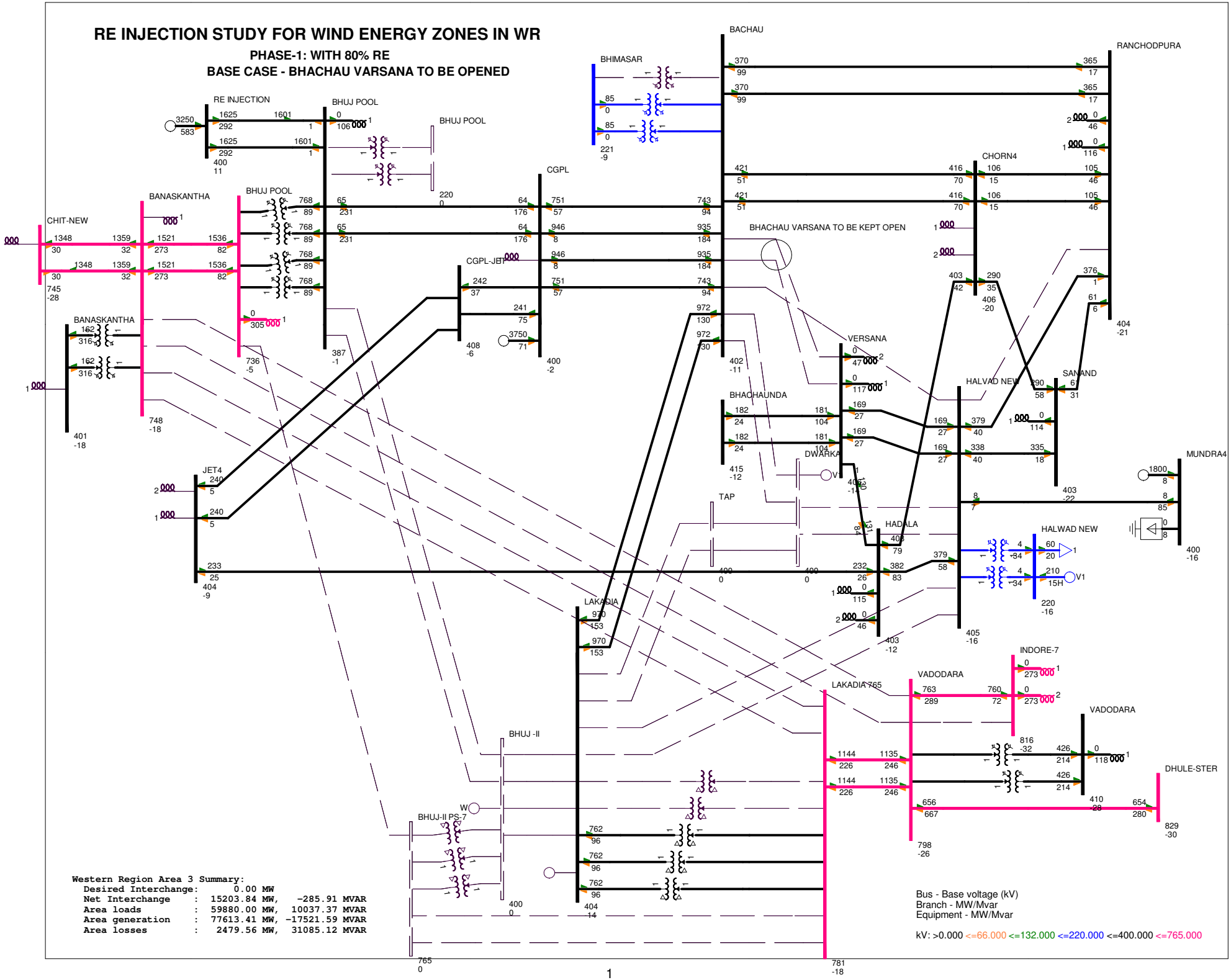


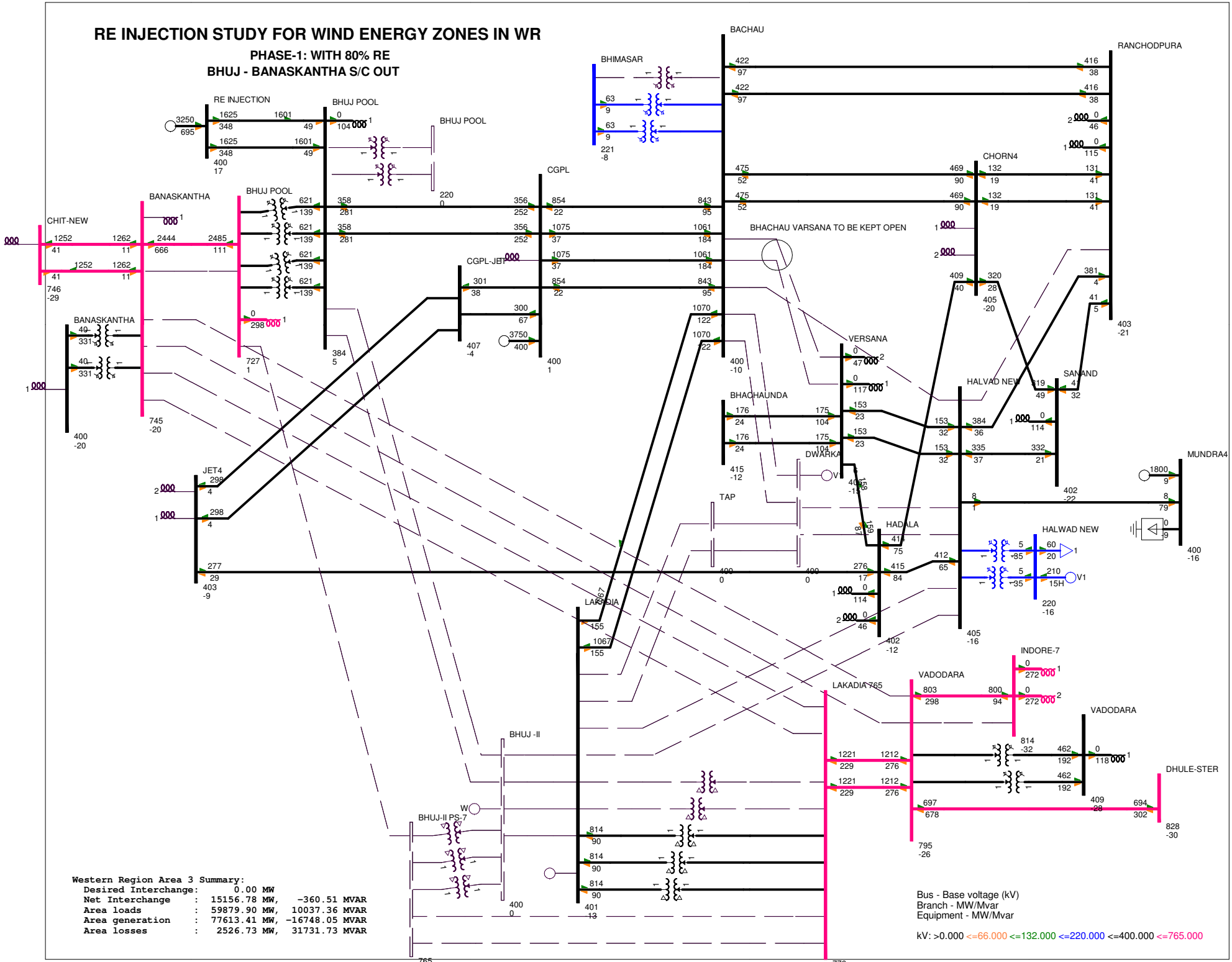
Western Region Area 3 Summary:

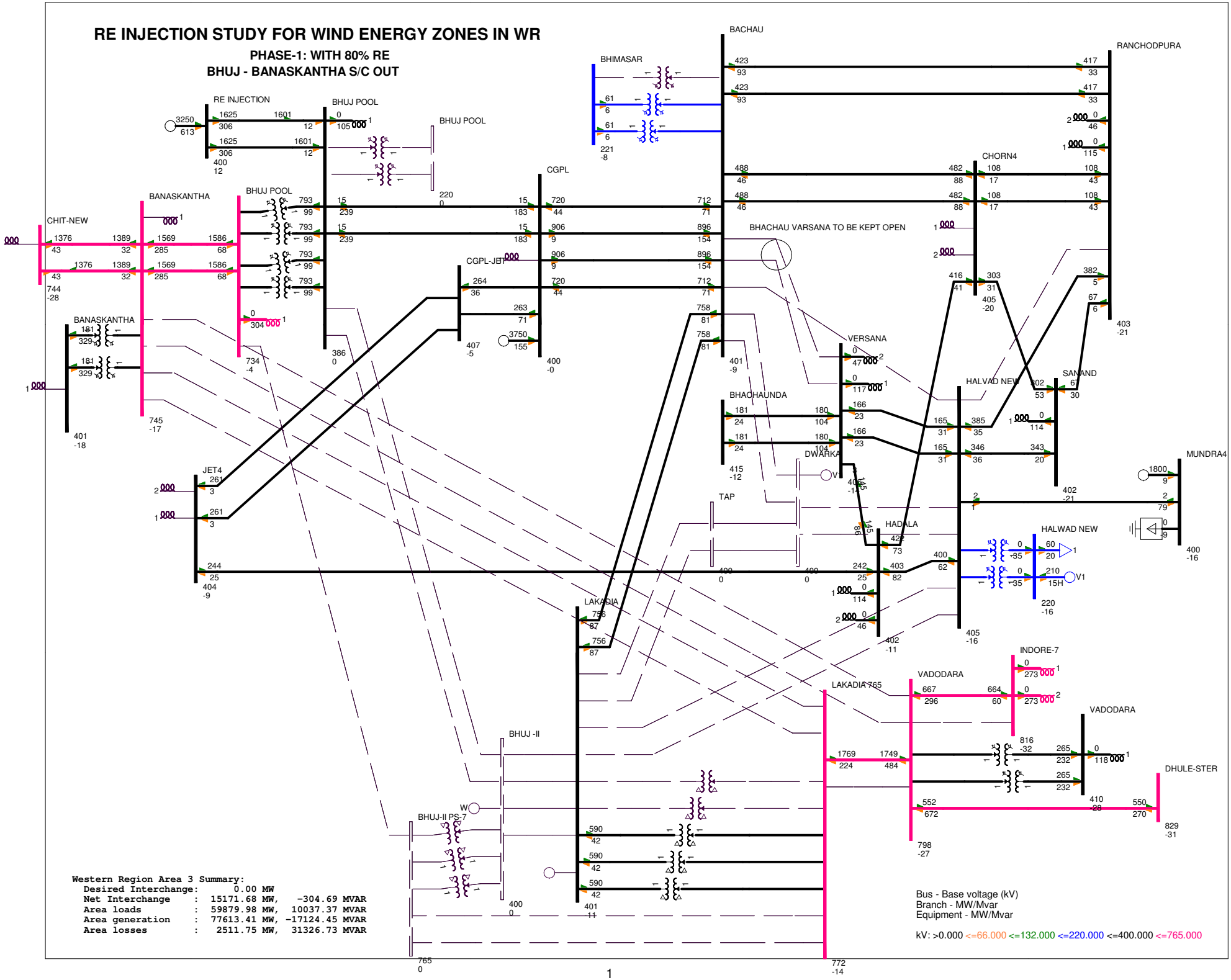
Desired Interchange:		0.00 MW	
Net Interchange	:	15200.71 MW,	-251.74 MVAR
Area loads	:	59880.05 MW,	10037.38 MVAR
Area generation	:	77613.41 MW,	-17641.46 MVAR
Area losses	:	2482.64 MW,	31011.10 MVAR

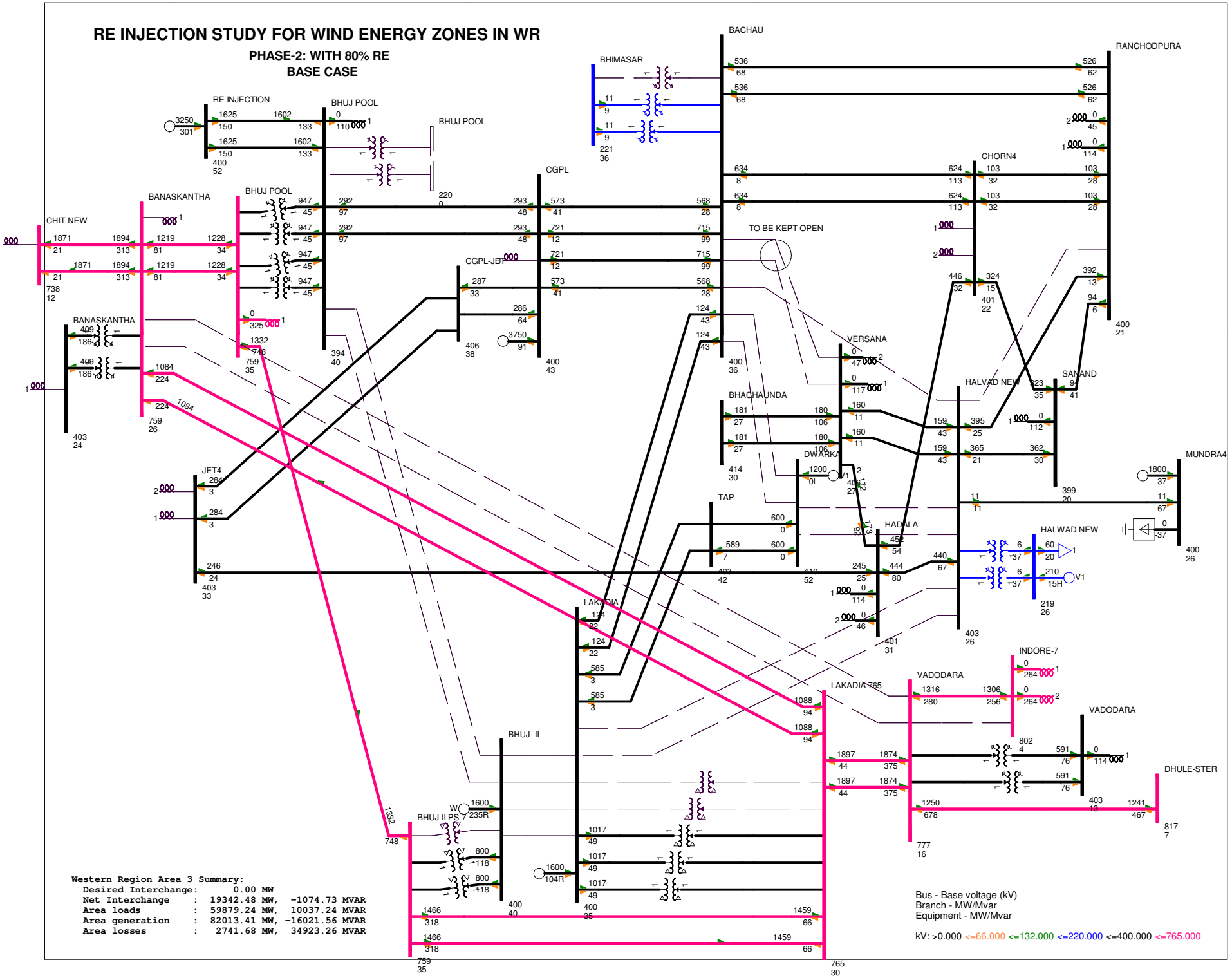
Bus - Base voltage (kV)
Branch - MW/Mvar
Equipment - MW/Mvar

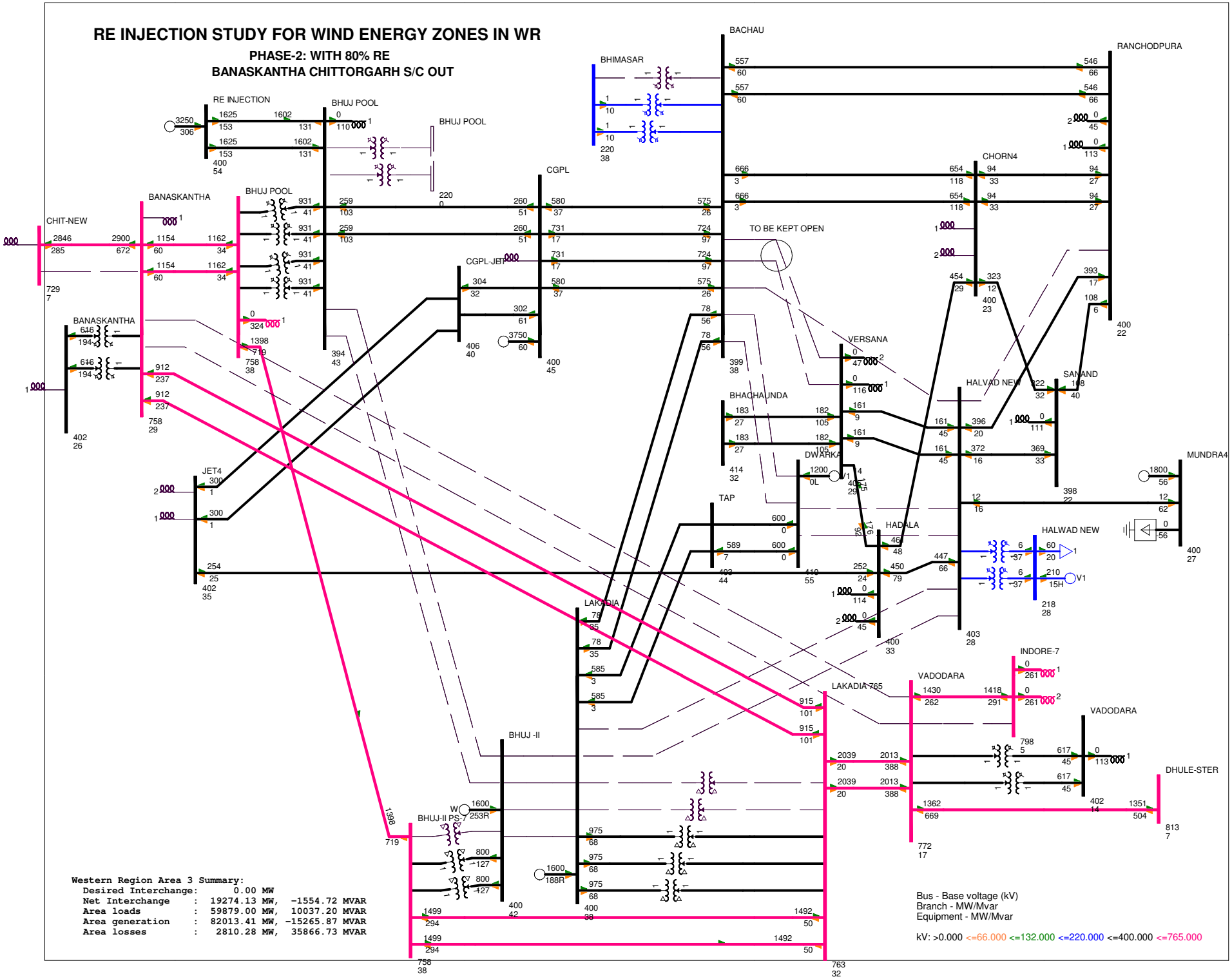
kV: >0.000 <=66.000 <=132.000 <=220.000 <=400.000 <=765.000

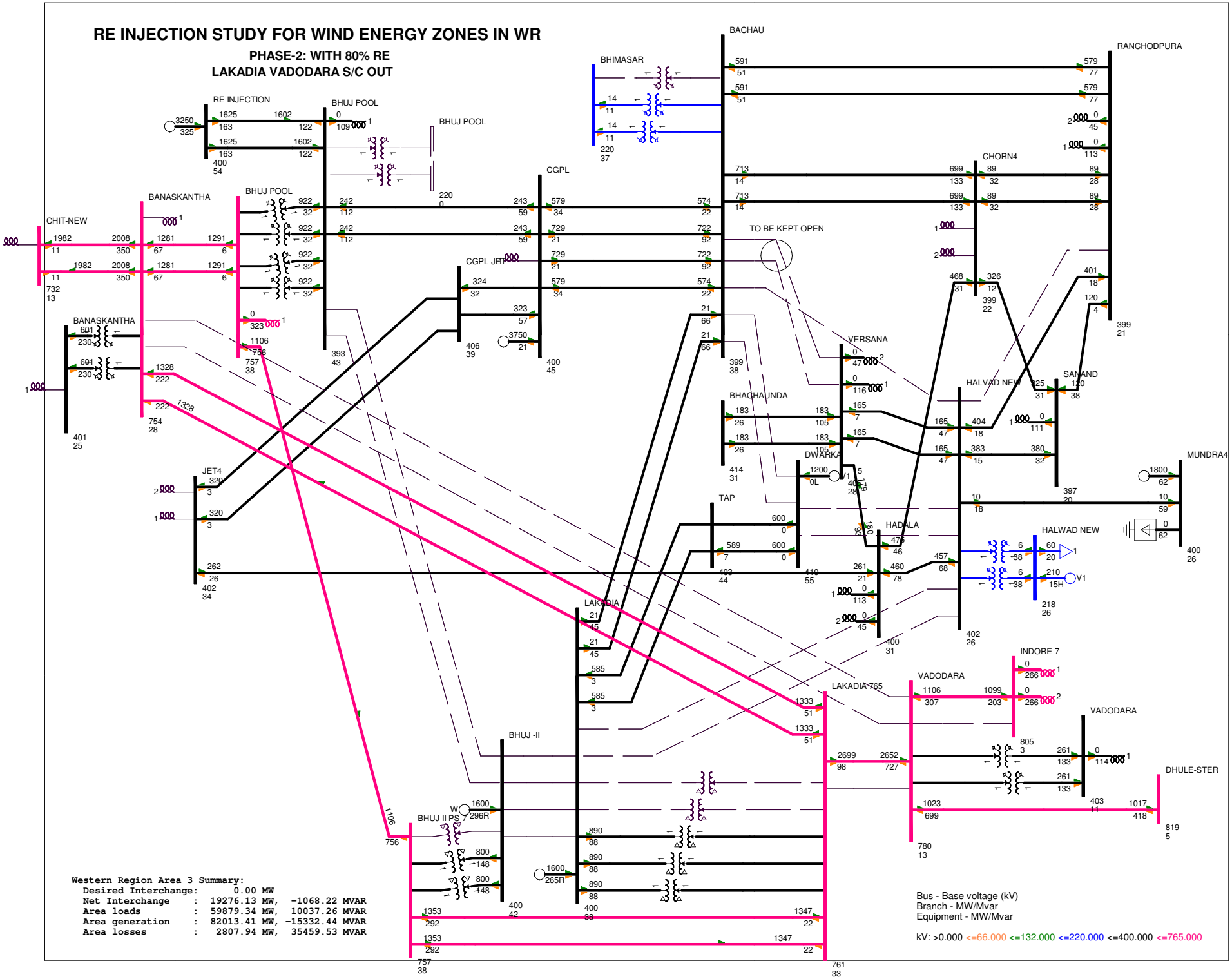

RE INJECTION STUDY FOR WIND ENERGY ZONES IN WR
PHASE-1: WITH 80% RE
BASE CASE - BHACHAU VARSANA TO BE OPENED
BACHAU
BHIMASAR
RANCHODPURA
RE INJECTION
BHUJ POOL
BHUJ POOL
CHORN4
CGPL
BANASKANTHA
BHUJ POOL
CHIT-NEW
BHACHAU VARSANA TO BE KEPT OPEN
CGPL-JET
VERSANA
BANASKANTHA
HALVAD NEW
SANAND
BHACHAUNDA
DWARKA
MUNDRA4
JET4
TAP
HADALA
HALVAD NEW
V1
LAKADIA
INDORE-7
VADODARA
LAKADIA 765
VADODARA
BHUJ -II
DHULE-STER
BHUJ-II PS-7
W
Western Region Area 3 Summary:
Desired Interchange: 0.00 MW
Net Interchange : 15203.84 MW, -285.91 MVAR
Area loads : 59880.00 MW, 10037.37 MVAR
Area generation : 77613.41 MW, -17521.59 MVAR
Area losses : 2479.56 MW, 31085.12 MVAR
Bus - Base voltage (kV)
Branch - MW/Mvar
Equipment - MW/Mvar
kV: >0.000 <=66.000 <=132.000 <=220.000 <=400.000 <=765.000


RE INJECTION STUDY FOR WIND ENERGY ZONES IN WR
PHASE-1: WITH 80% RE
BHUJ - BANASKANTHA S/C OUT
BACHAU
BHIMASAR
RANCHODPURA
RE INJECTION
BHUJ POOL
BHUJ POOL
CHORN4
CGPL
BANASKANTHA
BHUJ POOL
CHIT-NEW
BHACHAU VARSANA TO BE KEPT OPEN
CGPL-JET
VERSANA
BANASKANTHA
HALVAD NEW
SANAND
BHACHAUNDA
DWARKA
MUNDRA4
JET4
TAP
HADALA
HALVAD NEW
LAKADIA
INDORE-7
VADODARA
LAKADIA 765
VADODARA
BHUJ -II
DHULE-STER
BHUJ-II PS-7
Western Region Area 3 Summary:
Desired Interchange: 0.00 MW
Net Interchange : 15156.78 MW, -360.51 MVAR
Area loads : 59879.90 MW, 10037.36 MVAR
Area generation : 77613.41 MW, -16748.05 MVAR
Area losses : 2526.73 MW, 31731.73 MVAR
Bus - Base voltage (kV)
Branch - MW/Mvar
Equipment - MW/Mvar
kV: >0.000 <=66.000 <=132.000 <=220.000 <=400.000 <=765.000


RE INJECTION STUDY FOR WIND ENERGY ZONES IN WR
PHASE-1: WITH 80% RE
BHUJ - BANASKANTHA S/C OUT
RE INJECTION
BHUJ POOL
BHUJ POOL
BHIMASAR
BACHAU
RANCHODPURA
CHORN4
CGPL
CGPL-JET
BANASKANTHA
CHIT-NEW
BANASKANTHA
BHUJ POOL
BHACHAU VARSANA TO BE KEPT OPEN
VERSANA
HALVAD NEW
SANAND
BHACHAUNDA
DWARKA
TAP
HADALA
HALVAD NEW
MUNDRA4
JET4
LAKADIA
BHUJ -II
BHUJ-II PS-7
LAKADIA 765
VADODARA
INDORE-7
VADODARA
DHULE-STER
Western Region Area 3 Summary:
Desired Interchange: 0.00 MW
Net Interchange : 15171.68 MW, -304.69 MVAR
Area loads : 59879.98 MW, 10037.37 MVAR
Area generation : 77613.41 MW, -17124.45 MVAR
Area losses : 2511.75 MW, 31326.73 MVAR
Bus - Base voltage (kV)
Branch - MW/Mvar
Equipment - MW/Mvar
kV: >0.000 <=66.000 <=132.000 <=220.000 <=400.000 <=765.000

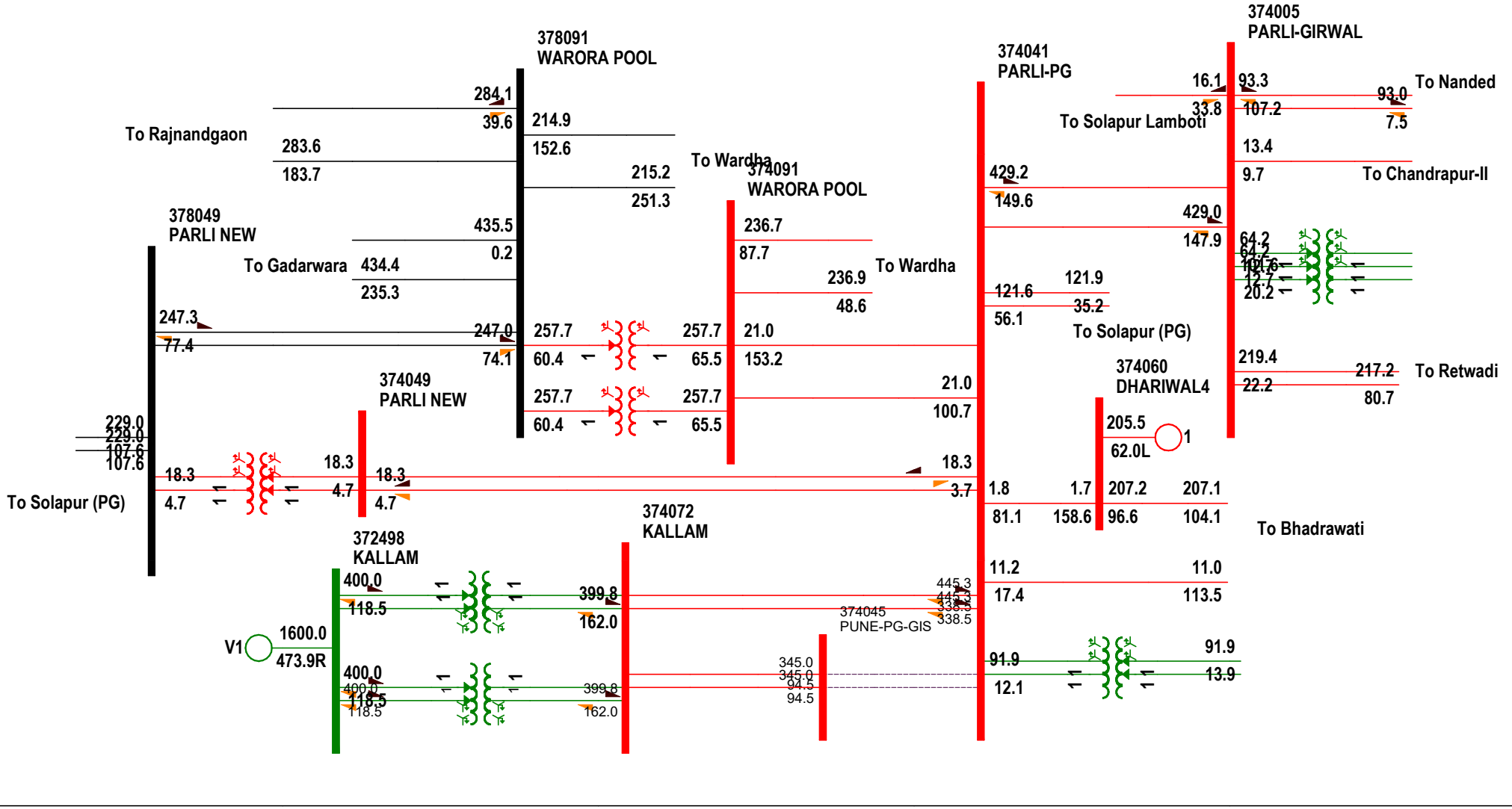

RE INJECTION STUDY FOR WIND ENERGY ZONES IN WR
PHASE-2: WITH 80% RE
BASE CASE
RE INJECTION
BHUJ POOL
BHUJ POOL
BHIMASAR
BACHAU
RANCHODPURA
CHORN4
CGPL
BANASKANTHA
BHUJ POOL
CHIT-NEW
CGPL-JBP
TO BE KEPT OPEN
VERSANA
BANASKANTHA
BHACHAUNDA
DWARKA
HALVAD NEW
SANAND
MUNDRA4
JET4
TAP
HADALA
HALVAD NEW
LAKADIA
LAKADIA 765
VADODARA
INDORE-7
VADODARA
BHUJ -II
BHUJ-II PS-7
DHULE-STER
Western Region Area 3 Summary:
Desired Interchange: 0.00 MW
Net Interchange : 19342.48 MW, -1074.73 MVAR
Area loads : 59879.24 MW, 10037.24 MVAR
Area generation : 82013.41 MW, -16021.56 MVAR
Area losses : 2741.68 MW, 34923.26 MVAR
Bus - Base voltage (kV)
Branch - MW/Mvar
Equipment - MW/Mvar
kV: >0.000 <=66.000 <=132.000 <=220.000 <=400.000 <=765.000


RE INJECTION STUDY FOR WIND ENERGY ZONES IN WR
PHASE-2: WITH 80% RE
BANASKANTHA CHITTORGARH S/C OUT
RE INJECTION
BHUJ POOL
BHUJ POOL
BHIMASAR
BACHAU
RANCHODPURA
CHORN4
CGPL
CGPL-JBP
BANASKANTHA
CHIT-NEW
BHUJ POOL
TO BE KEPT OPEN
VERSANA
BHACHAUNDA
DWARKA
HALVAD NEW
SANAND
MUNDRA4
JET4
TAP
HADALA
HALWAD NEW
LAKADIA
LAKADIA 765
VADODARA
INDORE-7
VADODARA
BHUJ -II
BHUJ-II PS-7
DHULE-STER
Western Region Area 3 Summary:
Desired Interchange: 0.00 MW
Net Interchange : 19274.13 MW, -1554.72 MVAR
Area loads : 59879.00 MW, 10037.20 MVAR
Area generation : 82013.41 MW, -15265.87 MVAR
Area losses : 2810.28 MW, 35866.73 MVAR
Bus - Base voltage (kV)
Branch - MW/Mvar
Equipment - MW/Mvar
kV: >0.000 <=66.000 <=132.000 <=220.000 <=400.000 <=765.000

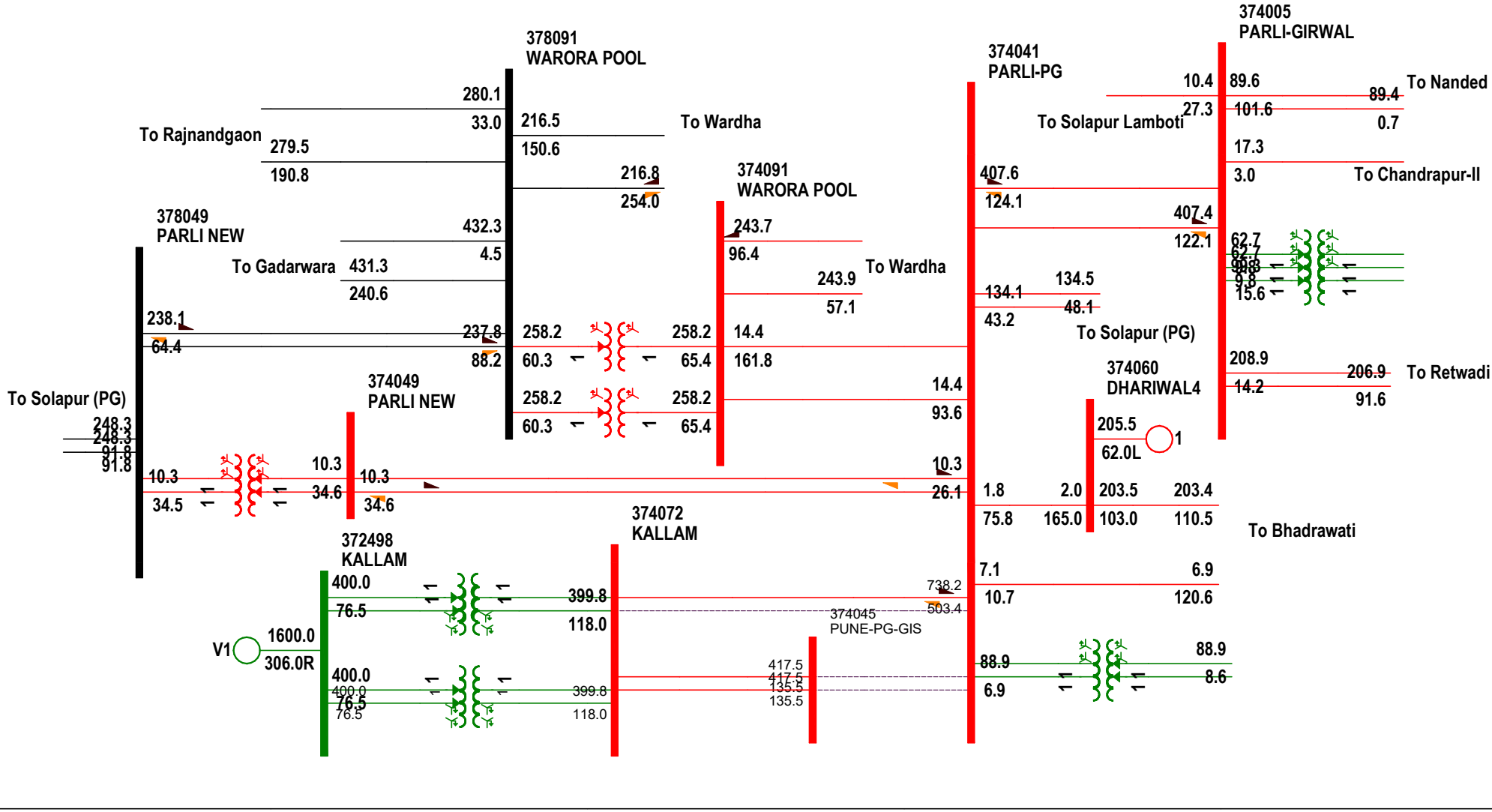

RE INJECTION STUDY FOR WIND ENERGY ZONES IN WR
PHASE-2: WITH 80% RE
LAKADIA VADODARA S/C OUT
RE INJECTION
BHUJ POOL
BHUJ POOL
BHIMASAR
BACHAU
RANCHODPURA
CHORN4
CGPL
BANASKANTHA
BHUJ POOL
CHIT-NEW
CGPL-JBP
TO BE KEPT OPEN
VERSANA
BANASKANTHA
BHACHAUNDA
HALVAD NEW
SANAND
DWARKA
MUNDRA4
JET4
TAP
HADALA
HALWAD NEW
LAKADIA
BHUJ -II
LAKADIA 765
VADODARA
INDORE-7
VADODARA
DHULE-STER
BHUJ-II PS-7
Western Region Area 3 Summary:
Desired Interchange: 0.00 MW
Net Interchange : 19276.13 MW, -1068.22 MVAR
Area loads : 59879.34 MW, 10037.26 MVAR
Area generation : 82013.41 MW, -15332.44 MVAR
Area losses : 2807.94 MW, 35459.53 MVAR
Bus - Base voltage (kV)
Branch - MW/Mvar
Equipment - MW/Mvar
kV: >0.000 <=66.000 <=132.000 <=220.000 <=400.000 <=765.000

Transmission System for Wind Energy Zone at Osmanabad, Maharashtra

ANNEXURE - 2B



Transmission System for Wind Energy Zone at Osmanabad, Maharashtra



सत्यमेव जयते

भारत सरकार

Government of India

विद्युत मंत्रालय

Ministry of Power

केन्द्रीय विद्युत प्राधिकरण

Central Electricity Authority

विद्युत प्रणाली योजना एवं मूल्यांकन-I प्रभाग

Power System Planning & Appraisal-I Division

सेवा में / To,

1. COO, CTU, PGCIL, Saudamini, Plot No. 2, Sector - 29, Gurgaon – 122001
2. CEO, POSOCO, B-9, Qutab Institutinal Area, Katwaria Sarai, New Delhi-110016, Fax 011-26852747.
3. Director (Operation), MAHATRANSCO, 'Prakashganga', Plot No.G-9, Bandra-East, Mumbai-400051, Fax 022-26390383/26595258.

विषय: एमएसईटीसीएल से संबंधित मुद्दों के लिए सिस्टम अध्ययन - बैठक का कार्यवृत्त

Subject: System studies for issues related to MSETCL – minutes of the meeting

महोदया / महोदय / Madam / Sir,

Please find enclosed minutes of the joint study meeting held on 18.07.2018 & 19.07.2018 at CEA, New Delhi to discuss the following issues related to MSETCL:

भवदीय,

21/8/2018

(अवधेश कुमार यादव / Awdhēsh Kumar Yadav)

निदेशक/Director

Minutes of the Joint Study meeting regarding the issues related to MSETCL held on 18.06.2018 & 19.06.2018 at CEA, New Delhi

Background:

In the 42nd and 43rd meeting of Standing Committee on Power System Planning of Western Region, it was agreed to carry out joint studies for the following issues:

i. Evacuation of power beyond Warora – 42nd SCM
ii. Overloading of 2x315 ICTs at Wardha(PG) – 43rd SCM
iii. Overloading of 400 kV Chandrapur-I – Chandrapur-II D/c line – 43rd SCM

In addition to above, MSETCL has proposed LILO of one circuit of 400 kV GWEL – Bhadaravati D/c line (dedicated line of M/s GWEL) at Warora (MSETCL) for drawl of MSEDCL's share of power from M/s GWEL generation switchyard directly through the STU network.

To carry out joint study on above issues, a meeting was held among CEA, CTU, POSOCO & MSETCL on 18.06.2018 & 19.06.2018 at CEA, New Delhi. The list of participants is enclosed as **Annexure – I.**

The details of the various cases studied are as given below:

I. **Evacuation of power beyond Warora:** The following cases were studied:
   (a) **Base Case:** LILO of Chandrapur-I – Parli 400 kV S/c line at Warora(M) without 400 kV bus splitting and with interim arrangement of interconnection of Koradi-II with Wardha(PG)/Warora(M)
   (b) **Case A**: LILO of Chandrapur-I – Parli 400 kV S/c line at Warora(M) with bus splitting at Wardha and with interim arrangement of interconnection of Koradi-II with Wardha(PG)/Warora(M) is retained
   (c) **Case B:** LILO of Chandrapur-I – Parli 400 kV S/c line at Warora(M) with final arrangement for interconnection of Koradi-II i.e. direct connection between Koradi-II and Warora(M)
   (d) **Case C:** Case B + Warora(M) – Warora Pool 400 kV D/c line
   (e) **Case D:** Case B + LILO of one circuit of Warora Pool – Parli PG 400 kV D/c line at Warora(M)
   (f) **Case E:** Case C + Wardha – Warora Pool 400 kV D/c kept open
   (g) **Case F:** Case D + Wardha – Warora Pool 400 kV D/c kept open

Fault level (in kA) of various 400 kV substations is tabulated below

	Fault level in kA						
400 kV S/s	**Base Case**	**Case A**	**Case B**	**Case C**	**Case D**	**Case E**	**Case F**
Warora(M)	33.2	32.2	24.5	38.8	34.6	35.9	33.4
Koradi-II	24.3	23.9	20.5	21.6	21.3	21.5	21.3
Warora Pool	47.5	43.6	40.6	50.5	46.3	35.6	30.8
Wardha-A	68.8	43.4	42.4	42.9	42.7	40.3	40.3
Wardha-B	68.8	52.6	43.7	47.1	45.8	29.8	29.8

Power flows on above cases are given below:

	Power Flows in MVA						
Transmission lines	**Base Case**	**Case A**	**Case B**	**Case C**	**Case D**	**Case E**	**Case F**
Koradi-II – Wardha 400 kV S/c line	1x732	1x746	-	-	-	-	-
Koradi-II – Warora/ IEPL 400 kV D/c line	1x327	1x327	2x323	2x405	2x404	2x384	2x388
Warora(M) - Wardha 400 kV S/c line	1x385	1x418	-	-	-	-	-
Warora(M) – Chandra pur-I 400 kV S/c line	1x90	1x83	1x228	1x90	1x92	1x115	1x110
Warora(M) – Parli 400 kV S/c line	1x557	1x552	1x659	1x553	1x553	1x565	1x561
Warora(M) – Chandra pur-II 400 kV D/c line	2x132	2x125	2x335	2x135	2x136	2x173	2x165
Tiroda – Warora(M) 400 kV D/c line	2x500	2x501	2x477	2x528	2x528	2x515	2x517
Wardha – Warora Pool 400 kV D/c line	2x196	2x147	2x75	2x264	2x255	-	-
Warora Pool – Parli (PG) 400 kV D/c line	2x379	2x374	2x332	2x383	1x379	2x403	1x404
Warora(M) – Warora Pool 400 kV D/c line	-	-	-	2x456	1x481	2x366	1x339
Warora(M) – Parli(PG) 400 kV D/c line	-	-	-	-	1x412	-	1x418

From above, it is seen that even after 400 kV bus splitting through series reactor at Wardha, fault level of 43.4 kA & 52.6 kA is observed at Wardha-A & Wardha-B respectively by keeping the interim arrangement of Koradi-II – Wardha/Warora in service. With the final arrangement (Koradi-II – Warora(M) 400 kV D/c line) as in Case B, the fault level is within design limits. Further, with connectivity of Warora(M) with ISTS (Warora Pool 765/400 kV S/s) and keeping Wardha – Warora Pool 400 kV D/c line open, short circuit levels are within limits (cases E & F). In view of the above, the following system strengthening as a part of intrastate transmission system was agreed:

i. LILO of Chandrapur-I – Parli 400 kV S/c line at Warora(M)
ii. LILO of one circuit of Warora Pool – Parli(PG) D/c line at Warora(M) or Warora (M) – Warora Pool 400 kV D/c line
iii. Wardha – Warora Pool 400 kV D/c line to be kept normally open

The above proposal would be put up in Standing Committee on Transmission for further deliberations.

II. Overloading of 2x315 ICTs at Wardha(PG):

In the 43rd meeting of SCPSPWR held on 11.05.2018, the issue of overloading of ICTs at Wardha(PG) was raised in the NLDC operational

feedback. It was stated that each of the 2x315 MVA, 400/220 kV ICTs are loaded above 200 MVA after the commissioning of 3x660 MW units at Koradi-II.

System studies has been carried out after the updation of 220 kV network of Maharashtra system. In the present scenario the loading of 200 MW is seen in each 2x315 MVA, 400/220 kV ICT at Wardha(PG) with the full generation at Koradi-II units but no overloading is observed after the implementation of 400 kV bus splitting arrangement as agreed in the 41st meeting of SCPSPWR to control the fault level at 400 kV bus at Wardha(PG).

It is also observed that the loading on 400/220 kV ICTs at Wardha S/s would further reduce in case of drawl of MSEDCL's share of power from M/s GWEL (2x300 MW) through 220 kV D/c line from M/s GWEL to Maharashtra system.

It is agreed that there is no need of any augmentation of 400/220 kV ICT at Wardha(PG) S/s at present and any future requirement of augmentation of 400/220 kV ICTs at Wardha(PG) would be taken up when required.

III. Overloading of 400 kV Chandrapur-I – Chandrapur-II D/c line

In the 43rd meeting of SCPSPWR, POSOCO has raised the issue of N-1 non-compliance of Chandrapur-I – Chandrapur-II 400 kV D/c line during the less/nil generation at Chandrapur-I complex.

System studies was carried out for the scenario, no generation at Chandrapur-I complex and full generation at Chandrapur-II complex.

The loading on the Chandrapur-II – Chandrapur-I 400 kV D/c line gets reduced after implementation LILO of Chandrapur-I – Parli 400 kV S/c line at Warora(M). Further, MSETCL proposed the LILO of one circuit of Chandrapur-I – Bhadravati 400 kV 2xD/c line at Chandrapur-II which is passing nearby Chandrapur-II S/s. The implementation of this LILO is very easy as the line passes to nearby of Chandrapur-II. This provides an additional path from Chandrapur-II to Chandrapur-I which make the system N-1 compliant. Also, the fault level is within limit at Chandrapur-I, Chandrapur-II & Bhadravati (34.7 kA, 34.7 kA & 32.5 kA respectively) after the implementation of LILO of one circuit of Chandrapur-I – Bhadravati 400 kV 2xD/c line at Chandrapur-II.

The following transmission system is agreed to reduce the loading of Chandrapur-II – Chandrapur-I 400 kV D/c line which makes the system N-1 compliant:

i. LILO of one circuit of Chandrapur-I – Bhadravati 400 kV 2xD/c line at Chandrapur-II

IV. STU connectivity of M/s GWEL generation plant situated at Warora:

To provide the STU connectivity to M/s GWEL (ISGS generation) as per the CERC order dated 27.03.2018 on the petition no. 245/MP/2016, following options has been studied:

(a) Case A: LILO of one circuit of GWEL – Bhadravati 400 kV D/c line at Warora(M)

(b) Case B: GWEL – Warora(M) 400 kV D/c line

(c) Case C: Creation of 220 kV level at M/s GWEL through 400/220, 2x315 MVA ICTs and its interconnection with 220 kV Warora S/s through 220 kV D/c line

I/1840/2018(2)

(d) Case D: Case A + LILO of Chandrapur-I – Parli 400 kV S/c line at Warora(M)

(e) Case E: Case B + LILO of Chandrapur-I – Parli 400 kV S/c line at Warora(M)

(f) Case F: Case C + LILO of Chandrapur-I – Parli 400 kV S/c line at Warora(M)

The power flows for various options studied is tabulated below:

	Power flows (MVA)					
Transmission line	Case A	Case B	Case C	Case D	Case E	Case F
GWEL-Bhadravati 400 kV D/c	1x410	2x377	2x217	1x316	2x255	2x214
GWEL-Warora(M) 400 kV D/c	1x161	-2x95	-	1x254	2x30	-
Warora(M)-Bhadravati 400 kV S/c	1x449	-	-	1x263	-	-
GWEL-Warora(220) 220 kV D/c	-	-	2x69	-	-	2x72

It can be seen that in there is injection of 449 MW and 190 MW power from MSETCL system into ISTS system at Bhadrawati in CASE A (through Warora- Bhadrawati 400 kV SC line) and CASE B (through Warora-Bhadrawati 400 kV D/C lines) respectively. The injection gets reduced to 254 MW and 60 MW in CASE D and CASE E respectively with LILO of Chandrapur-I – Parli 400 kV S/c line at Warora(M)

Therefore, proposal of LILO of one circuit of GWEL – Bhadravati 400 kV D/c line at Warora(M) as in CASE A or proposal of GWEL – Warora(M) 400 kV D/c line as in CASE B for drawal of MSEDCL share of power from GWEL bus actually injects power into the ISTS system.

With proposal of creation of 220 kV level at M/s GWEL through 400/220, 2x315 MVA ICTs and its interconnection with 220 kV Warora S/s through 220 kV D/c line as in CASE C and CASE F, there is drawal of about 140 MW from GWEL into MSETCL system.

Accordingly, the following system is proposed for providing connectivity to MSETCL for drawing MSEDCL share of power from M/s GWEL:

- Installation of 400/220, 2x315 or 500 MVA ICTs at GWEL generation switchyard along with associated ICT bays
- 2 nos. 220 kV line bays.
- GWEL – Warora (M) 220 kV D/c line

I/1840/2018(2)

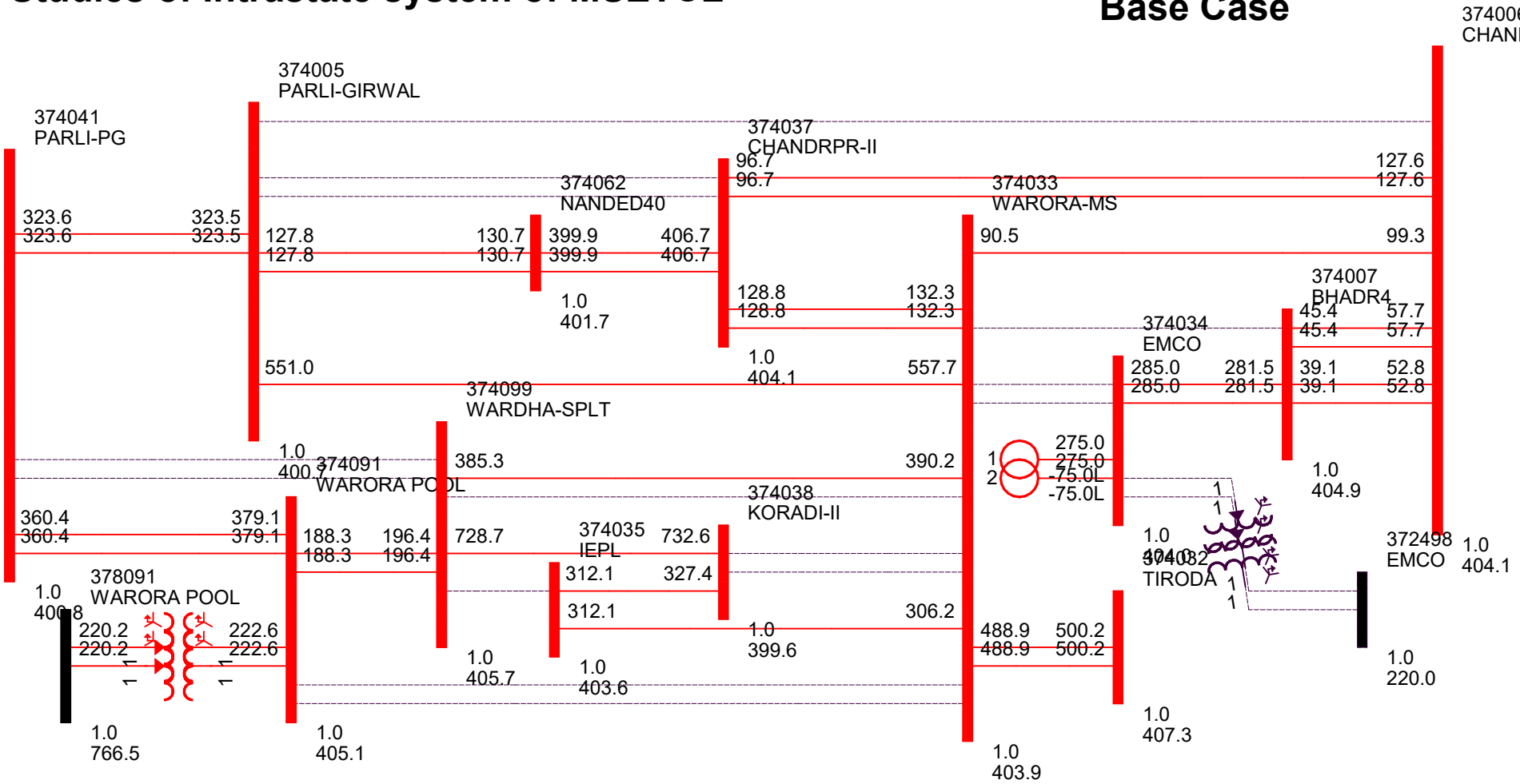
Annexure-I

S.No.	Name	Designation	Email ID
1	Ravinder Gupta	CE, CEA	Ravindergupta_cea@rediffmail.com
2	Awdhesh Kr. Yadav	Director, CEA	awd.cea@gmail.com
3	Vikas Sachan	AD, CEA	vikas.cea@gmial.com
4	Kanhaiya Singh Kushwaha	AD, CEA	kanhaiyasinghk@gmail.com
5	Pratyush Singh	SE, CTU	pratyush.singh@powergridindia.com
6	P.S Das	DGM, CTU	psdas@powergridindia.com
7	N. Nallarasan	DGM, POSOCO	nallarasan@posoco.in
8	Paresh Bhagwat	CE, MSEDCL	ccppmsedcl@gmail.com
9	D.K Rokade	SE, MSETCL	cestu@mahatransco.in
10	V.G. Khedekar	Add EE, MSETCL	khedekarvg@yahoo.com

ANNEXURE - 3A

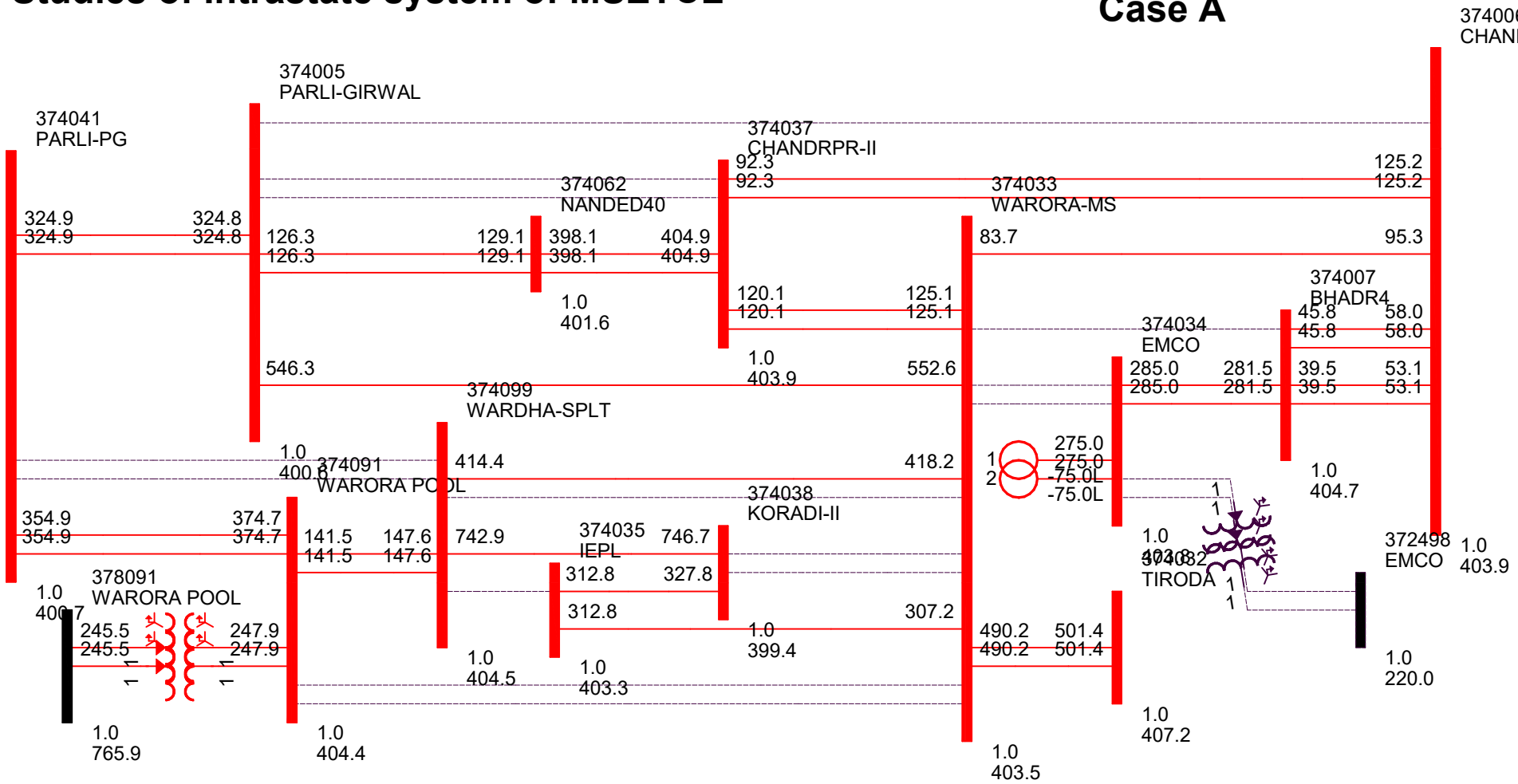
Studies of Intrastate system of MSETCL

Base Case



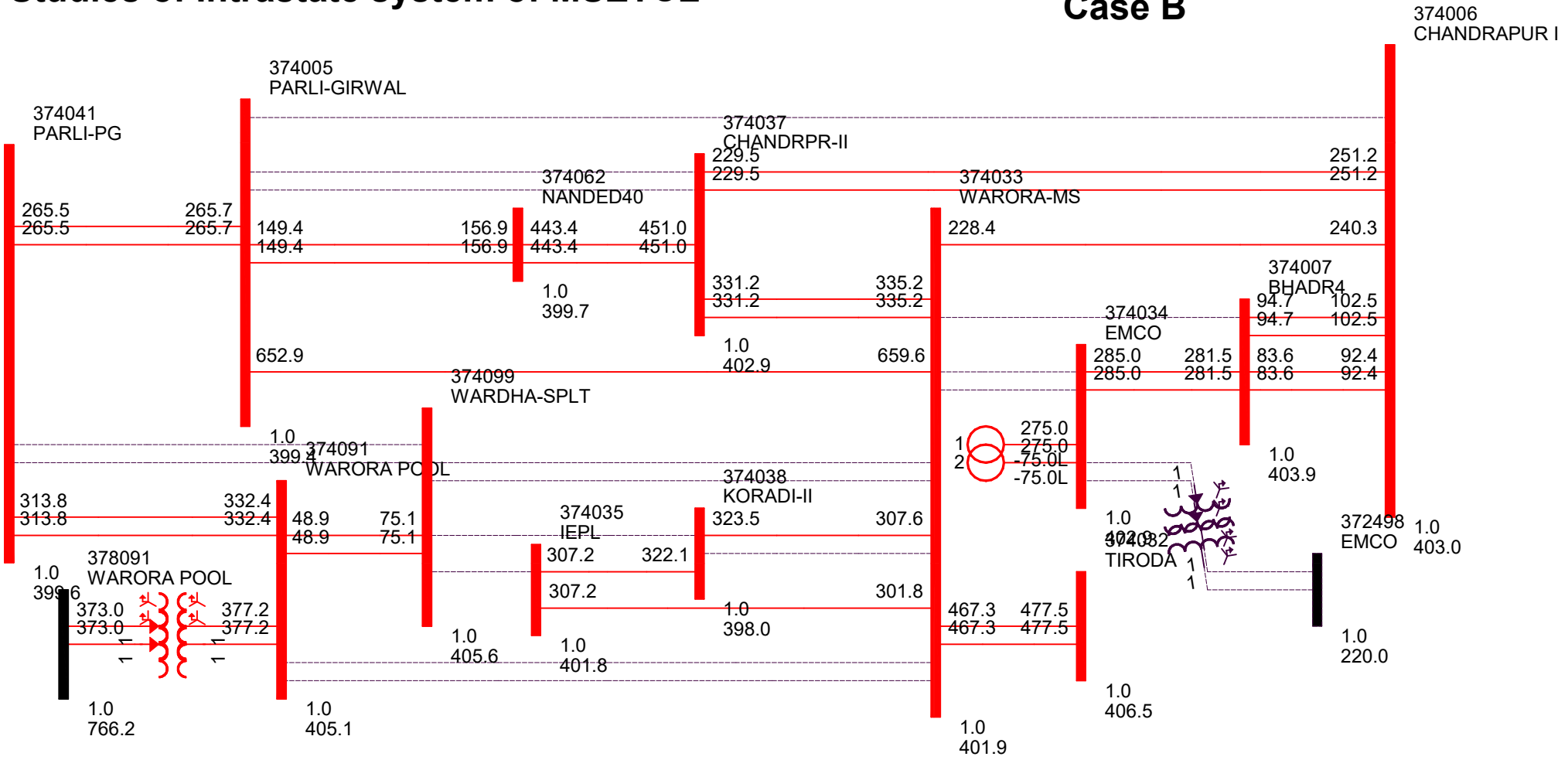
Studies of Intrastate system of MSETCL

Case A



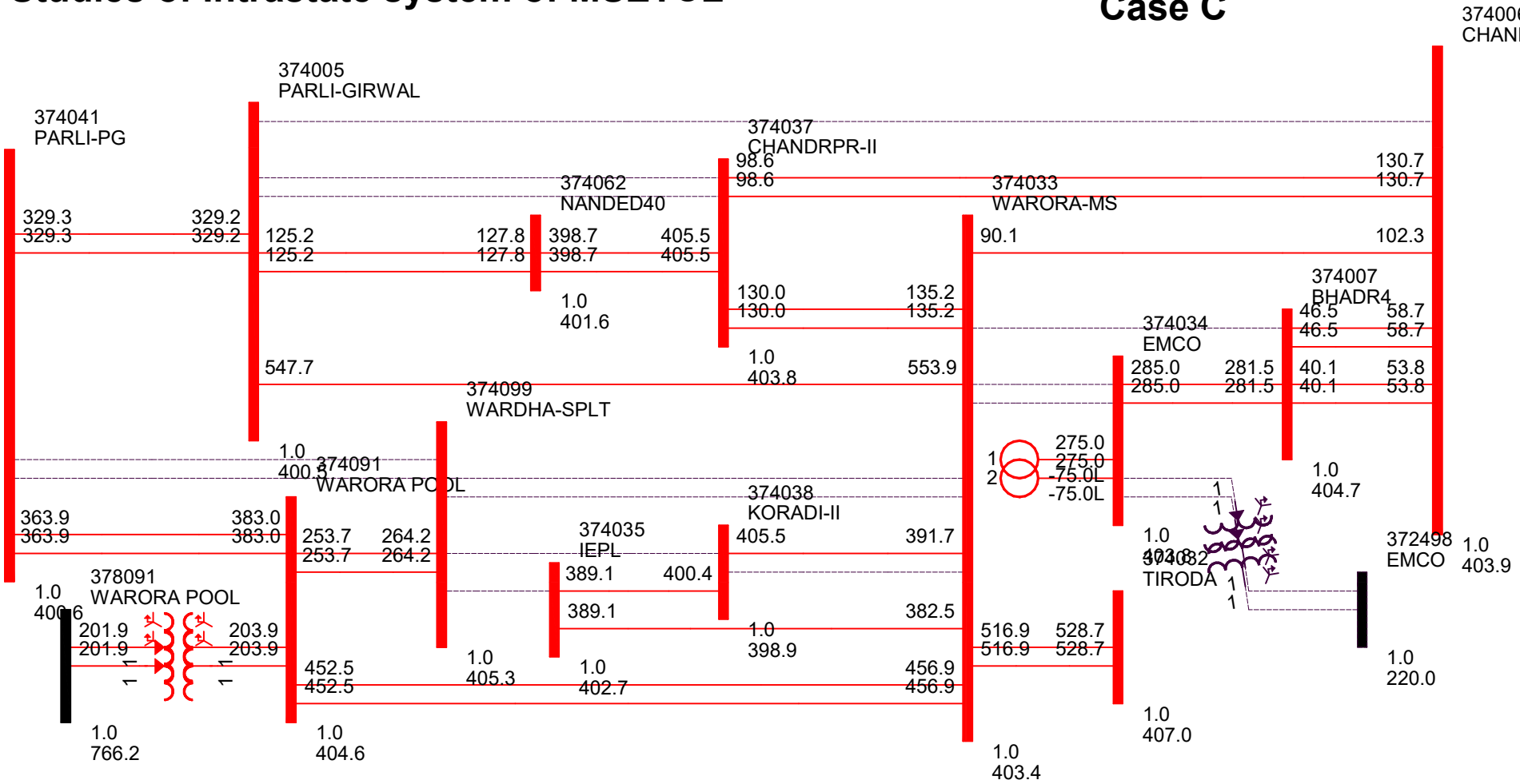
Studies of Intrastate system of MSETCL

Case B



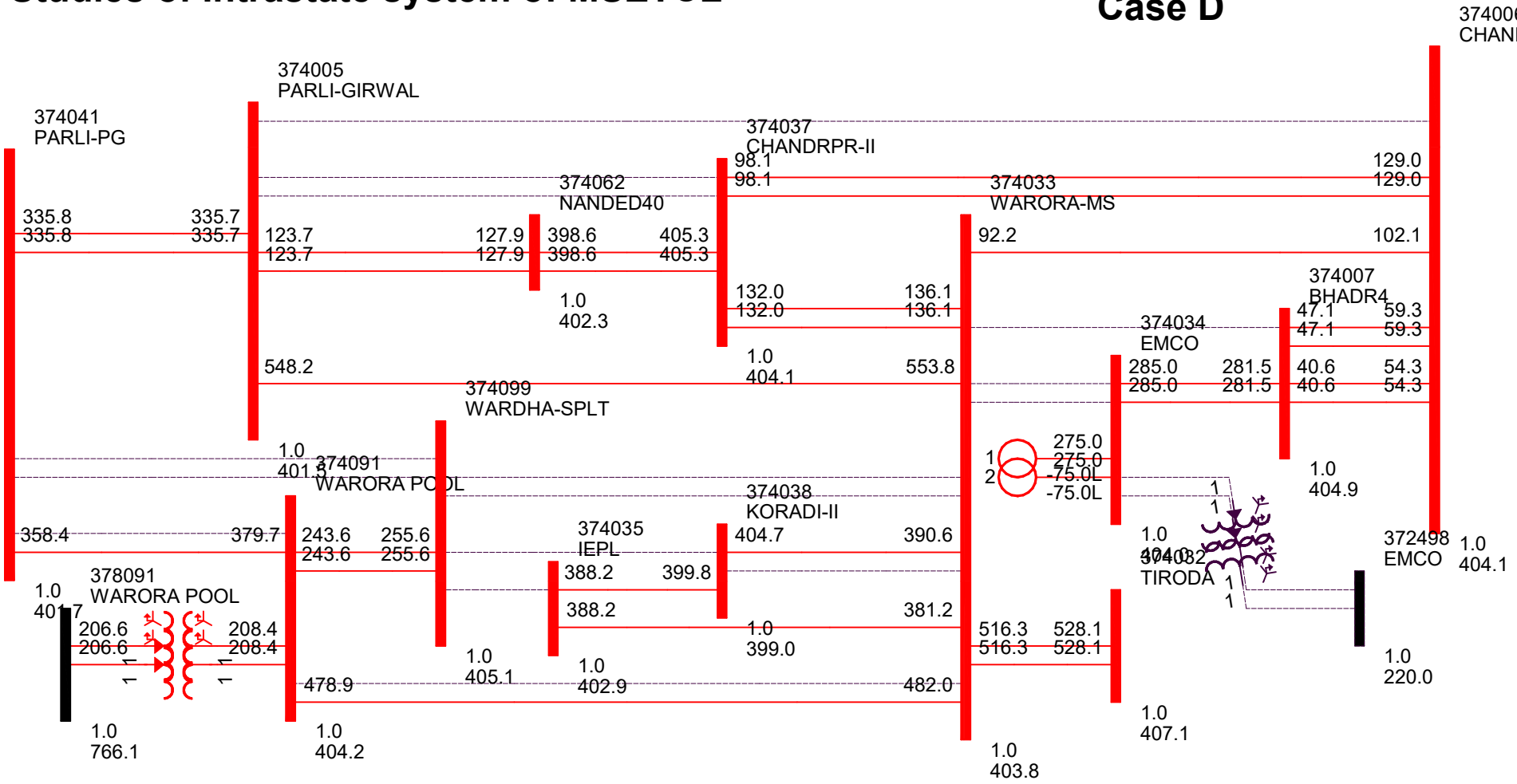
Studies of Intrastate system of MSETCL

Case C



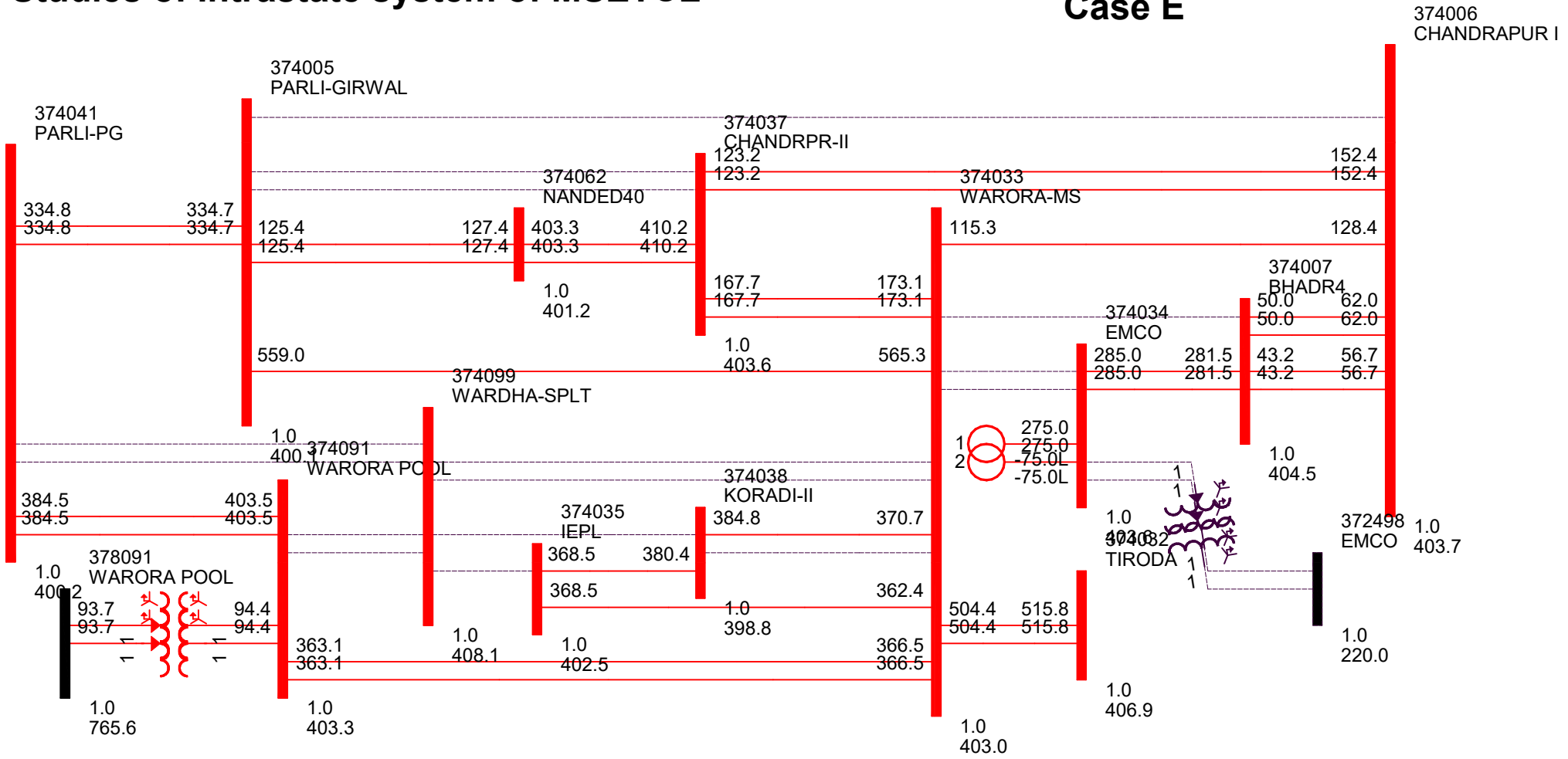
Studies of Intrastate system of MSETCL

Case D



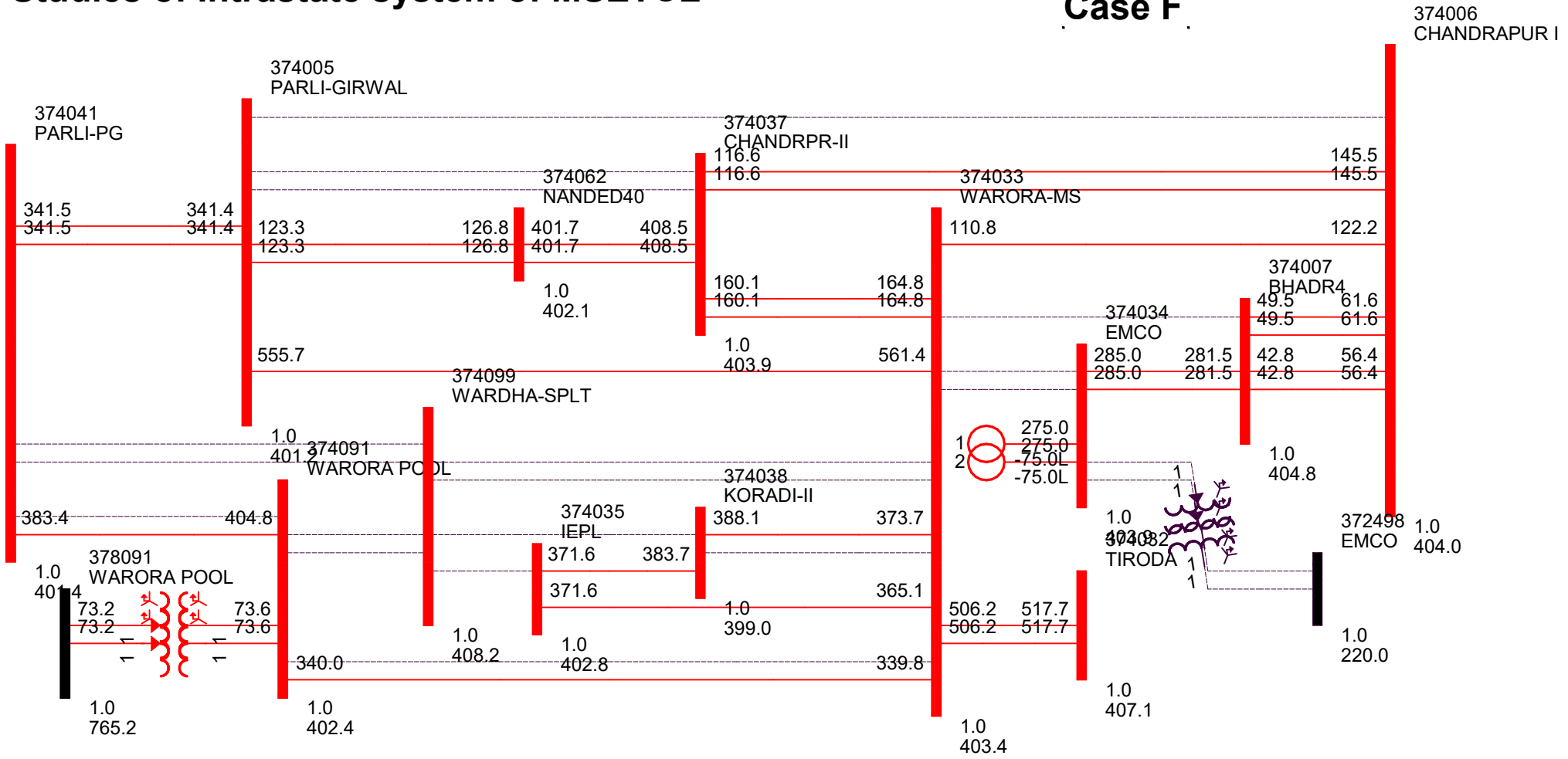
Studies of Intrastate system of MSETCL

Case E



Studies of Intrastate system of MSETCL

Case F



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Central Electricity Authority

विद्युत प्रणाली योजना एवं मूल्यांकन-I प्रभाग

Power System Planning & Appraisal-I Division

सेवा में / To,

1. COO, CTU, PGCIL, Saudamini, Plot No. 2, Sector - 29, Gurgaon – 122001
2. CEO, POSOCO, B-9, Qutab Institutinal Area, Katwaria Sarai, New Delhi-110016, Fax 011-26852747
3. Director (Operation), MSETCL, 'Prakashganga', Plot No. C-19, E – Block, Bandra(E), Mumbai-400051, Fax 022-26390383/26595258
4. Director (Commercial), MSEDCL, Prakashgad, Plot No. G-9, Bandra(E), Mumbai - 400051

विषय: मे. जीडब्ल्यूईएल (आईएसजीएस) की एसटीयू कनेक्टिविटी के संबंध में इस मुद्दे पर चर्चा के लिए सीईए, नई दिल्ली में 19.07.2018 को आयोजित बैठक की कार्यवृत्त

Subject: Minutes of the meeting held on 19.07.2018 at CEA, New Delhi to discuss the issue regarding the STU connectivity of M/s GWEL (ISGS)

महोदया / महोदय / Madam / Sir,

Please find enclosed minutes of the meeting held on 19.07.2018 at CEA, New Delhi to discuss the issue regarding the STU connectivity of M/s GWEL (ISGS).

भवदीय,

21/8/2018

(अवधेश कुमार यादव / Awdhesh Kumar Yadav)

निदेशक/Director

Copy to: Ajay Kumar Nathani, Head Transmission, Airport Building 302, New Shakti Bhawan, New Udaan Bhawan Complex, Near Terminal 3, IGI Airport, New Delhi - 110037

File No.CEA-PS-11-24(17)/1/2018-PSPA-I Division

I/1841/2018(3)

Minutes of the meeting held on 19.07.2018 at CEA, New Delhi to discuss the issue regarding the STU connectivity of M/s GWEL (ISGS)

The list of participants is enclosed as **Annexure – I.**

1. Chief Engineer, PSPA-I welcomed the participants to the meeting and stated that as per CERC order dated 09.03.2018, an inter-state generating station (ISGS) can be connected to both STU network and ISTS network for supply of powers to the beneficiaries within and outside the home state. He stated that M/s GWEL, which is an ISGS with 2x300 MW of installed capacity has PPA of 550 MW (200 MW to MSEDCL, 200 MW to Dadra & Nagar Haveli and 150 MW to TANGEDCO). Currently, M/s GWEL is connected with ISTS network through dedicated GWEL-Bhadravati 400 kV D/c line and all the beneficiaries are drawing their share of power through ISTS network and paying the respective ISTS charges. As per the PPA, Maharashtra has to draw its share of power from generation bus of GWEL. CERC in its order dated 2708-2018 in respect of petition filed by MSEDCL has also directed MSEDCL to make arrangement for drawl of their 200 MW of share from GWEL bus bar. Now, Maharashtra wants to draw their share of power through STU network to avoid the ISTS charges..

2. CEA stated that the various options for providing connectivity with GWEL switchyard to MSETCL for drawl of MSEDCL share has been jointly studied (with CTU, CEA, POSOCO and MSETCL on 18.07.2018) and the same is given below:

   (a) Case-A: LILO of one ckt. of GWEL–Bhadravati 400 kV D/c line at Warora (M)

   (b) Case-B: GWEL–Warora (M) 400 kV D/c line

   (c) Case-C: Creation of 220 kV level at M/s GWEL through 400/220, 2x315 MVA ICTs and interconnection it with 220 kV Warora S/s through 220 kV D/c line

   (d) Case-D: Case-A + LILO of Chandrapur-I – Parli 400 kV S/c line at Warora (M)

   (e) Case-E: Case-B + LILO of Chandrapur-I – Parli 400 kV S/c line at Warora (M)

   (f) Case-F: Case-C + LILO of Chandrapur-I – Parli 400 kV S/c line at Warora (M)

   The power flows for various options studied is tabulated below:

	Power flows (MVA)					
Transmission line	Case-A	Case-B	Case-C	Case-D	Case-E	Case-F
GWEL-Bhadravati 400 kV S/C or D/C line	1x410	2x377	2x217	1x316	2x255	2x214
GWEL-Warora (M) 400 kV S/C or D/C line	1x161	-2x95	-	1x254	2x30	-

Warora (M) -Bhadravati 400 kV S/C line	1x449	-	-	1x263	-	-
GWEL-Warora(220) 220 kV D/C line	-	-	2x69	-	-	2x72

From the above, it can be seen that there is injection of 449 MW and 190 MW power from MSETCL system into ISTS system at Bhadrawati in Case-A (through Warora- Bhadrawati 400 kV S/C line) and in Case-B (through Warora-Bhadrawati 400 kV D/C lines) respectively. The injection gets reduced to 254 MW and 60 MW in Case-D and Case-E respectively with LILO of Chandrapur-I – Parli 400 kV S/c line at Warora (M).

Therefore, proposal of either LILO of one circuit of GWEL–Bhadravati 400 kV D/c line at Warora(M) as in Case-A or GWEL–Warora(M) 400 kV D/c line as in Case-B does not serve the purpose of drawl of MSEDCL share of power from GWEL bus. It is seen that with the above proposals Maharashtra injects power into the ISTS system.

With the proposal of creation of 220 kV level at M/s GWEL through 400/220, 2x315 MVA ICTs and its interconnection with 220 kV Warora S/s through 220 kV D/c line as in Case-C and Case-F, Maharashtra draws about 140 MW of power from GWEL.

Accordingly, following system is proposed for providing connectivity to MSETCL for drawing MSEDCL share of power from M/s GWEL:

- Installation of 400/220, 2x315 or 500 MVA ICTs at GWEL generation switchyard along with associated ICT bays
- 2 nos. 220 kV line bays.
- GWEL – Warora (M) 220 kV D/c line

3. MSETCL representative stated that they were planning to implement LILO of one circuit of GWEL–Bhadravati 400 kV D/c line at Warora (M) for drawing Maharashtra share of power from GWEL as the proposal requires minimal investment and has less implementation time.

4. CTU representative stated that with the LILO of one circuit of GWEL–Bhadravati 400 kV D/c line at Warora (M), the dedicated nature of the GWEL – Bhadravati 400 kV D/c line would be lost. The studies also shows that with the LILO Maharashtra is not drawing power from GWEL but is injecting about 450 MW into ISTS grid, which is not desirable. Further, in the event of outage of Warora (M)-Bhadravati 400 kV line, GWEL-Bhadravati 400 kV S/C may get overloaded.

5. POSOCO representative endorsed the views of CEA and CTU. He stated that for drawl of 200 MW of share of Maharashtra from GWEL, MSETCL need to create 220 kV level in GWEL switchyard through implementation of 400/220 kV

ICTs as indicated in the studies and from there draw 220 kV D/C line to Warora (M).

6. MSETCL representative stated that interstate and intra state transmission system are interconnected and there would always be flow from intra to interstate and vice versa. Creation of 220 kV level in GWEL generation switchyard would amount to creating a new 400/220 kV substation and it would be a costly proposal.

7. CEA, CTU and POSOCO were of the opinion that MSETCL may finalize the proposal of 400/220, 1x315 or 500 MVA ICT at GWEL generation switchyard along with associated ICT bays for drawl of MSEDCL share from GWEL through 220 kV lines.

8. MSEDCL representative stated that presently, they are paying PoC charges for drawl of their share of power from GWEL as they are drawing their share from ISTS point (Bhadravati 400 kV substation). He suggested that for drawl of their share of power directly from GWEL switchyard, whatever transmission system is proposed, the same needs to be implemented at the earliest to avoid levying of PoC charges. He requested MSETCL to finalize and implement the scheme at the earliest.

9. GWEL representative stated that space for two nos. of 400 kV bays was available at generation switchyard, however, the availability of space for creation of 220 kV level in their switchyard needs to be ascertained.

10. MSETCL representative stated that they need to discuss the proposal of creation of 220 kV level in GWEL generation switchyard for drawl of Maharashtra power with their management.

11. After further deliberations, the following was agreed:

    a. MSETCL to convey their views regarding the proposal for installation of 400/220, 1x315 or 500 MVA ICT at GWEL generation switchyard along with associated ICT bays for drawl of MSEDCL share from GWEL through 220 kV lines.
    b. M/s GWEL and MSETCL to jointly explore the availability of space for creation of 220 kV level in GWEL generation switchyard.

The meeting ended with thanks to the chair.

Annexure-I

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1	Ravinder Gupta	CE, CEA	ravindergupta_cea@rediffmail.com
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6	P.S Das	DGM, CTU	psdas@powergridindia.com
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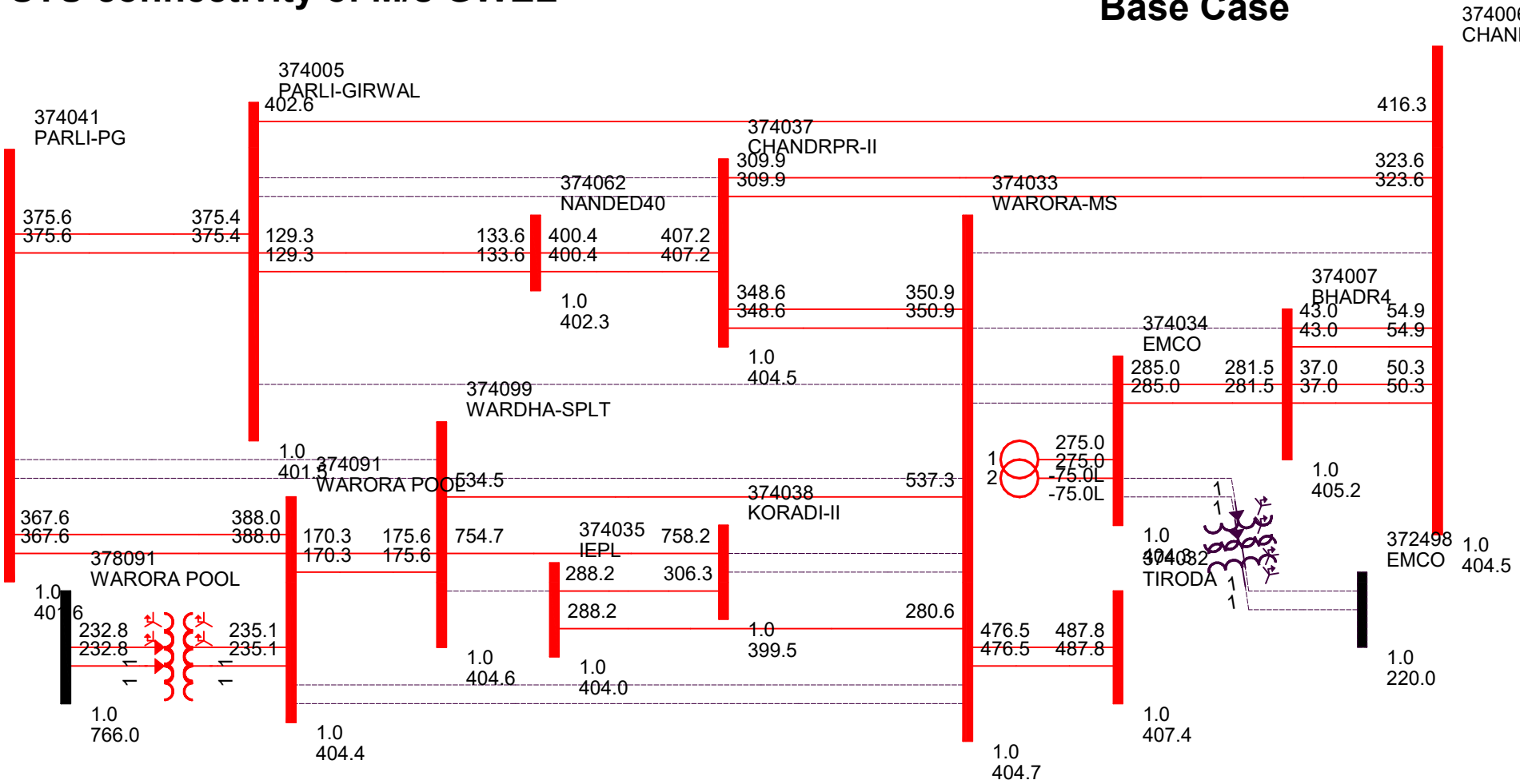
13	G. Muralidhar Gupta	AGM-CR, GMR	muralidhar.gupta@gmrgroup.in

STU connectivity of M/s GWEL

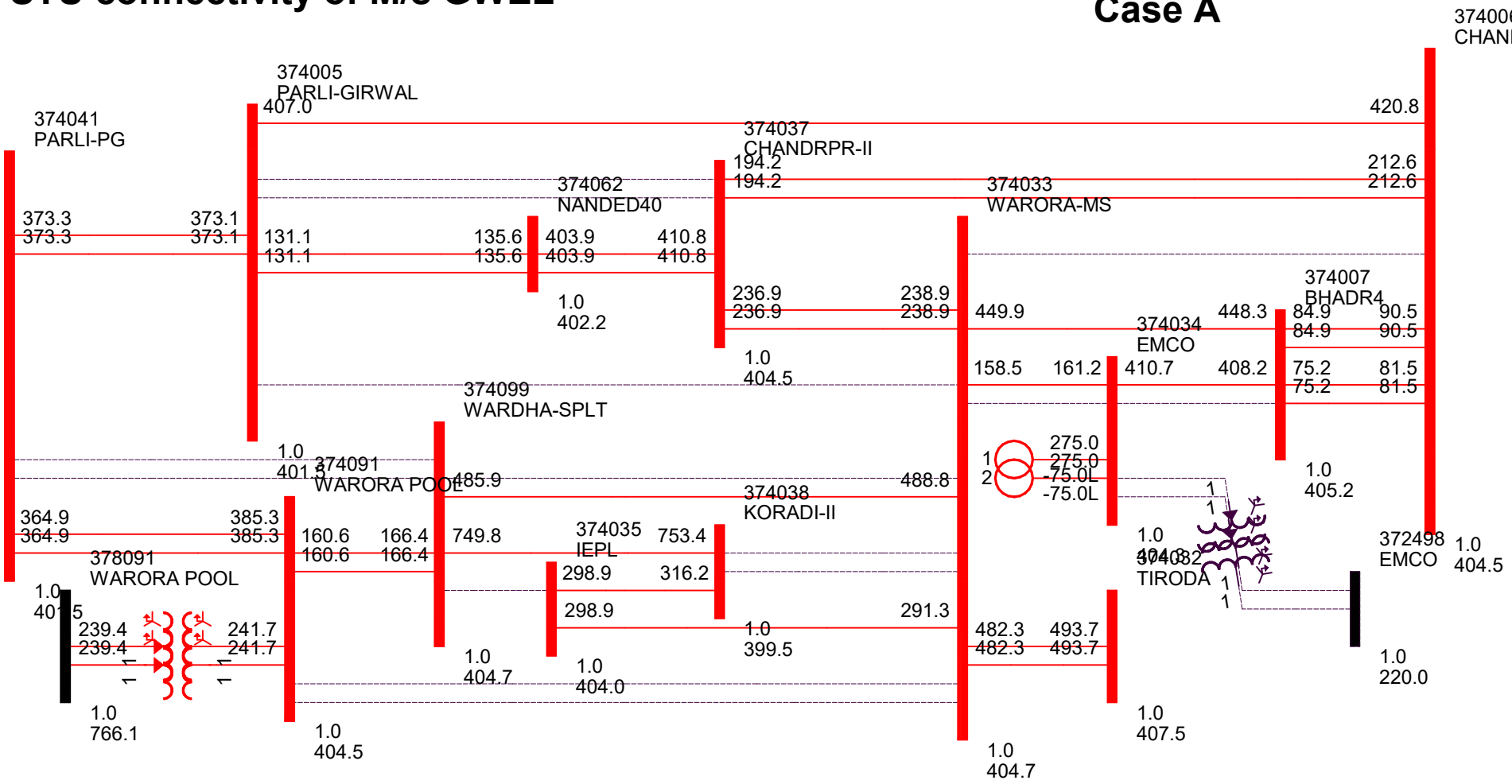
ANNEXURE - 4A

Base Case



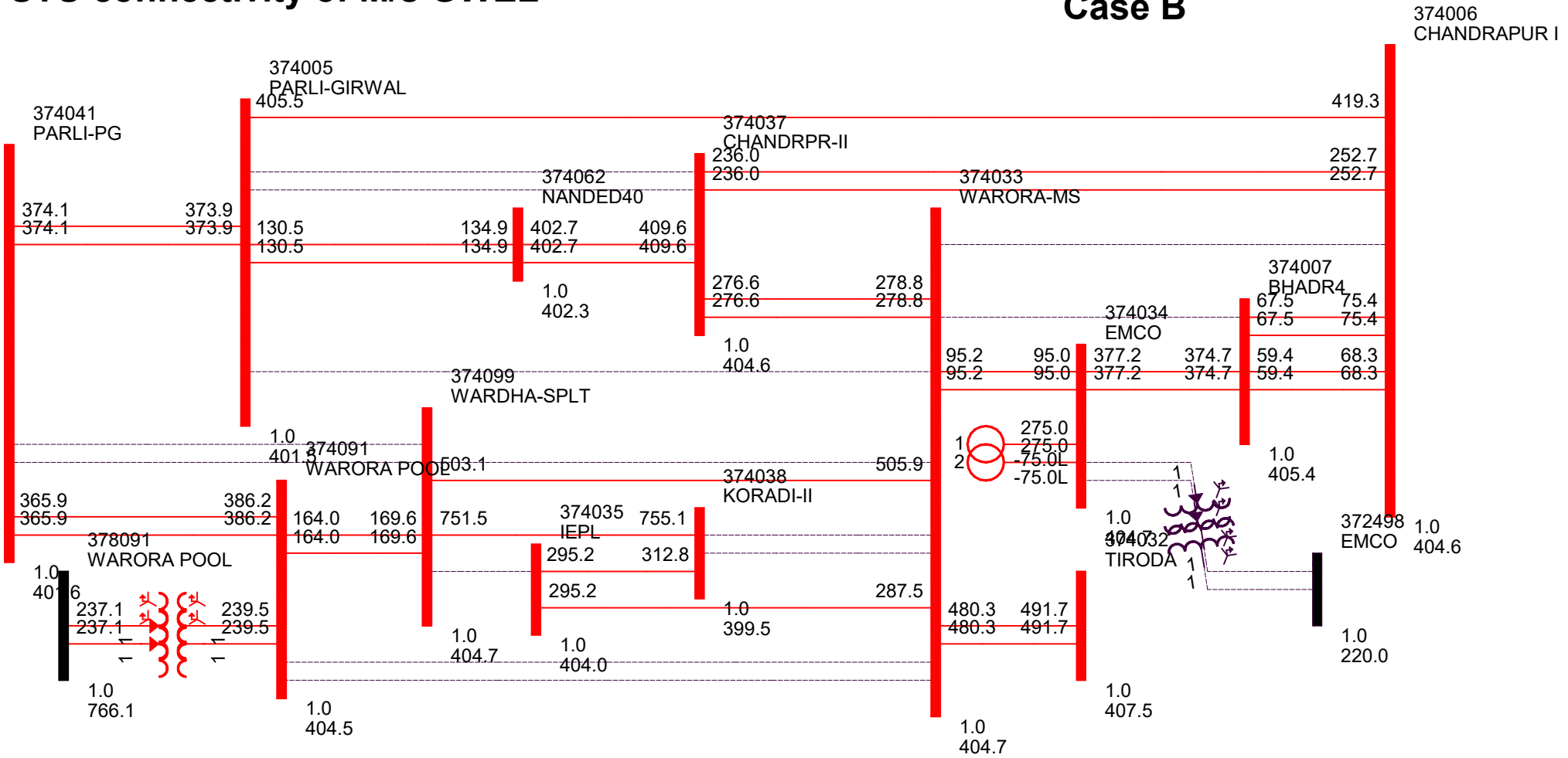
STU connectivity of M/s GWEL

Case A



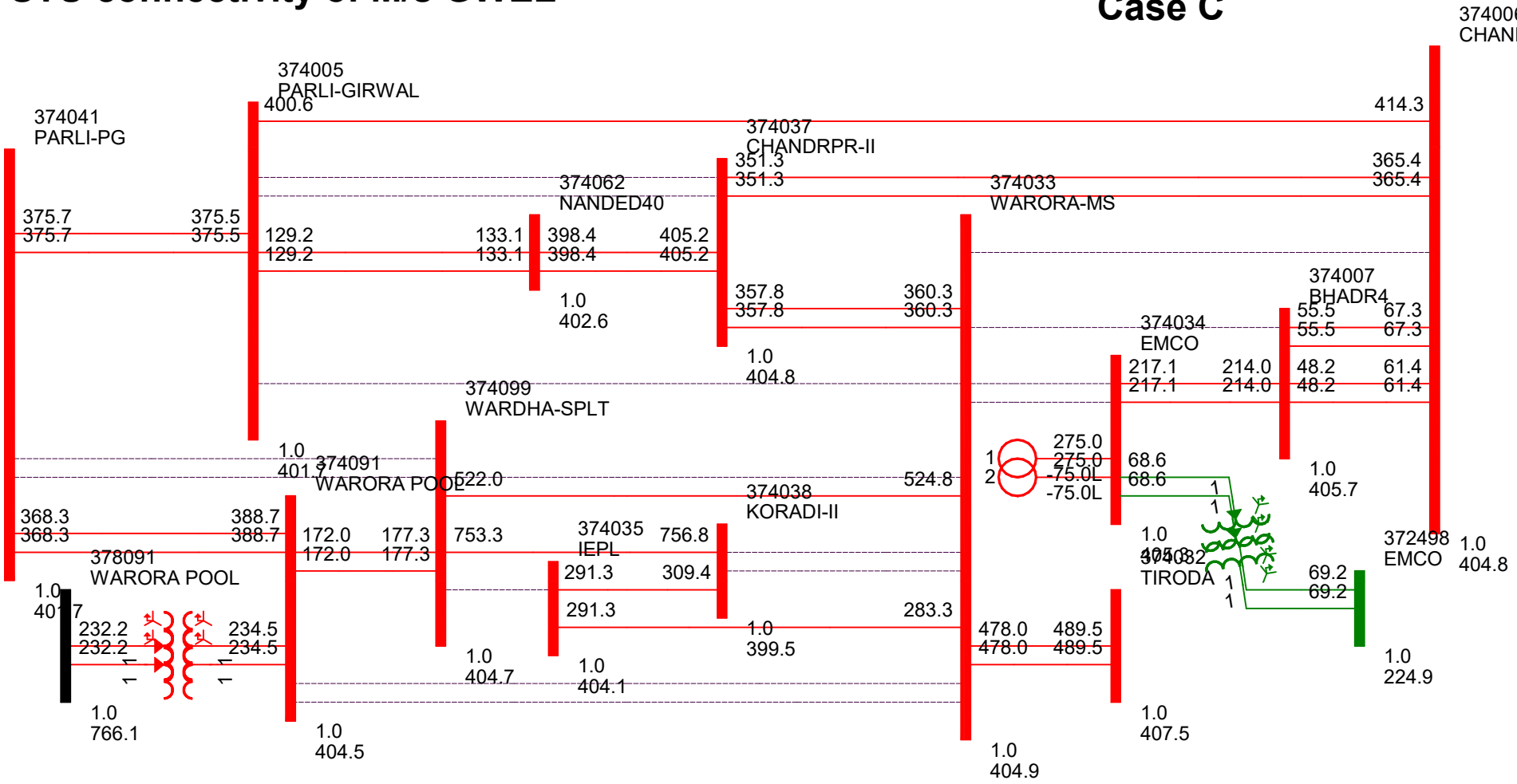
STU connectivity of M/s GWEL

Case B



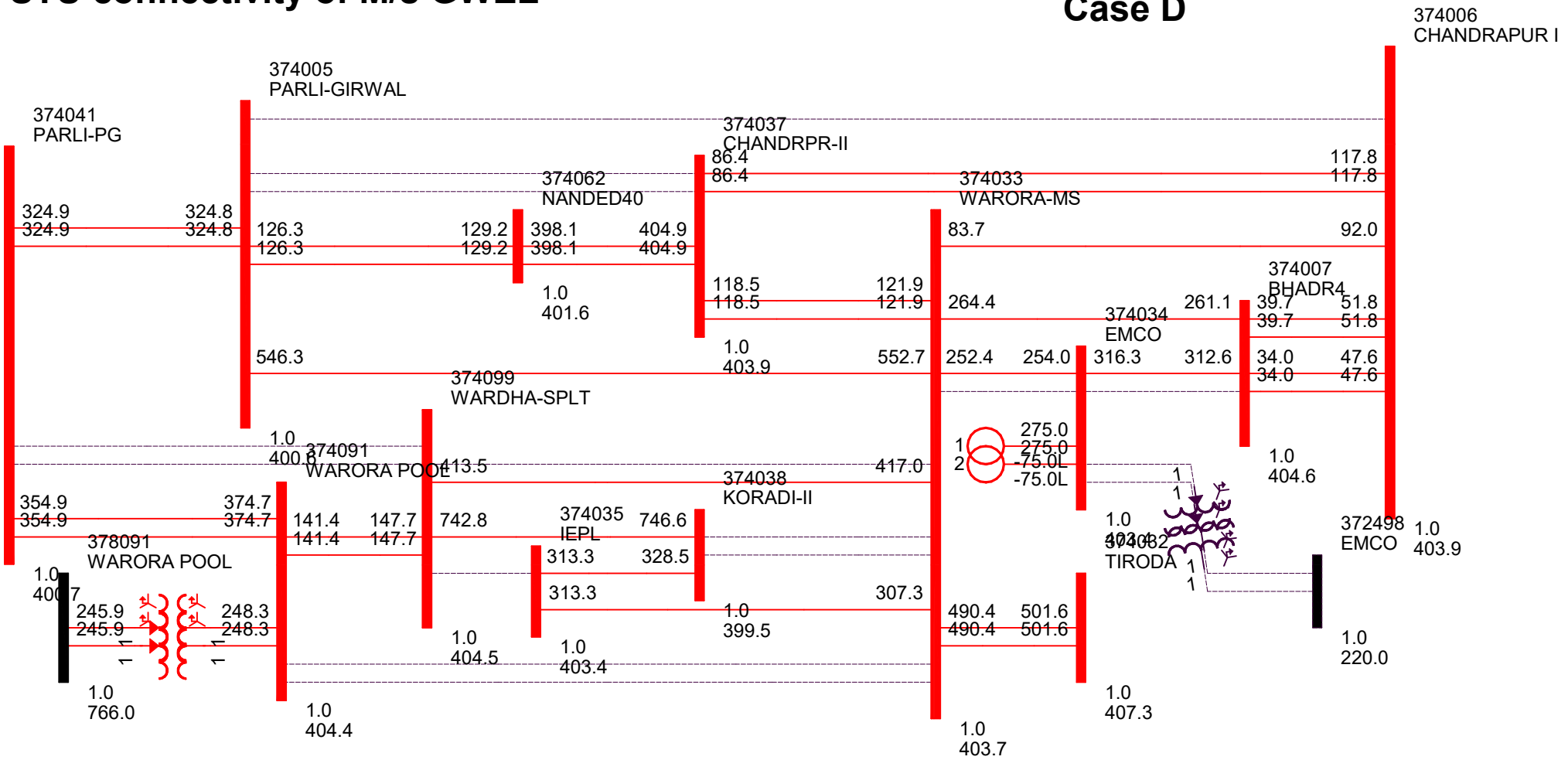
STU connectivity of M/s GWEL

Case C



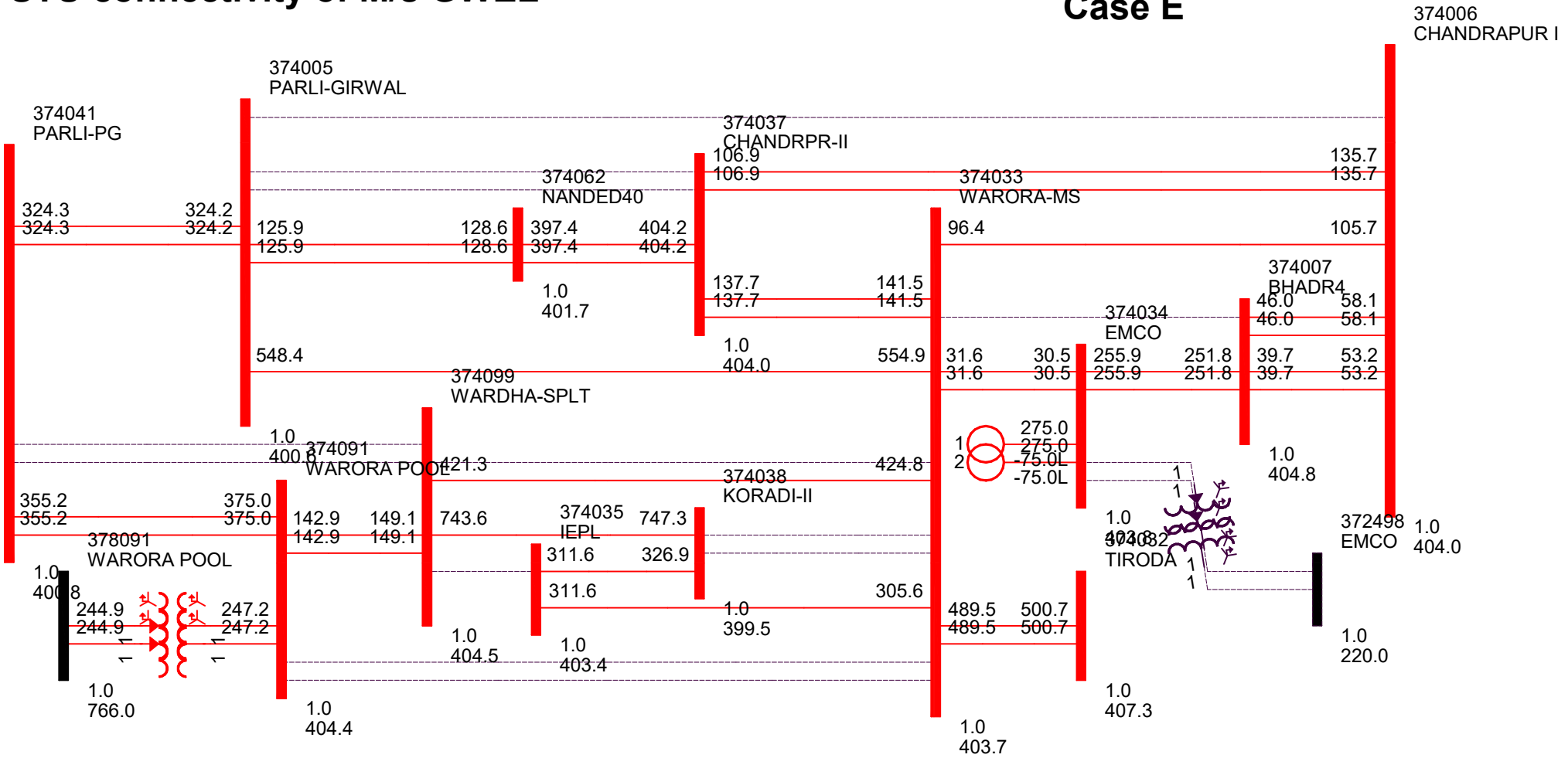
STU connectivity of M/s GWEL

Case D



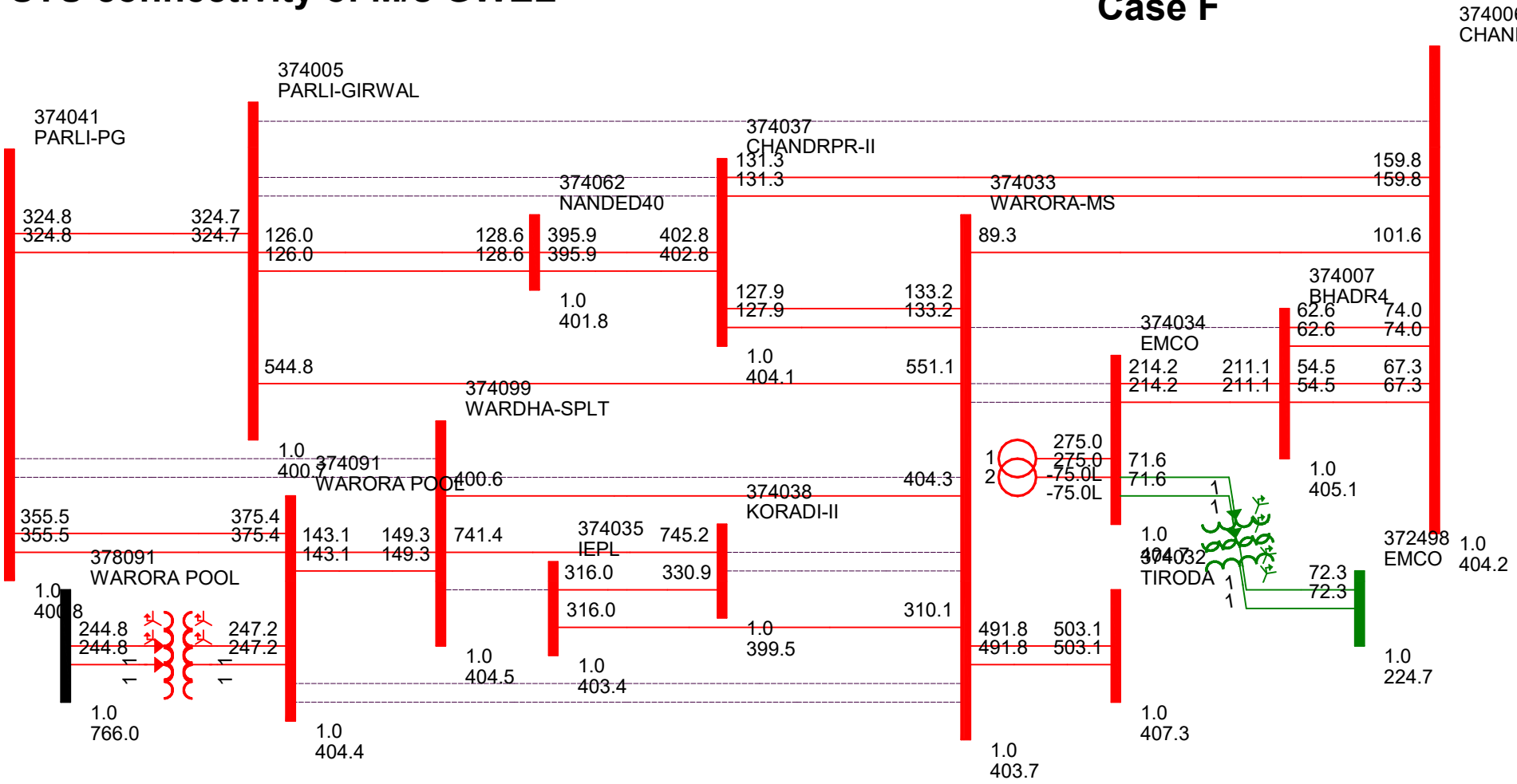
STU connectivity of M/s GWEL

Case E



STU connectivity of M/s GWEL

Case F



ANNEXURE - 13A

F. No. 367-12/4/2018-GEC
Government of India
Ministry of New and Renewable Energy
(Green Energy Corridor)

Block 14, CGO Complex, Lodhi Road,
New Delhi-110003, Dated: 8th June 2018

ORDER

Subject: Sub-Committee for Review of ISTS Connectivity for Renewable Energy power plants.

The Government of India has set an ambitious target of reaching 175 GW of installed capacity from renewable energy sources including 100GW from Solar and 60 GW from Wind by the year 2022. The trajectory of capacity addition of RE Power is to the tune of 30 GW, 40 GW & 40 GW in the years 2019-20, 2020-21 and 2021-22 respectively. To ensure capacity addition as per the above trajectory, coordinated efforts are required on part of various stakeholders for ensuring availability of encumbrance-free land for upcoming projects and planning of associated transmission systems and transmission corridors.

2. A Sub-Committee for Review of ISTS Connectivity for Renewable Energy power plants is here by constituted for aiding the Committee for better implementation of RE projects notified vide order no. 367-12/2/2018-GEC and dated 17.04.2018, with the following members:

a. Sh. Ravinder Gupta, Chief Engineer, CEA
b. Dr. Subir Sen, C.O.O. (CTU Planning), PGCIL
c. Dr. A.K. Tripathi, Director General, National Institute of Solar Energy
d. Sh. S. K. Mishra, Director (PS), SECI
e. Sh. Girish Kumar, Director (GEC), MNRE - Coordinator & Member (Secretary)

3. The mandate of the Committee would be as follows:

a. Review of the solar and wind resource potential area-wise.
b. Expected solar and wind power projects to come up by 2022 with year-wise trajectory.
c. Review of PGCIL's substation wise available capacity in point of view of connectivity to ISTS.
d. Any other issue related to the context, as felt appropriate by the Committee.

4. The first meeting of the above committee has been convened on 12th June 2018 (Tuesday) at 3pm in room no. 1009, Pt. Deendayal Upadhyaya Antyodaya Bhawan, CGO Complex. The members of the Committee are requested to kindly make it convenient to attend the meeting.

(Girish Kumar)
Director
011-24368915

To

1. All members of the Committee

Copy for information to:

1. PPS to Secretary, MNRE
2. PPS to AS, MNRE
3. PPS to JS (Solar), MNRE

(Girish Kumar)
Director

Annexure-13B

Transmission scheme for Renewable Energy Zones (REZs)

Govt. of India had set a target for establishing 175 GW renewable capacity by 2022 which includes 100 GW Solar, 60 GW Wind generation capacity. Recently Govt. of India scaled up its renewable target to 227GW by 2022 comprising 113.5GW Solar, 66.6 GW Wind, 31GW from floating solar & off shore wind and balance is from SHP & Biomass (Out of which, 49.5GW solar & 46.6GW wind is already commissioned/pipeline in different stages.

To plan transmission scheme for envisaged Renewable (wind/Solar) energy zones (REZs) comprising Wind, Solar or both the resources, pockets/ complexes are identified based on inputs from various state agencies in consultation with MNRE. Based on inputs, solar (50GW) and wind (16.5GW) generation is envisaged in seven (7) RE rich states i.e. Tamil Nadu, Andhra Pradesh, Karnataka, Gujarat, Maharashtra, Rajasthan and Madhya Pradesh.

Most of the wind and solar pockets are located in different complexes in above states. However, some of complexes/ pockets are common for both Wind & Solar (Hybrid) resources say for Kurnool in Andhra Pradesh, Kutch & Dwarka/Jamnagar in Gujarat for which common transmission scheme is identified.

Gestation period of RE project is short in comparison to development of its transmission facilities, therefore transmission implementation need to be taken up in advance so that it can match with renewable generation.

A) Transmission system to facilitate evacuation from potential Solar Energy Zones: 50,000 MW

To plan transmission scheme for envisaged solar generation, Solar potential zones in various districts of six (6) RE rich states were identified by SECI in association with MNRE for 50 GW quantum. The information was finalized by SECI in consultation with Solar Power developers & MNRE.

Details of prioritized SEZs (50,000 MW) in two phases i.e. 2020 & 2021 as under:

State/District	Taluk/Tehsil	Ph-1(GW)	Ph-2(GW)	Total
		2020	**2021**	
Rajasthan				
Jaisalmer	Ramgarh	2.5	1.5	4
	Fatehgarh	2.5	1.5	4
Jodhpur	Phalodi	2	1	3
Bikaner	Koyalat /Pugal	3	1	4
Barmer	Barmer	0	5	5
Subtotal		**10**	**10**	**20**
Andhra Pradesh				

State/District	Taluk/Tehsil	Ph-1(GW)	Ph-2(GW)	Total
		2020	**2021**	
Kurnool	Gooty	2.5	0	2.5
Ananthpuram	Urvakonda	0	2.5	2.5
Subtotal		**2.5**	**2.5**	**5**
Karnataka				
Gadag		0	2.5	2.5
Bidar		0	2.5	2.5
Subtotal		**0**	**5**	**5**
Gujarat				
Kutch	Rapar	3	2	5
Banaskantha	Vav /Tharad	0	2.5	2.5
Jamnagar	Lalpur	1	1.5	2.5
Subtotal		**4**	**6**	**10**
Maharashtra				
Solapur		1	1.5	2.5
Wardha		0	2.5	2.5
Subtotal		**1**	**4**	**5**
Madhya Pradesh				
Rajgarh		2.5	0	2.5
Khandwa		0	2.5	2.5
Subtotal		**2.5**	**2.5**	**5**
Total		**20**	**30**	**50**

B) Transmission system to facilitate evacuation from potential Wind Energy Zones: 16,500 MW

In order to identify wind potential rich pockets, an exercise was conducted with MNRE, National institute of Wind Energy (NIWE), STUs, State Nodal Agency of wind resource rich states, POWERGRID and wind developers/IPPs.

Based on various inputs like district wise NIWE potential, SNA developable potential, pooling station wise wind capacity sanctioned by STU, RE applications received in ISTS by CTU & detailed discussion with MNRE, wind IPPs/developers, prioritized wind energy zones (WEZ) along with its quantum were identified, which may come up by 2022 in wind resource rich states. Subsequently, based on bidding timeline, SECI provided phasing details of prioritized WEZs (16,500 MW) in two phases i.e. 2020 & 2021 as under:

State/District	Taluk/Tehsil	Ph-1 GW (2020)	Ph-2 GW (2021)	Total(GW)
Tamil Nadu				
Karur		1.5	1	2.5
Tirunelvelli		-	0.5	0.5
Subtotal		**1.5**	**1.5**	**3**
Andhra Pradesh				
Kurnool		2	1	3
Subtotal		**2**	**1**	**3**
Karnataka				
Koppal		2.5	-	2.5
Subtotal		**2.5**	**-**	**2.5**
Gujarat				
Kutch	Bhuj	-	2	2
	Lakadiya	2	-	2
Dwarka		1	1	2
Subtotal		**3**	**3**	**6**
Maharashtra				
Osmanabad		-	2	2
Subtotal		**-**	**2**	**2**
Total		**9**	**7.5**	**16.5**

C) Study Assumptions

1. Considering envisaged RE (wind & solar) capacity addition and to achieve Load-generation balance, Thermal generation dispatch is reduced upto 50% of total Installed capacity. At some of the locations, thermal generation is even needed to be backed down.

2. Solar & wind generation dispatch is considered as 80% & 70% (except for Rajasthan wind dispatch as 40% due to complementary pattern)

3. All India Demand is considered as per the 19th EPS of CEA

4. Long term RPO trajectory for Solar & non-solar for 2021-22 is considered as per MOP order dated 14.06.18

5. Transmission system is proposed considering forming a ring for RE complexes

D) Proposed Inter State Transmission Scheme for Wind & Solar Energy Zones

Comprehensive transmission system for Solar & Wind Energy Zones in two phases (2020 & 2021) is evolved as under:

Phase-I Solar & Wind Energy Zone Transmission Schemes:

1. Composite transmission scheme for Solar Energy Zone in Rajasthan(10,000 MW)

Jaisalmer 5GW (Ramgarh 2.5GW, Fatehgarh 2.5GW), Jodhpur (2GW) & Bikaner (3GW)

- Establishment of 400/220kV 5x500 MVA pooling station (RE PP1) at suitable location in Jaisalmer Distt (near Ramgarh/Kuchheri)
- Establishment of 765/400/220kV 4x1500 MVA, 5x500 MVA pooling station (RE PP2) at suitable location in Jaisalmer Distt (near Fatehgarh)
- Establishment of 765/400/220kV 2x1500 MVA, 4x500 MVA pooling station (RE PP3) at suitable location in Jodhpur Distt (between Phalodi & Osian)
- Establishment of 400/220kV, 6x500 MVA pooling station (RE PP4) at suitable location in Bikaner Distt (between Pugal & Kolayat)
- Establishment of 765/400kV, 2x1500 MVA substation at suitable location near Sikar (new)
- Sikar (New)– Jhatikara 765 kV D/c Line
- Sikar (New)– Sikar (PG) 400 kV D/c Line
- RE PP1 (near Ramgarh) – RE PP2 (near Fatehgarh) 400 kV D/c Line (Twin HTLS on M/c tower)
- LILO of both ckts of 765 kV Fatehgarh (TBCB) – Bhadla (PG) D/c line at RE PP2 (near Fatehgarh) (Charged at 400kV)
- Charging of Fatehgarh PP2 to Bhadla section at 765kV level
- RE PP1 (near Ramgarh) – Jaisalmer -2 (RVPN) 400 kV D/c Line (Twin HTLS)
- RE PP2 (near Fatehgarh) – RE PP3 (near Osian) 765 kV D/c Line
- RE PP3 (near Osian) – Ajmer (PG) 765 kV D/c Line
- RE PP3 (near Osian) –Jodhpur (new) [RVPN] 400 kV D/c Line (Twin HTLS)
- Ajmer – Bhiwani 765kV D/c line
- RE PP4 (near Bikaner) - Sikar (New) 400 kV 2xD/c Line (Twin HTLS on M/c tower)
- LILO of one ckt of 400kV Bikaner (RVPN) – Sikar(PG) D/c line at RE PP4 (near Bikaner)
- 220kV line bays for interconnection of solar projects (35 nos)
- Augmentation of 765/400KV & 400/220kV Transformation capacity at various substations
- Associated Reactive compensation

Estimated Cost : Rs 9180 Cr.

2. Composite scheme for Solar & Wind Energy Zone in Andhra Pradesh(4500 MW)

Kurnool HEZ (4500MW:2500 MW Solar & 2000 MW Wind), AP

- Establishment of 765/400/220kV 3x1500 MVA, 9x500 MVA Pooling station at suitable location in Kurnool Distt
- Kurnool PS - Kurnool(new) 765 kV D/c Line-100km
- Kurnool PS-Maheshwaram(PG) 765 kV D/c Line-250km
- 220kV line bays for interconnection of wind projects (15 nos)
- 1x330 MVAr (765kV) & 1x125MVAr (400kV) bus reactor at Kurnool PS

- 240 MVar Switchable line reactors at both ends of Kurnool PS –Maheshwaram(PG) 765 kV D/c Line

Estimated Cost: Rs 2730 Cr

3. Wind Energy Zone in Karnataka (2500 MW)

Koppal WEZ (2500MW), Karnataka

- Establishment of 400/220 kV 5x500 MVA pooling Substation in a suitable location in Koppal distt.
- Koppal PS - Munirabad 400 kV D/c (HTLS) Line-50 km
- Koppal PS - Narendra (New) 400 kV D/c(HTLS) Line-125 km
- 220kV line bays for interconnection of wind projects (8 nos)
- 1x125 MVAr bus reactor at Koppal PS

Estimated Cost: Rs 730 Cr

4. Wind Energy Zone in Tamil Nadu(1500 MW)

Karur WEZ (1500MW), Tamil Nadu

- Establishment of 3x500 MVA, 400/230 kV Karur Pooling Station
- LILO of Pugalur - Pugalur(HVDC) 400 kV D/c (Quad) line at Karur PS(50 km)
- 230kV line bays for interconnection of wind projects (5 nos)
- 1x125 MVAr Bus reactor at Karur PS

Estimated Cost: Rs 450 Cr

5. Composite scheme for Solar & Wind Energy Zone in Gujarat (7000 MW)

(a) Kutch 5000 MW (Rapar SEZ 3000 MW and Lakadiya WEZ 2000 GW)

- Establishment of 4x1500MVA & 10x500MVA, 765/400kV/220kV at Lakadia PS
- Lakadia – Vadodara 765kV D/c line ~350km
- Lakadia PS – Banaskantha PS 765kV D/c line - 200 km
- LILO of Bhachau – EPGL 400kV D/c (triple) line (both ckt) at Lakadia PS -2X50 km
- 220kV line bays for interconnection of wind & solar projects (17 nos)
- 1x330MVAr, 765kV Bus reactor & 1x125MVAr, 420kV Bus reactor at Lakadia PS & line reactive compensation

Estimated Cost: 4465 Cr

(b) **Jamnagar SEZ 1000 MW & Dwarka WEZ 1000 MW**

- Establishment of 4x500MVA, 400/220kV Jam Khambhaliya PS (GIS) (near Jamnagar and Dwarka district border)

- Extension of Essar – Lakadia/Bhachau 400kV D/c (triple) line upto Jam Khambhaliya PS -40 km
- 220kV line bays for interconnection of wind & solar projects - 7 nos
- 1X125 MVAR, 420 kV Bus Reactor at Jam Khambhaliya PS (GIS) & line reactive compensation

Estimated Cost: 480 Cr

6. Solar Energy Zone in Maharashtra (1000 MW)

Solapur 1000 MW

- Establishment of 400/220 kV, 2X500 MVA at Solapur PP (near Mohol)
- Solapur pooling point - Solapur PS 400 kV D/c line (twin HTLS) -50 km
- 220 kV line bays for interconnection of wind & solar projects(3 nos)
- 1X125 MVAR, 420 kV Bus Reactor at Solapur PP

Estimated Cost: 335 Cr

7. Solar Energy Zone in Madhya Pradesh (2500 MW)

Rajgarh 2500 MW

- Establishment of 400/220 kV, 5X500 MVA at Rajgarh PS
- Rajgarh PS -Bhopal 400 kV D/c line (HTLS) -150 km
- Rajgarh PS –Shujalpur 400 kV D/c line (HTLS) -80 km
- 220 kV line bays for interconnection of solar & wind projects (8 nos)
- 1X125 MVAR, 420 kV Bus Reactor at Rajgarh PP

Estimated Cost: 790 Cr

Total Estimated Cost for Ph-1 (29 GW): about Rs.19160 Cr.

Phase-II Solar & Wind Energy Zone Transmission Schemes:

1. Composite transmission scheme for Solar Energy Zone in Rajasthan (10,000 MW)

Jaisalmer (3 GW i.e. Ramgarh 1.5 GW, Fatehgarh- 1.5 GW), Jodhpur (1GW), Barmer (5GW) & Bikaner (1 GW) complex

- Augmentation of transformation capacity at 400/220kV 3x500 MVA pooling station (RE PP1) at suitable location in Jaisalmer Distt (near Ramgarh)
- Augmentation of transformation capacity 400/220kV, 3x500 MVA pooling station (RE PP2) at suitable location in Jaisalmer Distt (near Fatehgarh)
- Augmentation of transformation capacity 400/220kV, 2x500 MVA pooling station (RE PP3) at suitable location in Jodhpur Distt (between Phalodi & Osian)
- Augmentation of transformation capacity 400/220kV, 2x500 MVA pooling station (RE PP4) at suitable location in Bikaner Distt (between Pugal & Kolayat)
- Establishment of 765/400/220kV 4x1500 MVA, 10x500 MVA pooling station (RE PP5) at suitable location in Barmer Distt

- Establishment of 400/220kV, 2x500 MVA pooling station at suitable location near Bhinmal (new)
- RE PP1 (near Ramgarh) – RE PP2 (near Fatehgarh) 400 kV D/c Line (2nd Twin HTLS on M/c tower)
- RE PP5 (suitable location Barmer Distt) – RE PP3 (near Osian) 765kV D/c line
- RE PP5 (suitable location Barmer Distt) – Barmer (RVPN) 400 kV D/c Line
- RE PP5 (suitable location Barmer Distt) – Bhinmal (new) 400kV D/c line (Twin HTLS)
- Bhinmal (new) – Chittorgarh (PG) 400kV D/c line (Twin HTLS)
- Bhinmal (new) – Bhinmal 400kV D/c line
- Bhadla – Bikaner 765kV D/c (2nd) line
- RE PP3 (near Osian/Phalodi) – Sikar (New) 765 kV D/c Line
- Sikar (New)– Meerut 765 kV D/c Line
- 220kV line bays for interconnection of solar projects (35 nos)
- Augmentation of 400/220kV Transformation capacity at various substations
- Associated Reactive compensation

Estimated Cost : Rs 8265 Cr.

2. Wind Energy Zones in Tamil Nadu (1500 MW)

(a) Tirunelveli WEZ (500 MW), Tamil Nadu

- Augmentation of transformation capacity with 400/230kV, 1x500MVA (4th) ICT at Tirunelveli Pool
- 220kV line bays (GIS) for interconnection of wind projects (2 nos.)

Estimated Cost: Rs 60 Cr

(b) Karur WEZ (1000MW), Tamil Nadu

- Augmentation of transformation capacity with 400/230kV , 2x500 MVA(4th & 5^{th}) ICT at Karur PS
- 230kV line bays for interconnection of wind projects (3 nos)

Estimated Cost: Rs 90 Cr

3. Composite scheme for Solar & Wind Energy Zone in Andhra Pradesh(3500 MW)

- Establishment of 765/400/220kV 3x1500 MVA, 7x500 MVA Pooling station at suitable border location between Anantapur & Kurnool Distt
- LILO of Kurnool PS - Kurnool(new) 765 kV D/c Line at Anantapur PS-100km
- Anantapur PS-Pavagada(PG) 400 kV D/c Line(HTLS) -100km
- 220kV line bays for interconnection of wind projects (12 nos)
- 1x330 MVAr (765kV) & 1x125MVAr (400kV) bus reactor at Anantapur PS

Estimated Cost: Rs 1540 Cr

4. Solar Energy Zone in Karnataka (5000 MW)

(a) Gadag SEZ (2500 MW)

- Establishment of 400/220kV 5x500 MVA Gadag Pooling Station(with provisions to upgrade to 765 kV)

- Gadag PS-Koppal PS 400kV D/c Line(HTLS)-50 km
- LILO of Tumkur (Vasantnarsapura)-Narendra (New) 765 kV D/c Line(Ch. At 400 kV) at Gadag PS-50 km
- 220kV line bays for interconnection of solar projects (8 nos)
- 1x125MVAr (400kV) bus reactor at Gadag PS

Estimated Cost: Rs 780 Cr.

(b) Bidar SEZ (2500 MW)

- Establishment of 400/220kV 5x500 MVA Bidar Pooling Station
- Bidar PS- Nizamabad(PG) 400 kV D/c Line(HTLS) -150 km
- Bidar PS-Gulbarga(KPTCL) 400 kV D/c Line(HTLS)-100km
- 220kV line bays for interconnection of solar projects (8 nos)
- 1x125MVAr (400kV) bus reactor at Gadag PS

Estimated Cost: Rs 850 Cr.

5. Composite scheme for Solar & Wind Energy Zone in Gujarat (9000 MW)

(a) Bhuj WEZ 2000 MW

- Establishment of 2x1500MVA (765/400kV), 4x500MVA (400/220kV) Bhuj-II PS (GIS)
- Interconnection of 765kV Bhuj S/s with the proposed Bhuj-II (GIS) S/s through bus extension or 765kV D/c line - 30 km
- Bhuj-II PS – Lakadia PS 765kV D/c line -150 km
- 220kV bays for interconnection of wind projects (7 nos)
- 1x330MVAr, 765kV Bus reactor at Bhuj-II PS & 1x125MVAr, 420kV Bus reactor each at Bhuj-II PS

Estimated Cost: Rs. 1845 Cr

(b) Kutch (Rapar) SEZ 2000 MW & Banskantha SEZ 2500 MW

- Establishment of 400/220 kV 4X500 MVA Kutch Pooling Point (near Rapar)
- Establishment of 400/220 kV, 5X500 MVA Banaskantha Pooling Point
- Establishment of 400 kV switching station at Patan
- Establishment of 765/400/220 kV, 3X1500 MVA & 3X500 MVA at suitable location near Ahmedabad
- Kutch PP- Lakadiya 400 KV D/c line (Twin HTLS) -40 km
- Kutch PP- Patan 400 kV 2xD/c line (Twin HTLS-multi circuit) -120 km
- Banaskantha PP - Patan 400 kV D/c line (Twin HTLS) -100 km
- Banaskantha PP - Sankhari 400 kV D/c line (Twin HTLS) -50 km
- Patan - Sami 400 kV D/c line (Twin HTLS) -40 km
- Patan - Ahmedabad 400 kV 2xD/c line-Twin HTLS M/c -140 km
- Ahmedabad – Pirana 400 kV D/c line (Twin HTLS) -50 km
- Ahmedabad – Indore 765 kV D/c line -360 km
- Ahmedabad – Vadodara 400 kV D/c line –Twin HTLS -130 km
- Vadodra - Dhule 765 kV D/c line -330 km
- 220 kV line bays for interconnection of solar projects(15 nos)

- Associated Reactive Compensation (Line + Bus)

Estimated Cost: Rs 6865 Cr

(c) **Jamnagar SEZ 1500 MW & Dwarka WEZ 1000 MW**

- Establishment of 400/220 kV, 5X500 MVA at Lalpur (Jamnagar) PS
- Establishment of 400/220 kV, 2X500 MVA at Jasdan
- Lalpur (Jamnagar) Pooling station - Jasdan PS 400 kV D/c line (Twin HTLS) -180 km
- Lalpur (Jamnagar) Pooling station – Kalavad (GETCO) 400 kV D/c line (Twin HTLS) - 50 km
- Lalpur (Jamnagar) Pooling station – Jam Khmabliya 400 kV D/c line (Twin HTLS) - 50 km
- Jasdan- Hadala (GETCO) 400kV D/c (Twin HTLS) - 100 km
- Jasdan – Vadodara 400 kV D/c line (Twin HTLS) - 300 km
- 220 kV line bays for interconnection of solar projects (8 nos)
- Associated Reactive Compensation (Line + Bus)

Estimated Cost: Rs 1875 Cr

6. Solar and Wind Energy Zone in Maharashtra (6000 MW)

(a) Solapur SEZ 1500 MW

- Solapur pooling point - Solapur (MSETCL) 400 kV D/c line (twin HTLS) -50 km
- Augmentation of transformation capacity by 400/220kV, 3X500 MVA transformer at Solapur PP
- 220 kV line bays for interconnection of solar projects(5 nos)

Estimated Cost: Rs 240 Cr

(b) Wardha SEZ 2500 MW

- Establishment of 400/220 kV, 5X500 MVA at Wardha PS
- Wardha PS - Warora Pool 400 kV D/c line (Twin HTLS) -70 km
- Wardha PS - Warora (MSETCL) 400 kV D/c line (Twin HTLS) -60 km
- 220 kV line bays for interconnection of Solar projects (8 nos)
- 1x125MVAr bus reactor at Wardha PS

Estimated Cost: Rs 620 Cr

(c) Osmanabad and Beed WEZ 2000 MW

- Establishment of 4x500MVA, 400/220kV near Kallam PS
- LILO of both circuits of Parli(PG) – Pune(GIS) 400kV D/c line at Kallam PS
- 220 kV line bays for interconnection of solar projects (7 nos)
- 1x125MVAr bus reactor at Kallam PS

Estimated Cost: Rs 425 Cr

7. Solar Energy Zone in Madhya Pradesh (2500 MW)

Khandwa SEZ: 2500 MW

- Establishment of 400/220 kV, 5X500 MVA at Khandawa PS
- Khandwa PS - Khandwa Pool D/c line (Twin HTLS) -50 km
- Khandwa PS - Chehgaon (MPPTCL) D/c line (Twin HTLS) -80 km
- 220 kV line bays for interconnection of solar projects (8 nos)
- Associated Reactive Compensation

Estimated Cost: Rs 620 Cr

Total Estimated Cost for Ph-2 (37.5 GW) : about Rs.24075 Cr.

E) Summary of Abstract Cost Estimate

S.No.	Region	Capacity (GW)	Ph-1		Ph-2		Total (Ph-1 +Ph-2)	
			Cost (Cr.)	Capacity (GW)	Cost (Cr.)	Capacity (GW)	Cost (Cr.)	Capacity (GW)
1	Western Region							
A	Gujarat	16	4945	7	10585	9	15530	16
B	Maharashtra	7	335	1	1285	6	1620	7
C	Madhya Pradesh	5	790	2.5	620	2.5	1065	5
	Sub Total (WR)	28	6070	10.5	12490	17.5	18560	28
2	Northern Region							
A	Rajasthan	20	9180	10	8265	10	17445	20
3	Southern Region							
A	Tamil Nadu	3	450	1.5	150	1.5	600	3
B	Andhra Pradesh	8	2730	4.5	1540	3.5	4270	8
C	Karnataka	7.5	730	2.5	1630	5	2360	7.5
	Sub Total (SR)	18.5	3910	8.5	3320	10	7230	18.5
	Total	**66.5**	**19160**	**29**	**24075**	**37.5**	**43235**	**66.5**

F) Funding Requirements & Bidding Strategy

a. Transmission investment in ISTS is recovered through POC mechanism as per CERC sharing of Inter-state transmission charges regulation. As per the recent discussion in regional Standing committee, LTA/connectivity meetings, STU/ DICs have expressed their concerns in sharing of transmission charges on account of transmission addition for RE capacity in ISTS. Accordingly, it was suggested that suitable financing mechanism through grant/funding for transmission may be facilitated by MNRE.

b. In order to reduce burden of transmission tariff on DICs, it was suggested that suitable mode of financing such as upfront payment ranging from Rs 35 to 50 lakhs/MW from the RE generation developer at the time of bidding and/or grant from MNRE/Govt of India may be considered which can be utilized for the development of transmission system.

c. In case of part funding through upfront payment as proposed above, for sharing of balance transmission charges, scheme shall have to be concurred by the stakeholders. In case of 100% grant provided by the MNRE/GoI, for recovery of O&M charges, regulatory approval shall have to be taken from the CERC.

d. Transmission is a lumpy element, e.g. if a 765kV corridor is being developed which can facilitate transfer of 3500-4000 MW power and bidding is carried out only for 2000 MW, upfront payment needs to be realized for total power transfer requirement for its development by transmission implementation agency. Therefore generation bidding strategy must take care of above aspect.

e. Site specific RE generation bidding may be carried out in accordance with the transmission plan instead of anywhere in India basis. Accordingly, to facilitate development of the commensurate transmission system, which generally has high gestation period than RE generation, finalization of transmission system implementation mode & transmission implementation agency i.e. TBCB or RTM must be expeditiously decided.

G) Annual Transmission Charges

Envisaged solar (50 GW) & wind (16.5 GW) generation capacity is expected to generate about 115 billion units of renewable energy per annum. Considering estimated cost of Rs 43,235 Cr for proposed transmission scheme, annual transmission charges is expected to be about Rs 7782 Cr.

Accordingly total normative transmission charges for Ph-1 & Ph-2 are estimated as under:

S.No	Attribute	Option 1	Option 2 (25 lakh/MW Bid incl.)	Option 3 (35 lakh/MW Bid incl.)	Option 4 (50 lakh/MW Bid incl.)
1	Envisaged RE Capacity	**66500 MW**			
2	Units Generated (Wind CUF@25%, Solar CUF @18%)	115 Billion units/Year			
3	Transmission Cost	Rs 43,235 Cr	Rs 26,610 Cr	Rs 19,960 Cr	Rs 9,985 Cr
4	Annual transmission charges (@18%)	Rs 7782 Cr	Rs 4790 Cr	Rs 3593 Cr	Rs 1797 Cr
5	Tentative Transmission Tariff	Rs 0.67/Unit	Rs 0.42/Unit@	Rs 0.31/Unit	Rs 0.16/Unit

*** D: E- 70:30*
@ Generation tariff increase by 14-18 (25 lakh/MW Bid incl.) , 21-25 paise/unit (35 lakh/MW Bid incl.) & 32-36 paise/unit (50 lakh/MW Bid incl.)

Further normative transmission charges for Ph-1 & Ph-2 separately are estimated as under:

Phase-I

S.No	Attribute	Option 1	Option 2 (25 lakh/MW Bid incl.)	Option 3 (35 lakh/MW Bid incl.)	Option 4 (50 lakh/MW Bid incl.)
1	Envisaged RE Capacity (in MW)	**29000**			
2	Units Generated (Wind CUF@25%, Solar CUF @18%)(in BU/year)	51 BU/annum			
3	Transmission Cost (Rs. Cr)	19,160	11,910	9,010	4,660
4	Annual transmission charges (@18%)	3449	2144	1622	839
5	Tentative Transmission Tariff (Rs/Unit)	0.68	0.42	0.32	0.16

*** D: E- 70:30*
@ Generation tariff increase by 14-18 (25 lakh/MW Bid incl.) , 21-25 paise/unit (35 lakh/MW Bid incl.) & 32-36 paise/unit (50 lakh/MW Bid incl.)

Phase-2

S.No	Attribute	Option 1	Option 2 (25 lakh/MW Bid incl.)	Option 3 (35 lakh/MW Bid incl.)	Option 4 (50 lakh/MW Bid incl.)
1	Envisaged RE Capacity (in MW)	**37500**			
2	Units Generated (Wind CUF@25%, Solar CUF @18%)(in BU/year)	64 BU/annum			
3	Transmission Cost (Rs. Cr)	24,075	14,700	10,950	5,325
4	Annual transmission charges (@18%)	4334	2646	1971	959
5	Tentative Transmission Tariff (Rs/Unit)	0.68	0.41	0.31	0.15

*** D: E- 70:30*

@ Generation tariff increase by 14-18 (25 lakh/MW Bid incl.) , 21-25 paise/unit (35 lakh/MW Bid incl.) & 32-36 paise/unit (50 lakh/MW Bid incl.)

H) Other Requirements

- **Solar Generation shifting**

Envisaged solar generation capacity shall significantly impact the net load curve with deeper belly in noon hours. This will also impact requirement of quick ramp up generation (Thermal/Hydro) in the later afternoon when solar generation tends to decline. Therefore to mitigate above, energy storage in form of Pumped storage hydro or Battery energy storage system can be very useful. These resource shall store solar generation during their peak generation hours (noon time) and will be dispatched at the time of low or no solar generation such as evening/night or early morning.

- **Requirement of other Infrastructure**

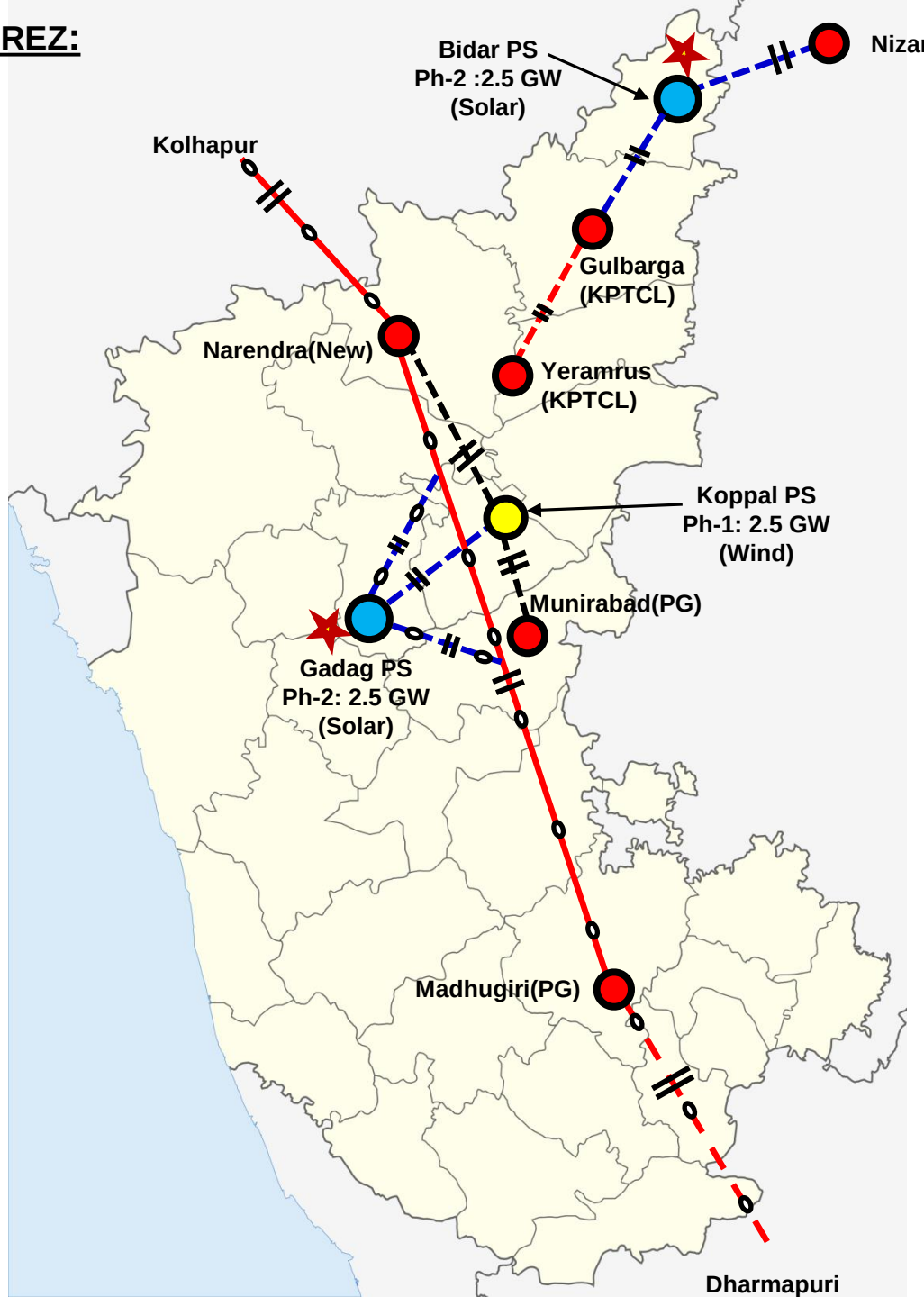
In order to facilitate drawl of power by the states, there would be additional requirement of Intra state system also. This shall be evolved based on the identification of the beneficiaries at the subsequent stage. Further, control infrastructure in form of dynamic compensation, storage etc shall also be required at strategic locations.

- **Inverter Control Feature**

SECI to explore requirement of including state–of-the-art controller/inverter features in specification so that Solar PV form can be used as STATCOM for reactive support to the grid in night time.

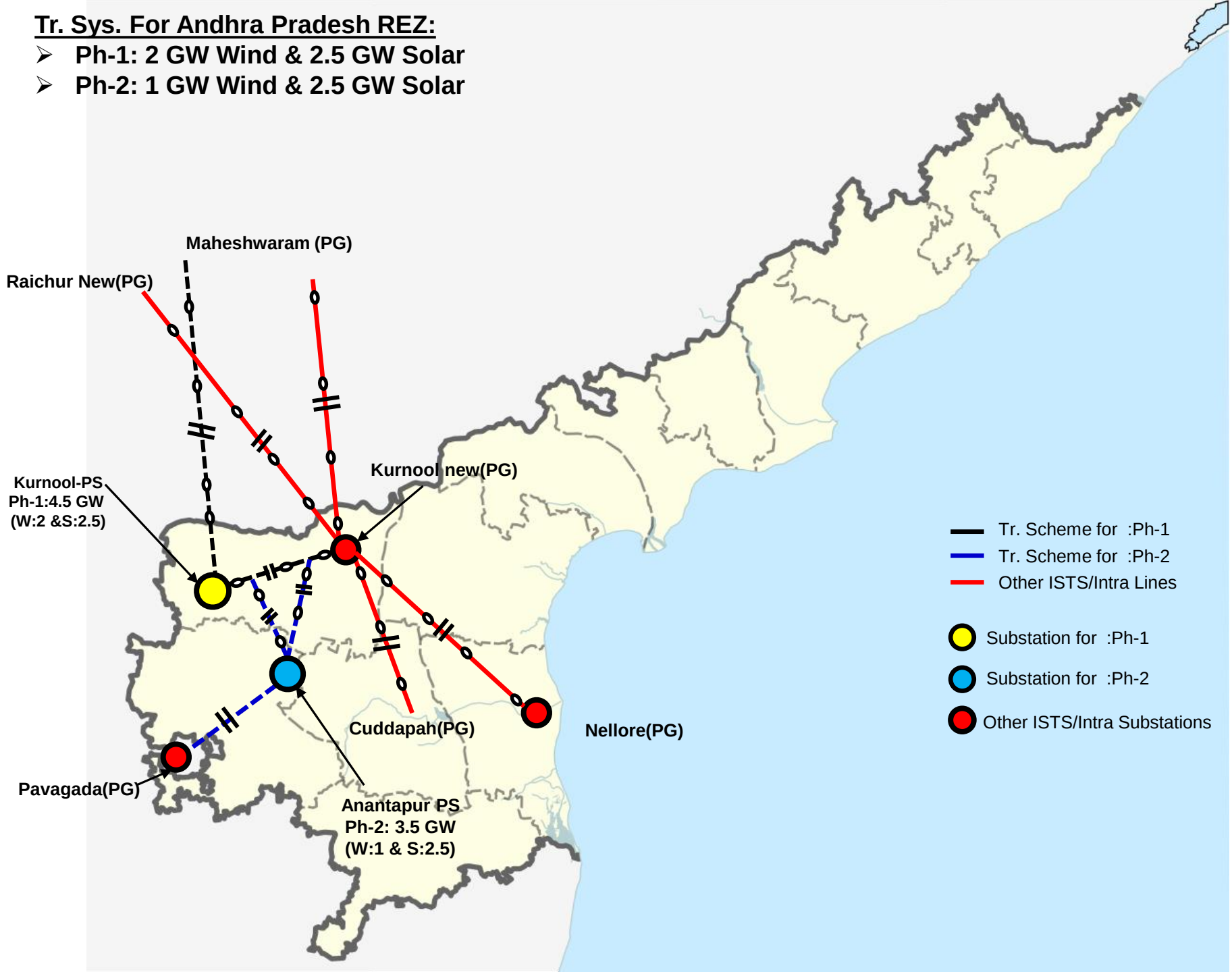
Tr. Sys. For Karnataka REZ:

- Ph-1: 2.5 GW Wind
- Ph-2: 5 GW Solar



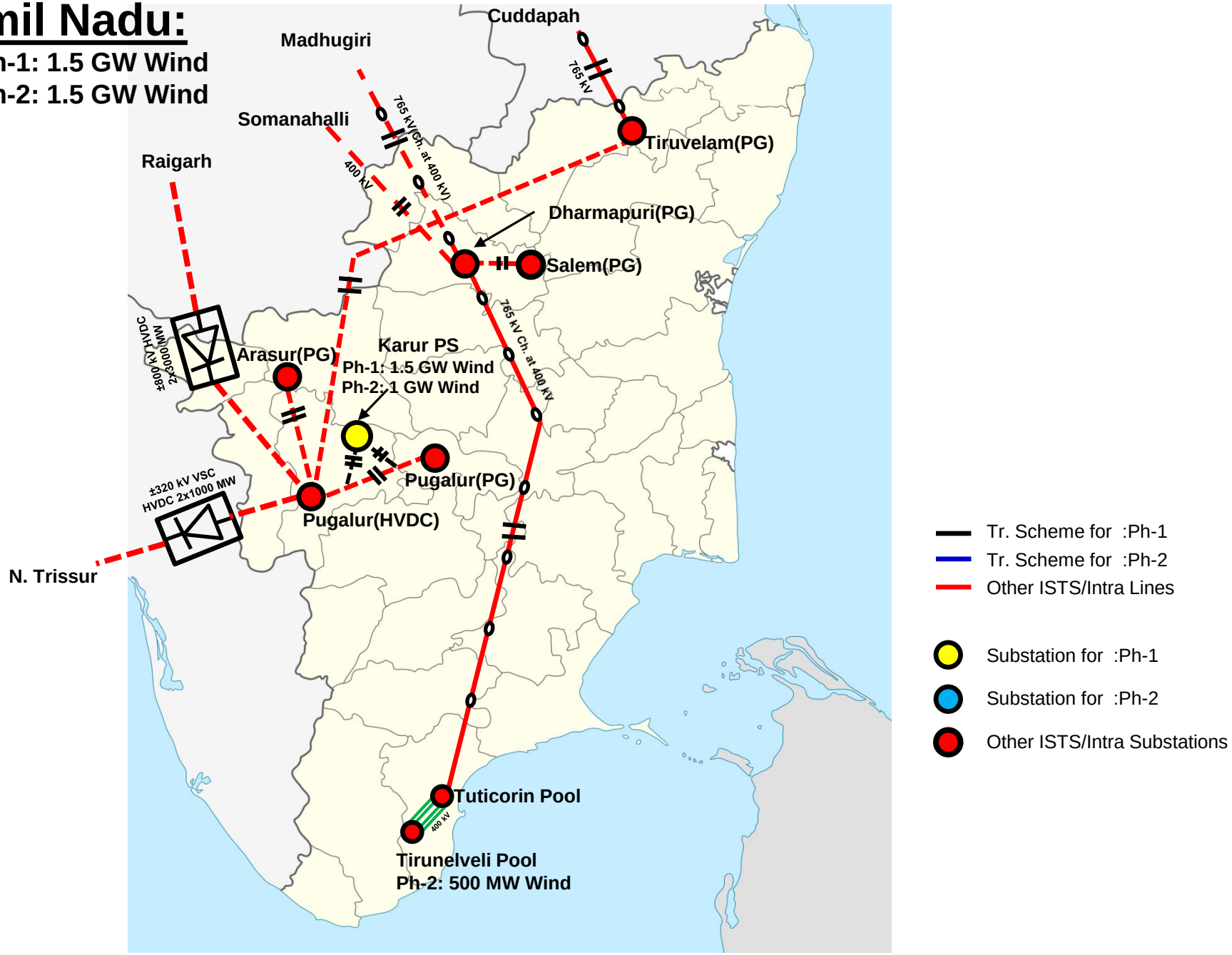
Tr. Sys. For Andhra Pradesh REZ:

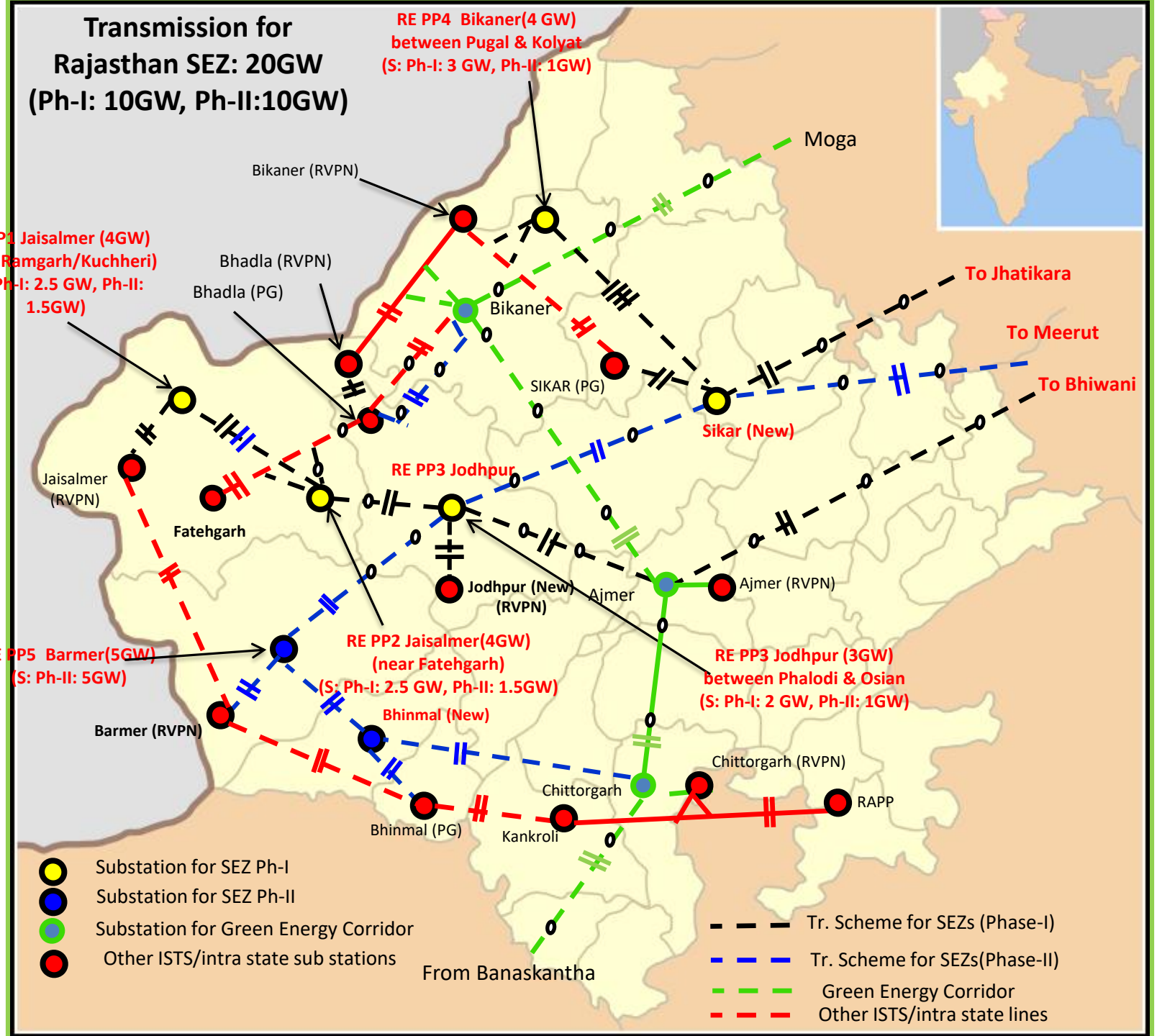
- **Ph-1: 2 GW Wind & 2.5 GW Solar**
- **Ph-2: 1 GW Wind & 2.5 GW Solar**



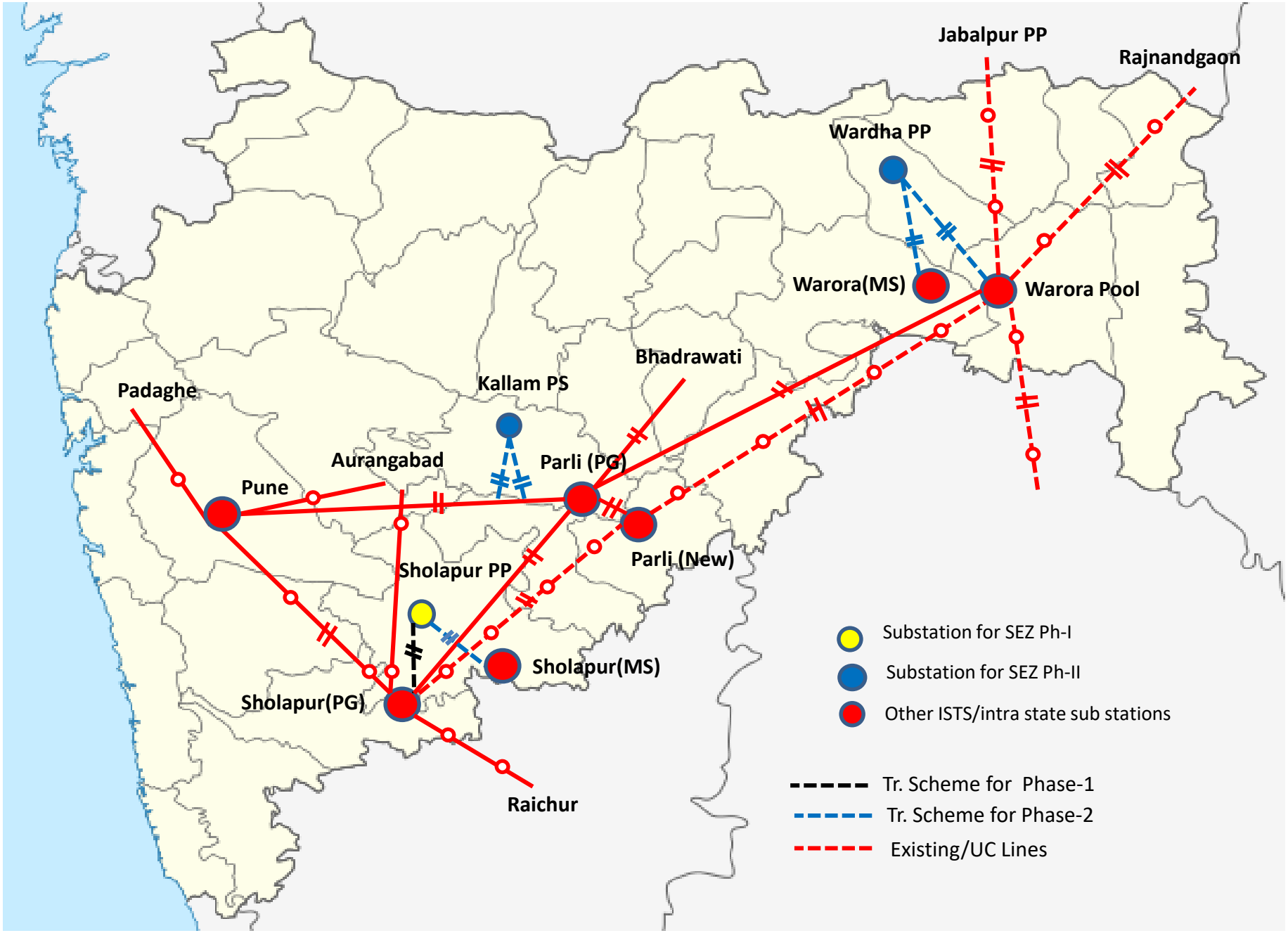
Tamil Nadu:

- Ph-1: 1.5 GW Wind
- Ph-2: 1.5 GW Wind




Transmission for
Rajasthan SEZ: 20GW
(Ph-I: 10GW, Ph-II:10GW)
RE PP4 Bikaner(4 GW)
between Pugal & Kolyat
(S: Ph-I: 3 GW, Ph-II: 1GW)
Moga
Bikaner (RVPN)
RE PP1 Jaisalmer (4GW)
(near Ramgarh/Kuchheri)
(S: Ph-I: 2.5 GW, Ph-II:
1.5GW)
Bhadla (RVPN)
Bhadla (PG)
Bikaner
To Jhatikara
To Meerut
To Bhiwani
SIKAR (PG)
Sikar (New)
RE PP3 Jodhpur
Jaisalmer
(RVPN)
Fatehgarh
Jodhpur (New)
(RVPN)
Ajmer
Ajmer (RVPN)
RE PP5 Barmer(5GW)
(S: Ph-II: 5GW)
RE PP2 Jaisalmer(4GW)
(near Fatehgarh)
(S: Ph-I: 2.5 GW, Ph-II: 1.5GW)
RE PP3 Jodhpur (3GW)
between Phalodi & Osian
(S: Ph-I: 2 GW, Ph-II: 1GW)
Bhinmal (New)
Barmer (RVPN)
Chittorgarh (RVPN)
Chittorgarh
RAPP
Bhinmal (PG)
Kankroli
From Banaskantha
Substation for SEZ Ph-I
Substation for SEZ Ph-II
Substation for Green Energy Corridor
Other ISTS/intra state sub stations
Tr. Scheme for SEZs (Phase-I)
Tr. Scheme for SEZs(Phase-II)
Green Energy Corridor
Other ISTS/intra state lines

Maharashtra – Solar Energy Zones



Gujarat - Solar Energy Zones

Madhya Pradesh – Solar Energy Zones