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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

**-As per enclosed list -**

विषय: पश्चिमी क्षेत्रीय विद्युत समिति (पारेषण योजना) (WRPCTP) की तीसरी बैठक का कार्यवृत्त।

**Subject: Minutes of the 3<sup>rd</sup> meeting of Western Regional Power Committee (Transmission Planning) [WRPC(TP)]**

महोदया (Madam) / महोदय (Sir),

The 3<sup>rd</sup> meeting of Western Regional Power Committee (Transmission Planning) [WRPC(TP)] was held on **14.06.2021** through VC (Microsoft Teams). Minutes of the meeting are attached herewith.

भवदीय/ Yours faithfully,

(ईशान शरण/ Ishan Sharan)  
मुख्य अभियन्ता / Chief Engineer

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**List of Addressees:**

1.	Member (Power System), Central Electricity Authority, Sewa Bhawan, RK Puram, New Delhi - 110066	2.	Member Secretary, WRPC, F-3, MIDC Area, Andheri (East), Mumbai – 400093 Fax – 022-28370193	3.	COO (CTUIL) Saudamini, Plot no. 2, Sector -29, Gurgaon-122 001 Fax-0124-2571809
4.	Director (System Operation), POSOCO, B-9, Qutub Institutional Area, Katwaria Sarai New Delhi – 110010	5.	Chief Electrical Engineer, Vidyut Bhavan, 3rd Floor, Panaji, Goa - 403001	6.	Managing Director, GETCO, Sardar Patel Vidyut Bhawan, Race Course, Vadodara-390007
7.	Managing Director, MPPTCL, Block no. 2, Shakti Bhawan, Rampur, Jabalpur – 482008 (M.P)	8.	Chairman & Managing Director, MSETCL, Prakashganga, Plot No.C-19, E-Block, Bandra-Kurla Complex, Bandra (E), Mumbai - 400051	9.	Secretary (Power), Administration of Daman & Diu (U.T.), Fort Area, Moti Daman-396220
10.	Secretary (Power), UT of Dadra & Nagar Haveli, Secretariat, Amli, Silvassa - 396230	11.	Managing Director, CSPTCL, Dangania, Raipur (CG)- 492013	12.	Chairman & Managing Director (NTPC), NTPC Bhawan, SCOPE Complex, Institutional Area, Lodhi Road, New Delhi - 110003
13.	Chairman & Managing Director (NHPC), N.H.P.C Office Complex, Sector-33, Faridabad - 121003 (Haryana)	14.	Managing Director (SECI), 1 <sup>st</sup> Floor, D-3, A Wing, Prius Platinum Building District Centre, Saket, New Delhi – 110017		

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### **Minutes of the 3<sup>rd</sup> Meeting of Western Regional Power Committee (Transmission Planning) held on 14.06.2021 through Video Conferencing**

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

Member (Power System), CEA, and Chairperson of the committee welcomed the participants and stated that earlier the meeting had been scheduled on 16.04.2021 but it had to be postponed on account of Covid-19 pandemic. He further stated that the constituents need to avoid submission of additional agenda items at the last hour. Chief Engineer (PSPA-I), CEA, stated that the meeting of RPC(TP) needs to be held by the end of every quarter and constituents can submit their agenda items to be incorporated in advance. Thereafter the agenda items were taken up for discussion.

#### **1. Confirmation of Minutes of 2<sup>nd</sup> meeting of Western Regional Power Committee (Transmission Planning) held through VC on 04.09.2020**

- 1.1. Director (PSPA-I), CEA stated that the minutes of the 2<sup>nd</sup> meeting of WRPC(TP) held through VC on 04.09.2020 were issued vide letter No.CEA-PS-11-23(19)/1/2019-PSPA-I Division/I/11987/2020 dated 26.10.2020.
- 1.2. CTU vide its email dated 14.12.2020 (Annexure-II) and MPPTCL vide letter no. 04-02/PSP-2143 dated 01.12.2020 (Annexure-III) had submitted the observations / comments on the minutes of the 2<sup>nd</sup> meeting of WRPC(TP).
- 1.3. In the email, CTU had suggested to add item 15.10 in the 2<sup>nd</sup> WRPC(TP) minutes as given below:

*"15.10 It was further observed that the proposed conversion of fixed line reactor at Bina (PG) end of Sagar (MP)- Bina(PG) 400kV line into switchable line reactor (under ISTS scope) does not mention about implementing the NGR bypassing arrangement for utilization of the line reactor as bus reactor for voltage control when required. In view of the same, it was agreed to modify the scope of work under ISTS as follows:*

- *Conversion of 50 MVA fixed line reactor at Bina (PG) end of Sagar (MP)- Bina(PG) 400 kV line into switchable line reactor along with NGR bypassing arrangement.*

- 1.4. Members agreed to the corrigendum suggested by CTU. Further, it was decided that observations submitted of MPPTCL would be discussed as separate agenda item.
- 1.5. Members confirmed the minutes of the 2<sup>nd</sup> meeting of WRPC(TP) issued vide CEA's letter No.CEA-PS-11-23(19)/1/2019-PSPA-I Division/I/11987/2020 dated 26.10.2020 along with the corrigendum suggested by CTU in item no. 15.10 of the minutes.

**A. ToR 2(i) – QUARTERLY REVIEW AND STRENGTHNING OF INTER-REGIONAL TRANSMISSION SYSTEM**

**2. Quarterly Review of transmission lines and substations**

2.1. Gist of transmission lines and substations/ICTs commissioned in the Western Region upto Q4 of FY 2020-21 is given below:

States/ISTS	Transmission Lines (ckm)			S/stns (MVA)		
	765 kV	400 kV	220 kV	765/400 kV	400/220 kV	220/132/66 kV
Gujarat	0	0	413	0	500	2680
Maharashtra	0	0	264	0	315	430
Madhya Pradesh	0	293	761	0	1420	2500
Chhattisgarh	0	0	114	0	630	0
Goa	0	0	0	0	0	0
Daman & Diu	0	0	0	0	0	0
Dadra & Nagar Haveli	0	0	0	0	0	0
<b>State Total</b>	<b>0</b>	<b>293</b>	<b>1552</b>	<b>0</b>	<b>2865</b>	<b>5610</b>
<b>ISTS</b>	<b>0</b>	<b>828</b>	<b>0</b>	<b>0</b>	<b>1500</b>	<b>0</b>
<b>Total</b>	<b>0</b>	<b>1121</b>	<b>1552</b>	<b>0</b>	<b>4365</b>	<b>5610</b>

The list of the transmission lines and substations/ICTs commissioned in Western Region upto Q4 of FY 2020-21 is attached as **Annexure-IV**.

2.2. Members noted the commissioned transmission lines and substations/ICTs.

**3. Assessment of growth in generation capacity and demand in the Western region:**

3.1. The installed generation capacity of Western Region as on 31.03.2021 was 125.18 GW and the state wise installed capacity is as given below:

State	Coal	Hydro	RES	Gas	Nuclear	Total
State Sector						
Goa	0	0	0.05	0	0	0
Daman & Diu	0	0	0	0	0	0
Gujarat	5410.00	772.00	86.09	2177.82	0	8445.91
Madhya Pradesh	5400.00	1703.66	83.96	0	0	0

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State	Coal	Hydro	RES	Gas	Nuclear	Total
Chhattisgarh	1840.00	120.00	11.05	0	0	0
Maharashtra	9750.00	2850.84	388.13	672.0	0	0
Dadra & Nagar Haveli	0	0	0	0	0	0
Central Sector	19972.95	1635.00	666.30	3280.67	1840.00	27394.92
Private	33347.17	481.00	28016.71	4676	0.00	66520.88
<b>Total</b>	<b>75720.12</b>	<b>7562.50</b>	<b>29252.29</b>	<b>10806.49</b>	<b>1840.00</b>	<b>00</b>

3.2. The actual/anticipated demand of states in Western Region are as under:

State	Peak Demand (in MW) as per 19 <sup>th</sup> EPS			Actual Peak demand (MW)
	2020-21	2021-22	2024-25	2020-21
Goa	813	858	999	572
Daman & Diu	405	426	498	349
Gujarat	20,172	21,429	25,471	17,292
Madhya Pradesh	14,802	15,676	18,014	14,965
Chhattisgarh	5,809	6,208	7,513	4,513
Maharashtra	27,148	28,866	34,911	24,097
Dadra & Nagar Haveli	1,201	1,291	1,584	872
<b>Total</b>	<b>66,847</b>	<b>71,020</b>	<b>84,502</b>	<b>61,229</b>

3.3. The anticipated capacity addition (2021-22 to 2024-25) in State sector, Central and Private Sector has been derived from the data furnished by states for carrying out all-India studies and the same is tabulated below:

State	Coal	Hydro	RES	Gas	Biomass	DG	Nuclear	Total
Goa	0	0	0	0	0	0	0	0
Daman & Diu	0	0	0	0	0	0	0	0
Gujarat	0	0	6900	0	92	0	0	0
Madhya Pradesh	0	0	0	0	0	0	0	0
Chhattisgarh	0	0	111.2	0	0	0	0	111.2
Maharashtra	2295.34	0	5465	0	652.9	0	0	0
Dadra & Nagar Haveli	0	0	13	0	0	0	0	13
Central Sector	6220	8888	28489.4	0	0	0	2000	0

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Private Sector	0	774.5	0	0	0	0	0	774.5
<b>Total</b>	<b>7685.34</b>	<b>9393.5</b>	<b>40978.6</b>	<b>0</b>	<b>744.9</b>	<b>0</b>	<b>2000</b>	<b>61901.34</b>

3.4. The anticipated capacity to be retired during the period 2021-22 to 2024-25 as furnished by the states for carrying out all-India studies is as given below:

State	Coal	Hydro	RES	Gas	Biomass	DG	Nuclear	Total
Goa	0	0	0	0	0	0	0	0
Daman & Diu	0	0	0	0	0	0	0	0
Gujarat	0	0	0	0	0	0	0	0
Madhya Pradesh	830	269	0	0	0	0	0	1099
Chhattisgarh	0	0	0	0	0	0	0	0
Maharashtra	0	0	0	0	0	0	0	0
Dadra & Nagar Haveli	0	0	0	0	0	0	0	0
Central Sector	0	0	0	0	0	0	0	0
Private Sector	0	0	0	0	0	0	0	0
<b>Total</b>	<b>830</b>	<b>269</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1099</b>

The anticipated capacity addition and retirement during the period 2021-22 to 2024-25 may be reconciled by the respective states/agencies.

#### 4. Requirement for strengthening of Inter-regional transmission system

4.1. For assessing the inter-regional export-import requirements for the year 2024-25, the Load Generation Balance for all India studies for 2024-25 was deliberated in the meeting held on 11.03.2021 among CEA, CTU and POSOCO (Minutes are attached as Annexure-V).

Based on the discussions held in the meeting, POSOCO had provided the revised demand factors to be considered in various scenarios which are given below:

	Scenarios	NR	WR	SR	ER	NER	All India
<b>June'19</b>	Solar Peak	83%	84%	75%	79%	60%	91%
	Peak Demand	90%	84%	76%	90%	76%	95%
	Off-peak Demand	81%	78%	67%	79%	58%	86%
<b>Aug'19</b>	Solar Peak	77%	72%	70%	78%	65%	83%
	Peak Demand	83%	75%	72%	91%	88%	89%
	Off-peak Demand	75%	65%	59%	82%	67%	78%
<b>Feb'19</b>	Solar Peak	66%	93%	89%	65%	52%	90%
	Peak Demand	70%	82%	82%	77%	75%	87%
	Off-peak Demand	45%	72%	72%	56%	40%	69%

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- 4.2. The inter-regional transmission capacity of Western Region in various time-frame is given below:

Sl.No	Inter-regional corridor	Present (upto Dec,20) capacity (MW)	Capacity expected by 2022 (MW)	Capacity expected by 2024-25 (MW)
1	West-East (WR-ER)	12790	21190	21190
2	West - North (WR-NR)	33920	38120	38120
3	West - South (WR-SR)	19580	24180	24180

The inter-regional corridors commissioned / planned to be commissioned are attached as Annexure-VI.

- 4.3. The above inter-regional transmission links are sufficient to take care of the export and import requirement from Western Region in 2024-25 time frame. An additional inter-regional transmission line viz. Chittorgarh-Neemuch-Mandsaur 400 kV D/C line has been proposed alongwith Neemuch SEZ.

## 5. Review of Transmission system by system operator

### 5.1. System Strengthening at Shujalpur on account of operational constraints ('n-1' non-compliance):

- 5.1.1. CEA stated that as per discussions in the 2<sup>nd</sup> WRPC(TP) meeting held on 04.09.2020, the following system strengthening was required on account of 'n-1' non-compliance of ICTs at 400/220 kV Shujalpur S/s and Shujalpur (PG)-Shujalpur (MP) 220 kV D/c line based on the operational feedback of NLDC:

- A. ICT Augmentation at Shujalpur(PG) substation under ISTS:  
(i) 1x500 MVA, 400/220 kV ICT augmentation at Shujalpur (PG)
- B. Reconductoring of Shujalpur (PG)-Shujalpur (MP) 220 kV D/c line (conductor with ampacity equivalent to ACSR twin moose at nominal voltage) under Intra – state by MPPTCL.

MPPTCL vide letter No. 04-02/PSP-2143 dated 01.12.2020 had sought the following clarifications:

- (i) Whether the system strengthening is associated with Phase-II works of power evacuation from Rajgarh SEZ or it is to be taken up independently.
- (ii) The conductor equivalent to ACSR twin moose capacity for 220 kV line may not be available in Indian Market and it may not be possible to use the conductor with ampacity equivalent to ACSR twin moose at nominal voltage on the existing towers of 220 kV line. MPPTCL has requested to confirm whether the reconductoring of Shujalpur(PG)-Shujalpur(MP) 220 kV D/c line was required to be carried out with the conductor with ampacity equivalent to ACSR twin moose at nominal voltage or with the conductor with ampacity equivalent to ACSR twin zebra at nominal voltage.



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CEA had already clarified to MPPTCL that reconductoring of Shujalpur (PG)-Shujalpur (MP) 220 kV D/c line was required to be implemented independently as the scheme had been agreed based on the operational feedback from POSOCO. Regarding the ampacity of the conductor, CEA vide email dated 28.01.2021 had provided the list of available options as per the CEA's "Guidelines for Rationalised Use of High Performance Conductors" for HTLS conductor equivalent to ACSR twin moose available in Indian Market.

- 5.1.2. MPPTCL stated that the conductor used in existing Shujalpur (PG) - Shujalpur (MPPTCL) 220 kV D/c line is Single Zebra Conductor with design temperature of 85 degrees. Therefore, achieving the ampacity equivalent to ACSR Twin Moose conductors on existing towers is not feasible. Alternatively, if MPPTCL is given flexibility to achieve the ampacity of 1300 Amp without specifying the twin moose equivalency clause, it would have flexibility to opt for any HTLS conductor with commensurate ampacity.
- 5.1.3. CTU stated that as per the system studies, conductor with ampacity of 1600 Amp is required and downgrading the ampacity of the conductor may lead to 'n-1' non-compliance.
- 5.1.4. POSOCO stated that the issue of high loading of 400/220 kV ICTs at Shujalpur (PG) and Shujalpur (PG)- Shujalpur 220 kV D/c line is generally observed in the Rabi season from October-March. To overcome this contingency which is observed for a period of six months, MPPTCL may consider implementation of Dynamic Line Rating.
- 5.1.5. On being enquired about the implementation time frame for the aforesaid reconductoring works, MPPTCL stated that it would take minimum of around one year and would certainly be completed in the matching time-frame of implementation of 3<sup>rd</sup> 400/220 kV, 500 MVA ICT at Shujalpur (PG).
- 5.1.6. CEA and CTU clarified that the aforesaid reconductoring works to be implemented as an intra-state scheme is not linked with the augmentation of transformation capacity at Shujalpur (PG) and is separately required to overcome the 'n-1' non compliance, as reported by POSOCO in their operational feedback. In view of the same, MPPTCL needs to expedite the works.
- 5.1.7. Keeping in view the restriction posed by existing tower design, the constituents agreed that MPPTCL may carry out reconductoring of Shujalpur (PG)-Shujalpur (MP) 220 kV D/c line as an intra-state scheme with conductor having ampacity equivalent to at least ACSR twin zebra or higher. MPPTCL agreed to implement the scheme within one year.

## 5.2. Operational Feedback of NLDC

The operational feedback of NLDC for the period from October,2020 to December,2020 is as follows:



**A. Transmission Line Constraints**

Sl. No.	Corridor	Season/ Antecedent Conditions	Description of the constraints
1	400 kV Kudus - Kala D/C corridor	This corridor is highly loaded as it is the low impedance path for DNH to meet its demand and also due to nonavailability of 220kV lines from kudus.	<p><b>Constraints:</b> When 400 kV Kudus-Kala D/c lines carry more than 1050 MW, the corridor is 'n-1' non-compliant.</p> <p><b>Remedial Actions:</b> Commissioning of 400kV Padghe (GIS) –Kharghar and Padghe (GIS)-Ghatkopar would relieve Kudus-Kala D/ C. Commissioning of 220kV outlets from Kudus would give some relief on Kudus-Kala D/C. At present 2x500 MVA, 400/220 kV Kudus ICTs are idle charged in the absence of 220 kV outlets.</p> <p><b>Present Status:</b> <b>CEA Monthly report Construction of Transmission Lines (220kV &amp; above)- Nov 2020:</b> 220kV Padghe-Wada &amp; Kolshet-Wada LILO at kudus by Dec 2021(Schedule date was Nov'18). 220kV Tarapur-Borivali &amp; Boisar-Ghodbandar LILO by Dec 2021(Schedule was Jul'19). 3<sup>rd</sup> WRPC(TP): MSETCL stated that the status would be submitted within a week, but it is yet to be furnished.</p>
2	220kV Boisar(PG)- Boisar(MS) T/C	Most of the time with higher Mumbai demand and less generation at 220kV Tarapur, Trombay and Dahanu	<p><b>Constraint:</b> The lines become 'n-1' non-compliant when total loading on these lines is above 600MW (Considering 'n-1' loading of 300 MW/ckt). These ckts are mostly loaded above 200MW each and managed with load trimming scheme implemented by MSETCL. The lines were 'n-1' non-compliant for 14% of the time during the quarter.</p> <p><b>Remedial Actions:</b> 400/220 kV, 2x500 MVA Kudus ICTs are idle charged since March 2018. Commissioning of downstream network at Kudus will help to relieve the congestion in Boisar area.</p>

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Sl. No.	Corridor	Season/ Antecedent Conditions	Description of the constraints
			MSETCL may update the status / timeline for the implementation 3 <sup>rd</sup> WRPC(TP): MSETCL stated that the status would be furnished within a week, but it is yet to be furnished.
3	400kV Warora(MS) - Wardha(PG) S/C and Koradi-II Wardha(PG) S/c	High loading is observed when generation at Koradi-II and APML Tiroda are high. <b>Sensitivity:</b> Koradi-II- 11.5% APML Tiroda- 25.4%	<b>Constraints:</b> When the total power flow on 400 kV Koradi II-Wardha (PG) S/C and 400 kV Warora (MS)- Wardha (PG) S/C is above 1800MW, the corridor becomes 'n-1' noncompliant. Sensitivity of Koradi-II-Wardha outage is 35% on Warora-Wardha. Bypassing of Koradi-Wardha(PG) and Wardha(PG)-Warora(MS) at Wardha(PG) and bus split at 400kV Wardha-PG have been discussed in 37 <sup>th</sup> , 39 <sup>th</sup> , 40 <sup>th</sup> & 41 <sup>st</sup> standing Committee meetings WR and was agreed. Restricted operation of HVDC Bhadrawati & Chandrapur-Padghe Bipole are done for controlling high loading of these ckts. <b>Remedial Actions:</b> The Evacuation plan for APML, Tiroda (5x660 MW) Rattan India Amravati (5x270 MW), Chandrapur Stg-II (2x500 MW), IEPL (1x270MW), and Dhariwal (1x300 MW) need to be studied by the STU in order to check whether the existing plan and available network will provide secure evacuation under various 'n-1' contingencies. <b>2nd WRPC(TP):</b> It was decided to have another Joint Study meeting for planning additional outlets from Warora (M) among CEA, CTU, POSOCO & STU, and MSETCL. <b>3<sup>rd</sup> WRPC(TP):</b> The matter was discussed and outcomes are at para 16.8.
4	400kV Chandrapur - Chandrapur (II) D/C	When generation at Chandrapur is less and Chandrapur (II) is high	<b>Constraint:</b> Less generation at Chandrapur is leading to critical loading on these lines. Chandrapur-Padghe HVDC flow had to be restricted to ensure 'n-1' security of these lines, which reduced the operational flexibility with HVDC and also caused low voltages at Parli,

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Sl. No.	Corridor	Season/ Antecedent Conditions	Description of the constraints
			<p>Lonikhand &amp; Padghe area. For 10% of the time, lines were N-1 non-compliant during in Oct 2020.</p> <p><b>Remedial Action</b>  <b>2<sup>nd</sup> WRPC(TP):</b> LILO of one D/c line of 400 kV Chandrapur-I – Bhadravati 2xD/ c line at Chandrapur-II was approved.</p> <p><b>3<sup>rd</sup> WRPC(TP):</b> MSETCL stated that the status would be furnished within a week, but it is yet to be furnished.</p>
5	400kV Parli PG-Parli MS D/c line	Maharashtra drawal above 9000MW and low generation at Parli	<p><b>Constraint:</b>  The lines become 'n-1' non-compliant when total power flow on these lines is 900MW and above. Further these line loadings were the limiting constraint for import TTC/ATC of Maharashtra. Bypassing of 400 kV Koradi-II-Wardha(PG) and 400 kV Wardha(PG)-Warora(MS) at 400kV Wardha(PG) and making 400 kV Koradi-IWarora(MS) S/ C(which is already approved in SCM) would relieve 400kV Parli(PG)-Parli(MS) by around 67 MW /ckt in addition to controlling the fault level at Wardha(PG). This reduction in line loading is equivalent to keeping 400MW generation at Parli in service. Constraint was observed for only 21% of the time in Oct 2020.</p> <p><b>Remedial Action</b>  <b>2<sup>nd</sup> WRPC(TP):</b> LILO of both circuits of Warora Pool – Parli (PG) D/c line at Parli (M) was approved.  <b>3<sup>rd</sup> WRPC(TP):</b> MSETCL stated that the status would be furnished within a week, but it is yet to be furnished.</p>
6	400kV Lonikhand - Jejuri S/C	Low generation at Koyna & high load in Western Maharashtra	<p>There are 3x500MVA, 400/220kV ICTs at Jejuri  S/s with only two incoming 400kV lines i.e 400kV Koyna IV-Jejuri S/C &amp; 400kV Lonikhand-Jejuri S/C line.</p> <p><b>Constraint:</b> Maximum load observed at Jejuri during the quarter was 1020MW and for about 17% of the time it was more than 800MW in month of Oct 2020. With this Jejuri system was 'n-1' non-compliant and this caused low</p>

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Sl. No.	Corridor	Season/ Antecedent Conditions	Description of the constraints
			<p>voltage issues at Jejuri during peak load hours of Maharashtra.</p> <p><b>Remedial Measures:</b> 400kV Lonikhand-Karad LILO at Jejuri was planned for commissioning by 2018-19. This LILO shall be done on priority basis to avoid any disturbance in Jejuri area.</p> <p><b>Present status:</b> LILO not yet commissioned.</p> <p>3<sup>rd</sup> WRPC(TP): MSETCL stated that the status would be furnished within a week, but it is yet to be furnished.</p>
7	400kV Padghe-Kalwa D/c	High loading is observed in general during High demand & Less generation in Mumbai system.	<p><b>Constraint:</b> The corridor becomes 'n-1' non-compliant when total loading is above 1100 MW. Many a times Chandrapur-Padghe Bipole flow had been restricted to control the loading on these lines in past. Also facilitating outage in this corridor on week days is difficult. Outages are being planned only on Saturday/Sundays with planned load shedding. Tripping of these ckts cause alert situation in Mumbai system. Mumbai internal generation has to be maximized immediately to contain loading on 400 kV Pune-Kharghar and Pune-Kalwa lines.</p> <p><b>Remedial Action:</b> Commissioning of 400 kV Ghatkopar S/ S and Padghe(GIS)-Kharghar, Padghe-Navi Mumbai-Vikroli and Kharghar-Vikroli lines would give additional infeed to Mumbai and relieve loading of Padghe- Kalwa D/C.</p> <p><b>3<sup>rd</sup> WRPC(TP):</b> <b>Present status:</b> The Transmission scheme "WRSS-XIX" is under implementation through TBCB route. The SPV has already been acquired by M/s Sterlite Grid 13 Limited on 23.06.2020. Scheduled commissioning is <b>December, 2023</b>. Further, a meeting was held on 03.11.2020 to deliberate on the early commissioning of the transmission scheme "WRSS-XIX" in</p>

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Sl. No.	Corridor	Season/ Antecedent Conditions	Description of the constraints
			<p>which revised SCoD was agreed as <b>September, 2023</b>.</p> <p>Regarding implementation of Khargar – Vikroli 400 kV D/c line, MSETCL stated that the status would be submitted within a week, but it is yet to be furnished.</p>
8	220kV Pune PG-Talegaon D/c	All the time	<p><b>Constraint:</b> When total loading on these lines is 260MW and above, ('n-1' loading considered as 250 MW), the corridor becomes 'n-1' non-compliant. For 94% of the time lines were 'n-1' non-compliant during the quarter.</p> <p><b>Remedial Action:</b> <b>43<sup>rd</sup> SCPSPWR:</b> 220 kV Talegaon (PG)– Talegaon(M)–Urse–Chinchwad 220 kV D/C is planned &amp; is under implementation. This line has been completed upto Urse S/s. Thus, Pune (PG) and Talegaon(M) have 4 no. of 220 kV lines. However, 2 no. of Talegaon (PG) – Talegaon (M) circuits are kept open to restrict the loading on 220 kV Urse– Chinchwad. It was intimated that Urse – Chinchwad 220 kV D/C and Pune (PG)– Hingewadi 220 kV D/C line would be completed by Dec, 2018. <b>3<sup>rd</sup> WRPC(TP):</b> MSETCL stated that the status would be submitted within a week, but it is yet to be furnished.</p>
9	400kV Wanakbori-Dehgam D/c	With WTPS generation above 1900MW	<p><b>Constraint:</b> When generation at WTPS is above 1900MW, WTPS-Dehgam D/c lines become 'n-1' non-compliant. Wanakbori Unit-8 (800 MW) was commissioned on 3<sup>rd</sup> March 2019. However, associated transmission system ie. 400 kV WTPS-Soja D/c line is not yet commissioned (Schedule-Dec'19).</p> <p><b>Measures taken in real time:</b> Outages are being facilitated during less generation period and backing down of generation done in case of</p>

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Sl. No.	Corridor	Season/ Antecedent Conditions	Description of the constraints
			contingencies. <b>3<sup>rd</sup> WRPC(TP):</b> GETCO informed that the line would be completed by December, 2021.
10	220kV DSPM-Korba(E)	With full generation in DSPM and less generation in Korba East and Budhipadar	<b>Constraint:</b> DSPM (2x250 MW) generation was commissioned with LILO of existing 220kV Korba West-Korba East one ckt and 220kV Suhela-Banari line. No additional lines were planned for DSPM evacuation. This has resulted in overloading of 220kV DSPM-Korba East line when the power flow is towards Budhipadar end. SLDC CSPTCL raised concerns of forced backing down at DSPM even when they were overdrawing from the grid in past. For more than 24% (Avg) of the time, line was loaded above 200MW during this quarter. <b>3<sup>rd</sup> WRPC(TP):</b> CSPTCL informed that the line work has already been completed. The bay work at DSPM end would be completed by August, 2021.
11	220 kV Bhilai- Bhilai D/c line	Most of the time	<b>Constraint:</b> When total loading on these lines is above 300 MW, the system is 'n-1' non-compliant. For more than 10% of the time, lines were 'n-1' non-compliant during the quarter. 220 kV Bhilai-Gurur D/c lines kept opened by CSPTCL to control the loading. <b>3<sup>rd</sup> WRPC(TP):</b> 220 kV re-arrangements were agreed at agenda no. 20 to provide an additional circuit to Bhilai (CSPTCL) from Raipur(PG). <b>Measures taken by CSPTCL:</b> For strengthening of 220 kV & 132 kV network at Bhilai, CSPTCL has planned for construction of 3 Nos 220/132 kV S/ s at Patan (expected by March 23), Semariya (expected by March 23) & Ahiwara (expected by March 24). After commissioning of these S/s and their associated lines, loading on 220 kV Bhilai S/s will be reduced & will provide relief to 220 kV Bhilai (Khedamara)-Bhilai D/C line.
12	220kV Kala-	With	<b>Constraint:</b> When total loading on lines

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Sl. No.	Corridor	Season/ Antecedent Conditions	Description of the constraints
	Khadoli D/C Line	commissioning of 3 <sup>rd</sup> ICT at Kala and High Demand of DNH	<p>is above 280 MW, lines become 'n-1' non-compliant. Also, it is a limiting factor for import capability of DNH system. The lines were 'n-1' non-compliant for 66% of the time in September, 2020.</p> <p><b>41<sup>st</sup> SCSPWR:</b> Commissioning of 2x500MVA Vapi-II S/S, 400 kV Kakrapar-Vapi-D/C LILO at Vapi-II, 220 kV Vapi II-Sayali D/C and Vapi-Khadoli D/C by reconfiguration had been agreed.</p> <p><b>Present status:</b> The Transmission scheme "WRSS-XIX" is under implementation through TCB route. The SPV has already been acquired by M/s Sterlite Grid 13 Limited on 23.06.2020. Scheduled commissioning is <b>April, 2023.</b></p>

**B. ICT Constraints:**

Sl No	ICT	Season/ Antecedent Conditions	Description of the constraints
1	2x315 MVA+ 1x500 MVA 400/220 kV Dhule MSETCL ICTs	When drawl is above 7000 MW	<p><b>Constraint:</b> ICT-2 (315 MVA) is under prolonged outage from 23<sup>rd</sup> Sept-2020. ICTs become 'n-1' (considering tripping of 500MVA ICT) non-compliant when total loading is above 460 MW. About 42% of the time, ICTs were 'n-1' non-compliant during the quarter.</p> <p><b>3<sup>rd</sup> WRPC(TP):</b> MSETCL stated that the status of ICT-2 would be submitted with in a week, but it is yet to be furnished.</p>
2	2x315 MVA Akola MSETCL ICTs	Demand of Maharashtra above 21000 MW & Drawal of 6500 MW & less generation at Paras	<p><b>Constraint:</b> Akola ICTs become N-1 non-compliant when total loading is above 440 MW. About 27% of the time, ICTs were 'n-1' non-compliant in the Oct-Dec, 2020 quarter.</p> <p><b>2<sup>nd</sup> WRPC(TP):</b> MSETCL informed that additional 1x500 MVA ICT is</p>



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SI No	ICT	Season/ Antecedent Conditions	Description of the constraints
			planned by STU and is under implementation.  <b>3<sup>rd</sup> WRPC(TP):</b> MSETCL stated that the status would be submitted within a week, but it is yet to be furnished.
3	2x315+2x500 MVA Babaleshwar (MSETCL) ICTs	Demand of Maharashtra above 21000 MW & forced outage of Dhule ICT-2	<b>Constraint:</b> ICTs become 'n-1' non-compliant when total loading is above 1210 MW. About 15% of the time, ICTs were 'n-1' non-compliant in Dec 2020. <b>3<sup>rd</sup> WRPC(TP):</b> MSETCL stated that remedial measures to be taken to make the system 'n-1' compliant would be intimated within a week, but it is yet to be furnished.
4	2x315+1x500 MVA Kolhapur (MSETCL) ICTs	Demand of Maharashtra above 21000 MW & ICT-1 under outage	<b>Constraint:</b> ICT-1 under outage since 10 Aug-2020 for replacement with 500 MVA ICT. ICTs become 'n-1' non-compliant when total loading is above 480 MW. About 25% of the time ICTs were 'n-1' non-compliant during the quarter. <b>3<sup>rd</sup> WRPC(TP):</b> MSETCL stated that the status of ICT-1 would be submitted within a week, but it is yet to be furnished.
5	2x315 MVA Morena(CWRTL ) ICTs	With high demand of MP	<b>Constraint:</b> ICTs become 'n-1' non-compliant when total loading is above 440 MW. About 10% of the time, ICTs were 'n-1' non-compliant during the quarter. <b>3<sup>rd</sup> WRPC (TP):</b> POWERGRID intimated the commissioning schedule of 3 <sup>rd</sup> 500 MVA ICT as December, 2021.
6	2x315 MVA ICTs at Jabalpur(PG)	With high demand of MP	<b>Constraint:</b> When total loading is above 430 MW, the ICTs become 'n-1' non-compliant. About 17% of the time, ICTs were 'n-1' non-compliant in Dec-2020. These ICTs are limiting constraint for MP import TTC. <b>3<sup>rd</sup> WRPC (TP):</b> POWERGRID intimated the commissioning schedule of 3 <sup>rd</sup> 500 MVA ICT as

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SI No	ICT	Season/ Antecedent Conditions	Description of the constraints
			July, 2021.
7	2x315 +1x500 MVA ICTs at Satna(PG)	With MP Drawl of 6500 MW.	<b>Constraint:</b> ICTs become 'n-1' non compliant when total loading is above 660 MW. For about 31% of the time, ICTs were 'n-1' non-compliant during the quarter. Above loadings are with 220 kV Satna PG-Maihar line open. <b>3<sup>rd</sup> WRPC (TP):</b> The loading on the ICTs at Satna would reduce after the commissioning of Rewa UMSP-Rewa 220 kV DC line. MPPTCL intimated the commissioning schedule of Rewa UMSP- Rewa 220 kV DC line as March, 2022.
8	2x315 MVA Astha MPPTCL ICTs	During Rabi Season with high demand of MP	<b>Constraint:</b> ICTs become 'n-1' non-compliant when total loading is above 400 MW. For about 32% of the time ICTs were 'n-1' non-compliant during the quarter. <b>3<sup>rd</sup> WRPC (TP):</b> Augmentation of 3 <sup>rd</sup> 315 MVA, 400/220 kV ICT at Astha was agreed.
9	2x315 MVA ICTs at Shujalpur PG	During Rabi Season	<b>Constraint:</b> ICTs become 'n-1' non-compliant when total loading is above 380 MW. For about 21% of the time ICTs were 'n-1' non-compliant during the quarter. <b>2<sup>nd</sup> WRPC (TP):</b> 3 <sup>rd</sup> 1x500 MVA ICT planned at Shujalpur. <b>3<sup>rd</sup> WRPC (TP):</b> 3 <sup>rd</sup> 1x500 MVA ICT allocated to POWERGRID under RTM.
10	2x315 MVA ICTs at Wardha(PG)	Demand of Maharashtra above 22000 MW	<b>Constraint:</b> ICTs become 'n-1' non-compliant when total loading is above 450 MW. For about 12% of the time, ICTs were 'n-1' non-compliant in December, 2020. <b>1<sup>st</sup> WRPC(TP):</b> Additional 500 MVA ICT is planned at Wardha PG. <b>3<sup>rd</sup> WRPC (TP):</b> POWERGRID intimated that the commissioning schedule of ICT is June, 2022. Efforts being made to commission it by December, 2021.

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SI No	ICT	Season/ Antecedent Conditions	Description of the constraints
11	2x315 MVA Bhatapara (PG) ICTs	Demand of Chhattisgarh above 4000 MW with 1900 MW drawal	<b>Constraint:</b> ICTs become 'n-1' non-compliant when total loading is above 420 MW. For 10% of the time ICTs were 'n-1' non-compliant in Dec-2020. <b>3<sup>rd</sup> WRPC (TP):</b> Augmentation of 3 <sup>rd</sup> 315 MVA, 400/220 kV ICT at Bhatapara (PG) with the LILO of one circuit of Bhatapara (PG) – Suhela 220 kV T/c line at Bhatapara (CSPTCL) to be implemented in same time-frame is agreed.
12	2x315 MVA ICTs at NSPCL	When Chhattisgarh Demand more than 4000MW	<b>Constraint:</b> ICTs become 'n-1' non-compliant when total loading is above 450 MW. About 32% of the time, ICTs were 'n-1' non-compliant in Dec-2020. These ICTs are the limiting constraint for Import TTC of Chhattisgarh. <b>3<sup>rd</sup> WRPC (TP):</b> Re-arrangement of 220 kV network of CSPTCL and swapping of circuit 2 & 3 of Chandrapur (Bhadravati) with circuit 3 & 4 of Korba at 400 kV Bus of Raipur (PG) S/s to relieve the loading of ICTs at NSPCL is agreed.

**B. ToR 2(ii) – ASSESSMENT OF TRANSMISSION SYSTEM REQUIREMENTS IN NEAR, MEDIUM AND LONG TERM AND FORMULATE TRANSMISSION SCHEME**

**6. Transmission system for evacuation of power from Neemuch SEZ (1000 MW):**

6.1. CEA stated that in the 2<sup>nd</sup> WRPC(TP) meeting held on 04.09.2020, the following Transmission system had been agreed for evacuation of power from Neemuch SEZ (1000 MW):

(i) **Transmission system for evacuation of power from Neemuch SEZ (1000 MW):**

- a) Establishment of 2x500MVA, 400/220kV Pooling Station at Neemuch
- b) Neemuch PS – Kota 400kV D/c line~ 70 km
- c) 1x125 MVAR, 420 kV bus reactor at Neemuch PS
- d) 4 nos. 220 kV line bays for solar park interconnection

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- (ii) With the agreed scheme, the issue of 400/220 kV ICTs at Kota becoming 'N-1' non-compliant in the scenario of low generation at KTPS would be studied further in coordination with NR constituents. The scheme would also be discussed in the meeting of NRPC (TP). Any additional requirement arising out of Kota 400/220 ICT overloading would be included in the scheme. The same would be intimated to the WRPC(TP) in the next meeting.
- (iii) RUMS would apply for LTA for its 500 MW Neemuch Solar Park (to be commissioned in July'2022 timeframe) for which Stage-II Connectivity has already been applied. Further, RUMS would also apply for Stage-II Connectivity application for additional 250 MW (out of remaining 500 MW) for which land has already been identified in nearby Singoli village.

The matter was subsequently deliberated in the 3<sup>rd</sup> NRPC(TP) meeting held on 19.02.2021 wherein after detailed deliberations it was decided that considering the large REZ potential already planned for interconnection in Rajasthan and that majority of power allocation from the Neemuch SEZ is to MP only, Neemuch SEZ may be interconnected at a suitable location in Madhya Pradesh instead of the alternatives that includes interconnection at Kota / Chhittorgarh.

Subsequently, a meeting was held on 21.05.2021 (MoM attached as Annexure-VII) to discuss the Transmission system for evacuation of power from Neemuch SEZ. In the meeting, considering the requirement of NRED, Govt. of MP for ISTS connectivity, the following transmission system was agreed for evacuation of power from Neemuch SEZ:

- i. Phase-I: Neemuch PS – Chhittorgarh (PG) S/s 400 kV D/c line – for evacuation of 500 MW of power from Neemuch SEZ, to be implemented at present.
- ii. Phase-II: Neemuch PS – Mandsaur s/s 400 kV (quad) D/c line – to be implemented after the receipt of LTA application for additional 500 MW capacity at Neemuch SEZ.

The Neemuch PS – Mandsaur S/s 400 kV (quad) line could be taken up separately as a grid strengthening scheme.

Further, RVPNL vide letter dated 28.05.2021 had objected any to injection of RE power in Rajasthan. It was also mentioned in the aforesaid letter that MPPTCL (450 MW) & Indian Railways (50 MW) are the beneficiaries of power from Neemuch SEZ of RUMS. The share of MPPTCL could be drawn through 400/220 kV Mandsaur S/s (being implemented as a part of Green Energy Corridor as intra-state scheme). Further, RUMS may divert the supply of Railways' share of power from Neemuch Solar Park to Agar/Shajapur Solar Park (of RUMS) which is connected to an ISTS point i.e. Pachora PS.

- 6.2. CTU stated that in the 59<sup>th</sup> meeting of Western Region Constituents regarding LTA and Connectivity applications in Western Region held on 28.05.2021, RVPNL objected the transmission system as agreed in the meeting held at CEA on 21.05.2021. Accordingly, the LTA application of RUMS has been kept on hold.

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- 6.3. Member (Power System), CEA stated that the combined scheme agreed under Phase-I and Phase-II would provide an additional inter-regional corridor between NR and WR and would facilitate evacuation of power from RE rich areas in Rajasthan towards Western Region. Keeping in view that M/s RUMS is seeking an ISTS connectivity for its Neemuch Solar Park in order to supply its share of power to India Railways, technically this comes out as the most feasible alternative.
- 6.4. POSOCO stated that all the Renewable energy generators are concentrated in western part of India like Gujarat, Rajasthan etc. and therefore power would generally flow from western to eastern side. In this context connecting Neemuch Solar park to Chittorgarh would not accrue any benefit as power eventually needs to be evacuated to eastern side. Instead, it is better to opt for implementation of Neemuch P.S – Mandsaur S/stn 400 kV D/c line during the first phase alongwith any 220 kV interconnections at Neemuch PS.
- 6.5. CEA stated that although the implementation of Neemuch PS. – Mandsaur S/stn 400 kV D/c line is the most favourable choice technically, however keeping in view that ISTS connectivity has been sought by RUMS for its Neemuch Solar park, Chittorgarh S/stn being the nearest ISTS S/stn has been proposed as the ISTS point. In order to make the proposal agreeable to the constituents of both WR and NR, Neemuch PS-Mandsaur S/s 400 kV D/c line could also be taken up under Phase-I itself as a Regional System Strengthening Scheme.
- 6.6. MPPTCL stated that the bids floated by M/s RUMS for development of Neemuch Solar park are at final stage. Accordingly, it is necessary to expedite the finalisation of the evacuation scheme. Further, MPPTCL is in favour of taking up the implementation of Phase-I of the scheme at the first instance as any interconnection with Mandsaur S/s would result in flow of power from Rajasthan as well as Neemuch Solar park towards Mandsaur. Mandsaur 400/220 kV S/s is being developed as an intra-state scheme under Green Energy Corridor wherein connectivity to around 1000 MW of RE projects has already been granted. Implementation of Chittorgarh- Neemuch - Mandsaur 400 kV D/c line might result in overloading of Mandsaur – Nagda 400 kV D/c intra-state twin moose line. Accordingly, it is suggested to proceed with the minimum system comprising of Neemuch P.S.- Chittorgarh S/stn 400 kV D/c line in the first phase. On being enquired about whether there is possibility of evacuation of power from Neemuch SEZ by establishing 400 kV interconnection with Nagda S/stn, MPPTCL stated that there is no space available for implementation of bays at Nagda.
- 6.7. CTU stated that establishing interconnection at Nagda S/stn would provide an ISTS route for evacuation of power from Neemuch SEZ as there are 400 kV ISTS lines from Nagda towards Dehgam and Shujalpur. However, Nagda S/stn being an Intra-state s/stn, there would arise commercial issues in respect of whether the Intra-state transmission charges for evacuation of power would be levied or not. Further, the short circuit level at Nagda S/stn is on higher side.
- 6.8. As far as MPPTCL's doubt regarding overloading of Mandsaur – Nagda 400 kV D/c line is concerned, CTU confirmed through system studies that there is no

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overloading observed and agreed to share the study files with MPPTCL for examining the same.

- 6.9. After detailed deliberations over the feasible technical options available for evacuation of power from Neemuch Solar park without any complexities in respect of commercial issues, it was agreed that the entire corridor of Chittorgarh – Neemuch – Mandsaur 400 kV D/C line would be implemented. This corridor would serve as an inter-regional corridor for dispersal of RE power as well the evacuation system for Neemuch SEZ. Chittorgarh – Neemuch – Mandsaur corridor being an inter-regional corridor needs to be implemented with high ampacity conductor. The agreed scheme is given below:

Transmission system for evacuation of power from Neemuch SEZ (1000 MW):

- A. Transmission system for providing connectivity and LTA.
- (i) Establishment of 2x500 MVA, 400/220 kV Pooling Station at Neemuch with 1x125 MVA Bus Reactor
  - (ii) Neemuch PS – Chhittorgarh (PG) S/s 400 kV D/C line (conductor with minimum capacity of 2100 MVA/Ckt at nominal voltage).
- B. Transmission system strengthening in matching timeframe of Neemuch SEZ.
- (i) Neemuch PS- Mandsaur S/stn 400 kV D/c line (conductor with minimum capacity of 2100 MVA/Ckt at nominal voltage).
7. **Review of Transmission scheme for evacuation of power from Dholera UMSP**

- 7.1. CEA stated that in the 2<sup>nd</sup> meeting of WRPC(TP) held on 04.09.2020, GETCO had requested to review the transmission system for evacuation of power from Dholera UMSP (Phase I: 2 GW) approved in the 1<sup>st</sup> meeting of WRPC (TP) held on 11.01.2020.

GETCO had informed that 1 GW capacity (under intra-state) out of the 5 GW Dholera UMSP being developed by GPCL has already been awarded. With award of this 1 GW capacity, it appears that the entire potential of 5 GW Dholera UMSP would materialise in near future. Proceeding with the already approved scheme under ISTS would require planning of additional system to cater to evacuation requirement under Phase-II (2 GW) of ISTS. Accordingly, it would be prudent to revise the already approved scheme and plan a 765/400 kV pooling station at Dholera along with 765 kV outlet upto planned Ahmedabad S/stn. The line may initially be kept charged at 400 kV under Phase-I. This would result in an optimal system to cater to the total evacuation requirement of 4 GW under ISTS which is being developed in two phases with 2 GW in each phase.

Accordingly, it was agreed to review the transmission scheme for evacuation of power from Dholera UMSP (Phase-I: 2 GW), so as to develop an optimal ISTS system that cater to evacuation requirement of 2 GW each under Phase-I and Phase-II.

Based on studies, the following revised transmission system is proposed for evacuation of power from Dholera UMSP:



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- (i) Establishment of 3x1500 MVA, 765/400 kV Dholera Pooling Station with 1x330 MVA, 765 kV bus reactor & 1x125 MVA, 420 kV bus reactor.
- (ii) Dholera PS – Vataman switching station 765 kV D/C line – 40 km.
- (iii) 400 kV line bays for termination of lines from solar park.

7.2. CEA stated that the immediate evacuation system would be sufficient for evacuation of entire 4 GW power from Dholera Solar Park. In the studies for time frame of 2024, only 2 GW capacity has been considered in Dholera Solar park alongwith the 15 GW RE capacity in Khavda RE Park. Transmission system strengthening for additional evacuation of 2 GW RE power (in Phase-II) from Dholera Solar park, if any, would be planned after firming of its time frame.

7.3. After deliberations, the following was agreed:

Transmission system for evacuation of power from Dholera UMSP (2 GW in Phase-I):

- (i) Establishment of 3x1500MVA, 765/400 kV Dholera Pooling Station with 1x330 MVA, 765 kV bus reactor & 1x125 MVA 400 kV bus reactor.
- (ii) Dholera PS – Vataman switching station 765 kV D/C line – 40 km.
- (iii) 400 kV line bays for termination of lines from solar park.

The above system would be adequate for evacuation of additional 2 GW (of Phase-II) from Dholera Solar Park. Additional transmission system strengthening, if any, would be planned after firming up of time-frame of implementation of Dholera UMSP.

## 8. System Strengthening in Gujarat associated with integration of RE projects from Khavda potential RE zone

8.1. CEA stated that in the 2<sup>nd</sup> WRPC (TP) meeting, the issue of high loading on several Intra-state and ISTS transmission lines in Gujarat with integration of 16 GW RE capacity (10.5 GW at Khavda, 2 GW at Lakadia, 2 GW at Bhuj-II and 1.5 GW at Jam Khambaliya) in Gujarat had been discussed. Two alternatives for dispersal of power beyond Vadodara towards southern Gujarat and Maharashtra under high RE conditions had been evolved (one 400 kV corridor and other 765 kV corridor). GETCO has given their preference for 765 kV corridor for onward power disbursal. In the meeting it was agreed that the transmission system strengthening in Gujarat associated with integration of RE projects from Khavda potential RE zone would be further studied.

Accordingly, system studies were carried out by CTU in the time frame of 2024-25 considering June afternoon scenario condition (High RE scenario) (alongwith RE capacity of 37 GW planned in Rajasthan). As per the studies, high loadings as well as fault level issues were observed in Gujarat system. High short circuit level was observed at 400 kV Dehgam (PG), Ranchodpura(GETCO), Asoj (GETCO) & Vadodara(PG) substations. High loadings were observed on Banaskantha 765/400 kV ICTs, Banaskantha – Sankhari 400 kV D/C line, Ahmedabad 765/400 kV ICTs, Jhanor- GPEC- Kasor 400 kV line, Jhanor- Dehgam 400 kV D/C line etc.

For overcoming the above constraints, the following 765 kV alternatives were



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studied as system strengthening schemes:

- Establishment of Vadodara – Bharuch – Vapi-III – Phadge 765 kV D/C corridor along with establishment of 765/400 kV substations at Bharuch and Vapi-III. With these options, ICT loadings on Vadodara and Baruch ICT was not 'n-1' compliant and overloading on 220 kV systems were also observed. To optimize the system without the requirement of establishment of sub-station near Vapi, the scheme was reviewed and it was found prudent to shift Bharuch S/s further south to Kosamba and interconnect it with Kala and Magarwada substations for direct feed of power towards Kudus / Boisar (major load centers).
  - With total 37 GW RE integration in Rajasthan and in scenarios of high solar and low wind (Scenario-7, February Afternoon), instead of power flow on Banaskantha – Chittorgarh GEC towards Rajasthan, the power flow was observed on these lines towards Gujarat. To avoid overloading on Banakantha ICTs and associated 400 kV lines from Banskantha, Banaskantha – Ahmedabad 765 kV corridor was studied.
  - To reduce the number of interconnections at Vadodara and to reduce short circuit level at Vadodara, Ahmedabad – Vadodara 765 kV D/C line included in the '*Transmission scheme for evacuation of 4.5 GW RE injection at Khavda P.S. under Phase-II – Part C*', was reconfigured as Ahmedabad – Kosamba 765 kV D/C line.
  - To take care of power flow towards Gujarat through Chittorgarh-Banaskantha 765 kV D/C line and to facilitate bidirectional power transfer from WR to NR and vice versa in various scenarios, Indore – Chittorgarh 765 kV D/c line was also studied. It was observed that Indore – Chittorgarh 765 kV D/c line was facilitating power flow towards Indore directly from Chittorgarh but the system feeding Chittorgarh in Rajasthan was getting 'n-1' non-compliant. Further, Ahmedabad- Indore 765 kV D/C line included in the '*Transmission scheme for evacuation of 4.5 GW RE injection at Khavda P.S. under Phase-II – Part E*' was not found to be of significant help in any of the nine scenarios studied.
  - With establishment of Banskantha – Ahmedabad – Kosamba – Phadge 765 kV D/C corridor, high loadings observed on several Intra-state and ISTS transmission lines in Gujarat with integration of 16 GW RE (including 10 GW at Khavda) in Gujarat gets resolved. Further, the Ahmedabad- Indore 765 kV D/C line included in the '*Transmission scheme for evacuation of 4.5 GW RE injection at Khavda P.S. under Phase-II – Part E*' was not found to be of significant help in any of the 9 scenarios studied with the above. The loadings on the Ahmedabad- Indore 765 kV D/C line was observed to have got reduced and its implementation for evacuation of RE power of 16 GW from Gujarat was not required.
- 8.2. Based on the system studies conducted by CTU for the 2024-25 period considering June afternoon scenario (High RE scenario) and deliberations held with POSOCO, GETCO and CTU, the following system was proposed as system strengthening scheme associated with evacuation of RE power from Khavda RE park:

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- i) Banaskantha – Ahmedabad 765 kV D/c line (~200 km length) with 330 MVA, 765 kV Switchable line reactor on each ckt at Ahmedabad S/s end.
- ii) Establishment of 2x1500 MVA, 765/400 kV & 2x500 MVA, 400/220 kV Kosamba S/s with 2x330 MVA, 765 kV and 1x125 MVA, 400 kV Bus reactors. [with 110MVA & 80 MVA, 765 kV single phase reactor units (spare units for bus/line reactor) and 1x500 MVA, 765/400 kV single phase spare transformer].
- iii) Kosamba - Kala (GIS) 400 kV D/c line (conductor with minimum capacity of 2100 MVA/Ckt at nominal voltage) (~180 km length) with 50 MVA switchable line reactors on each ckt at both ends.
- iv) Kosamba – Magarwada (GIS) 400 kV D/c line (conductor with minimum capacity of 2100 MVA/Ckt at nominal voltage) (~140 km length) with 63 MVA switchable line reactors on each ckt at Magarwada end.
- v) It may be noted that since Kala and Magarwada are located close to each other, majority of common stretch of Kosamba – Kala and Kosamba – Magarwada 400kV D/c line may be constructed using Multi-circuit towers in order to save RoW and hence both the 400 kV lines may be kept part of the same package.
- vi) Kosamba – Padghe (GIS) 765 kV D/c line (~270-280km length) with 330 MVA, 765 kV Switchable line reactor on each ckt at Kosamba S/s end and 240 MVA, 765 kV Switchable line reactor on each ckt at Padghe (GIS) S/s end.
- vii) Augmentation of Transformation capacity at Padghe (GIS) 765/400 kV substation by 1x1500 MVA ICT.
- viii) Augmentation of Transformation capacity at Banaskantha 765/400 kV S/s by 1x1500 MVA ICT.
- ix) Banaskantha – Sankhari 400 kV 2<sup>nd</sup> D/c line.

The above strengthening scheme would also facilitate the evacuation of additional 7 GW of power from Khavda RE park.

With the above proposed strengthening schemes, the number of interconnection gets reduced at Vadodara 765 kV (by reconfiguring Ahmedabad- Vadodara as Ahmedabad – Kosamba 765 kV D/C line) and reduction in short circuit level at Vadoadara 400 kV (to 39 kA) and Asoj 400 kV (to 42 kA) is observed. With bypassing of SSP-Asoj-Chornia 400 kV S/C line at Asoj, short ckt level at Asoj is within the design limit.

Similarly, for reducing the short circuit level at Dehgam and Ranchodpura, it is proposed to bypass Rachhodpura(GETCO) – Dehgam(PG) 400 kV D/c line at Dehgam(PG) S/s and connecting it with Dehgam(PG) – Pirana 400 kV D/c line (one circuit via Nicol) so as to form Ranchhodpura(GETCO) – Pirana(PG) 400 kV D/c line.

- 8.3.** GETCO stated that the overloading on the Banakantha 765/400 kV ICTs and Banaskantha – Sankhari 400 kV D/C line was due to installation of Prantij 400 kV substation, which would be fed from Sankhari 400 kV D/C line. Therefore, augmentation of Banakantha 765/400 kV ICTs, Banaskantha – Sankhari 400 kV D/C line (2<sup>nd</sup> line) needs to be taken up in matching time frame of implementation of Prantij 400 kV substation.

8.4. After deliberations, the following schemes were agreed:

**A. System Strengthening in Gujarat associated with integration of RE projects from Khavda potential RE zone**

- i) Banaskantha – Ahmedabad 765 kV D/c line (~200 km length) with 330 MVAR, 765 kV Switchable line reactor on each ckt at Ahmedabad S/s end.
- ii) Establishment of 2x1500 MVA, 765/400 kV & 2x500 MVA, 400/220 kV Kosamba S/s with 2x330 MVAR 765 kV and 1x125 MVAR 400 kV Bus reactor. [with 110MVAR & 80 MVAR, 765kV single phase reactor units (spare units for bus/line reactor) and 1x500 MVA, 765/400 kV single phase spare transformer].
- iii) Kosamba - Kala (GIS) 400 kV D/c line (conductor with minimum capacity of 2100 MVA/Ckt at nominal voltage) (~180 km length) with 50 MVAR switchable line reactors on each ckt at both ends
- iv) Kosamba – Magarwada (GIS) 400 kV D/c line (conductor with minimum capacity of 2100 MVA/Ckt at nominal voltage) (~140 km length) with 63 MVAR switchable line reactors on each ckt at Magarwada end.
- v) Kosamba – Padghe (GIS) 765 kV D/c line (~270-280 km length) with 330 MVAR, 765 kV Switchable line reactor on each ckt at Kosamba S/s end and 240 MVAR, 765 kV Switchable line reactor on each ckt at Padghe (GIS) S/s end.
- vi) Augmentation of transformation capacity at Padghe (GIS) 765/400 kV substation by 1x1500 MVA ICT.
- vii) Augmentation of transformation capacity at Banaskantha 765/400 kV S/s by 1x1500 MVA ICT.
- viii) Banaskantha – Sankhari 400 kV 2<sup>nd</sup> D/c line

Note:

- As Kala and Magarwada are located close to each other, majority of common stretch of Kosamba – Kala and Kosamba – Magarwada 400 kV D/c line may be constructed using Multi-circuit towers in order to save RoW and hence both the 400 kV lines may be kept part of the same package.
- Implementation of item no. (vii) & (viii) to be done in matching time frame of establishment of Prantij 400/220 kV and Sankhari- Prantij 400 kV D/C line by GETCO.
- Implementation of 4 nos. of 220 kV outlets from Kosamba 765/400/220 kV s/s to be implemented by GETCO in matching time frame of Kosamba 765/400/220 kV substation (with 4 nos. 220 kV line bays for 220 kV outlets)
- The above scheme needs to be implemented in the matching time frame of Transmission scheme for evacuation of 8 GW RE power from Khavda RE park (Phase-A).

The above scheme would be implemented as an ISTS scheme. The estimated cost of the above scheme is about Rs. 3551 Cr.

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**B. Scheme for fault level control at Dehgam (PG) & Ranchhodpura (GETCO) S/s**

- Bypassing of Ranchhodpura(GETCO) – Dehgam(PG) 400 kV D/c line at Dehgam(PG) S/s and connecting it with Dehgam(PG) – Pirana 400 kV D/c line (one circuit via Nicol) so as to form Ranchhodpura(GETCO) – Pirana(PG) 400 kV D/c line (one circuit via Nicol).

**Note:**

a) 400 kV D/c Dehgam-Ranchhodpura line is crossing with 400 kV Dehgam-Pirana D/c line near boundary wall of sub station premises (tower 2 & 3 of Ranchhodpura line and tower 3 & 4 of Pirana line from Dehgam SS end). It is possible to disconnect both the lines towards Dehgam end and join with each other so that 400 kV D/c Ranchhodpura-Pirana line shall be established.

b) With above bypassing, 4 nos. bays at Dehgam S/s shall become vacant.

c) After the implementation of above scheme, fault level at 400 kV buses at Dehgam S/s (PG) & Ranchhodpura S/s (GETCO) is observed to reach about 31 kA & 38 kA respectively (within limits).

d) Length of Ranchhodpura - Dehgam 400 kV D/c line (twin) is 62 km, length of Dehgam – Pirana and Dehgam – Nicol 400 kV lines are 56 km & 26 km respectively.

The above scheme would be implemented as an ISTS scheme.

**C. Scheme to control high fault level at Asoj (GETCO) S/s:**

- Bypassing of SSP - Asoj 400 kV line (twin) (~83 km length) & Asoj-Chorania 400 kV line (twin) (~170 km length) at Asoj S/s so as to form SSP – Chorania 400 kV line (~250 km length)
- Adequate Shunt compensation is to be provided for the above SSP – Chorania 400 kV line alongwith PIR in the associated CBs.

The above scheme would be implemented as an intra- state scheme by GETCO.

**D. Scheme to control high loading on Vadodara- Jambua 220 kV D/C line.**

- Vadodara- Jambua 220 kV (2<sup>nd</sup>) D/C line or
- Asoj - Jambua 220 kV D/c line or
- Reconductoring of the existing Asoj- Jambua 220 kV D/C line.

GETCO to implement the feasible option as an intra-state scheme.

**9. Transmission System for evacuation of power from Khavda RE park (15 GW)**

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- 9.1. CEA stated that 30 GW capacity hybrid renewable energy park at Khavda is expected to play a major role in fulfilling India's vision of generating 450 GW of Renewable Energy (RE) power by 2030.

Govt. of Gujarat has allocated approx. 50,000 acres of land to a mix of private and public sector project developers for development of renewable energy projects in the Renewable Energy Park at Khavda. As per Govt. of Gujarat, the allocated land would be sufficient for 27.7 GW RE capacity. As per the terms and conditions, the developers have given an undertaking that they would setup 50% of allocated capacity within the three (03) years and 100 % capacity within five (05) years from the date of lease deed agreement. As per the timeline indicated by the Government of Gujarat, 50% of park capacity is to be commissioned by 2024 and balance by end of 2026. Hence, out of 27.7 GW RE capacity, about 14 GW RE capacity is expected to come up by 2024-25 and balance by 2026-27 time-frame.

In the RE park location, three ISTS pooling stations have already been identified by GPCL to pool RE power for further evacuation as given below:

S.No.	Pooling Station	Location	Total pooling capacity	Likely capacity by December 2024
1	Khavda Pooling Station-I (KPS1)	near the AGEL plot	9.5 GW	4.5 GW
2	Khavda Pooling Station-II (KPS2)	near GSECL/ GIPCL/ NTPC plot	10.5 GW	6 GW
3	Khavda Pooling Station-III (KPS3)	near SECI/ NTPC /SRL plot	7.7 GW	4.5 GW
		Total	27.7 GW	15 GW

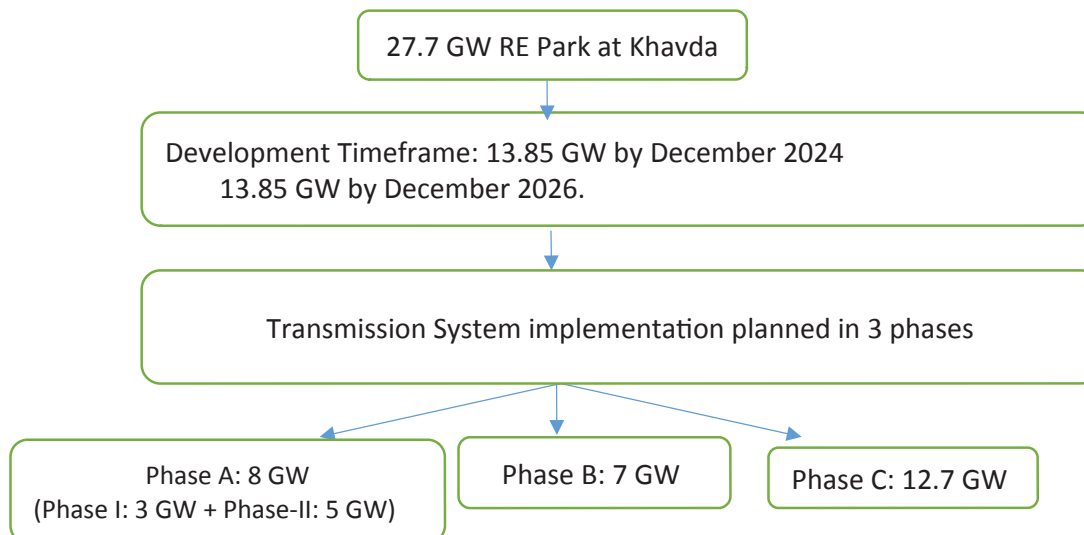
The developer wise capacity allocated and the likely pooling station for pooling RE power from RE park developers has been assumed as given below:

Sl. No.	Name of Developers	Allocated Capacity (MW)	Capacity in GW by 2024-25 (GW)			
			KPS 1	KPS2	KPS 3	Total
1.	Adani Green Energy Limited	9500 (Hybrid)	4.5			4.5
2.	Gujarat State Electricity Corporation Limited	3325 (Hybrid)		1.7		1.7
3.	Gujarat Industries Power Company limited	2375 (Hybrid)		1.2		1.2
4.	NTPC Limited	4750 (Hybrid)		1.2	1.2	2.4
5.	Sarjan Realities Limited (Suzlon Group)	4750(Hybrid)		1.2	1.2	2.4

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Sl. No.	Name of Developers	Allocated Capacity (MW)	Capacity in GW by 2024-25 (GW)			
			KPS 1	KPS2	KPS 3	Total
	Company)					
6.	Solar Energy Corporation of India (Land reserved for SECI)	3000 (Wind only)			1.5	1.5
	<b>Total</b>	<b>27700 MW</b>	<b>4.5</b>	<b>5.3 ~ 6</b>	<b>3.9 ~4.5</b>	<b>13.7 ~ 15</b>

For evacuation of power from Khavda RE park, the planning and implementation of the associated transmission scheme would be taken up in three phases as shown below:



Phase A of the transmission system has already been agreed in the meetings of 2<sup>nd</sup> WRPC (TP) & 3<sup>rd</sup> NCT and notified by Govt. of India for implementation through TBCB route. The transmission system under Phase A has been notified into six transmission schemes, vide Gazette notification dated 23.09.2000 by Ministry of Power, to be implemented through TBCB route as detailed below:

Sl.no	Name of Transmission scheme	Scope
1.	Transmission scheme for evacuation of 3 GW RE injection at Khavda P.S. under Phase-I	<ul style="list-style-type: none"> <li>Establishment of Khavda pooling station (GIS), 3x1500 MVA 765/400 kV and 2x500 MVA 400/220 kV.</li> <li>Khavda PS (GIS) – Bhuj PS 765 kV D/c line.</li> </ul>
2.	Transmission scheme for evacuation of 4.5 GW RE injection at Khavda P.S. under	<ul style="list-style-type: none"> <li>Augmentation of Khavda PS by 4x1500 MVA, 765/400 kV and 2x500 MVA, 400/220 kV.</li> </ul>



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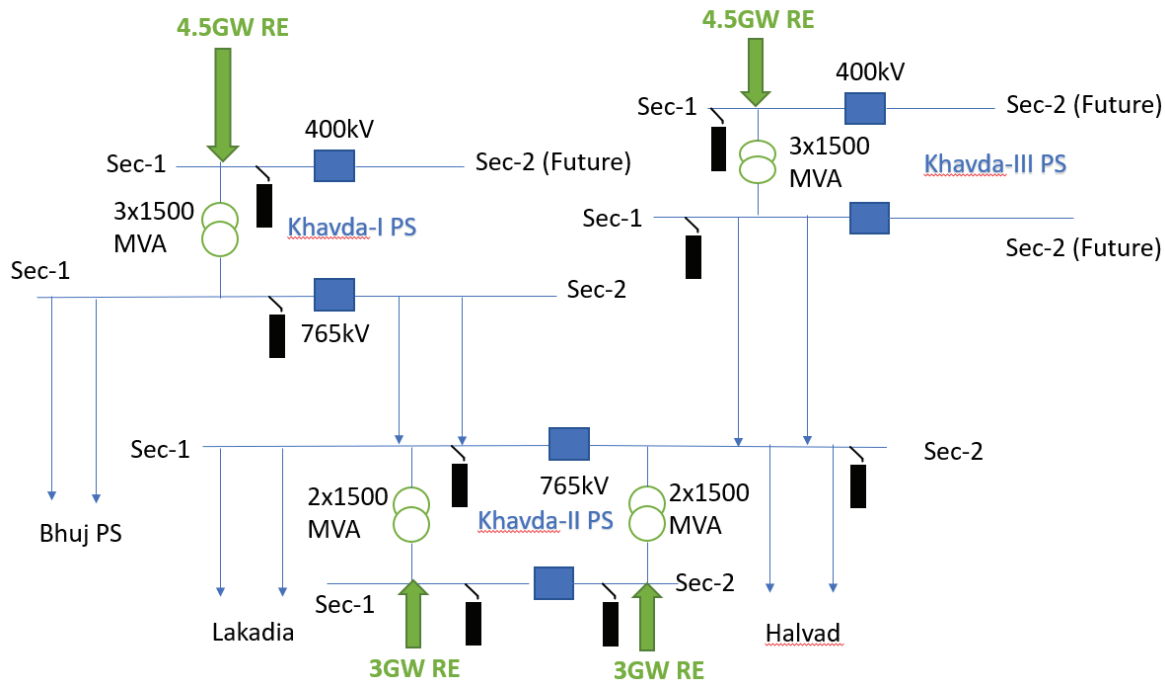
Sl.no	Name of Transmission scheme	Scope
	Phase-II – Part A	<ul style="list-style-type: none"> <li>• Khavda PS (GIS) – Lakadia PS 765 kV D/c line</li> </ul>
3.	Transmission scheme for evacuation of 4.5 GW RE injection at Khavda P.S. under Phase-II – Part B	<ul style="list-style-type: none"> <li>• Lakadia PS – Ahmedabad 765 kV D/c line</li> </ul>
4.	Transmission scheme for evacuation of 4.5 GW RE injection at Khavda P.S. under Phase-II – Part C	<ul style="list-style-type: none"> <li>• Establishment of 2x1500 MVA, 765/400 kV Ahmedabad substation.</li> <li>• Ahmedabad – Vadodara 765 kV D/c line</li> </ul>
5.	Transmission scheme for evacuation of 4.5 GW RE injection at Khavda P.S. under Phase-II – Part D	<ul style="list-style-type: none"> <li>• LILO of Pirana (PG) – Pirana (T) 400 kV D/c line at Ahmedabad S/s</li> </ul>
6.	Transmission scheme for evacuation of 4.5 GW RE injection at Khavda P.S. under Phase-II – Part E	<ul style="list-style-type: none"> <li>• Ahmedabad – Indore 765 kV D/c line</li> </ul>

Transmission scheme for evacuation of 3 GW RE injection at Khavda PS under Phase-I is currently under bidding and bidding for the balance five schemes would be taken up on receipt of LTA beyond 3 GW from RE developers in Khavda RE park.

**9.2. Establishment of pooling stations in Khavda RE park:** Under Phase A one pooling station had been agreed. This would have required pooling of RE power from all the RE park developers at one pooling station, which would have not been feasible as per layout of Khavda RE park as finalized by GPCL. Therefore, development of all the three ISTS pooling stations depending on the receipt of LTA applications from RE park developers is required. The onward transmission system for further evacuation of power upto 8 GW would be through transmission scheme finalized in Phase A with some minor changes. The schematic and details of the pooling station along with their interconnection line for pooling of 15 GW RE power (8 GW: PhaseA + 7GW: Phase B) is as given below:



### Khavda PS- I, II & III Schematic Diagram



Sl. No.	Pooling station	Ultimate Capacity	Initial implementation by December, 2024
1	Khavda pooling station (KPS1) along with KPS1-Bhuj 765 kV D/C line.  Already agreed as Transmission scheme for evacuation of 3 GW RE injection at Khavda P.S. under Phase-I.	8x1500 MVA, 765/400 kV	3x1500 MVA, 765/400 kV.  Space for additional 5x1500 MVA, 765/400 kV ICTs.  Only one 400 kV & 765 kV bus section to be implemented for injection upto 3GW.
2	Khavda pooling station (KPS2) along with LILO of one ckt KPS1-Bhuj 765 kV D/C line at KPS2	9x1500 MVA, 765/400 kV	4x1500 MVA, 765/400 kV.  Space for additional 5x1500 MVA, 765/400 kV ICTs.  Both bus sections to be implemented.
3	Khavda pooling station (KPS3) along with KPS3-KPS2 765 kV D/C line.	8x1500 MVA, 765/400 kV	3x1500 MVA, 765/400 kV.  Space for additional 5x1500 MVA, 765/400 kV ICTs.  Only one bus section to be implemented.

All the three pooling stations namely, KPS1, KPS2 and KPS3 pooling stations shall be established in two sections (with bus sectionalizer at 765 kV & 400 kV level). Bus sectionalizer at 765 kV level shall normally be closed and bus

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sectionalizer at 400 kV level shall normally be open. In all the three pooling station, space for future provision would be kept for 400/220 kV ICTs to take care of drawal needs in the area.

**Khavda Pooling Station 2 (KPS2) scope of works:**

- i) Establishment of 765/400 kV, 4x1500 MVA, KPS2 (GIS) with 2x330 MVAR 765 kV bus reactors and 2x125 MVAR 400 kV bus reactors. It will have space provisions for future expansion of 765/400 kV, 5x1500 MVA.
- ii) The pooling station shall be established in two sections (with bus sectionalizer at 765 kV & 400 kV level). On each bus section, there shall be 2x1500 MVA 765/400 kV ICTs, 1x330 MVAR, 765 kV & 1x125 MVAR, 420 kV bus reactor. First section will have space for future expansion of 3x1500 MVA, 765/400 kV ICTs and second section will have space for future expansion of 2x1500 MVA, 765/400 kV ICTs. Also space for future provision for 2 nos. 400/220 kV ICTs and 4 nos. of 220 kV line bays to be kept to take care of drawal needs of the area, if any. Bus sectionalizer at 765 kV level shall normally be closed and bus sectionalizer at 400 kV level shall normally be open.
- iii) 1x500 MVA, 765/400kV (single phase) spare transformer at KPS2
- iv) 110 MVAR, 765 kV single phase reactor (spare unit for bus/line reactor) at KPS2.
- v) LILO of one ckt of KPS1-Bhuj 765 kV D/C line at KPS2.

**Khavda pooling station 3 (KPS3) scope of works:**

- i) Establishment of 765/400 kV, 3x1500 MVA KPS3 (GIS) with 1x330 MVAR, 765 kV bus reactor and 1x125 MVAR, 400 kV bus reactor. The pooling station would have space provision for future expansion of 5x1500 MVA, 765/400 kV ICT.
- ii) The pooling station shall be created with bus section I with 765/400, 3x1500 MVA ICTs and 1x330 MVAR, 765 kV & 1x125 MVAR, 400 kV bus reactor along with future space provision for expansion of 1x1500 MVA, 765/400 kV ICT. Bus section II (future) shall be created with 765/400 kV, 4x1500 MVA ICTs and 1x330 MVAR, 765 kV & 1x125 MVAR, 400 kV bus reactors. Also space for future provision for 2 nos. 400/220 kV ICTs and 4 nos. of 220 kV line bays to be kept to take care of drawal needs of the area, if any. Bus sectionalizer at 765 kV level shall normally be closed and bus sectionalizer at 400kV level shall normally be open
- iii) 1x500 MVA, 765/400 kV (single phase) spare transformer at KPS3
- iv) 110 MVAR, 765 kV single phase reactor (spare unit for bus reactor) at KPS3.
- v) KPS3- KPS2 765 kV D/C line.

Till date, LTA of 1 GW has been granted at KPS1 to M/s AREHFL and no LTA applications has been received from RE developers at KPS2 and KPS3. The evacuation of RE power upto 3 GW (total of LTA granted at KPS1, KPS2 and KPS3) from Khavda RE park would take place through KPS1- Bhuj 765 kV D/C line. On receipt of LTA at KPS2, KPS2 would be established through LILO of one ckt of KPS1-Bhuj 765 kV D/C line at KPS2. On receipt of LTA at KPS3, KPS3 would be established along with KPS3-KPS2 765 kV D/C line. The three pooling stations would be established with 765/400 kV transformation capacity

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of 4.5 GW, 6 GW and 4.5 GW at KPS1, KPS2 and KPS3 respectively. This would take care of injection requirement of up to 15 GW. ICT augmentation at these pooling stations to meet 'n-1' criteria would be taken up progressively as space provision for future ICTs has been kept at these pooling stations.

With the above proposed transmission system, slight modification is required in the already agreed transmission scheme for evacuation of power from Khavda RE park Phase-A, as given below:

- i) Establishment of Khavda pooling station KPS1 with 3x1500 MVA, 765/400 kV ICT along with KPS1-Bhuj 765 kV D/C line
- ii) Establishment of Khavda pooling station KPS2 with 4x1500 MVA, 765/400 kV ICTs along with LILO of one ckt of KPS1-Bhuj 765 kV D/C line at KPS2.
- iii) Establishment of Khavda pooling station KPS3 with 3x1500 MVA, 765/400 kV ICTs along with KPS3-KPS2 765 kV D/C line.
- iv) The summary of the changes required in the already agreed scheme is as summarized below:

Sl.no	Name of Transmission scheme	Change in Nomenclature and Scope	Remarks
1.	<p>Transmission scheme for evacuation of 3 GW RE injection at Khavda P.S. under Phase-I</p> <ul style="list-style-type: none"> <li>• Establishment of Khavda pooling station (GIS), 3x1500 MVA 765/400 kV and 2x500 MVA 400/220 kV ICTs.</li> <li>• Khavda PS (GIS) – Bhuj PS 765 kV D/c line.</li> </ul>	<ul style="list-style-type: none"> <li>• Khavda PS (GIS) to be re-designated as Khavda Pooling Station 1 (KPS1).</li> </ul>	Only change in nomenclature.
2.	<p>Transmission scheme for evacuation of 4.5 GW RE injection at Khavda PS under Phase-II Part A.</p> <ul style="list-style-type: none"> <li>• Augmentation of Khavda PS by 4x1500 MVA, 765/400 kV and 2x500 MVA, 400/220 kV ICTs.</li> <li>• Khavda PS (GIS) – Lakadia PS 765 kV D/c line</li> </ul>	<p>Transmission scheme for evacuation of 4.5 GW RE injection at Khavda PS under Phase-II Part A.</p> <ul style="list-style-type: none"> <li>• KPS2 (GIS) – Lakadia 765 kV D/C line.</li> </ul> <p>Transmission scheme for injection beyond 3GW RE power at Khavda PS1</p> <ul style="list-style-type: none"> <li>• Augmentation of Khavda PS1 by 4x1500 MVA, 765/400 kV and 2x500 MVA, 400/220 kV ICTs.</li> <li>• KPS1-Khavda PS2 GIS (KPS2) 765 kV D/C line</li> </ul>	<ul style="list-style-type: none"> <li>• Scheme split into two parts. Original scope reduced and included in new scheme <i>Transmission scheme for injection beyond 3GW RE power at Khavda PS1</i></li> </ul>

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Sl.no	Name of Transmission scheme	Change in Nomenclature and Scope	Remarks
		(to be established with bypassing of LILO of one ckt. of KPS1-Bhuj at KPS2 and utilisation of LILO section)	
3.	Transmission scheme for evacuation of 4.5 GW RE injection at Khavda P.S. under Phase-II – Part B  • Lakadia PS – Ahmedabad 765 kV D/c line	No change	
4.	Transmission scheme for evacuation of 4.5 GW RE injection at Khavda P.S. under Phase-II – Part C  • Establishment of 2x1500MVA, 765/400 kV Ahmedabad substation. • Ahmedabad – Vadodara 765kV D/c line • 2 nos. of 765 kV bays at Vadodara	<ul style="list-style-type: none"> <li>Establishment of 3x1500 MVA, 765/400 kV Ahmedabad substation</li> <li>Ahmedabad- Kosamba 765 kV D/C line instead of Ahmedabad – Vadodara 765kV D/c line</li> <li>2 nos. of 765 kV bays at Vadodara to be deleted</li> </ul>	• Change in scope
5.	Transmission scheme for evacuation of 4.5 GW RE injection at Khavda P.S. under Phase-II – Part D  • LILO of Pirana (PG) – Pirana (T) 400kV D/c line at Ahmedabad S/s	No change	
6.	Transmission scheme for evacuation of 4.5 GW RE injection at Khavda P.S. under Phase-II – Part E • Ahmedabad – Indore 765kV D/c line	Implementation not required under Phase-A as Banaskantha-Ahmedabad-Kosamba-Phadge 765 kV D/C corridor has been agreed.	Requirement to be assessed for evacuation beyond 15 GW RE at Khavda complex

**9.3. Transmission system for evacuation of additional 7 GW RE power from Khavda RE Park.** For evacuation of total 15 GW power from Khavda RE Park, the following transmission planning assumption has been made:

- i) Out of total 27.7 GW REZ in Khavda area, **24.7 GW is considered as Hybrid and balance 3GW as Wind.** As Solar is expected to be dominant

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in Khavda region, Wind capacity shall be at least 33% of total installed capacity of Hybrid (24.7 GW). In view of the above, the RE capacity for Wind and Solar in Khavda area has been considered as: Solar- 16.7 GW (~60%), Wind- 11 GW (~40%). Hence, solar/wind breakup for 15GW Khavda REZ by 2024-25 Time-frame has been assumed as: Solar- 9 GW (~60%), Wind- 6 GW (~40%)

- ii) For optimization of transmission system requirement, **75% diversity in wind** generation has been considered i.e. wind dispatch of 4.5 GW against installed capacity of 6 GW. The diversity is in line with peak dispatches observed at Bhuj PS in recent past (as per information received by CTU from WRLDC vide e-mails dated 17.08.2020 and 26.11.2020) as well as the capacity factor prescribed in CEA Transmission Planning Criteria, 2013. No diversity in solar generation has been considered as ~100% generation output may be expected in afternoon period. Hence, actual peak RE despatch from Khavda area is assumed as: Solar- 9 GW, Wind- 4.5 GW i.e., total dispatch of 13.5 GW
- iii) No Storage capacity in Khavda RE park has been considered by 2024-25 time-frame. If developers plan to put storage capacity, the evolved transmission system would be able to integrate RE capacity beyond 15 GW at Khavda RE park.
- iv) The entire capacity would be evacuated through ISTS system. No transmission system under intra-state has been assumed.
- v) Minimum Transmission System for evacuation of RE from Khavda has been planned so as to avoid unnecessarily burden on consumers.
- vi) LGBR considered for afternoon peak scenario is given at Annexure-VIII.
- vii) Dholera Ph-I (2 GW) has also been considered to be pooled at proposed Dholera PS.

For evacuation of additional 7 GW power from Khavda RE park, an additional 765 kV corridor would be required from Khavda pooling stations to load centers in south Gujarat in addition to the following schemes:

- Bhuj-Bhuj-II- Lakadia- Vadodara 765 kV D/C corridor planned for evacuation of 5.5 GW power from Bhuj-II, Lakadia and Jam Khambaliya RE potential area in Gujarat and is currently under implementation.
- Khavda PS – Bhuj 765 kV D/C line and Khavda PS- Lakadia- Ahmedabad- Indore 765 kV D/C line planned for evacuation of additional 8 GW power from Khavda RE park and is under bidding/ bidding to be initiated.

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- Banskantha- Ahmedabad- Kosamba- Phadge 765 kV D/C has been planned to overcome the issue of high loadings observed on several intra-state and ISTS transmission lines in Gujarat. This would also facilitate evacuation of additional 7 GW RE from Khavda RE park.

The alternatives studied for additional corridor were Khavda PS- Rapar- Ahmedabad & Vataman- Kosamba 765 kV corridor and Khavda PS- Halvad- Vataman- Kosamba 765 kV corridor. Based on the studies the following transmission system is proposed for evacuation of additional 7 GW power Khavda RE park.

- i) Establishment of 765 kV switching station at Halvad with 765 kV, 2x330 MVAR bus reactors (with 110 MVAR & 80 MVAR 765 kV single phase reactor (spare unit for bus/line reactors at Halvad)
- ii) KPS2- Halvad 765 kV D/c line (~220 km length) with 240 MVAR switchable line reactor at both ends.
- iii) LILO of Lakadia – Ahmedabad 765 kV D/c line at Halvad (LILO length~50 km)
- iv) 240 MVAR 765 kV switchable line reactor on each ckt at Halvad end of Halvad – Ahmedabad 765 kV D/c line (~220 km length)
- v) Halvad – Vataman 765 kV D/c line (~170 km length) with 1x330 MVAR switchable line reactor at Vatman end on each ckt.
- vi) Establishment of 765 kV switching station near Vataman with 2x330 MVAR, 765 kV bus reactor [with 110 MVAR, 765 kV single phase reactor (spare unit for bus/line reactor)]
- vii) LILO of Lakadia – Vadodara 765 kV D/c line at Vataman 765 kV switching station (~10 km LILO length)
- viii) Vataman switching station – Kosamba 765 kV D/c line (~200km length) with 330 MVAR switchable line reactors on each ckt at Kosamba end.
- ix) Conversion of 240 MVAR, 765 kV switchable line reactor on each ckt at Lakadia end of Lakadia – Ahmedabad 765 kV D/c line (being LILOed at Halvad) into bus reactors with NGR bypassing arrangement [considering requirement of additional reactive compensation at Lakadia S/s and also Lakadia – Halvad 765 kV D/c line (~100km length) shall have ~100% compensation after LILO of Lakadia – Ahmedabad at Halvad]
- x) Reactive Compensation at Vadodara S/s to control high voltages: Conversion of 330 MVAR 765 kV switchable line reactor on each ckt at Vadodara end of Lakadia – Vadodara 765 kV D/c line (being LILOed at Vataman) into bus reactors with NGR bypassing arrangement. (considering requirement of additional reactive compensation at Vadodara S/s and also Vadodara – Vataman 765 kV D/c line (~120km length) shall have ~100% compensation after LILO of Lakadia – Vadodara 765 kV line at Vataman)

9.4. POSOCO observed that the proposed pooling stations have been planned with the transformation capacity of ICTs at 220/400 kV, 400/765 kV equal to RE



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injection envisaged. As such they were 'n-1' non-compliant. Connecting REs at 400 kV level and not considering 'n-1' contingency of 400/765 kV ICTs would result in large generation outage under contingency of single ICT at substation. Therefore, there was a need for consideration of 'n-1' criteria while deciding the 220/400 kV and 400/765 kV ICTs at the proposed pooling stations. It was clarified that the initial transformation capacities proposed at KPS1, KPS2 and KPS3 is 4500 MVA (against total injection of 4.5 GW), 6000 MVA (against total injection of 6 GW) and 4500 MVA (against total injection of 4.5 GW) respectively. However, space provision for future 765/400 kV ICTs at all the proposed pooling stations in Khavda has been kept keeping in mind the 'n-1' criteria.

- 9.5. WRLDC enquired whether STATCOMs have been planned to handle voltage fluctuations as huge RE capacity addition has been planned in Khavda. In case of Northern region, STATCOMs have been planned along with the transmission system for RE. It was clarified that the transmission system planned for evacuation of 15 GW RE from Khavda RE park does not include any STATCOM. CTUIL stated that the requirement of STATCOMs may be assessed vide a joint study amongst CEA, POSOCO, CTUIL and STUs, and the same if required, could be taken up as a system strengthening scheme.
- 9.6. SECI stated that at Khavda Pooling Station 3 (KPS3), no provision of 220 kV level has been made. As SECI would be developing only wind RE projects, therefore injection of wind power at KPS3 may be planned at 220 kV level.
- 9.7. CTU stated that providing connectivity at 220 kV level to RE projects in Khavda would not be an optimal planning strategy. Moreover, providing connectivity at 220 kV level may limit the corridor availability for transmission corridor in the Khavda RE park.
- 9.8. GETCO stated that initially, GIPCL and GSECL had also requested for 220 kV connectivity for their RE projects at the proposed pooling station at Khavda. Keeping in view the RE capacity to be developed by different RE developers (in the range of 2.3 GW to 9.5 GW) at Khavda, it was decided that each developer would be pooling their power and would get connected to the ISTS pooling station at 400 kV level.
- 9.9. CEA stated that Khavda pooling station 1 (KPS1), which has already been agreed, included creation of 220 kV level but the same has been dropped from the scope of works as the RE developer has been granted connectivity at 400 kV level. Accordingly, Khavda pooling station 2 and 3 have been planned to provide connectivity to RE developers at 400 kV level. However, only space provision would be kept in the pooling stations for 400/220 kV ICTs to take care of any future drawal requirement.
- 9.10. MSETCL stated that as per the power flow studies, power is flowing towards Padghe from Gujarat and towards Aurangabad and Pune from Southern Region which may cause overloading of MSETCL intra-state system. CEA clarified that power flow on the 765 kV network and inter-regional lines would depend on the various scenario (9 nos.) of state's electricity demand and



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dispatches considered from various generation sources. If any part of intra-state network of MSETCL was getting overloaded due to integration of RE power, MSETCL can study and intimate it so that suitable strengthening could be studied and planned.

9.11. After further deliberations, the following transmission system was agreed for evacuation of 15 GW RE power from Khavda RE park:

A. Modification in the already agreed Transmission system for evacuation of 8 GW RE power from Khavda RE park: Phase-A

i) Establishment of 3 nos. of pooling stations namely, Khavda pooling station 1 (KPS1), Khavda pooling station 2 (KPS2) and Khavda pooling station 3 (KPS3) instead of single Khavda pooling station.

Sl. No.	Pooling station	Scope of initial implementation by Dec 2024
1	<p>Khavda pooling station 1 (KPS1) along with KPS1-Bhuj 765 kV D/C line.</p> <p><b>Ultimate Capacity:</b> 8x1500 MVA, 765/400 kV</p> <p>Already agreed as Transmission scheme for evacuation of 3 GW RE injection at Khavda PS under Phase-I". Scheme is under bidding</p>	<p>3x1500 MVA, 765/400 kV ICT with 1x330 MVAR, 765 kV bus reactor and 1x125 MVAR, 400 kV bus reactor.</p> <p>2x500 MVA, 400/220 kV ICTs with 8 nos. of 200 kV line bays has been deleted as stage-II connectivity has been granted at 400 kV level. Only future space provision has been kept.</p> <p>Only one 400 kV &amp; 765 kV bus section to be implemented for injection upto 3 GW.</p> <p>Space for 1x1500 MVA, 765/400 kV ICT at Bus section-I</p> <p>Space for following in Bus Section-II of 765 kV and 400 kV 4x1500 MVA, 765/400 kV ICT with 1x330 MVAR 765 kV bus reactor and 1x125 MVAR 400 kV bus reactor, 2x500 MVA, 400/220 kV ICTs with 4 nos. of 200 kV line bays.</p> <p>Bus sectionalizer at 765 kV to be kept normally closed and bus section at 400kV level to kept normally open.</p>
2	<p>Khavda pooling station 2 (KPS2) along with LILO of one ckt KPS1-Bhuj 765 kV D/C line at KPS2</p>	<p>i) Establishment of 765/400 kV, 4x1500MVA, KPS2 (GIS) with 2x330 MVAR 765 kV bus reactor and 2x125 MVAR 400 kV bus reactor. It will have space provisions for future expansion of 765/400 kV, 5x1500MVA.</p> <p>ii) The pooling station shall be established in two sections (with bus sectionalizer at 765kV &amp; 400kV level). On each bus section, there shall be</p>

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Sl. No.	Pooling station	Scope of initial implementation by Dec 2024
	<p><b>Ultimate Capacity:</b> 9x1500 MVA,765/400 kV</p>	<p>2x1500MVA 765/400kV ICTs, 1x330MVA, 765 kV &amp; 1x125MVA 420kV bus reactor. First section will have space for future expansion of 3x1500, 765/400 kV ICTs and second section will have space for future expansion of 2x1500 MVA, 765/400 kV ICTs. Also space for future provision for 2 nos. 400/220 kV ICTs and 4 nos. of 220 kV line bays to be kept to take care of drawal needs of the area, if any. Bus sectionalizer at 765 kV level shall normally be closed and bus sectionalizer at 400 kV level shall normally be open.</p> <p>iii) 1x500 MVA, 765/400 kV (single phase) spare transformer at KPS2</p> <p>iv) 110 MVA 765 kV single phase reactor (spare unit for bus/line reactor) at KPS2.</p>
3	<p>Khavda pooling station 3 (KPS3) along with KPS3-KPS2 765 kV D/C line.</p> <p><b>Ultimate Capacity:</b> 8x1500 MVA,765/400 kV</p>	<p>i) Establishment of 765/400 kV, 3x1500 MVA, KPS3 (GIS) with 1x330 MVAR 765 kV bus reactor and 1x125 MVAR 400 kV bus reactor. The pooling station would have space provision for future expansion of 5x1500 MVA, 765/400 kV ICT.</p> <p>ii) The pooling station shall be created with bus section I with 765/400 kV, 3x1500MVA ICTs and 1x330 MVAR 765 kV &amp; 1x125 MVAR 400 kV bus reactors along with future space provision for expansion of 1x1500 MVA, 765/400 kV ICT. Bus section II (future) shall be created with 765/400 kV, 4x1500MVA ICTs and 1x330 MVAR 765 kV &amp; 1x125 MVAR 400 kV bus reactors. Also, space for future provision for 2 nos. 400/220 kV ICTs and 4 nos. of 220 kV line bays to be kept to take care of drawal needs of the area, if any. Bus sectionalizer at 765kV level shall normally be closed and bus sectionalizer at 400kV level shall normally be open</p> <p>iii) 1x500 MVA, 765/400 kV (single phase) spare transformer at KPS3</p> <p>iv) 110 MVA 765 kV single phase reactor (spare unit for bus reactor) at KPS3.</p>

Establishment of pooling stations to be taken up only after receipt of LTA applications from RE developers. The evacuation of RE power upto 3 GW (total of LTA granted at KPS1, KPS2 and KPS3) from Khavda RE park would take place through KPS1- Bhuj 765 kV D/C line. On receipt of LTA at KPS2, KPS2 would be established through LILO of one ckt of KPS1-Bhuj 765 kV D/C line at KPS2. On receipt of LTA at KPS3, KPS3 would be established along with KPS3-KPS2 765 kV D/C line.

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- ii) Transmission scheme for evacuation of 4.5 GW RE injection at Khavda P.S. under Phase-II – Part A to be split into two parts:

**Transmission scheme for evacuation of 4.5 GW RE injection at Khavda P.S. under Phase-II – Part A.**

- a) KPS2 (GIS) – Lakadia 765 kV D/C line with 330 MVAR switchable line reactors at Khavda end.
- b) 2 nos. of 765 kV line bays each at Lakadia PS & KPS2 (GIS) for Khavda PS2 (GIS) – Lakadia PS 765 kV D/c line.

**Transmission scheme for injection beyond 3 GW RE power at Khavda PS1 (KPS1)**

- a) Augmentation of Khavda PS1 by 765/400 kV transformation capacity \* (max. upto 4x1500 MVA) with 1x330 MVAR 765 kV bus reactor and 1x125 MVAR 420 kV bus reactor on 2<sup>nd</sup> 765 kV and 400 kV bus respectively
- b) KPS1-Khavda PS GIS (KPS2) 765 kV D/C line (to be established with bypassing of LILO of one ckt. of KPS1-Bhuj at KPS2 and utilisation of LILO section)

*\* Actual no. of ICTs may be decided based on LTA requirement*

- iii) Transmission scheme for evacuation of 4.5 GW RE injection at Khavda P.S. under Phase-II – Part C

S.No	Earlier scope	Modified scope
a)	Establishment of 2x1500 MVA, 765/400 kV, Ahmedabad S/s with 1x330 MVAR 765 kV bus reactor and 1x125 MVAR 420 kV bus reactor.	Establishment of 3x1500 MVA, 765/400 kV Ahmedabad S/s with 1x330 MVAR 765 kV bus reactor and 1x125 MVAR 420 kV bus reactor.
b)	Ahmedabad – Vadodara 765 kV D/c line	Ahmedabad – Kosamba 765 kV D/c line with 240 MVAR switchable line reactor at both ends (~line length 220 km)
c)	2 nos. of 765 kV line bays each at Vadodara for Ahmedabad – Vadodara 765kV D/c line	To be deleted

Transmission scheme for evacuation of 4.5 GW RE injection at Khavda P.S. under Phase-II – Part A to Part-D can also cater to 0.5 GW capacity shifted from Bhuj PS.

- B. Transmission system for evacuation of additional 7 GW RE power from Khavda RE park: Phase-B
  - i) Establishment of 765 kV Halvad switching station with 765 kV, 2x330 MVAR bus reactors (with 110 MVAR & 80 MVAR 765kV single phase reactor (spare unit for bus/line reactors at Halvad)

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- ii) KPS2- Halvad 765 kV D/c line (~220 km length) with 240 MVA<sub>r</sub> switchable line reactor at both ends and 80 MVA<sub>r</sub> single phase spare reactor unit at KPS2 end.
- iii) LILO of Lakadia – Ahmedabad 765 kV D/c line at Halvad (LILO length~50 km)
- iv) 240 MVA<sub>r</sub> 765 kV switchable line reactor on each ckt at Halvad end of Halvad – Ahmedabad 765 kV D/c line (~220 km length)
- v) Halvad – Vataman 765 kV D/c line (~170 km length) with 1x330 MVA<sub>r</sub> switchable line reactor at Vatman end on each ckt.
- vi) Establishment of 765 kV switching station near Vataman with 2x330 MVA<sub>r</sub>, 765 kV bus reactor (with 110 MVA<sub>r</sub> 765 kV single phase reactor (spare unit for bus/line reactor)
- vii) LILO of Lakadia – Vadodara 765 kV D/c line at Vataman 765 kV switching station (~10 km LILO length).
- viii) Vataman switching station – Kosamba 765 kV D/c line (~200 km length) with 330 MVA<sub>r</sub> switchable line reactors on each ckt at Kosamba end.
- ix) Conversion of 240 MVA<sub>r</sub> 765 kV switchable line reactor on each ckt at Lakadia end of Lakadia – Ahmedabad 765 kV D/c line (being LILLOed at Halvad) into bus reactors with NGR bypassing arrangement.
- x) Conversion of 330 MVA<sub>r</sub> 765 kV switchable line reactor on each ckt at Vadodara end of Lakadia – Vadodara 765 kV D/c line (being LILLOed at Vataman) into bus reactors with NGR bypassing arrangement.

The estimated cost of the scheme is about Rs 7428 Cr.

## 10. Creation of 220 kV level at 765/400 kV Pune GIS (Shikrapur) Substaion:

10.1. CEA stated that in the 2<sup>nd</sup> meeting of WRPC (TP) held on 04.09.2020, the proposal of creation of 220 kV level at 765/400 kV Pune GIS (Shikrapur) Substation by MSECTL was discussed. The proposal included following elements:

### A. Under ISTS:

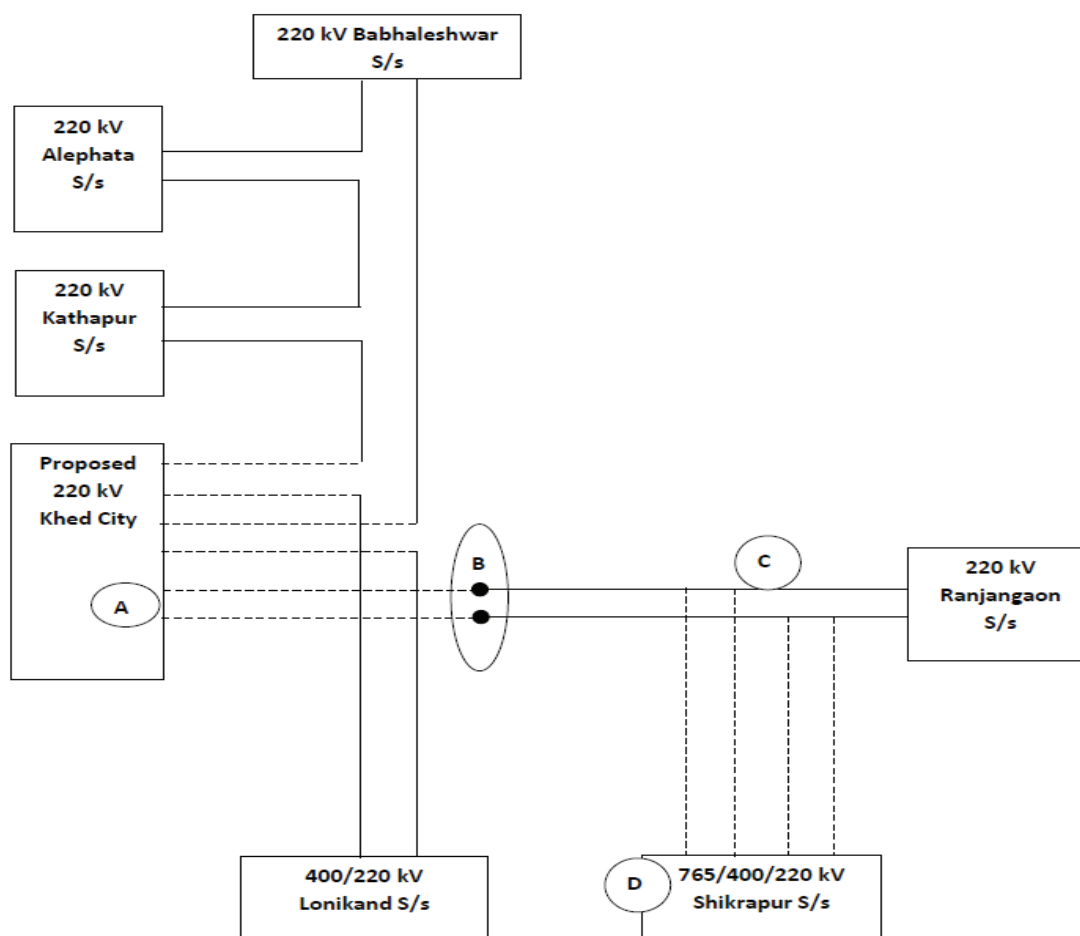
- (i) 220 kV level creation at 765/400 kV Pune GIS (Shikrapur) S/s along with 2x500 MVA, 400/220 kV ICT at 765/400 kV Pune GIS (Shikrapur)
- (ii) 220 kV line bay - 4 nos. at 765/400 kV Pune GIS (Shikrapur) S/s.

### B. As a part of STU system:

- (i) Reorientation and termination of 220 kV Babhleshwar – Ranjangaon ckt & Lonikand –Ranjangaon ckt at Point-B.
- (ii) 220 kV Khed City – Point B (Ranjangaon) D/C line – 13.5 km (STU Plan Year 2022-23)
- (iii) LILO on both ckts of 220 kV Khed City – Ranjangaon D/C line at 765/400/220 kV Pune GIS (Shikrapur) S/s – LILO distance 5 km. (STU Plan Year 2022-23)

SLD for proposed 220 kV Network from 765/400/220 kV Pune GIS (Shikrapur) S/s is as follows:

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**Point A – Point B = 13.5 km Proposed D/C line**  
**Point C – Point D = 5 km proposed M/C line**

In the 2<sup>nd</sup> meeting of WRPC(TP) meeting, the issue of 'n-1' non-compliance of proposed 2x500 MVA, 400/220 kV ICTs at Pune GIS (Shikrapur) was highlighted as adequate space was available for implementation of only for 2 nos. 500 MVA, 400/220 kV ICTs and 4 nos. of 220 kV line bays.

- 10.2.** On the query of space availability, PGCIL confirmed that adequate space is available for implementation of 3x500 MVA, 400/220 kV ICTs and 4 nos. of 220 kV bays, only if the scheme is implemented as GIS.
- 10.3.** After detailed deliberations, members agreed in principle with the implementation of the following scheme as an inter-state scheme:
- (i) Creation of 220 kV level (GIS) at 765/400 kV Shikrapur (PGCIL) Substation with 3x500 MVA, 400/220 kV ICTs and 4 nos. of 220 kV line bays.

MSETCL was requested to submit the complete proposal after deliberations with PGCIL along with the 220 kV outlets and their implementation time frame.

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## 11. Transmission system strengthening beyond Kolhapur for export of power from Solar & Wind Energy Zones in Southern Region

11.1. CEA stated that the following transmission system had been agreed in the 2<sup>nd</sup> SRSCT meeting held on 10.06.2019 for evacuation of power from Solar Energy Zone in Gadag, Karnataka:

### Gadag SEZ (2500 MW)

- i. Establishment of 400/220 kV, 5x500 MVA Gadag Pooling Station.
- ii. Gadag PS-Koppal PS 400 kV (high capacity equivalent to quad moose) D/C Line.
- iii. Gadag PS-Narendra (New) PS 400 kV (high capacity equivalent to quad moose) D/C Line.
- iv. 220 kV line bays for interconnection of solar projects (8 nos.)
- v. 1x125 MVA (400 kV) bus reactor at Gadag PS.
- vi. Upgradation of Narendra (New) to its rated voltage of 765 kV level alongwith 2x1500 MVA transformer and 1x330 MVA Bus Reactor.
- vii. Upgradation of Kolhapur (PG) to its rated voltage of 765 kV level alongwith 2x1500 MVA transformer and 1x330 MVA Bus Reactor.
- viii. Upgradation/charging of Narendra new - Kolhapur (PG) 765 kV D/c line (initially charged at 400 kV) to its rated voltage of 765 kV along with 1x330 MVA switchable Line Reactor on Kolhapur (PG) end of each circuit.

It was also noted that the proposed system strengthening in the inter-regional corridors and system strengthening beyond Kolhapur in Western region shall require all-India study.

11.2. Further, in the 3<sup>rd</sup> meeting of NCT held on 20<sup>th</sup> & 28<sup>th</sup> January, 2021, it was agreed that Strengthening of Kolhapur (PG) - Kolhapur (MSETCL) 400 kV section may be taken in WRPC(TP) based on the operational constraint reported by POSOCO.

Subsequently, POSOCO vide letter dated 02.02.2021 (Annexure-IX) has intimated that during Dec'20 – Jan'21, the power flow in the Kolhapur (PG) - Kolhapur(MSETCL) 400kV D/c line has been observed very high with 'N-1' non-compliance. NLDC and RLDCs are taking various measures in operations such as reduction in power order of HVDCs toward southern region (Talcher – Kolar, Bhadravati, Raigarh – Pugalur) to relieve the loading of Kolhapur (PG) - Kolhapur(MSETCL) 400 kV D/c line.

11.3. System studies were carried out with the following considerations:

- i. Scenario: Solar Max (June, 24 Afternoon Peak) with high generations in Narendra complex (Kudgi, Raichur, Bellary, Gadag SEZ & Koppal WEZ)
- ii. All India Demand of 235GW considered (against EPS demand of 266GW)
- iii. Demand for WR & SR as 73 GW & 56 GW respectively (against 19<sup>th</sup> EPS demand of 85 GW & 75 GW respectively)
- iv. For simulating the worst case scenario:
  - 100% Solar Despatch has been considered at Gadag SEZ (2500MW)
  - 85% Wind Despatch has been considered at Koppal WEZ (2500MW)
  - 90% Thermal Despatch has been considered at Kudgi TPS (3x800MW)



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With this, the Net SR Surplus in Solar Max scenario works out to 7800 MW with SR to WR inter-regional flow to the tune of 9300 MW. LGB is shown at Annexure-X.

- v. Narendra New existing 765/400kV 2x1500MVA ICTs are seen to be heavily loaded in all study cases. Hence, addl. (3<sup>rd</sup>) 1x1500MVA, 765/400kV ICT has also been considered at Narendra New S/s. System strengthening, if any, in Southern Region is out of the scope of the present study.
- vi. LILO of both circuits of Warora Pool – Parli (PG) 400 kV D/c line at Parli (M) (Implementation by MSETCL) has been considered in studies as agreed in the 2<sup>nd</sup> WRPC(TP) meeting held on 04.09.2021 and needs to be expedited by MSETCL.

11.4. The following alternatives were studied and the study results are attached as Annexure- XI:

- i. Kolhapur (PG) (GIS) - Kolhapur (MH) reconductoring with conductor of min capacity of 2100 MVA at nominal voltage & with Kolhapur 765/400kV 3<sup>rd</sup> 1500MVA ICT
- ii. Kolhapur (PG) (GIS) - Kolhapur (MH) 2<sup>nd</sup> D/c line with conductor of minimum capacity of 2100 MVA at nominal voltage & with Kolhapur 765/400kV 3<sup>rd</sup> 1500MVA ICT
- iii. Kolhapur (PG) (GIS) - Pune (PG) (GIS) 765 kV D/c line along with Kolhapur (PG) (GIS) - Kolhapur (MH) reconductoring with conductor of min capacity of 2100 MVA at nominal voltage\*
- iv. Kolhapur (PG) (GIS) - Solapur (PG) 765 kV D/c line along with Kolhapur (PG) (GIS) - Kolhapur (MH) reconductoring with conductor of minimum capacity of 2100 MVA at nominal voltage
- v. LILO of Solapur (PG) – Pune (PG) (GIS) 765 kV S/c line at Kolhapur PG along with Kolhapur (PG) (GIS) - Kolhapur (MH) reconductoring with conductor of min capacity of 2100 MVA at nominal voltage\*
- vi. Narendra New – Solapur (PG) 765kV D/c line along with Kolhapur (PG) (GIS) - Kolhapur (MH) reconductoring with conductor of min capacity of 2100 MVA/Ckt at nominal voltage and with Narendra-Madhugiri-Salem-Tuticorin charged at 400 kV & Narendra New-Kolhapur 765 kV D/c line charged at 400 kV

11.5. CTU stated that Alt- iii is providing an additional path to Pune S/stn which is a load centre.

11.6. CEA stated that Alt-vi is technically feasible and a cost effective option involving Narendra New - Solapur (PG) 765 kV D/c line of appx.150 km. This would avert the need of upgrading Kolhapur to 765 kV level. Also, the losses in case of Alt-vi were observed to be minimum. Further, as far as providing additional path to Pune is concerned, it may be noted that Pune(GIS) is well connected at 765 kV and 400 kV level.

11.7. CTU stated that in case of Alternative vi, with full generation at Kaiga Nuclear Power Plant, there is possibility that Narendra New – Solapur (PG) 765 kV D/c line may become overloaded. Accordingly, before finalizing any alternative, it is suggested to hold a joint study meeting.

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- 11.8. POSOCO stated that there is a need to resolve the overloading of Kolhapur (PG) – Kolhapur 400 kV D/c line as the line is currently ‘n-1’ non-compliant.
- 11.9. CEA and CTU stated that as re-conductoring of Kolhapur (PG) – Kolhapur 400 kV D/c line is required in all alternatives, accordingly, the same can be agreed to be taken up.
- 11.10. After detailed deliberations, members agreed for the following:
- Re-conductoring of Kolhapur (PG) – Kolhapur 400 kV D/c line with conductor of minimum capacity of 2100 MVA/Ckt at nominal voltage along with bay upgradation work at Kolhapur (MSETCL).
  - The strengthening requirement beyond Kolhapur other than re-conductoring of Kolhapur (PG) – Kolhapur 400 kV D/c line would be studied in separate joint study meeting with CEA, CTU, WRPC & POSOCO.

<b>C. ToR 2(iii) – APPLICATIONS FOR CONNECTIVITY AND ACCESS</b>
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## 12. Summary of the connectivity and LTA granted in the connectivity and LTA meetings of WR

### 12.1. Stage-II Connectivity granted to RE developers in Western Region

The details of stage-II connectivity / RE connectivity (within own premises) granted to RE applicants from 44<sup>th</sup> to 55<sup>th</sup> meetings of WR constituents for Connectivity & Long-term Access applications in Western Region is tabulated below:

Sl	Name of Applicant (Organization)	Stage-II Application No	Stage-II Conn Quantum (MW)	Date: Stage-II connectivity required	Criteria Stage II*	Proposed ISTS System for Stage-II connectivity	Dedicated Transmission System for Stage-II connectivity (under scope of applicant)
1.	Srijan Energy Systems Private Limited	1200002419	150	15/01/2021	A SECI Tr-VI (Wind)	<b>Bhuj-II PS (GIS) (New)</b> <ul style="list-style-type: none"> <li>Establishment of Bhuj II PS with at least 1x1500MVA (765/400kV), 1x500MVA (400/220kV) ICTs</li> <li>Reconfiguration of Bhuj PS – Lakadia PS 765kV D/c line so as to</li> </ul>	Srijan Energy Systems Private Limited - Bhuj-II PS 220kV S/c line along with associated line bays at generation end

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Sl	Name of Applicant (Organization)	Stage-II Application No	Stage-II Conn Quantum (MW)	Date: Stage-II connectivity required	Criteria Stage II*	Proposed ISTS System for Stage-II connectivity	Dedicated Transmission System for Stage-II connectivity (under scope of applicant)
						establish Bhuj II – Lakadia 765 kV D/c line as well as Bhuj -Bhuj II 765kV D/c line	
2.	Sherisha Rooftop Solar SPV Four Private Limited	1200002452	50	31/03/2021	A (REMCL LOA for 50MW <sup>^</sup> )	<b>Raipur (PG) S/s (existing)</b>	Sherisha Rooftop Solar SPV Four Private Limited - Raipur 220kV S/c line (capacity at least 300MW at nominal voltage) along with associated line bays at both ends
3	Adani Renewable Energy Holding Four Ltd. (Erstwhile Adani Green Energy Four Limited)	1200002437	500	01/07/2022 <sup>s</sup>	A [Solar PV Power plant (2000MW) linked with Solar PV Manufacturing Plant (500MW per annum)]	<b>Khavda PS (GIS)</b> <ul style="list-style-type: none"> <li>Establishment of Khavda 765/400kV, 1x1500MVA, 400/220kV, 1x500MVA PS (GIS)</li> <li>Khavda PS (GIS) – Bhuj PS 765 kV D/c line</li> </ul>	Adani Green Energy Four Limited - Khavda PS(GIS) 400kV S/c line (on D/c towers)* (with minimum power carrying capacity of 1250MW per ckt at nominal votage) along with associated line bays at generation end <b>(Implementation of 400kV GIS bay at ISTS end to be under ISTS scope)</b>
3.	Masaya Solar Energy Private Limited	1200002397	300	02/08/2021	A SECI Tr-VI (Solar)	<b>Khandwa (PG) (existing)</b>	Masaya Solar Energy Private Limited - Khandwa(PG) 220kV S/c line <sup>s</sup> along with associated line bay at both ends (under the scope of applicant)
4.	Adani Wind Energy Kutchh Three Limited (Erstwhile Adani Green Energy Three Limited)	1200002773	250	30/10/2020	A SECI Tr-VI (Solar)	Bhuj PS (existing)	<ul style="list-style-type: none"> <li>Interconnection of AGETL's wind project to Dayapar/Ratadiya PS (Established Stage-II connectivity to AGEMPL for its 175MW &amp; 300MW wind projects)</li> <li>Dayapar/Ratadiya Pooling Station - Bhuj PS 220kV D/c line (with capacity of at least 725MW at nominal voltage) along-with associated bays at Bhuj PS (nos. 219 &amp; 220) &amp;</li> </ul>

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Sl	Name of Applicant (Organization)	Stage-II Application No	Stage-II Conn Quantum (MW)	Date: Stage-II connectivity required	Criteria Stage II*	Proposed ISTS System for Stage-II connectivity	Dedicated Transmission System for Stage-II connectivity (under scope of applicant)
							generation switchyard (Existing line of AGEMPL and AGETL to share this line with AGE(MP)L's projects with application nos. 1200001362 at Dayapar/Ratadiya & 1200001484 at Chhugar/Atada)
5.	Adani Renewable Energy Holding Four Ltd. (Erstwhile Adani Green Energy Four Limited)	1200002678	2000	30/12/22 <sup>s</sup>	A [SECI LOA no. 37292 for 6000MW: Solar PV Power plant (3x2000MW) linked with Solar PV Manufacturing Plant (3x500MW per annum)]	Khavda PS (Proposed)	<ul style="list-style-type: none"> <li>Adani Green Energy Four Limited - Khavda PS(GIS) 400kV D/c line (with minimum power carrying capacity of 1250MW per ckt at nominal voltage) along with associated line bays at generation end</li> <li>Implementation of 2 no. 400kV GIS bay at Khavda PS end is under ISTS.</li> </ul>
6.	Adani Renewable Energy Holding Four Ltd. (Erstwhile Adani Green Energy Four Limited)	1200002679	1000	30/06/23 <sup>s</sup>			<ul style="list-style-type: none"> <li>Adani Green Energy Four Limited Pooling Station-2 (PS-2) - Khavda PS(GIS) 400kV S/c line (on D/c towers)* (with minimum power carrying capacity of 1250MW per ckt at nominal voltage) along with associated line bays at generation end.</li> <li>Implementation of 3rd 400kV GIS bay (total 3nos.) will be under ISTS</li> </ul>
7.	Continuum Power Trading (TN) Pvt Ltd	1200002879	90	01/10/2020	B L&A Mode	Bhuj PS (existing)	<ul style="list-style-type: none"> <li>Interconnection of CTN's wind project to Pooling Station of M/s IWISL (Dayapar) (Established for grant of connectivity to IWISL for its 500MW wind project)</li> <li>IWISL (Dayapar) - Bhuj PS 220kV D/c line along-with associated bays at Bhuj PS (AIS bay nos. 205 &amp; 208) &amp; generation switchyard (To be shared with</li> </ul>

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Sl.	Name of Applicant (Organization)	Stage-II Application No	Stage-II Conn Quantum (MW)	Date: Stage-II connectivity required	Criteria Stage II*	Proposed ISTS System for Stage-II connectivity	Dedicated Transmission System for Stage-II connectivity (under scope of applicant)
							IWISL's 500MW wind project with application no. 1200000390 at Dayapar) (Already commissioned)
8.	NTPC Ltd. (20 MW solar PV project)	1200002930 (Connectivity application)	20	08/06/2021	Under provision 2(1)(b)(i) (e) of CERC Connectivity Regulations, 2009 (and its amendments thereof)	Existing 220 kV switchyard of NTPC Jhanor Gandhar Gas Power Plant (JGGPP) (Principal generator)	<ul style="list-style-type: none"> <li>Interconnection with 220kV bus of the NTPC JGGPP</li> </ul>
9.	NTPC Ltd. (56 MW solar PV project)	1200002957 (Connectivity application)	56	21/07/2021	Under provision 2(1)(b)(i) (e) of CERC Connectivity Regulations, 2009 (and its amendments thereof)	Existing 220kV switchyard of NTPC Kawas Gas Power Plant (KGPP) (Principal Generator)	<ul style="list-style-type: none"> <li>Interconnection with 220kV Bus of NTPC KGPP</li> </ul>

**Note:**

^ LOA submitted with the application is in the name of M/s Refex Energy Limited (REL). Applicant has submitted REMCL letter dtd. 15.01.20 clarifying that above LOA (has been issued to the consortium of M/s Refex Energy Ltd. & M/s Sherisha Solar Pvt. Ltd. and for all practical and regulatory purposes, the LOA is deemed to have been issued by REMCL to 100% SPV of the consortium company i.e. M/s SRSSFPL (applicant) & can be utilized by the above SPV.

**12.2. LTA Applications from RE developers in Western Region**

Sl.	Name of Applicant (Organization)	Stage-I Connectivity Quantum Granted (in MW)	Stage-II Connectivity Details	ISTS substation for Stage-II connectivity	Seeking LTA for (MW)	Date of Receipt of App.	Date from which LTA sought	Date upto which LTA required	Beneficiaries for LTA	LTA Application No
1	Sitac Kabini Renewables Private Limited	300	300	Bhuj-II PS	300	28/12/19	30/06/21*	30/06/46	100MW-SR (Target) 200MW-NR (Target)	1200002413
2	Srijan Energy	150	150	Bhuj-II PS	50	12/03/20	15/03/21*	15/03/46	Goa (WR)	1200002522

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Sl.	Name of Applicant (Organization)	Stage-I Connectivity Quantum Granted (in MW)	Stage-II Connectivity Details	ISTS substation for Stage-II connectivity	Seeking LTA for (MW)	Date of Receipt of App.	Date from which LTA sought	Date upto which LTA required	Beneficiaries for LTA	LTA Application No
	Systems Private Limited									
3	Masaya Solar Energy Private Limited	300	300	Khandwa (PG) (existing)	300	27/01/20	25/03/22	25/03/47	SR (Target)	1200002451
4	Renew Wind Energy (AP2) Private Limited	300	300	Bhuj PS	37.5	17/09/20	20/11/20*	31/12/45	GRIDCO-ER	1200002862
5	Adani Wind Energy Kutchh Three Limited (Erstwhile Adani Green Energy Three Limited)	250	250	Bhuj PS	250	30/09/20	31/01/21*	31/01/46	40MW-Chandigarh Administration 85MW-UPPCL 75MW-KSEBL 50MW-GRIDCO Ltd.	1200002874
6	Continuum Power Trading (TN) Pvt. Ltd	140	90	Bhuj PS	50	22/10/20	31/12/20'	15/11/45	MPPMCL	1200002895
7	CLP India Pvt. Ltd	250.8	250.8	Jam Khambhal iya	250.8	10/12/20	22/04/22'	21/04/47	WR TARGET-170.7MW SR TARGET-80.1MW	1200002953

\* Or Availability of Transmission System for LTA, whichever is later

**Application at Sl. No. 1 & 2:**

For grant of LTA to the above applicant, the following transmission system was agreed:

- i) Establishment of 2x1500MVA (765/400kV), 4x500MVA (400/220kV) Bhuj-II PS (GIS)



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- ii) Reconfiguration/LILO of Bhuj PS – Lakadia PS 765kV D/c line at Bhuj-II PS so as to establish Bhuj II –Lakadia 765 kV D/c line and Bhuj-Bhuj II 765kV D/c line
  - iii) Establishment of 2x1500MVA, 765/400kV Lakadia PS
  - iv) Bhuj PS – Lakadia PS 765kV D/c line
  - v) LILO of Bhachau – EPGL 400kV D/c (triple) line at Lakadia PS
  - vi) Lakadia – Vadodara 765kV D/c line
- OR**  
Lakadia – Banaskantha 765kV D/c line

**Application at Sl. No. 3:**

Granted with existing system

**Application at Sl. No. 4,5 & 6:**

For grant of LTA to the above applicants, the following transmission system was agreed:

- i) Establishment of 2x1500MVA, 765/400kV Lakadia PS
  - ii) Bhuj PS – Lakadia PS 765kV D/c line
  - iii) LILO of Bhachau – EPGL 400kV D/c (triple) line at Lakadia PS
  - iv) Lakadia – Vadodara 765kV D/c line
- OR**  
Lakadia – Banaskantha 765kV D/c line

**Application at Sl. No. 7**

For grant of LTA to the above applicant, the following transmission system was agreed:

**Connectivity System for RE projects (1500 MW) in Dwarka (Gujarat)**

- i) Establishment of 4x500MVA, 400/220kV Jam Khambhaliya PS (GIS)
- ii) Extension of Essar–Lakadia/ Bhachau 400kV D/c (triple snowbird) line upto Jam Khambhaliya PS

**Common Strengthening Scheme required for LTA**

- i) Establishment of 2x1500MVA, 765/400kV Lakadia PS
  - ii) LILO of Bhachau – EPGL 400kV D/c (triple) line at Lakadia PS
  - iii) Bhuj PS – Lakadia PS 765kV D/c line
- OR**  
Lakadia – Vadodara 765kV D/c line
- OR**  
Lakadia – Banaskantha 765kV D/c line

**12.3. MTOA Details**

Total MTOA quantum of 200.77 MW has been granted after the 1st WRPCTP

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meeting with drawl in WR (MPPMCL-58MW, JITPL-142.77MW). MTOA of 13.65MW with injection in WR is granted after 1<sup>st</sup> WRPCTP meeting.

**12.4. Offering the Stage-II connectivity grantees at Bhuj-II PS an opportunity to get connected at Bhuj PS [44th WR Conn/LTA meeting held on 28.01.2020]**

In the 44th WR Conn/LTA meeting held on 28.01.2020, It was informed that CERC vide common order dated 13.01.2020 in the Petition Nos. 56/MP/2019, 57/MP/2019 & 58/MP/2019 filed by M/s Vaayu Renewable Energy (Sironj) Private Ltd., M/s Vaayu Renewable Energy (Kaveri) Private Ltd. & M/s Vaayu Renewable Energy (Krishna) Private Ltd. respectively has directed to revoke the Stage-II connectivity granted to the 3 nos. projects of Vaayu (Sironj: 300MW, Kaveri: 250MW & Krishna: 300MW). Accordingly, the Stage-II connectivity granted to the above projects has been revoked vide letters dated 17.01.2020. With this, 3 nos. 220kV bays (Nos. 222, 223 & 231) are now available at Bhuj PS.

In this regard, it was informed that some Stage-II connectivity grantees at Bhuj-II PS had initially requested for connectivity grant at Bhuj PS but were instead granted connectivity at Bhuj-II PS on account of technical/physical limitations in providing additional connectivity at Bhuj PS. With the availability of 3 nos. 220kV bays at Bhuj PS, it was proposed to offer the Stage-II connectivity grantees at Bhuj-II PS an opportunity to get connected at Bhuj PS through a joint exercise based on their willingness & as per priority defined by the date of Stage-II application.

Out of the various grantees at Bhuj-II PS, only M/s Netra showed willingness to get connected at Bhuj PS keeping all other terms and conditions of the earlier connectivity / LTA grants unchanged. M/s NWPL also requested that the 220kV bay at Bhuj PS end may be implemented under ISTS and the same was agreed in the meeting. The transmission system for LTA was also modified with the above change in connectivity point from Bhuj-II PS to Bhuj PS as per details given below:

<b>Transmission system required for LTA as per original intimation dated 06.03.2019</b>	<b>Revised Transmission system required for LTA (after shifting of connectivity point from Bhuj-II PS to Bhuj PS)</b>
<b>Transmission system strengthening at Bhuj-II PS:</b> <ol style="list-style-type: none"> <li>1. Establishment of 2x1500MVA (765/400kV), 4x500MVA (400/220kV) Bhuj-II PS (GIS)</li> <li>2. Reconfiguration of Bhuj PS – Lakadia PS 765kV D/c line at Bhuj-II PS so as to establish Bhuj</li> </ol>	<ol style="list-style-type: none"> <li>i) Establishment of 2x1500MVA, 765/400 kV Lakadia PS</li> <li>ii) Bhuj PS – Lakadia PS 765 kV D/c line</li> <li>iii) LILO of Bhachau – EPGL 400 kV D/c (triple snowbird) line at Lakadia PS</li> <li>iv) Lakadia – Vadodara 765kV D/c</li> </ol>

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Transmission system required for LTA as per original intimation dated 06.03.2019	Revised Transmission system required for LTA (after shifting of connectivity point from Bhuj-II PS to Bhuj PS)
<p>II – Lakadia 765 kV D/c line and Bhuj PS -Bhuj II PS 765 kV D/c line.</p> <p><b>Western Region Strengthening Scheme-21 (WRSS-21)</b></p> <p><b>PART-A</b></p> <p>i) Establishment of 2x1500MVA, 765/400kV Lakadia PS</p> <p>ii) Bhuj PS – Lakadia PS 765kV D/c line</p> <p>iii) LILO of Bhachau – EPGL 400kV D/c (triple) line at Lakadia PS</p> <p><b>PART-B</b></p> <p>iv) Lakadia – Vadodara 765kV D/c line</p>	<p>line (Time-line as per TSA: Dec-20)</p> <p><b>OR</b></p> <p>Lakadia – Banaskantha 765kV D/c line (Time-line as per TSA: Jun-21)</p>

### 12.5. LTA Applications from RE/ Conventional developers in other regions with drawl in Western Region

Sl. No.	Application No.	Applicant	Location	Date of Application	LTA (MW)	Beneficiaries (MW)	Date of start of LTA
1	1200002422	SBE Renewables Ten Pvt Ltd	Jaisalmer, Rajasthan	31.12.2019	450	Target (NR): 50MW Target (WR): 400MW. Subsequently firmed up as HPPC (NR): 50MW CSPDCL (WR): 400MW	07.05.2021
2	1200002477	Azure Power India Pvt Ltd	Jodhpur, Rajasthan	19.02.2020	200	MPPMCL (firm)	15.10.2020
3	1200002454	Tata Power Renewable Energy Ltd	Jaisalmer, Rajasthan	30.01.2020	150	Target (WR)	01.07.2021

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Sl. No.	Application No.	Applicant	Location	Date of Application	LTA (MW)	Beneficiaries (MW)	Date of start of LTA
4	1200002634	Renew Surya Roshni Pvt Ltd	Jaisalmer, Rajasthan	09.06.2020	400	WR (Target)-200MW NR (Target)-200MW	01.08.2022
5	1200002639	Altra Xergi Power Pvt. Ltd.	Jaisalmer, Rajasthan	09.06.2020	380	WR (Target)-330MW NR (Target)-50MW	01.08.2022
6	1200002650	NTPC Ltd	Ramagundam, Telangana	29.06.2020	100	NTPC, Kudgi NTPC Solapur NTPC Mauda	01.03.2021
7	1200002494	Madhya Bharat Power Corporation Limited	Rongnichu HEP, Sikkim	29.02.2020	96	WR: Chhattisgarh State Power Distribution Company Limited (CSPDCL)	31.01.2021

12.6. Members noted.

<b>D.R 2(iv) – REVIEW OF UPSTREAM AND DOWNSTREAM NETWORK</b>
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**13. Status of downstream 220kV or 132kV network by STUs from the various commissioned and under-construction ISTS substations**

The status of the 220 kV line bays from various 400/220 kV ISTS substations as well as downstream network is updated in the table below:

Sl. No	ISTS S/s	Voltage ratio, Trans. Cap	Un utilised bays	Status of ISTS bay	Lines for unutilised bays	Status of Lines
<b>WR</b>						
1	Mapusa (PG)	400/220kV (3x315 MVA)	2	Existing bay	Mapusa – Cuncolin 220 kV D/c line	Anticipated DOCO Sep'20 <b>3<sup>rd</sup> WRPC(TP)</b> : GED did not attend the meeting
			2		Mapusa– Tuem 220 kV D/c line	The agency has been finalized for carrying out work from Mapusa to Tuem D/C line with GIS S/ s at Tuem. The work will be awarded after the receipt of approval from the Govt. The completion period will be 20 months from the date of award (As per 2nd WRSCT Minutes). <b>3<sup>rd</sup> WRPC(TP)</b> : GED did not attend the meeting
2	Navsari	400/220 kV (2x315MVA + 1x500 MVA)	2	Existing bay	Navsari – Bhestan 220kV D/c line	M/s DGENTPL is not taking up the implementation of the scheme. Assigned to PGCIL on RTM basis. <b>3<sup>rd</sup> WRPC(TP)</b> : PGCIL updated <b>September,2021</b> as expected completion schedule.
3	Pirana	400/220kV (2x315MVA)	2	Existing bay	Pirana – Barjadi 220 kV D/c line	December, 2020 <b>3<sup>rd</sup> WRPC(TP)</b> : GETCO updated <b>Dec,2021</b> as expected completion schedule.
4	Vadodara GIS	400/220 kV (2 x 500 MVA)	2	Existing bay	220 kV Jhambua – Vadodara D/ C Line	April/May, 2020 <b>3<sup>rd</sup> WRPC(TP)</b> : Commissioned on <b>Dec,2020</b> .
5	Indore (PG)	400/220 kV (2 x 500 MVA)	2	Existing bay	LILO portion of 220kV line for	2 years after the award of contract. Approximate award schedule is April, 2020.

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Sl. No	ISTS S/s	Voltage ratio, Trans. Cap	Un utilised bays	Status of ISTS bay	Lines for unutilised bays	Status of Lines
					Indore(NZ) 220kV S/S upto Indore(PGCI L) 765kV S/s	<b>3<sup>rd</sup> WRPC(TP):</b> MPPTCL has intimated that work has already been started. The expected commissioning schedule is <b>March, 2022.</b>
6	Wardha	400/220 kV (2x315 MVA)	2	Existing bay	Wardha – Yavatmal 220 kV D/c line	Under construction, May 20 <b>3<sup>rd</sup> WRPC(TP):</b> MSETCL updated <b>December,2021</b> as expected completion schedule.
7	Solapur	400/220 kV (2x315 +1x500 MVA)	2	Existing bay	Solapur – Bale (M) 220kV D/c line	Mar'20 <b>3<sup>rd</sup> WRPC(TP):</b> MSETCL updated <b>March,2022</b> as expected completion schedule as severe RoW problem is there. Also updated that Karjat S/s would be commissioned by March'22.
			2		Solapur – Narangwadi 220 kV D/c line	Mar'20 <b>3<sup>rd</sup> WRPC(TP):</b> MSETCL updated <b>September,2021</b> as expected completion schedule.
8	Navi Mumbai	400/220 kV (2 x 315 MVA)	4	Existing bay	LILO of Apta – Talaja and Apta - Kalwa section of the Apta-Talaja/Kalwa 220 kV D/c line at Navi Mumbai (PG)	Agreed to be implemented as ISTS under WRSS-XIX. Comm. Sch. - 30 months from date of transfer of SPV. <b>3<sup>rd</sup> WRPC(TP):</b> CEA informed that SPV has acquired by M/s Sterlite Grid 13 Limited on 23.06.2020 and the <b>SCoD is 22.12.2023</b>

**400 kV line bays:**

S. No.	ISTS Substation	Proposed Bays	Commissioning Schedule	Lines emanating from Substation	Status of lines
1	Indore (PG)	2	July, 2018	Indore (PG) – Ujjain 400 kV D/c line	May' 2020 <b>3<sup>rd</sup> WRPC(TP):</b> MPPTCL informed that only 4 locations are remaining due to litigation. Expected to complete by <b>March, 2022.</b>



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**14. Status of 400kV and above level substations and transmission lines being implemented by STUs in WR under intra-state schemes**

14.1. In the meeting, it was agreed that STUs would furnish the details and update the status of planned / under construction 220 kV & above level sub-stations and transmission lines. Accordingly, only GETCO & CSPTCL had updated their status as given below:

S.No.	State	UC / Planned ckm	UC / Planned transformation capacity in MVA
1	Gujarat	4309	13500
2	Chhattisgarh	-	2870

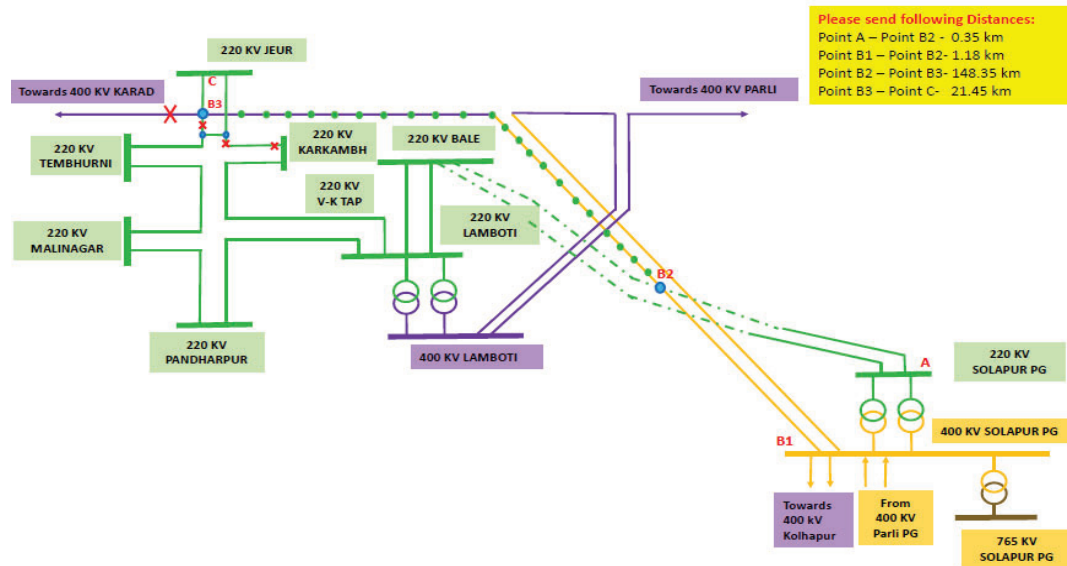
The details of UC / planned sub-stations and transmission lines are attached as Annexure-XII.

**E. ToR 2(v) – EXAMINE AND EVALUATE INTRA-STATE PROPOSALS**

**15. Restoration of 400 kV Solapur – Karad line to its original configuration**

15.1. CEA stated that MSETCL's proposal for charging a part of the existing 400 kV Solapur (PG)–Karad S/C line at 220 kV level using one circuit of under construction Solapur (PG)-Bale 220 kV D/C line as an interim arrangement, to solve the low voltage problems in Solapur District during agriculture peak load, was agreed in a meeting held on 12.04.2017 at CEA, New Delhi amongst CEA, CTU, POSOCO, MSETCL and RPTL. It was also agreed that the interim arrangement shall be disconnected by Dec, 2017 or after the completion of Solapur (PG) – Bale 220 kV D/C line, whichever is earlier.

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The MSETCL's proposal was ratified in the 42<sup>nd</sup> meeting of Standing Committee on Power System Planning of Western Region held on 17.11.2017.

In the 42<sup>nd</sup> SCPSPWR meeting, MSETCL had requested that the interim arrangement may be allowed to be continued beyond December 2017 and further till commissioning of proposed 400/220 kV Karjat S/s. WRLDC had requested that further time extension for charging 400 kV Sholapur (PG)–Karad S/C line at 220 kV level may not be considered as there would be evacuation constraints for Sholapur STPS.

In view of the concerns raised by MSETCL (low voltage after removal of interim arrangement) and WRLDC (evacuation constraint for Sholapur STPP due to continuation of interim arrangement), it was agreed that the issue may be further deliberated in OCC forum of WRPC. MSETCL was requested to expedite implementation of 400/220 kV Karjat S/s and 220 kV Sholapur (PG) – Bale D/C line.

- 15.2.** Regarding the current status of Karjat 400/220 kV substation, MSETCL stated that 400/220 kV Karjat S/s and 220 kV connectivity lines are currently under implementation and expected to be commissioned by March, 2022, which would relieve the low voltage problem in Jeur area during agriculture peak load. In the same time-frame, Solapur – Karad 400 kV S/c line would be restored to its original configuration.
- 15.3.** POSOCO stated that the above proposal was agreed as an interim arrangement upto Dec, 2017, but it is still being continued even after 4 years. Solapur-Kolhapur 400 kV D/c line becomes 'n-1' non-compliant in case of full generation at Solapur TPP especially after commissioning of 2<sup>nd</sup> unit of Solapur TPP.
- 15.4.** WRPC stated that the concern of WRLDC was flagged in OCC forum and it was observed that on account of severe RoW issues in Solapur area, the implementation of 400/220 kV Karjat S/stn alongwith 220 kV connectivity lines

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are getting delayed. With commissioning of Karjat 400/220 kV S/stn, the load of Jeur area would be fed from Karjat instead of Solapur side, thereby relieving the constraint observed on Solapur-Kolhapur 400 kV D/c line as well as low voltage problem being observed in Solapur area. Accordingly, MSETCL may be allowed to continue with the interim arrangement till March, 2022.

**15.5.** CEA stated that since the issue pertains to the implementation of already planned lines by MSETCL, the progress of the same can be monitored and perused at Western Region Power Committee level.

**15.6.** After detailed deliberations, the following was agreed:

- (i) MSETCL would be allowed to continue with the interim arrangement till March'2022.
- (ii) MSETCL shall expedite the implementation of Karjat 400/220 kV S/stn and Sholapur (PG) – Bale 220 kV D/c line.
- (iii) The progress with respect to implementation of aforesaid intra-state elements would be monitored by WRPC.

## **16. Evacuation of power beyond Warora**

**16.1.** CEA stated that the implementation issues associated with the scheme “Measures to control fault level at Wardha Substation” were discussed in the 2<sup>nd</sup> meeting of WRPC(TP) held on 04.09.2020. In the meeting, MSETCL had stated that after the implementation of bypass arrangement, overloading was observed in Warora (MSETCL) – Chandrapur-II 400 kV D/c quad line during outage of one circuit. In the meeting, it had been agreed that MSETCL would further study the proposal of (2<sup>nd</sup>) 400 kV line between Warora (M) - Chandrapur-II.

**16.2.** MSETCL stated that additional outlets from Koradi-II is under implementation to relieve the loading of Warora (MSETCL) – Chandrapur-II 400 kV D/c quad line. However, the implementation of the scheme “Measures to control fault level at Wardha Substation” may be taken only after adequate measures to relieve the overloading on Warora (MSETCL) – Chandrapur-II 400 kV D/c quad line are in place.

**16.3.** CEA stated that Wardha splitting scheme should not be linked with Warora strengthening as fault level of Wardha at present was already beyond the design limit. Therefore, the scheme needs to be implemented at the earliest.

**16.4.** POWERGRID stated that to establish the Wardha bus splitting scheme, some of the elements (400 kV line bays, section of 400 kV line) owned by MSETCL was to be utilised for ISTS purpose. To sort out the ownership issues and associated financial issues several requests were sent to MSETCL but no concrete proposal has been received till date.

**16.5.** MSETCL stated that intimation has already been sent to zonal office for meeting with POWERGRID for tower re-arrangement wrt Wardha splitting.

**16.6.** CTU stated that no overloading has been observed in Warora (MSETCL) – Chandrapur-II 400 kV D/c quad line in their studies.

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16.7. Member (Power System), CEA, stated that the issue with respect to usage of few of the towers and bays belonging to MSETCL as ISTS for implementation of Wardha splitting scheme was under deliberation for quite sometime, however, no progress can be seen. POWERGRID and MSETCL need to finalize the tower re-arrangement at Wardha S/s within a month and intimate the same to CEA.

16.8. After further deliberations, the following is agreed:

- (i). POWERGRID and MSETCL would finalize the modalities with respect to implementation of the scheme "Measures to control fault level at Wardha Substation" within a month and intimate the same to CEA.
- (ii). MSETCL would plan additional outlets from Warora (M), if required at the earliest and put up in the next meeting of WRPC(TP) for discussion.

### 17. Establishment of the proposed Kistampeth – Sironcha 132 kV SC line on DC tower as ISTS

17.1. CEA stated that MSETCL's proposal of establishment of 2X25 MVA, 132/33 kV substation at Sironcha along with 132 kV SCDC line from Kistampeth (Telangana State) with end bays each at Kistampeth and Sironcha S/s has been deliberated in the 1<sup>st</sup> meeting of WRSCT held on 05.09.2018, 2<sup>nd</sup> meeting of WRSCT held on 21.05.2019 and 1<sup>st</sup> meeting of WRPC(TP) held on 11.01.2020.

In line with the decision taken in the 1<sup>st</sup> meeting of WRPC(TP) held on 11.01.2020, the proposal was discussed in a separate meeting held on 14.08.2020 among CEA, WRPC, CTU, WRLDC, MSETCL & TSTRANSCO. Minutes of the meeting is enclosed as Annexure-XIII. In the meeting, the following was agreed:

- i. MSETCL has proposed establishment of Sironcha 132/33 kV substation to increase the redundancy of supply, improve the voltage profile and quality of power supply to Sironcha area. Currently existing Sironcha 66 kV substation was getting its feed through 132 km long line passing through dense forest area. The proposal to connect 132 kV Sironcha S/s with 132 kV Kistampeth S/s of Telangana State Transmission Company Limited through 132 kV line involves only 32 km line length and was forest free terrain. TSTRANSCO has agreed with the MSETCL proposal.
- ii. With no requirement of any ISTS scheme in Kistampeth area by Telangana, there was no merit in taking up the Kistampeth – Sironcha 132 kV SCDC line as an interstate scheme to serve a load of about 20 MW.
- iii. Kistampeth – Sironcha 132 kV S/C line, traversing two states is an interstate line, however its implementation has already been taken up by MSETCL based on bilateral agreement with TSTRANSCO. As agreed in the 1<sup>st</sup> WRSCT meeting held on 05.09.2018, the Sironcha 132/33 kV substation (MSETCL) would operate in radial mode from 132 kV Kistampeth S/s in Telangana.

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- iv. Regarding the commercial accounting of the energy transaction, WRPC to facilitate the same by deliberating the issue in Commercial Coordination Meeting.

17.2. Members noted the same.

**18. Permission for Charging of 125MVAR switchable bus cum line reactor at Sagar 400kV substation of MPPTCL**

- 18.1. CEA stated that as per the decision taken in the 2<sup>nd</sup> meeting of WRPC(TP) held on 04.09.2020 regarding permission of charging of 125 MVAR switchable bus cum line reactor at Sagar 400kV S/s on Satna (PGCIL)-Sagar (MP) 400kV S/c line, MPPTCL has furnished the the layout of Sagar S/s (attached as Annexure-XIV) along with the SLD depicting the operation of 125 bus reactor as line reactor and as bus reactor.

It is apparent that when 125 MVAR line reactor at Sagar end and 50 MVAR line reactor at Satna end are in service, it would result in overcompensation of the line. However, keeping the 125 MVAR line reactor out would result in non-utilisation of the assets.

- 18.2. WRLDC stated that permission for charging of 125 MVAR switchable bus cum line reactor at Sagar 400kV S/s on Satna (PGCIL)-Sagar (MP) 400kV S/c line was refused because of deviation from the scheme originally agreed in the Standing Committee forum.
- 18.3. CTU stated that charging of 125 MVAR bus cum line reactor would result in overcompensation of the Satna (PGCIL)-Sagar (MP) 400kV S/c line. Also, in case of auto-reclosing during the single phase line to ground fault, resonance effects may be observed.
- 18.4. WRPC stated that to resolve the issue of resonance, appropriate controls may be installed so that the 125 MVAR reactor at Sagar end gets bypassed during auto-reclosure and after the line stabilises, the reactor can be put back into service.
- 18.5. CEA stated that establishment of 400 kV Sagar S/s alongwith 125 MVAR bus reactor was approved under Green Energy Corridor-I (GEC-I) scheme and is being partly funded through NCEF grant. Non-availability of 50 MVAR line reactor at Sagar end of Sagar (MP) – Satna 400kV S/c line would result in non flexibility in charging the line from both ends. Accordingly, as agreed earlier, the implementation of 50 MVAR line reactor at Sagar end and 125 MVAR bus reactor at Sagar 400kV S/s needs to be implemented by MPPTCL as per the agreed scheme.
- 18.6. MPPTCL stated that 125 MVAR reactor could be implemented as bus reactor, However, the installation of 50 MVAR line reactor may take some time as it is to be procured fresh before installation.
- 18.7. After detailed deliberations, the following was agreed:  
Interim arrangement:  
(i). MPPTCL may be allowed to charge 125 MVAR switchable bus cum line reactor at Sagar 400kV substation with the installation of intertrip scheme so that reactor could be bypassed during the auto-reclosing.

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Final arrangement:

- (i). Implementation of 125 MVAR bus reactor at Sagar S/s – by MPPTCL
- (ii). Implementation of 50 MVAR switchable line reactor at Sagar end of Satna (PGCIL)-Sagar (MP) 400kV S/c line – by MPPTCL
- (iii). MPPTCL would intimate the progress of implementation of the final arrangement in next meeting of WRPC(TP)

## 19. Other Agenda points by MPPTCL

### 19.1. Installation of 3<sup>rd</sup> 3x315 MVA, 400/220 kV ICT at Astha S/s of MPPTCL

19.1.1. CEA stated that MPPTCL vide letter dated 24.02.2021 has intimated that currently 2 nos. of 2x315 MVA, 400/220 kV ICTs are installed at Astha S/s. The maximum load on ICTs recorded during the last three years is given below:

Installed Capacity	Max. Load during 2018-19	Max. Load during 2019-20	Max. Load during 2020-21
630 MVA	558 MVA	533 MVA	547 MVA

The loading on the 400/220 kV ICTs at Astha is critical during peak load and is 'n-1' non-compliant. In view of this, MPPTCL has proposed to install 3<sup>rd</sup> 315 MVA, 400/220 kV ICT at Astha.

19.1.2. CEA enquired about the additional 220 kV outlets planned from Astha 400/220 kV substation. MPPTCL stated that no additional 220 kV outlets was planned. Only additional ICT was planned to overcome the high loading observed on the existing 2x315 MVA ICTs at Astha.

19.1.3. Based on the loading observed in the 2x315 MVA, 400/220 kV ICTs, members agreed for the installation of 3<sup>rd</sup> 315 MVA, 400/220 kV ICT at Astha by MPPTCL.

### 19.2. Installation of additional ICTs at ISTS sub-stations in MP

19.2.1. CEA stated that MPPTCL vide letter dated 05.02.2021 has intimated that the additional ICTs at Jabalpur, Itarsi, Gwalior, Seoni, Morena and Shujalpur had been agreed in the Regional standing committee/ RPC(TP) meetings, but same are yet to be commissioned. Installation of ICT at above places is utmost required to handle the expected Rabi season electricity demand.

19.2.2. The details of the ICTs with the implementation time-frame as updated by POWERGRID is given below:

S.no.	ICT capacity	Sub-station	Name of the meeting	MoP OM regarding allotment	Implementation timeframe
1.	1x500 MVA	Jabalpur	41 <sup>st</sup> & 42 <sup>nd</sup> SCPSPWR	MoP OM No: 15/3/2018-Trans dated 21.08.2018 (MoM of 2 <sup>nd</sup> ECT)	July, 2021
2.	1x500 MVA	Itarsi	41 <sup>st</sup> & 42 <sup>nd</sup> SCPSPWR	MoP OM No: 15/3/2018-Trans	August, 2021



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				dated 21.08.2018 (MoM of 2 <sup>nd</sup> ECT)	
3.	1x500 MVA	Seoni	1 <sup>st</sup> WRPC(TP)	MoP OM No: 15/3/2018-Trans- Pt(2) dated 25.09.2020.	July, 2022
4.	1x500 MVA	Morena	1 <sup>st</sup> WRPC(TP)	MoP OM No: 15/3/2018-Trans- Pt(2) dated 25.09.2020	Dec, 2021
5.	1x500 MVA	Shujalpur	2 <sup>nd</sup> WRPC(TP)	MoP OM No. 15/3/2018-Trans- Part(1) dated 16.07.2021.	In matching time frame of Reconductor ing of Shujalpur (PG) Shujalpur (MP) 220 kV D/c line by MPPTCL.

- 19.2.3. CEA stated that the commissioning schedule of 1x500 MVA, 400/220 kV ICT at Seoni should be December, 2021 as per the MoP OM dated 25.09.2020 in which 15 months time-frame was given to POWERGRID to install the ICTs from the date of MoP OM. POWERGRID stated that they will try to commission 1x500 MVA, 400/220 kV ICT at Seoni as early as possible.
- 19.2.4. MPPTCL stated that load in and around Gwalior area is increasing and as per their studies an additional ICT is required in Gwalior to meet the demand of MP.
- 19.2.5. CTU stated that shifting of 1x315 MVA, 400/220 kV ICT was agreed in 42<sup>nd</sup> meeting of SCPSPWR, however, the same was dropped in the 43<sup>rd</sup> meeting of SCPSPWR held on 11.05.2018 as 400/220 kV Morena S/s was coming in the same area.
- 19.2.6. Based on the request of additional ICT at Gwalior by MPPTCL, CTU has carried out load flow studies to ascertain the requirement of additional ICT at Gwalior. In the studies, electricity demand has been considered as 19400 MW in the time-frame of 2023-24 as intimated by MPPTCL vide letter dated 15.03.2021. The loading on the Gwalior ICTs were observed to be within limits (2x301 MW under 'n'-1 of 3<sup>rd</sup> ICT) even with NIL generation considered at Auraiya for simulating worst case. Further, POWERGRID has also intimated that there is no space for installation of any additional 400/220kV ICT at Gwalior S/s. Also, no overloadings were reported in the operational feedback of POSOCO.
- 19.2.7. Therefore, even in case of requirement of additional ICT at Gwalior, it was not possible to install the same due to space constraints. The other possibilities are replacement of existing 315 MVA ICTs with 500 MVA ICTs or

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planning of a new 400/220 kV substation for feeding 220 kV sub-stations located south of Gwalior depending upon load growth in the area.

## 20. Agenda points by CSPTCL

20.1. CEA stated that CSPTCL vide its letter no. 02-04/PL-25(F-1)/1315/Raipur dated 03.12.2020 has submitted the various issues being faced by them. To discuss the issues, a meeting was held on 17.12.2020. The summary of the discussions held in the meeting are given below:

Sl.No.	Agenda items submitted by CSPTCL	Decision taken in the meeting held on 17.12.2020
1.	High loading of NSPCL ICT's, requirement of 3 <sup>rd</sup> 315 MVA 400/220 kV ICT at 400/220 kV NSPCL S/s, Bhilai	The agenda items from S. No. 1 to 4 are basically to reduce the loading of ICT's at 400/220 kV NSPCL S/s, Bhilai. It was decided to study the various options in a separate joint study meeting with CEA, CTU, POSOCO, CSPTCL, NSPCL and BSP. NSPCL was also requested to see the feasibility of splitting of 400 kV bus at NSPCL. CSPTCL was requested to provide the details of 220 kV interconnection and their loads so that the studies could be carried out holistically.
2.	Rearrangement of 400 kV Bus at 400 kV S/s PGCIL Raipur	
3.	Rearrangement of 220 kV Bhatapara-Raipur (PGCIL) & 220 kV Bhilai-Siltara lines as 220 kV Bhatapara-Bhilai & 220 kV Siltara-Raipur(PGCIL) lines	
4.	Rearrangement of 220 kV Raipur (PGCIL)-Khedamara & 220 kV Khedamara-Borjhara lines as 220 kV Raipur (PGCIL)-Borjhara line	
5.	Requirement of 3 <sup>rd</sup> 315 MVA 400/220 kV ICT at 400/220 kV Raigarh (PGCIL) S/s	Requirement of additional ICT would be studied is a separate joint study meeting with CEA, CTU, POSOCO & NSPCL.
6.	Requirement of 3 <sup>rd</sup> 315 MVA 400/220 kV ICT at 400/220 kV Bhatapara (PGCIL) S/s	Requirement of additional ICT would be studied is a separate joint study meeting with CEA, CTU, POSOCO & NSPCL.
7.	Request for providing 2 nos. of 400 kV feeder bays at 765/400 kV Sipat Pooling Station at Sipat, Bilaspur	CTU would provide the status of availability of space at 765/400 kV Sipat (Bilaspur) PS. The issue would be deliberated in a separate joint study meeting.
8.	Feasibility for extending 400 kV alternate source to 400/220/132 kV CSPTCL, Jagdalpur from 400/220 kV Jeypur (PGCIL) S/s, Orissa	It was decided to deliberate this issue in a separate joint study meeting. Since this involves interconnection of two regions, hence it needs deliberation in ERPC(TP) forum also.
9.	400 kV Khedamara-Kiranpur (MP) line is kept undesired switched off due to over voltage issue at Kiranpur end	CSPTCL was requested to take up this issue with MPPTCL directly. CSPCTL could approach CEA at later stage, if required.
10.	Request for providing 2 nos. of	CTU would provide the status of

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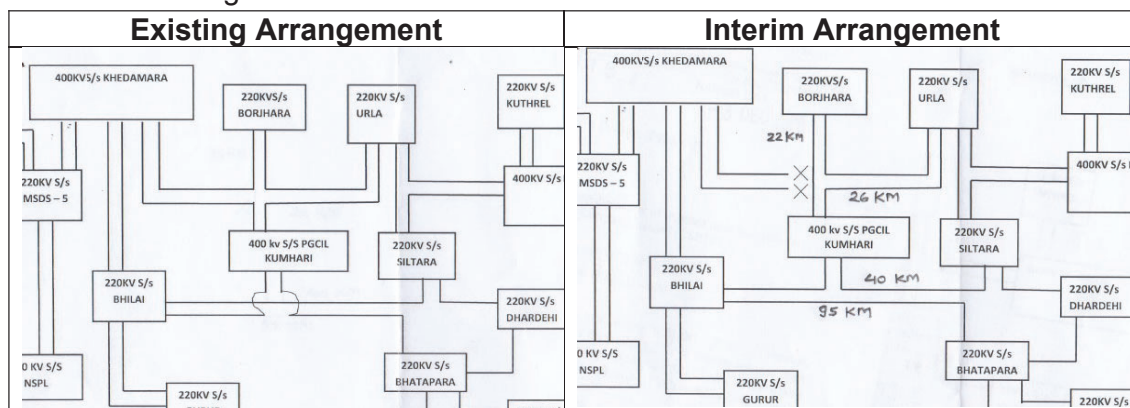
Sl.No.	Agenda items submitted by CSPTCL	Decision taken in the meeting held on 17.12.2020
	220 kV bays at 400/220 kV S/s Raipur (PGCIL)	availability of space at 400/220 kV Raipur S/s(PGCIL). The issue would be deliberated in a separate joint study meeting.

**20.2.** In addition to this, the issue of loading of DSPM-Korba(E) 220 kV S/c line was discussed in the 2<sup>nd</sup> meeting of WRSCT held on 21.05.2019. In the 43<sup>rd</sup> meeting of SCPSPWR held on 11.05.2018, CSPTCL had intimated that LILO of Siltara – Korba (E) S/C at DSPM was under implementation, which would be completed by Aug, 2018. However, the 2 no. of 220 kV bays at DSPM had to be provided by M/s CSPGCL, which were expected to be ready by December, 2019.

The issue of requirement of 3<sup>rd</sup> 315 MVA ICT at 400/220 kV Raigarh S/s has also been discussed in the 2<sup>nd</sup> meeting of WRSCT. In the meeting, it was observed that the loading under 'n-1' condition was marginal and the issue may be discussed in separate meeting with their STU.

**20.3.** Further, the issue of high loading of ICTs at NSPCL was deliberated in two meetings held on 15.01.2021 & 23.02.2021 respectively. The MoM of the meeting held on 23.02.2021 were issued vide CEA letter dated 23.03.2021 (attached as Annexure-XV). The following was agreed:

- (i) Re-arrangement of 220 kV feeders by CSPTCL
- Re-arrangement of 220 kV Khedamara – Borjhara S/s line & 220 kV Khedamara – Raipur S/c line to 220 kV Raipur – Borjhara S/c line.
  - Re-arrangement of 220 kV Raipur – Bhatapara S/c line & 220 kV Bhilai – Siltara S/c line to 220 kV Bhilai – Bhatapara S/c line & 220 kV Raipur – Siltara S/c line.
  - As intimated by CSPTCL the above re-arrangement provides marginal relief on NSPCL ICT ( 2x315 MVA) loadings. CSPTCL may implement the scheme and the same would be brought to the notice of WRPC(TP) forum in the next meeting.
  - Existing configuration and configuration after re-arrangement is as give below:



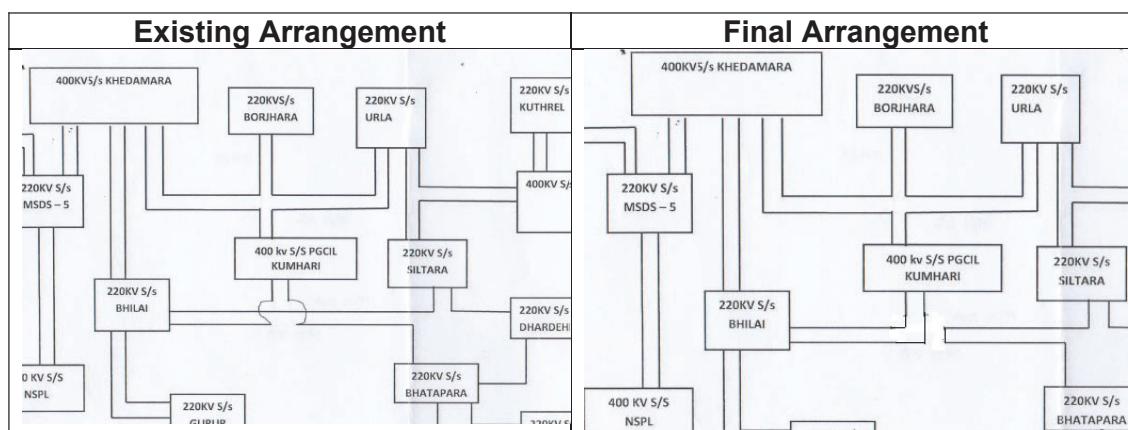
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(ii) Swapping of Circuit 2 & 3 of Chandrapur (Bhadravati) with Circuit 3 & 4 of Korba at 400 kV Bus of Raipur (PG) S/s.

- Along with swapping of 400 kV ckts Raipur (PG), CSPTCL to carry out the following re-arrangement of 220 kV lines to increase 220 kV feeds to Bhilai 220 kV substation:

Re-arrangement of 220 kV Bhilai – Bhatapara S/c line & 220 kV Raipur – Siltara S/c line so as to form 220 kV Bhilai – Raipur D/c line & 220 kV Bhatapara – Siltara S/c line- By CSPTCL

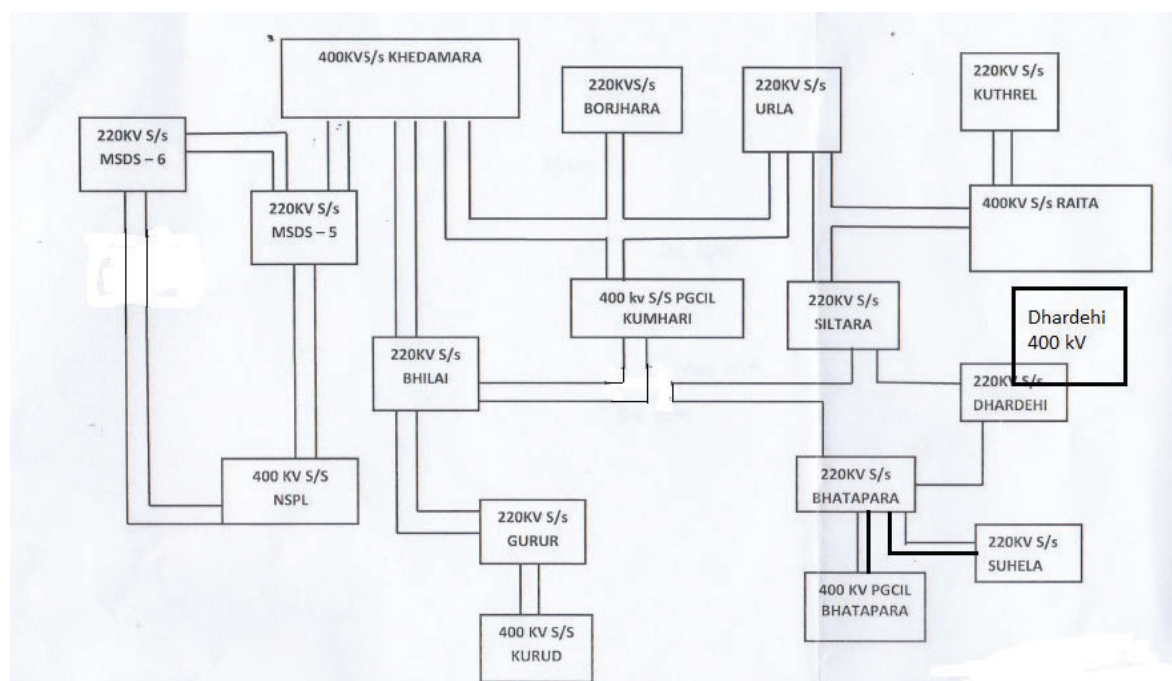
- CSPTCL had shown willingness to implement the swapping works with their own resources in view of the severe load management problem being faced by them due to restricted drawl capacity from ISTS.
- Scheme agreed in principle and the same would be taken up for ratification by WRPC(TP). Regarding the implementation modalities of the scheme, CSPTCL to deliberate with PGCIL and convey their decision wrt implementation of the scheme by CSPTCL or as an ISTS scheme
- Existing configuration and configuration after re-arrangement is as given below:



(iii) In addition CSPTCL would take up the implementation of the following schemes as Intra-state strengthening scheme:

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- Establishment of 400 kV Dhardehi S/s by LILO of one circuit of 400 kV Korba(W) – Raita D/c line and 400 kV Sipat – Dhardehi D/c line. Proposal would be included in the agenda for the next WRPCTP meeting.
- LILO of one ckt of 220 kV Bhatapara (PG) – Suhela line at Bhatapara (CSPTCL).
- The single line diagram showing proposals at (ii) and (iii) is as given below:



20.4. Further, a meeting was held on 12.04.2021 among CEA, CTU, POSOCO, POWERGRID & CSPTCL to discuss the implementation modalities of swapping of circuits 2 & 3 of Chandrapur (Bhadravati) with circuits 3 & 4 of Korba at 400 kV Bus of Raipur (PG) S/s. In the meeting, it was decided that the work would be implemented by CSPTCL as intra-state scheme under supervision of POWERGRID. Minutes of the meeting are enclosed as Annexure-XVI.

20.5. POWERGRID stated that swapping of Circuit 2 & 3 of Chandrapur (Bhadravati) with Circuit 3 & 4 of Korba at 400 kV Bus of Raipur (PG) S/s has already been completed as per the details given below:

Name of the feeder	Date of outage	Time	Date of restoration	Time
400kV RAIPUR-BHADRAVATI II	28-May-21	10:36	6-Jun-21	22:00
400kV RAIPUR-BHADRAVATI III	28-May-21	11:02	6-Jun-21	20:54
400kV KORBA-RAIPUR III	28-May-21	14:08	1-Jun-21	03:11
400kV KORBA-RAIPUR IV	28-May-21	14:15	4-Jun-21	19:03

20.6. Members noted the 220 kV re-arrangements proposed at point 20.3 and ratified the 400 kV bus swapping arrangement at Raipur (PG).



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20.7. Based on the ratification of 400 kV bus swapping arrangement at Raipur (PG) by Members and updates provided by CTU, CSPTCL & MPPTCL, the status of the issues highlighted by CSPTCL is as given below:

Sl.No.	Agenda items submitted by CSPTCL	Status
1.	High loading of NSPCL ICT's, requirement of 3 <sup>rd</sup> 315 MVA 400/220 kV ICT at 400/220 kV NSPCL S/s, Bhilai	The issue gets resolved with the implementation of agreed scheme at point 20.3.
2.	Rearrangement of 400 kV Bus at 400 kV S/s PGCIL Raipur	
3.	Rearrangement of 220 kV Bhatapara-Raipur (PGCIL) & 220 kV Bhilai-Siltara lines as 220 kV Bhatapara-Bhilai & 220 kV Siltara-Raipur(PGCIL) lines	
4.	Rearrangement of 220 kV Raipur (PGCIL)-Khedamara & 220 kV Khedamara-Borjhara lines as 220 kV Raipur (PGCIL)-Borjhara line	
5.	Requirement of 3 <sup>rd</sup> 315 MVA, 400/220 kV ICT at 400/220 kV Raigarh (PGCIL) S/s	No constraint reported in operational feedback of POSOCO regarding 'n-1' non-complaint of existing ICTs
6.	Requirement of 3 <sup>rd</sup> 315 MVA 400/220 kV ICT at 400/220 kV Bhatapara (PGCIL) S/s	Augmentation of 1x500 MVA, 400/220 kV ICT at Bhatapara is agreed.
7.	Request for providing 2 nos. of 400 kV feeder bays at 765/400 kV Sipat Pooling Station at Sipat, Bilaspur	CTU intimated that adequate space is available at 765/400 kV Bilaspur PS for implementation of 2 nos. of 400 kV bays
8.	Feasibility for extending 400 kV alternate source to 400/220/132 kV CSPTCL, Jagdalpur from 400/220 kV Jeypur (PGCIL) S/s, Orissa	CTU intimated that no space is available at 400/220 kV Jeypore (PG) S/s. To strengthen the Jagadalpur S/s, any other scheme needs to be evolved.
9.	400 kV Khedamara-Kirnapur (MP) line is kept undesired switched off due to over voltage issue at Kiranpur end	MPPTCL stated that 125 MVAR bus reactor is currently under implementation at 400/132 kV Kirnapur S/s of MPPTCL. The expected commissioning schedule of the 125 MVAR reactor is March, 2022.
10.	Request for providing 2 nos. of 220 kV bays at 400/220 kV S/s Raipur (PGCIL)	CSPTCL stated that the proposal to feed the proposed Ahiwara S/s from 400/220 kV Raipur (PG) S/s has been reviewed. Therefore, currently there is no requirement of 220 kV bays at 400/220 kV Raipur (PG) S/s.
11.	High loading of DSPM-Korba(E) 220 kV S/c line	The issue gets resolved with the establishment of LILO of Siltara –



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Sl.No.	Agenda items submitted by CSPTCL	Status
		Korba (E) S/C at DSPM. CSPTCL informed that the line work has already been completed. The bay work at DSPM end would be completed by <b>August, 2021</b> .

**20.8.** CEA stated that from Bhatapara (PG) 400/220 kV substation, there was one 220 kV ckt to Bhatapara (CSPTCL) and 3 circuits to Suhela. The loading on the Bhatapara (PG) – Bhatapara (CSPTCL) 220 kV S/c line is high in present scenario even with the existing 2x315 MVA, 400/220 kV ICTs t Bhatpara(PG) substation. With additional ICT at Bhatpara(PG), the loading on Bhatapara (PG) – Bhatapara (CSPTCL) 220 kV S/c line would further increase. Therefore, LILO of one circuit of Bhatapara (PG) – Suhela 220 kV T/c line at Bhatapara (CSPTCL) may be implemented in the time-frame of implementation of 1x500 MVA, 400/220 kV ICT at Bhatapara (PG).

**20.9.** After the detailed deliberations, following is agreed:

- (i). Implementation of 220 kV re-arrangements at CSPTCL network as proposed at point 20.3 – Under Intra-state
- (ii). Implementation of Swapping of Circuit 2 & 3 of Chandrapur (Bhadravati) with Circuit 3 & 4 of Korba at 400 kV Bus of Raipur (PG) S/s – Under Intra-state by CSPTCL
- (iii). Augmentation of 1x500 MVA, 400/220 kV ICT at Bhatapara (PG) – Under ISTS
- (iv). LILO of one circuit of Bhatapara (PG) – Suhela 220 kV T/c line at Bhatapara (CSPTCL) – Under Intra-state in the matching timeframe of implementation of 1x500 MVA, 400/220 kV ICT at Bhatapara (PG)- under intra-state by CSPTCL.
- (v). Establishment of 400 kV Dhardehi S/s by LILO of one circuit of 400 kV Korba(W) – Raita D/c line and 400 kV Bilaspur PS – Dhardehi D/c line – under intra-state by CSPTCL.

## **21. Scheme to control fault level at Indore S/s**

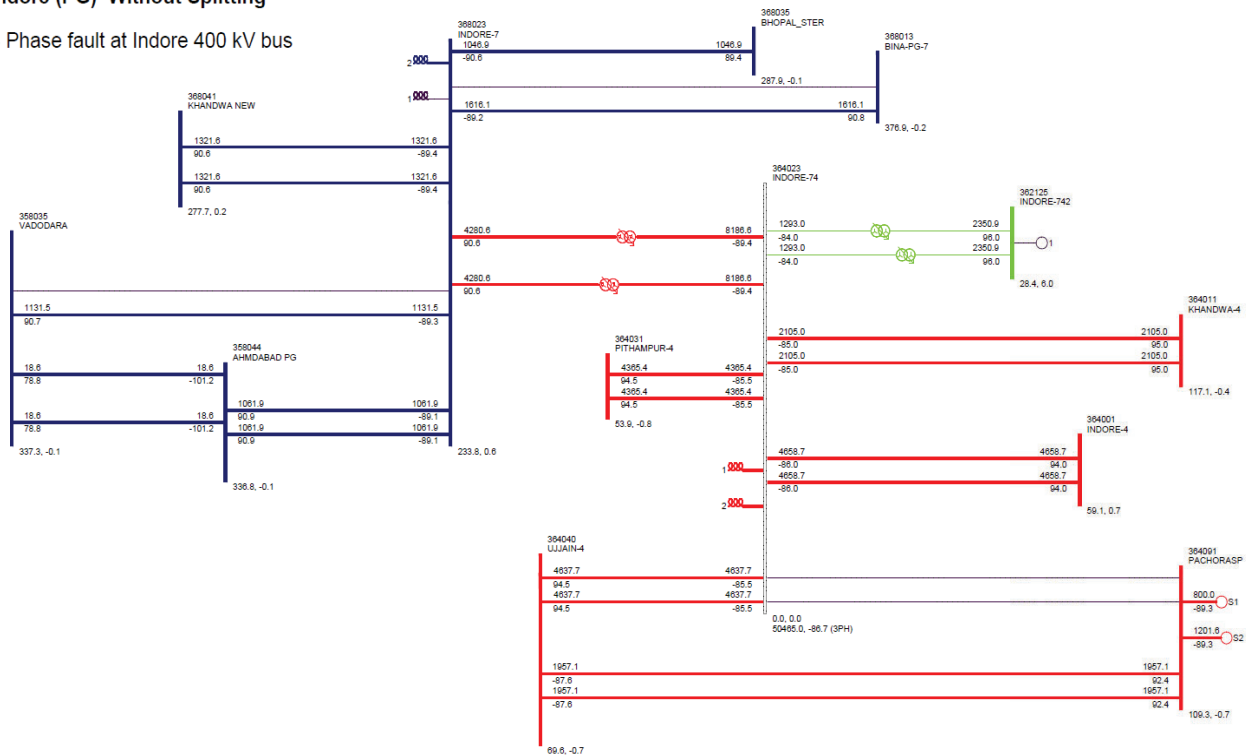
**21.1.** CEA stated that Indore 765/400/220 kV S/s in MP acts as a node for transfer of power from generation projects in MP and Gujarat to load centres in MP through high capacity 400 kV and 765 kV networks. A large number of RE generation projects are coming up in Gujarat whose power is getting dispersed through various substations (at 765kV level) including Indore (PG) for onward transfer of power to other parts of the grid resulting in high short circuit levels of interconnected grid. Short circuit level at Indore (PG) 400kV substation in 2022-2023 time-frame crosses 50 kA which is designed at 40kA. Even in the current time-frame, the fault level is about 42 kA.

Contributions from various 400kV lines can be seen from the diagram below (for high RE scenario):

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## Indore (PG) Without Splitting

3 Phase fault at Indore 400 kV bus



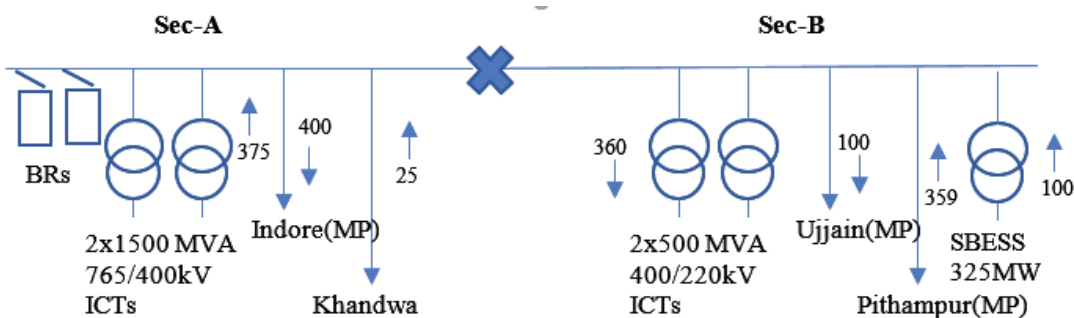
Accordingly, System study was carried out by CTU for 2022-23 time frame for High RE and Low RE scenarios to control the high fault level at Indore(PG) S/s keeping in view the fact that 765/400 kV ICTs, Indore (MP), Ujjain (MP) and Pithampur (MP) feeders are the major SC Fault contributors at Indore 400 kV (PG) S/s. Study results for various configurations are enclosed at Annexure-XVII.

- 21.2. CTU stated that insertion of series reactor instead of Bus splitting offers improved system reliability in view of no requirement of Bus segregation as the Bus sections remain coupled through the Series reactor. However, as per information received from Powergrid S/s, only 400 kV bus splitting can be done using GIS/hybrid bays. Installation of 400 kV Series reactor for Bus splitting and 400kV lines is not feasible as per site/layout constraints. Considering the same, the options studied for series bus/line reactors are not feasible to implement. Hence, it is observed that the fault level is within limits for alternatives 1, 4 & 6 (re-iterated below) along with peak short circuit values and load flows for evening peak scenario.

- **Alternative-1:** Bus Splitting without disturbing the existing lines/ICTs at Indore(PG) S/s
  - Section-A: 36kA & Section-B: 26kA

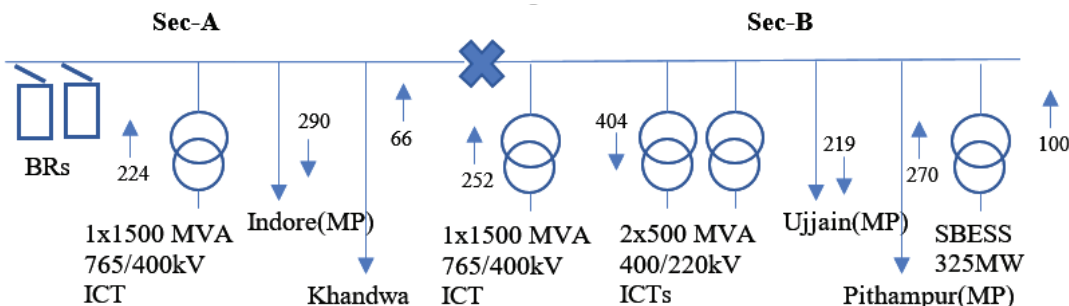
Diagram along with flows for peak load case is given below. Flow on sectionaliser when closed is 127 MW:

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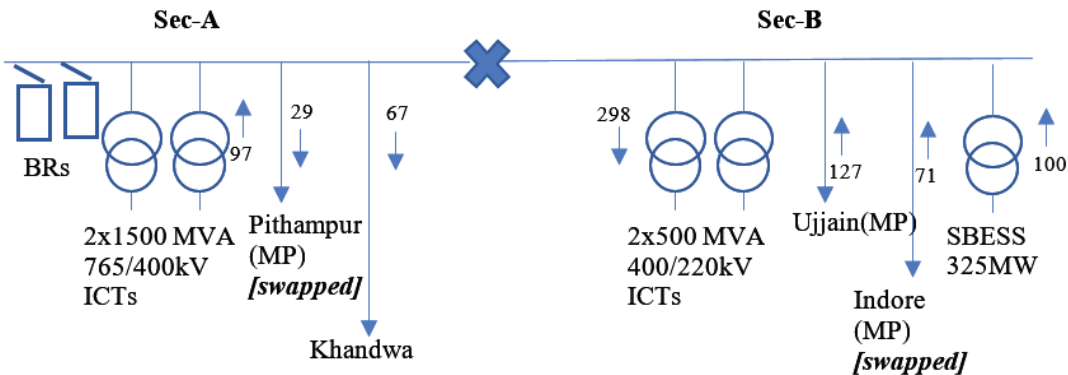
- **Alternative-4:** Bus Splitting along with shifting of 765/400 kV, 1X1500MVA ICT to Section B (through jumpering arrangement)
  - Section-A: 30 kA & Section-B: 36 kA

Diagram along with power flows for peak load case is given below. Flow on sectionaliser when closed is only 15 MW:



- **Alternative-6:** Bus Splitting along with swapping of Indore (PG)-Pithampur 400 kV D/c line (to Section A) and Indore (PG)- Indore(MP) 400 kV D/c line (to Section B)
  - Section-A: 34 kA & Section-B: 27 kA

Diagram along with flows for peak load case is given below. Flow on sectionaliser when closed is 395 MW:



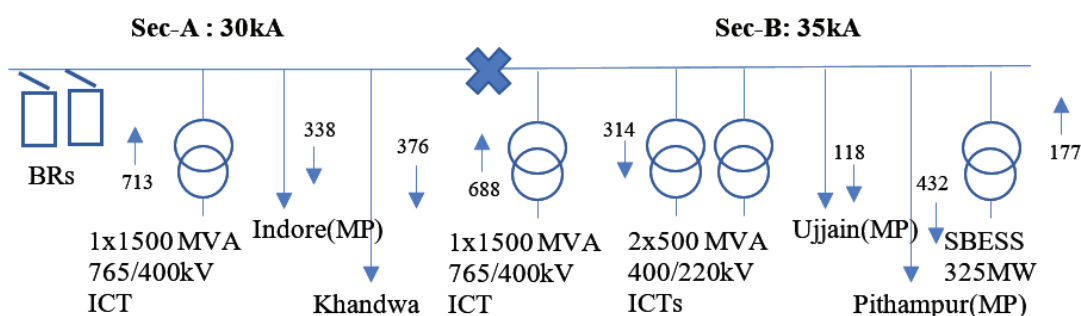
Among the three alternatives, power flow is balanced in both the sections in **Alternative-4** i.e. closing bus sectionaliser does not lead to significant flow from one

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section to another and hence the overall flow pattern is not disturbed before and after splitting. Further, 1x1500 MVA 765/400 kV ICT can be installed in Section-A in future for the above case. In case of outage of existing 1x1500 MVA 765/400 kV ICT on any of the sections, both the sections may be interconnected as per the requirement through the bus sectionaliser.

Power flow is not well balanced in both Alternatives 1 and 6. Further, **Alternative-6** requires line shifting which would be difficult to implement due to layout constraints. In each of the above cases, 1x125MVA bus reactor would be required in section B.

The splitting arrangement has also been studied for **Alternative-4** in **2024-25 High RE scenario (Afternoon Peak)** and SC level / flows are obtained as follows:



No issues were observed under 'n-1' of 765/400 kV ICT in either section.

In view of the above, it is proposed to split 400 kV bus of Indore S/s into two sections along with shifting of 765/400 kV, 1x1500MVA ICT to Section B (through jumpering arrangement) along with provision of 1x125 MVA bus reactor in section B.

- 21.3. After further deliberations, the implementation of alternative-4 to control the fault level at Indore (PG) was agreed.

## Annexure-I

List of the participants of the 3<sup>rd</sup> meeting of WRPC(TP) held on 14.06.2021 through Video Conferencing

Sl.	Name	Designation
<b>Central Electricity Authority</b>		
1.	Goutam Roy	Member (Power System)
2.	Ishan Sharan	Chief Engineer (PSPA-I)
3.	Awdhesh Kumar Yadav	Director (PSPA-I)
4.	Priyam Srivastava	Deputy Director (PSPA-I)
5.	Vikas Sachan	Deputy Director (PSPA-I)
6.	Tejas Patil	Assistant Director (PSPA-I)
<b>Western Region Power Committee</b>		
7.	S Satyanarayan	Member Secretary
8.	P.D. Lone	Superintendent Engineer
9.	Deepak Sharma	Executive Engineer
<b>Central Transmission Utility of India Limited</b>		
10.	Subir Sen	COO
11.	Ashok Pal	Dy. COO
12.	Partha Sarthi Das	Sr. General Manager
13.	Bhaskar Wagh	Sr. Manager
14.	Pratyush Singh	Manager
15.	Shashank shekhar Singh	Dy. Manager
16.	Ajay Kumar Singh	Engineer
<b>POSOCO / WRLDC</b>		
17.	S. R. Narasimhan	Director, System Operation
18.	V. Balaji	CGM (I/C)
19.	K. Muralikrishna	Chief General Manager
20.	S. Usha	Sr. General Manager
21.	Pushpa Seshadri	General Manager
22.	Pradeep Kumar Sanodiya	Manager
23.	Priyam Jain	Manager
24.	M. Venkateswara Rao	Deputy Manager
<b>POWERGRID</b>		
25.	Kuleshwar Sahu	Sr. GM
26.	Poornima Sejakar	Sr. DGM
27.	Ashish Agrawal	CGM
<b>SECI</b>		
28.	R. K. Agarwal	Consultant
<b>MPPTCL</b>		
29.	Sunil Tiwari	Managing Director
30.	Sanjay Kulshreshtha	Chief Engineer (Planing & Design)
31.	Mohan Dhoke	Superintending Engineer (STU)
32.	Lokesh Dwivedi	Executive Engineer (PSS)
33.	Manoj Tripathi	Executive Engineer (STU)

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Sl.	Name	Designation
<b>GETCO</b>		
34.	Shri Upendra Pande	Managing Director
35.	Shri N. P. Jadav	Chief Engineer (R&C)
36.	Shri B. P. Soni	Superintending Engineer (Engineering)
37.	Shri Dipak H. Patel	Dy. Engineer (STU)
<b>MSETCL</b>		
38.	Umesh Bhagat	Executive Engineer (STU)
39.	Vinay Khedekar	Dy. Executive Engineer (STU)
<b>CSPTCL</b>		
40.	R. K. Shukla	Chief Engineer
41.	G. Anand Rao	Add. CE
42.	Manoj Verma	CE(P&P)
<b>NTPC</b>		
43.	S S Mishra	GM
44.	Subhash Thakur	AGM
45.	Animesh Manna	DGM
<b>NHPC</b>		
46.	Subhash Kumar Singh	Senior Manager