

Stakeholders Comments on ISTS schemes evolved from Aug'23 to Jan'24

Date: 20-02-2024

ISTS network expansion schemes to be included in Final Rolling Plan Repot 2028-29(to be published by Mar'24) are enclosed herewith.

Stakeholders (Generators, STUs, RLDCs, SLDC & Distribution Licensees) may give their observations, if any, latest by 05.03.2024 at mail ids chinmays@powergrid.in and shashankshekhar@powergrid.in

ISTS Schemes evolved from Aug'23 to Jan'24

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ISTS Schemes evolved from Aug'23 to Jan'24

1. ISTS Network Expansion Scheme in Eastern Region

Various transmission schemes have been discussed/finalized in the Consultative Meeting for Evolution of Transmission System of Eastern Region (CMETS-ER) from Aug 2023 to Jan 2024. The details of the schemes are summarized below:

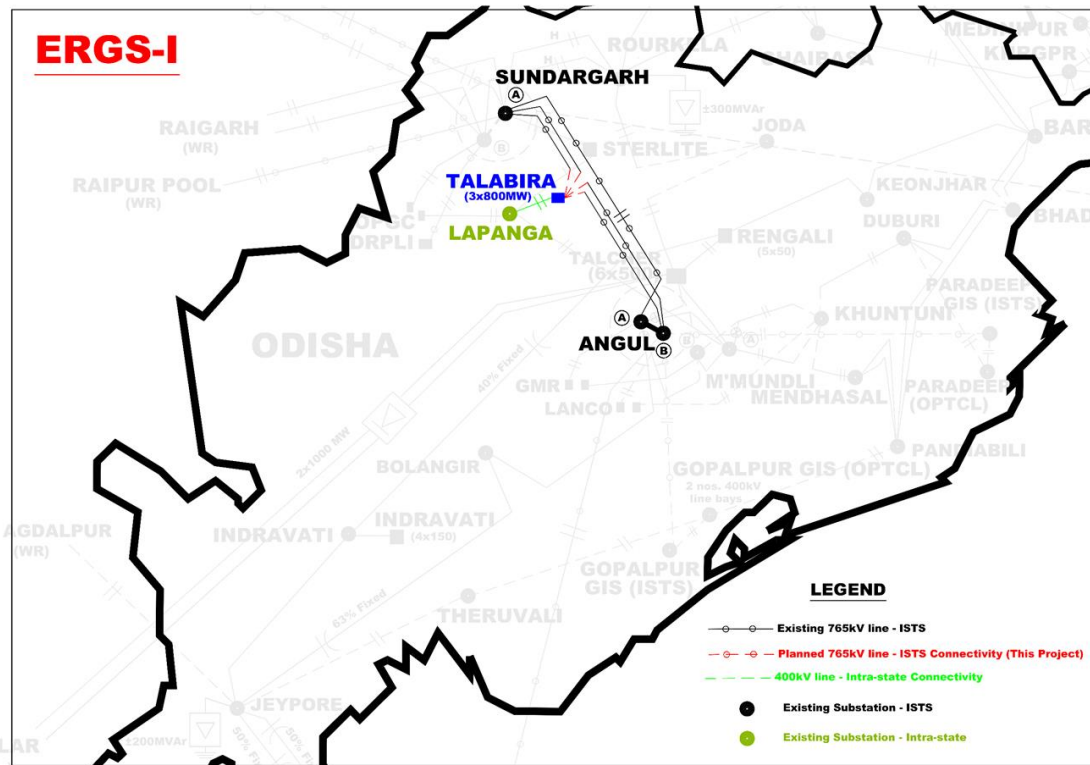
1.1. Odisha

(a) ERGS-I – Talabira Connectivity

NLC India Ltd. had applied ISTS connectivity for 2000MW and intra-state connectivity for 400MW for its upcoming generation plant of 2400MW (3x800MW) at Talabira, Odisha. Alternatives for providing Connectivity to this generation project at nearby ISTS substations viz. Angul (POWERGRID), Sundargarh-A (Jharsuguda) (POWERGRID) & Sundargarh-B (Jharsuguda) (POWERGRID), were explored. Considering future generation project and load demand in Odisha, system studies were carried out for 2027-28 timeframe for providing ISTS Connectivity to Talabira and planning of evacuation system for upcoming intra-state generations in Odisha and discussed in the joint study meeting among ERPC, CTU, ERLDC, OPTCL and NLC on 11-07-2023. As decided in the 20th Consultation Meeting for Evolving Transmission Schemes in Eastern Region (CMETS-ER) held on 28-06-2023 and based on the outcomes of the joint study meeting held on 11-07-2023, ISTS Connectivity of 2000MW was provided to NLCIL for it Talabira generation project through LILO of both circuits of Angul – Sundargarh (Jharsuguda) 765kV 2xS/c lines at NLC-Talabira generation switchyard. It was agreed that the LILO line shall be implemented in ISTS as ATS under the Eastern Region Generation Scheme-I (ERGS-I).

Further, as per request of NLCIL regarding implementation modalities of line reactor (including spare reactor, NGR bypass scheme) and communication /protection related matters, a meeting was held on 24-08-2023 between CTU and NLCIL. Based on discussion, final scope of works under Eastern Region Generation Scheme-I (ERGS-I) was agreed in the 22nd Consultation Meeting for Evolving Transmission Schemes in Eastern Region (CMETS-ER) held on 29-08-2023.

For 400MW intra-state Connectivity, OPTCL has planned Talabira – Lapanga 400kV D/c (Quad) line (to be implemented by NLC).



Sl. No.	Scope of the Transmission Scheme	Capacity (MVA) / Line length (km)/ Nos.
1.	LILO of both circuits of Angul – Sundargarh (Jharsuguda) 765kV 2xS/c lines at NLC-Talabira generation switchyard	50km (25km Loop in and 25km Loop out)

Implementation time-frame: 01-05-2027

Note:

NLC India Ltd. shall provide following at 765kV level its Talabira generation switchyard:

- 2 no. 765kV GIS line bays with PIR in different diameters for termination of Talabira – Sundargarh (Jharsuguda) 765kV D/c line.
- 2 no. of 765kV GIS line bays with PIR in different diameters for termination of Talabira – Angul 765kV D/c line, each with 765kV, 1x240MVAR (3x80MVAR single phase units) switchable line reactor along with 400ohm NGR (with NGR bypass arrangement). There shall be total 7x80MVAR single phase units against 2x240MVAR line reactors and the 7th 1-phase unit shall be spare as hot stand by. The spare 1-phase shunt reactor unit shall be placed and connected in such a way that the spare unit can be utilized without its physical movement. Further, the connection arrangement of switchable line reactors shall be such that it can be used as line reactor as well as bus reactor with suitable NGR bypass arrangement.

2. ISTS Network Expansion Scheme in North Eastern Region

Various transmission schemes have been discussed/finalized in the Consultative Meeting for Evolution of Transmission System of Eastern Region (CMETS-NER) from Aug 2023 to Jan 2024. The details of the schemes are summarized below:

2.1. Assam

(a) NERES-XXII (Bongaigaon bus reactor)

Presently, 2x50MVA_r + 2x80MVA_r (installed in parallel) + 1x125MVA_r bus reactors are available at Bongaigaon (POWERGRID) S/s at 400kV voltage level. Out of which 50MVA_r Bus Reactors - I & II were commissioned in 1987 & 1994 respectively. After serving more than 29 years, it has been observed that the reactors are continuously giving problems. For further assessment of the health, matter was referred by POWERGRID to CPRI, Bangalore for Residual Life Assessment. After reviewing all parameters, CPRI has opined for replacement of the subject bus reactor.

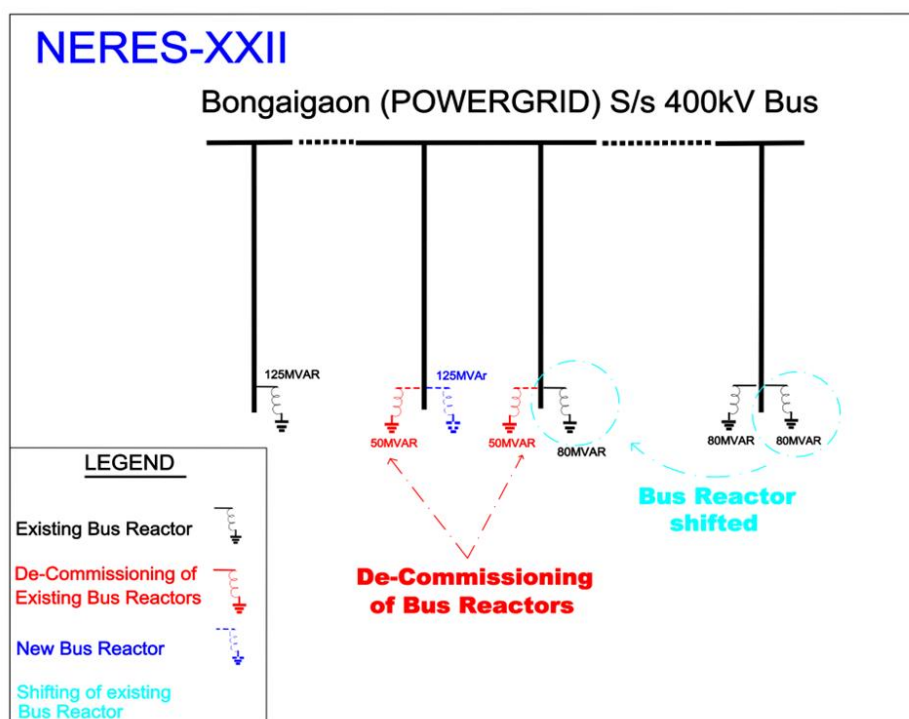
On annual basis at Bongaigaon 400kV bus, average of minimum voltage is about 402kV, and average bus voltage is about 409kV. Accordingly, in order to keep the bus voltage near nominal levels, the existing quantum of reactive compensation is required to be maintained. As per the study, it was observed that new reactors of 50MVA_r may not be installed due to their reduced capability in changing bus voltage upon switching. Thus, a new 125MVA_r bus reactor has been planned to be installed in one of the vacated bus reactor bays after decommissioning of old 2x50MVA_r bus reactors. Further, as the existing 2x80MVA_r bus reactors are installed in parallel, one of these 80MVA_r bus reactors is planned to be installed in the other vacated bay after decommissioning of 2x50MVA_r bus reactors. After decommissioning of old 2x50MVA_r bus reactor and commissioning of new 1x125MVA_r, there would be 2x80MVA_r + 2x125MVA_r bus reactors at Bongaigaon (POWERGRID) S/s and all bus reactors would be installed in separate bays.

The above proposal was agreed in the 22nd CMETS-NER held on 28-08-2023.

Sl. No.	Scope of the Transmission Scheme	Capacity/ km
1.	Decommissioning of existing 420kV, 2x50MVA _r bus reactors at Bongaigaon (POWERGRID) S/s	-
2.	Installation of a new 420kV, 1x125MVA _r bus reactor at Bongaigaon (POWERGRID) S/s in one of the vacated bays after decommissioning of above mention 420kV, 2x50MVA _r bus reactors. <i>Note: The new 1x125MVA_r bus reactor would be installed in one of the 400kV bays (1st bay) vacated after decommissioning of existing 420kV,</i>	Bus reactor: 420kV, 1x125MVA _r – 1 no.

Sl. No.	Scope of the Transmission Scheme	Capacity/ km
	2x50MVA bus reactors at Bongaigaon (POWERGRID) S/s without any modification/ upgradation in the existing bus reactor bay equipment.	
3.	<p>One of the existing 2x80MVA bus reactors (presently installed in parallel in same bay) may be installed at Bongaigaon (POWERGRID) S/s in other vacated bay after decommissioning of above mentioned 420kV, 2x50MVA bus reactors.</p> <p><i>Note: One of the existing 2x80MVA bus reactor would be installed in other 400kV bay (2nd bay) vacated after decommissioning of existing 420kV, 2x50MVA bus reactors at Bongaigaon (POWERGRID) S/s without any modification/ upgradation in the existing bus reactor bay equipment.</i></p>	-

Implementation time-frame: 18 months from allocation



(b) NERES-XXV (Bornagar)

In the 5th meeting of erstwhile Standing Committee on Power System Planning of NER, it was agreed that there is a need for 2nd 400kV AC node in NER for interconnection with national grid to address the case of any eventuality at Bongaigaon S/s. The same was taken into account, while planning new interconnection between India and Bangladesh viz. Bornagar (Assam, NER) – Parbotipur (Bangladesh) – Katihar (Bihar, ER) 765kV D/c line. Both the schemes viz. High

Capacity India-Bangladesh AC Corridor and formation of second 400kV node in NER-ER corridor were deliberated in the 6th meeting of erstwhile Standing Committee on Power System Planning of NER held on 03-10-2016. In 2nd NERPC-TP it was recorded that “NERLDC expressed that another 400kV entry point of Bornagar in North Eastern states will be crucial and helpful in system operation.”.

Ministry of Power, Govt. of India vide letter dated 31-12-2020 had assigned implementation of the entire KPB link (Indian and Bangladesh portions) to POWERGRID under Regulated Tariff Mechanism (RTM) with completion schedule as Dec 2022. NER portion of the interconnection has been delinked linked with the Bangladesh interconnection to meet the requirement of Grid operator.

AEGCL has planned new 220/132kV substation at Bornagar is expected to be implemented in the next 3-4 years i.e. by 2028-29. It was opined by all stakeholders that Bornagar (AEGCL) is yet to be taken up and finalisation of funding and implementation thereafter could mean that substation would be available in next 4-5 years only, however, implementation of Bornagar S/s for reliability is a long pending matter, which was agreed in the 5th meeting of erstwhile Standing Committee on Power System Planning of NER held on 08-08-2015 wherein it was agreed that there is a need for 2nd 400kV AC node in NER for interconnection with national grid to address the case of any eventuality at Bongaigaon S/s. Accordingly, it was decided that in first phase, Bornagar S/s may be implemented in ISTS as 400kV switching station with space provision for 400kV switchyard along with 400/220kV ICTs; and the 400/220kV ICTs can be installed subsequently as when implementation modalities and timeline for implementation of Bornagar (AEGCL) S/s is finalised. It was decided that AEGCL would regularly update status of Bornagar (AEGCL) 220/132kV S/s in CMETS-NER and at suitable time installation of ICTs at Bornagar (ISTS) S/s can be planned.

Keeping in view RoW issues near Bongaigaon S/s, it is better to keep unutilised line portion anti-theft charged so as to utilise the same for termination of new 400kV line in the future, and there would be no impact on the tariff to be recovered by M/s ENICL for their line including the proposed unutilized line section. Further, tariff of line bays of POWERGRID at Bongaigaon end should also not be affected.

The scheme was agreed in the 26th CMETS-NER held on 27-12-2023.

Sl. No.	Scope of the Transmission Scheme	Capacity/ km
1.	<p>Establishment of new 400kV Bornagar (ISTS) switching station in Assam (765kV and 220kV levels to be established in future)</p> <p>Additional space for future expansion:</p> <p>6x1500MVA, 765/400kV ICTs (19x500MVA single phase including one spare unit) along with associated ICT bays at both voltage levels</p> <p>5x500MVA, 400/220kV ICTs along with associated ICT bays at both voltage levels</p>	<ul style="list-style-type: none"> • 420kV, 1x125MVA Bus Reactor: 2 no. • 400kV bus reactor bays: 2 no. • 400kV line bays: <ul style="list-style-type: none"> i) 2 no. with provision for installation of 1x80MVA switchable line reactor [for termination of Alipurduar (POWERGRID) – Bornagar

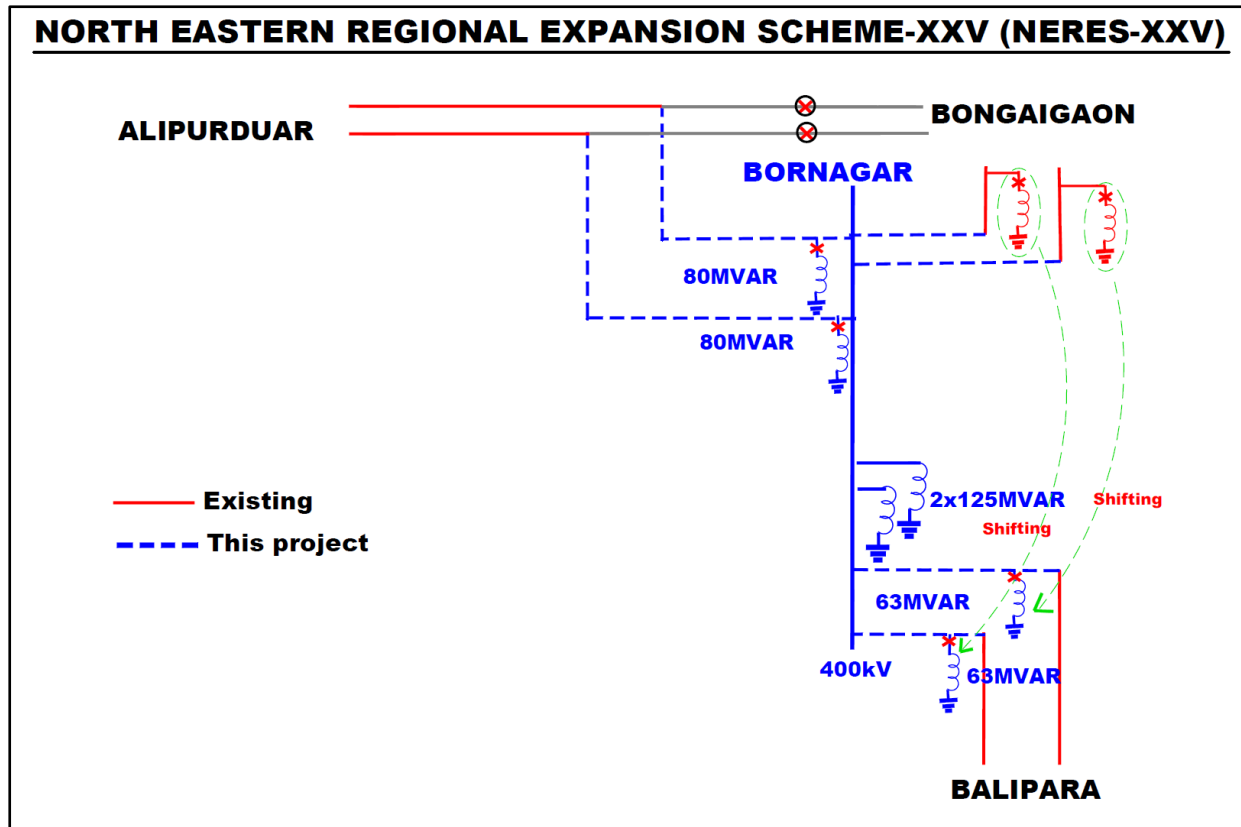
Sl. No.	Scope of the Transmission Scheme	Capacity/ km
	<p>765kV line bays (along with space for switchable line reactor) for future lines: 8 nos.</p> <p>400kV line bays (along with space for switchable line reactor) for future lines: 8 nos.</p> <p>220kV line bays: 10 nos.</p> <p>4x330MVAR, 765kV Bus Reactors (13x110MVAR single phase including one spare unit) along with associated bays</p> <p>3x125MVAR, 420kV Bus Reactors along with associated bays</p> <p>765kV Bus Sectionaliser: 1 set</p> <p>400kV Bus Sectionaliser: 1 set</p> <p>220kV Bus Sectionaliser: 1 set</p> <p>220kV Bus Coupler bays: 2 no.</p> <p>220kV Transfer Bus Coupler bays: 2 no.</p>	<p>(ISTS) 400kV D/c (Quad) line formed after shifting of Alipurduar (POWERGRID) – Bongaigaon (POWERGRID) 400kV D/c (Quad) line from Bongaigaon (POWERGRID) end to Bornagar (ISTS) S/s]</p> <p>ii) 2 no. [for termination of Bongaigaon (POWERGRID) – Bornagar (ISTS) 400kV D/c (Quad) line formed after LILO of both circuits of existing Bongaigaon (POWERGRID) – Balipara (POWERGRID) 400kV D/c (Quad) line at Bornagar (ISTS)]</p> <p>iii) 2 no. with provision for installation of 1x63MVAR switchable line reactor [for termination of Bornagar (ISTS) – Balipara (POWERGRID) 400kV D/c (Quad) line formed after LILO of both circuits of existing Bongaigaon (POWERGRID) – Balipara (POWERGRID) 400kV D/c (Quad) line at Bornagar (ISTS)]</p>
2.	LILO of both circuits of existing Bongaigaon (POWERGRID) – Balipara (POWERGRID) 400kV D/c (Quad) line at Bornagar (ISTS)	About 5 km (2.5km Loop-in + 2.5km Loop-out)
3.	%Shifting of the existing line reactor of 63MVAR (along with NGR and switching equipment) at Bongaigaon (POWERGRID) S/s end in Bongaigaon (POWERGRID) – Balipara (POWERGRID) 400kV D/c (Quad) line and installation of the same as switchable line reactor (along with NGR and NGR bypass arrangement) at Bornagar (ISTS) S/s end in the Bornagar (ISTS) – Balipara (POWERGRID) 400kV D/c (Quad) line formed after above LILO.	<ul style="list-style-type: none"> 420kV, 1x63MVAR switchable line reactor (along with NGR and NGR bypass arrangement) - 2 no. [line reactor along with NGR and switching equipment to be shifted from Bongaigaon (POWERGRID) S/s and installed at Bornagar (ISTS) S/s] Switching equipment for 420kV, 1x63MVAR switchable line reactor (along with NGR and NGR bypass arrangement) - 2 no.

Sl. No.	Scope of the Transmission Scheme	Capacity/ km
4.	#Disconnection of Alipurduar (POWERGRID) – Bongaigaon (POWERGRID) 400kV D/c (Quad) line from Bongaigaon (POWERGRID) end and extension of the line for termination at Bornagar (ISTS) S/s so as to form Alipurduar (POWERGRID) – Bornagar (ISTS) 400kV D/c (Quad) line	About 70km
5.	Installation of 420kV, 1x80MVA switchable line reactor at Bornagar (ISTS) end in each circuit of Alipurduar (POWERGRID) – Bornagar 400kV D/c (Quad) line formed after shifting of Alipurduar (POWERGRID) – Bongaigaon (POWERGRID) 400kV D/c (Quad) line from Bongaigaon (POWERGRID) end to Bornagar (ISTS) S/s	<ul style="list-style-type: none"> 420kV, 1x80MVA switchable line reactor - 2 no. Switching equipment for 420kV, 1x80MVA switchable line reactor - 2 no.

Note:

- (i) *%The existing Bongaigaon (POWERGRID) – Balipara (POWERGRID) 400kV D/c (Quad) line has line reactor of 63MVA at both ends of the line along with 30% FSC at Balipara (POWERGRID) end. With LILO of this line at Bornagar (ISTS) S/s, the line reactors (along with NGR and switching equipment) needs to be shifted from Bongaigaon (POWERGRID) end and installed at Bornagar (ISTS) end in the Bornagar (ISTS) – Balipara (POWERGRID) line section as switchable line reactor (with NGR bypass arrangement).*
- (ii) *#Siliguri (POWERGRID) – Bongaigaon (POWERGRID) 400kV D/c (Quad) line was implemented by M/s East North Interconnection Company Limited (M/s ENICL, SPV of M/s Sterlite). Line bays at both ends were implemented by POWERGRID. Further, this line was LILOed at Alipurduar (POWERGRID) S/s by POWERGRID along with implementation of line bays for termination of line, resulting in formation of Alipurduar (POWERGRID) – Bongaigaon (POWERGRID) 400kV D/c (Quad) line. The Alipurduar (POWERGRID) – Bongaigaon (POWERGRID) 400kV D/c (Quad) line (partly owned by M/s ENICL and partly by POWERGRID) is to be disconnected from Bongaigaon (POWERGRID) end and extended for termination at Bornagar (ISTS) S/s so as to form Alipurduar (POWERGRID) – Bornagar (ISTS) 400kV D/c (Quad) line. Upon shifting of line, the line section left unutilised at Bongaigaon (POWERGRID) end needs to be kept anti-theft charged so that the same can be used in future for termination of new line. Further, upon shifting of Alipurduar (POWERGRID) – Bongaigaon (POWERGRID) line from Bongaigaon (POWERGRID) S/s to Bornagar (ISTS) S/s, connectivity of all operational communication links through Bongaigaon has to be ensured. For the same additional OPGW and FOTE needs to be planned as per requirement.*
- (iii) *The line lengths mentioned above are approximate as the exact line length shall be obtained after the detailed survey.*

Implementation schedule: 30 months from allocation



2.2. Assam & Meghalaya

(a) NERES-XXIV (Reconductoring of Khandong - Haflong - Jiribam)

Khandong (NEEPCO) – Umrangshu (AEGCL) – Haflong (POWERGRID) – Jiribam (POWERGRID) 132kV corridor is owned by POWERGRID (excluding LILO portion at Umrangshu which is owned by AEGCL).

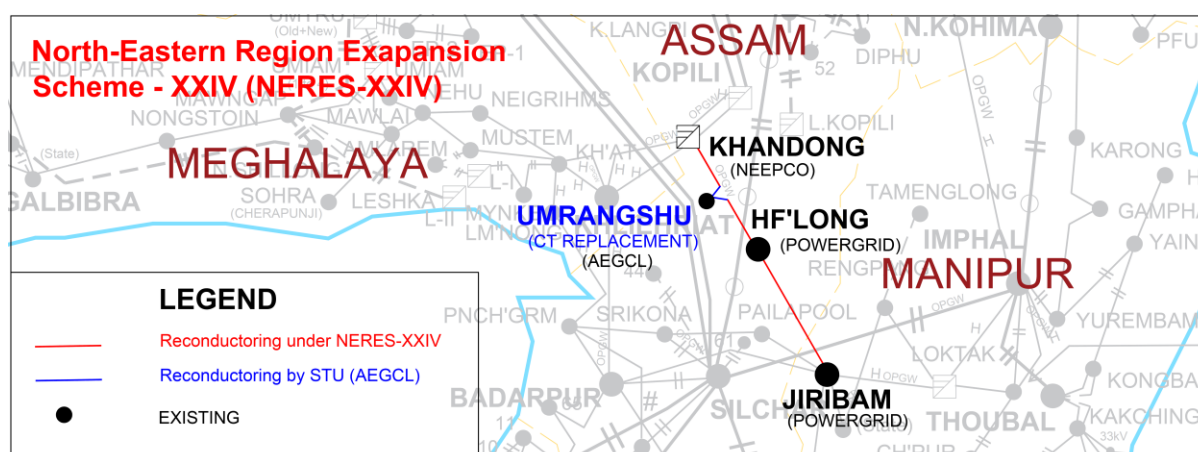
The load at Umrangshu (AEGCL) S/s is expected to rise to about 37MW (15MW present and 21.75MW new load of cement factory) by 2024 timeframe. With the addition of the load, critical loading & low voltage were observed in the Khandong (NEEPCO) – Umrangshu (AEGCL) – Haflong (POWERGRID) – Jiribam (POWERGRID) 132kV S/c line under normal and outage conditions. It was noted that the thermal limit of this 132kV corridor is about 185A (ACSR Panther) i.e. 42MVA (40MW @ 0.95pf).

Accordingly, to strengthen this corridor and to meet the additional load requirement of AEGCL at its Umrangshu S/s, reconductoring of this 132kV corridor with single HTLS conductor of rating 600A was discussed and agreed in the 25th CMETS-NER held on 29-11-2023.

ISTS portion of this corridor is to be reconducted under this scheme. The LILO portion of the corridor at Umrangshu (AEGCL) S/s is owned by AEGCL, accordingly, reconductoring of this LILO portion along with replacement of CTs of 132kV line bays of the LILO line at Umrangshu (AEGCL) S/s is being taken up by AEGCL under intra-state scheme in matching timeframe of ISTS.

Sl. No.	Scope of the Transmission Scheme	Capacity/ km
1.	<p>Reconductoring of Khandong (NEEPCO) – Halflong (POWERGRID) 132kV S/c line [excluding the LILO portion of this line at Umrangshu (AEGCL) S/s, which is owned by AEGCL] with Single HTLS conductor of ampacity 600A (at nominal voltage level)</p> <p><i>Note: Reconductoring of LILO portion of this line along with replacement of CTs of 132kV line bays of the LILO line at Umrangshu (AEGCL) S/s is to be taken up by AEGCL under intra-state scheme.</i></p>	63.036
2.	Reconductoring of Halflong (POWERGRID) – Jiribam (POWERGRID) 132kV S/c line with Single HTLS conductor of ampacity 600A (at nominal voltage level)	100.63

Implementation time-frame: 18 months from allocation



3. ISTS Network Expansion Scheme in Western Region

Various transmission schemes have been discussed/finalized in the Consultative Meeting for Evolution of Transmission System of Western Region (CMETS-WR) from Aug 2023 to Jan 2024. The details of the schemes are summarized below:

3.1.Gujarat

(a) Augmentation of transformation capacity at Bhuj-II PS

Augmentation of transformation capacity at Bhuj-II PS involves creation of New 220kV Bus Section at Bhuj-II PS, augmentation of transformation capacity at Bhuj-II PS (GIS) by 1x1500MVA, 765/400kV ICT (3rd) and by 2x500MVA, 400/220kV ICT (5th & 6th) along with implementation of 220 kV GIS line bay for ABREL (RJ) Projects Ltd. at New 220kV Bus Section. The transmission scheme would facilitate integration of 0.5GW power beyond 2GW at Bhuj-II PS (i.e., up to 2.5GW) and further, enable compliance of loading limits under 'N-1' contingency criteria considering connectivity under GNA applications received at Bhuj-II PS.

The scheme was agreed in the 22nd CMETS-WR (1st sitting) meeting held on 23.10.2023 for ensuring N-1 compliance on existing Bhuj-II ICTs considering full dispatch from RE under GNA (2426.5MW connectivity received till Sep-23). The subject Transmission system was deliberated and approved in the 16th NCT meeting held on 30.11.2023.

Scope:

Augmentation of transformation capacity at Bhuj-II PS

<i>Sl. No.</i>	<i>Scope of the Transmission Scheme</i>	<i>Capacity /km</i>
1	Creation of New 220kV Bus Section at Bhuj-II PS	<ul style="list-style-type: none"> 220kV Bus sectionaliser bay - 1 Set (<i>to be kept normally CLOSED and may be opened based on system requirement</i>) 220kV BC – 1 No.
2	Augmentation of transformation capacity at Bhuj-II PS (GIS) by 2x500MVA, 400/220kV ICT (5 th & 6 th) (to be terminated at New 220kV Bus Section) and by 1x1500MVA, 765/400kV ICT (3rd)	<ul style="list-style-type: none"> 500 MVA, 400/220 kV ICTs: 2 Nos. 1500 MVA, 765/400 kV ICTs: 1 No. 765 kV ICT bay: 2 No. [1 No. for ICT & 1 No. for Dia. completion (with provision of Switchable LR)] 400 kV ICT bays: 4 Nos. [3 Nos. for ICT termination and 1 No. for Dia. Completion (with provision of Switchable LR)] 220 kV ICT bays: 2 Nos. <p><u>GIB Duct length for 1x1500 MVA, 765/400 kV ICT:</u></p> <ul style="list-style-type: none"> 1 Ph. 765 kV GIB Duct – 600 m (approx.) 1 Ph. 400 kV GIB Duct – 625 m. (approx.)

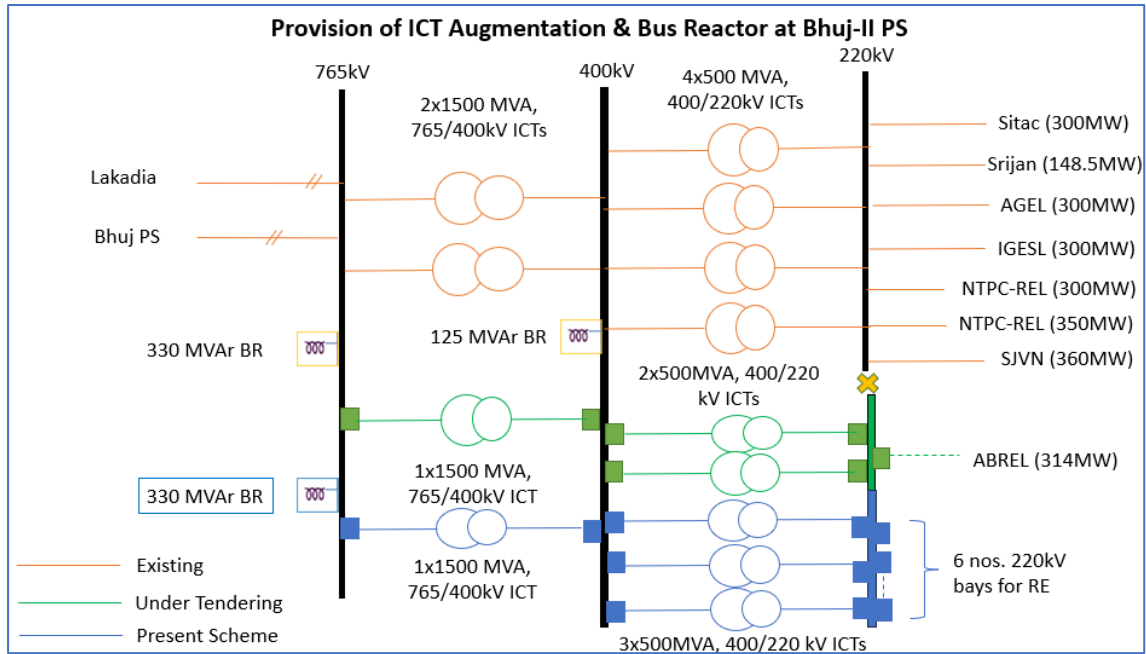
Sl. No.	Scope of the Transmission Scheme	Capacity /km
		<u>GIB Duct length for 2x500 MVA, 400/220 kV ICTs:</u> <ul style="list-style-type: none"> • 1 Ph. 400 kV GIB – 300 m (approx.) • 1 Ph. 220 kV GIB – 750 m (approx.)
3	Implementation of 220 kV GIS line bay at Bhuj-II PS for ABREL (RJ) Projects Ltd. (to be terminated at New 220kV Bus Section)	<ul style="list-style-type: none"> • 220 kV line bay – 1 No. (GIS) <u>GIB Duct length:</u> <ul style="list-style-type: none"> • 1 Ph. 220 kV GIB – 150 m (approx.)

Note:

- (1) Wherever required, TSP shall implement complete Dia consisting of 2 Main Bays & 1 Tie Bay required for completion of diameter (GIS) in one-and-half breaker scheme.
- (2) GIB Bus Duct lengths are as communicated by TSP of Bhuj-II PS.
- (3) TSP of Bhuj-II PS shall provide space for execution of above works.

Scheduled COD: 21 months from SPV transfer

Estimated Cost: Rs. 413 Cr.



(b) ICT Augmentation at Bhuj-II PS: Part B

- Para 4.4.5 of the Manual on Transmission Planning Criteria, 2023 published by CEA states as under:
 - “The ‘N-1’ criteria may not be applied to the immediate connectivity system of renewable generations with the ISTS/Intra-STS grid i.e. the line connecting the generation project switchyard to the grid and the step-up transformers at the grid station.
 - Provided that, ‘N-1’ criteria shall be applicable in case of renewable generation projects with storage, which are firm in nature and fully dispatchable.
 - Provided that, ‘N-1’ reliability criteria may be considered for ICTs at the ISTS / STU pooling stations for renewable energy-based generation of more than 1000 MW after considering the capacity factor of renewable generating stations.”
- Bhuj-II PS is an existing substation with 4x500MVA, 400/220kV ICTs and 2x1500MVA, 765/400kV ICTs. To cater to applications received beyond 2000MW (upto 2500MW considering N-1) at Bhuj-II PS, Creation of New 220kV Bus Section at Bhuj-II PS, installation of 2x500MVA, 400/220kV ICTs (5th & 6th) and 1x1500MVA, 765/400kV ICT (3rd) and Implementation of 220 kV GIS line bay at Bhuj-II PS for ABREL (RJ) Projects Limited (Terminated at New 220kV Bus Section) was agreed in the 16th NCT meeting held on 30.11.2023 through TBCB route. The scheme is presently under tendering process.
- Now, Connectivity under GNA for 3324.5MW has been received at Bhuj-II PS till month of Dec-23. Considering the rapid pace of applications being received at Bhuj-II PS, it was agreed in the 25th CMETS-WR meeting held on 29.01.2024 to install all remaining ICTs and 220kV bays at Bhuj-II PS in one go so as to minimize multiple implementation time-lines / co-ordination issues, etc. Further, Installation of 1x330MVA 765kV Bus Reactor (2nd) was also agreed at Bhuj-II PS with increasing RE penetration, in order to control voltages at the S/s. The BR has sensitivity of 2-3kV.

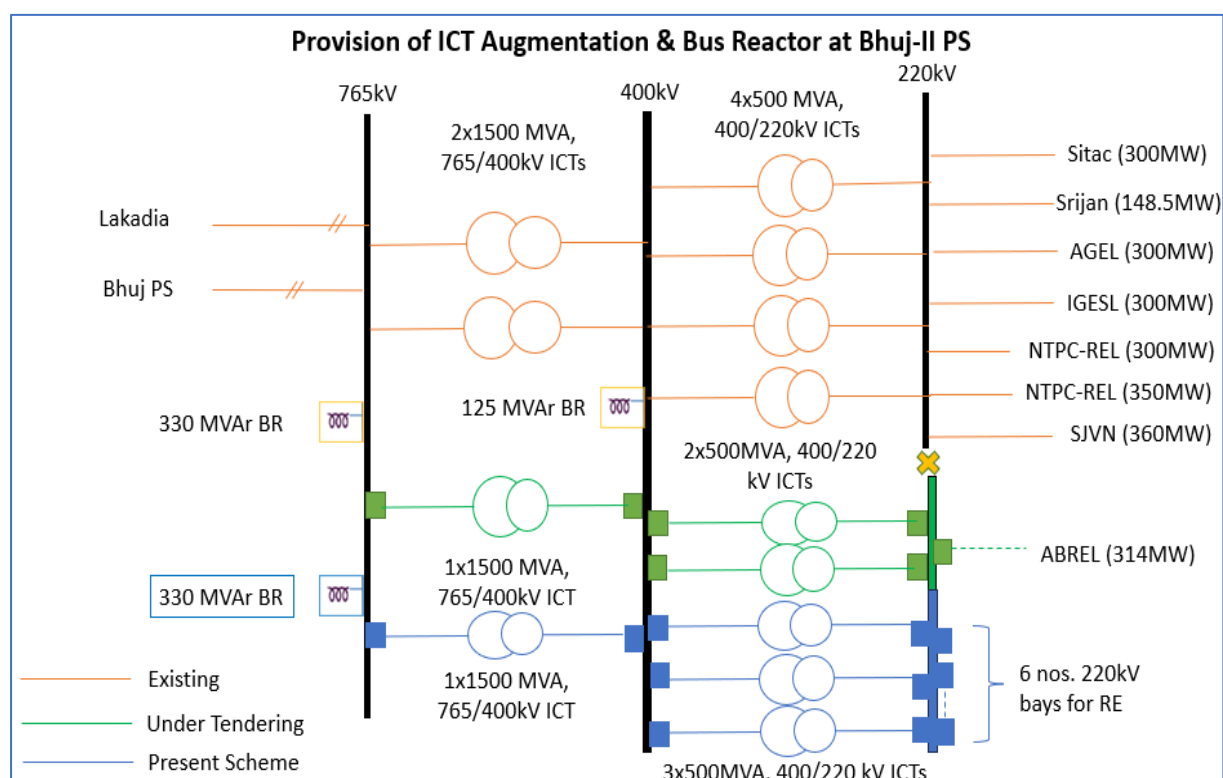
Scope:**ICT Augmentation at Bhuj-II PS**

Sl. No.	Scope of the Transmission Scheme	Capacity /km
1.	Augmentation of transformation capacity at Bhuj-II PS (GIS) by 3x500MVA, 400/220kV ICT (7 th , 8 th & 9 th)	500MVA, 400/220kV ICTs: 3 No. 400kV ICT bays: 3 No. 220kV ICT bays: 3 No..
2.	Augmentation of transformation capacity at Bhuj-II PS (GIS) by 1x1500MVA, 765/400kV ICT (4 th)	1500MVA, 765/400kV ICT: 1 No. 765kV ICT bay: 1 No. 400kV ICT bay: 1 No.
3.	Installation of 1x330MVA 765kV Bus Reactor (2nd) along-with associated bay	330MVA, 765kV Bus Reactor: 1 No. 765kV BR bay: 1 No.
4.	Implementation of 220kV GIS line bay at Bhuj-II PS for Aditya Birla Renewables Subsidiary Limited (ABRSL) [Appln No: 2200000321(362MW)]	220kV line bay – 1 No. (GIS) (Bus Sec-II)

Sl. No.	Scope of the Transmission Scheme	Capacity /km
5.	Implementation of 220kV GIS line bay at Bhuj-II PS for ACME Cleantech Solutions Private Limited (ACSPL) [Appln No: 2200000382(350MW)]	220kV line bay – 1 No. (GIS) (Bus Sec-II)
6.	Implementation of 220kV GIS line bay at Bhuj-II PS for ACME Cleantech Solutions Private Limited (ACSPL) [Appln No: 2200000431(50MW)]	220kV line bay – 1 No. (GIS) (Bus Sec-II)
7.	Implementation of 220kV GIS line bay at Bhuj-II PS for Avaada Energy Pvt Ltd. (AEPL) [Appl. No: 2200000444(100MW)]	220kV line bay – 1 No. (GIS) (Bus Sec-II)
8.	Implementation of 220kV GIS line bays at Bhuj-II PS for future applicants (commensurate with 400/220kV transformation capacity in Bus section-II)	220kV line bay – 2 Nos. (GIS) (Bus Sec-II)

Implementation time-frame: 21 months

Tentative Cost: Rs. 587 Cr.



(c) Augmentation of transformation capacity at 765/400kV Lakadia S/s (WRSS XXI(A) Transco Ltd) in Gujarat – Part A

The following proposed system shall enable evacuation of RE power from various generation projects in Lakadia area who have applied for connectivity under GNA at Lakadia S/s at 220kV

level. The 2x500MVA ICTs proposed at Lakadia form part of ATS of RE projects mentioned above.

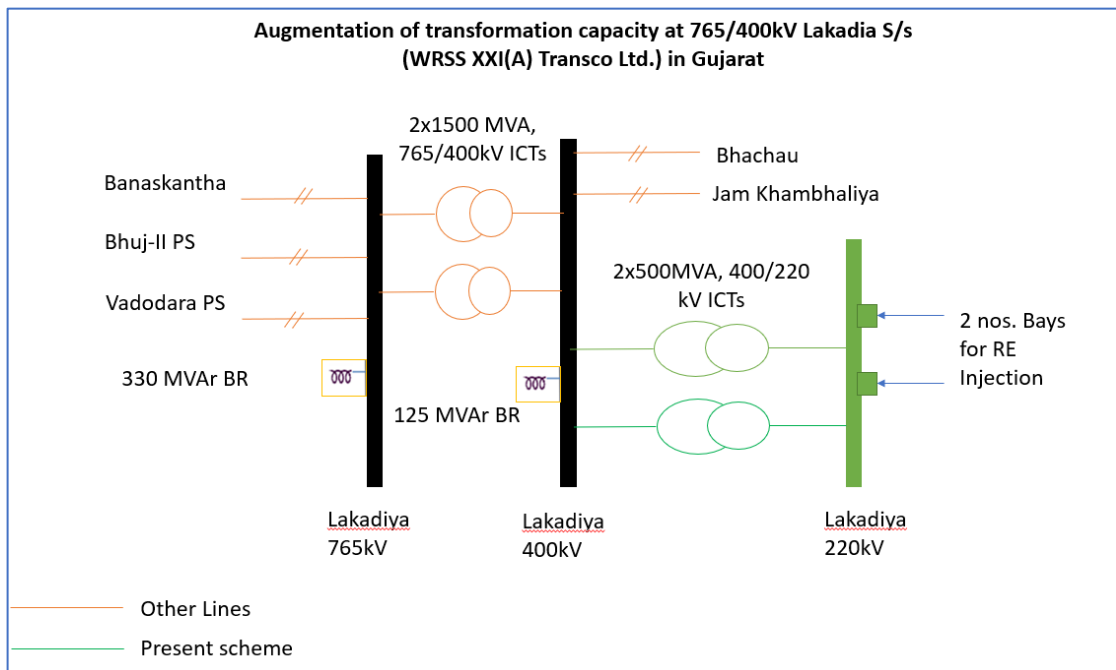
SI No.	Scope of the Transmission Scheme	Capacity /km
1.	Creation of 220kV switchyard at Lakadia 765/400kV S/s along with 220kV line bays for RE Interconnection	220 kV switchyard & 220kV line bays – 2 Nos. 220 kV Bus coupler – 1 No. 220 kV Transfer bus coupler – 1 No.
2.	Installation of 2x500 MVA, 400/220 kV ICTs (1 st & 2 nd) at Lakadia PS along with associated ICT bays	400/220kV, 1x500MVA ICT – 2 No. 400kV bay – 2 No. 220kV bay – 2 No. Associated 400 kV Bus Bar extension

2 nos. 220kV bays at Lakadia S/s allotted to:

- Avaada Inclean Pvt. Ltd. (AIPL) (50MW): Appl. No. 2200000011
- Avaada Energy Private Limited (AEPL) (300MW): Appl. No. 2200000131

Further, M/s Avaada Energy Private Limited (200MW): Appl. No. 2200000200 is sharing the 220kV bay of M/s AIPL (Appl. No. 2200000011).

The scheme was agreed in the 21st (2nd sitting) & 22nd (1st sitting) Consultation Meetings for Evolving Transmission Schemes in Western Region held on 28.08.2023 & 23.10.2023 respectively. The subject Transmission system was deliberated and approved in the 17th NCT meeting held on 31.01.2024 with an estimated cost of Rs. 142 Cr. & tentative implementation timeframe of 18 months.



(d) Augmentation of transformation capacity at 765/400kV Lakadia S/s (WRSS XXI(A) Transco Ltd) in Gujarat – Part B

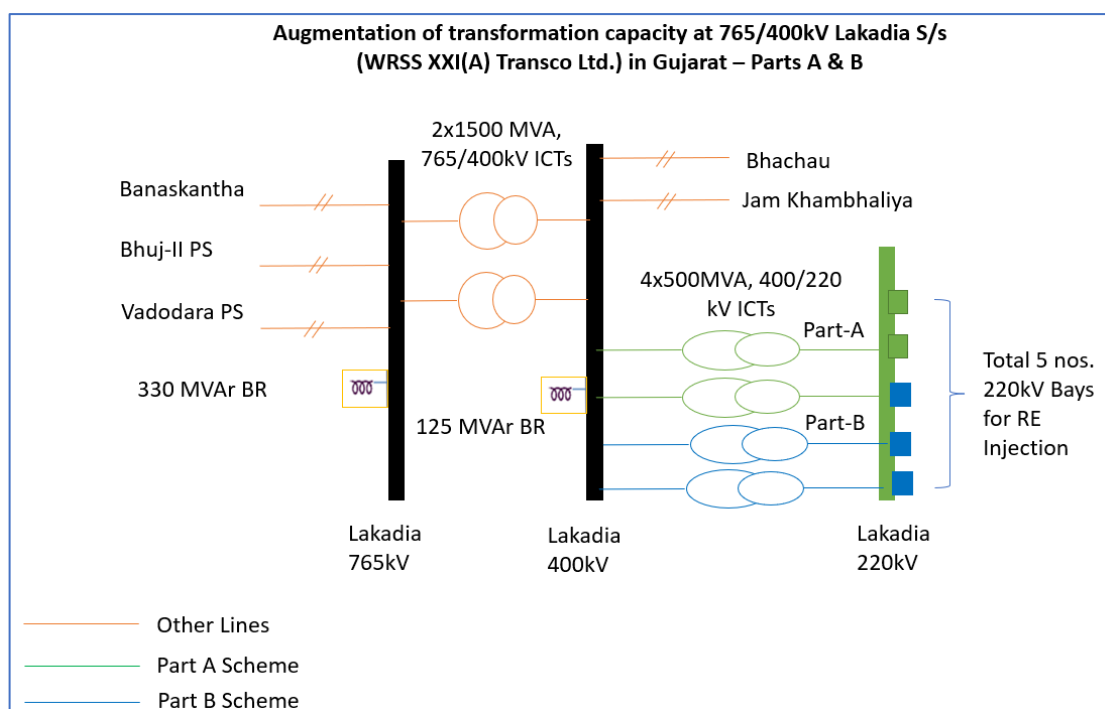
The proposed system shall enable evacuation of RE power from various generation projects in Lakadia area who have applied for connectivity under GNA at Lakadia S/s at 220kV level. The 2x500MVA ICTs proposed at Lakadia form part of ATS of RE projects for 550MW (AMNSIL: 350MW & RS(S8)PL: 200MW).

<i>Sl.</i>	<i>Scope of the Transmission Scheme</i>	<i>Capacity /km</i>
1.	Installation of 2x500MVA, 400/220kV ICTs (3 rd & 4 th) at Lakadia PS along with associated ICT bays	400/220kV, 1x500MVA ICT – 2 No. 400kV ICT bay – 2 No. 220kV ICT bay – 2 No.
2.	Implementation of 220kV line bay at Lakadia PS for TEQ Green Power XVII Private Limited (TGPXVIIPL: 300MW)	220kV line bay – 1 no.
3.	Implementation of 220kV line bay at Lakadia PS for Arcelor Mittal Nippon Steel India Limited (AMNSIL: 350MW)	220kV line bay – 1 no.
4.	Implementation of 220kV line bay at Lakadia PS for Renew Solar (Shakti Eight) Private Limited (RS(S8)PL: 200MW)	220kV line bay – 1 no.

3 nos. 220kV bays at Lakadia S/s allotted to:

- TEQ Green Power XVII Private Limited (TGPXVIIPL: 300MW): Appl. No. 2200000311
- Arcelor Mittal Nippon Steel India Limited (AMNSIL: 350MW): Appl. No. 2200000324
- Renew Solar (Shakti Eight) Private Limited (RS(S8)PL: 200MW): Appl.No. 2200000341

The scheme was agreed in the 23rd Consultation Meeting for Evolving Transmission Schemes in Western Region held on 29.11.2023. The subject Transmission system was deliberated in the 17th NCT meeting held on 31.01.2024 at an estimated cost of Rs. 135 Cr. with tentative implementation timeframe of 18 months. It was decided that the same may be discussed again in subsequent meetings along with other 400/220kV ICTs at Lakadia so that the entire scope w.r.t. ICT Augmentation at Lakadia is implemented in one go.



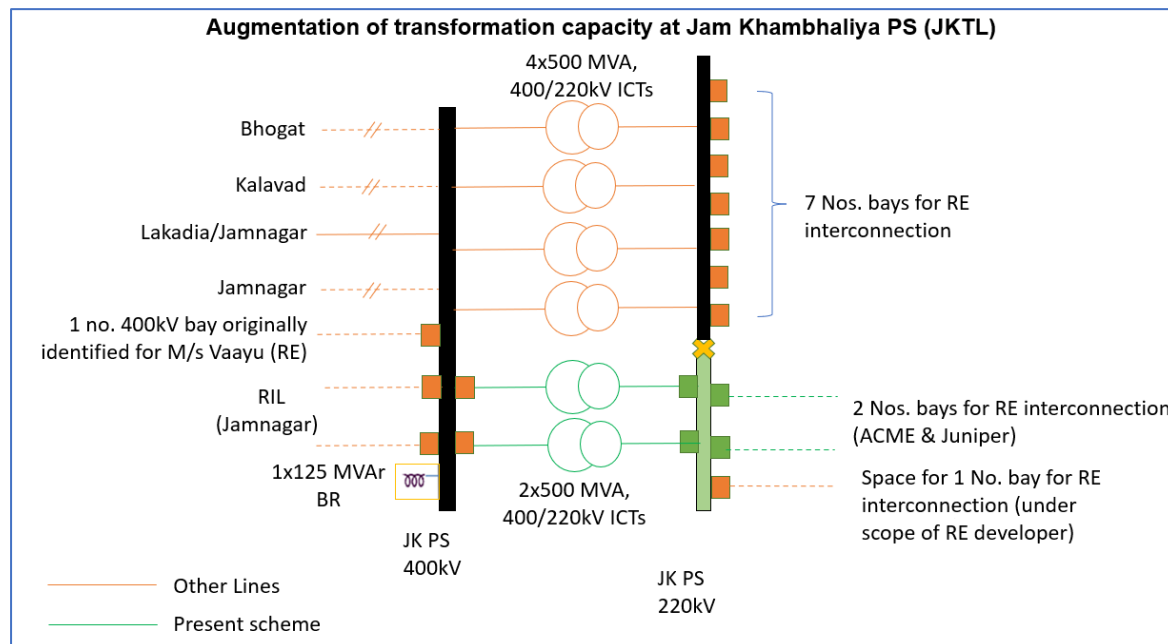
(e) Augmentation of transformation capacity at Jam Khambhaliya PS (JKTL): Part A

The proposed augmentation of transformation capacity at Jam Khambhaliya PS (JKTL) shall enable evacuation of RE power from various generation projects in Jam Khambhaliya area who have applied for connectivity under GNA at Jam Khambhaliya PS at 220 kV level. Cumulative injection from developers at 220 kV bus section-2 shall be: 750 MW out of which 650 MW (ACME & MRPL) is linked with 2x500 MVA, 400/220 kV ICT (5th & 6th). The estimated cost of the scheme is about INR 110 Cr. M/s MRPL have informed that they shall implement their 220kV bay by themselves matching with availability of 220kV GIS Bus section-2 and have requested that the Bus section-2 be implemented at the earliest.

Sl.	Scope of the Transmission Scheme	Capacity /km
1.	Creation of New 220kV Bus Section at Jam Khambhaliya PS Space to be kept for 1 no. 220kV line bay in the same GIS Hall for RE Interconnection being implemented by the RE developer (in addition to 2 nos. bays at Sl. 3)	220kV Bus sectionaliser bay - 1 Set (<i>to be kept normally CLOSED and may be opened based on system requirement</i>) 220kV BC – 1 No.
2.	Augmentation of transformation capacity at at Jam Khambhaliya PS (GIS) by 2x500MVA, 400/220kV ICT (5th & 6th) terminated on New 220kV bus section	500MVA, 400/220kV ICTs: 2 Nos. 400kV ICT bays: NIL* 220kV ICT bays: 2 Nos.

Sl.	Scope of the Transmission Scheme	Capacity /km
3.	Implementation of 220kV GIS line bays at Jam Khambhaliya PS for RE Projects on New 220kV bus section	220kV line bay – 2 No. (GIS) (1 for ACME Sun Power Pvt Ltd and 1 for Juniper Green Energy Pvt Ltd.)
<p><i>*Note: Termination of the 2x500MVA ICTs under present scope is proposed in the '2' seperate dia's which are being developed by POWERGRID for RIL for termination of 400kV Jam Khambhaliya - Jamnagar D/c line. In this respect, POWERGRID vide e-mail dated 08.12.2023 has informed the following:</i></p> <ul style="list-style-type: none"> 2 complete 400kV diameters (Line-Tie-ICT) along with 400kV D/C Line upto Jamnagar is being constructed and owned by POWERGRID for providing connectivity to Bulk Consumer i.e. RIL. Transmission charges for the said asset are not included in PoC pool and will be recovered based on bilateral agreement between POWERGRID and RIL. 400kV side GIS Duct length required for interconnection of ICT-5 & 6 at 400kV Jam Khambhaliya PS is approx. 350m. (Actual length shall be finalized based upon final layout). 		

The scheme was agreed in the 22nd Consultation Meetings for Evolving Transmission Schemes in Western Region held (1st sitting) on 23.10.2023. The subject Transmission system was deliberated and approved in the 17th NCT meeting held on 31.01.2024 with an estimated cost of Rs. 110 Cr. & tentative implementation timeframe of 21 months.



(f) Transmission System for Offshore Wind Zone Phase-1 (500 MW VGF on coast of Gujarat for Subzone B3)

- Govt. of India has set a target of 500 GW capacity addition from non-fossil fuel based generation capacity by 2030. MNRE has identified about 30 GW Offshore wind potential each in the coast of Gujarat and Tamil Nadu. Initially 5 GW Offshore wind potential each at Gujarat (CUF – 38%) and Tamil Nadu (CUF – 48%) has been prioritized for implementation.
- The Offshore wind potential may be integrated with the Onshore pooling station through Submarine cables and transmission system beyond Onshore wind has been planned as AC transmission system. The transmission system for integration of 5 GW Offshore wind potential each at Gujarat and Tamil Nadu has already been identified.
- In the meeting held on 16.08.2023, between MNRE & CTUIL, following was decided:
 - Initial 02 GW transmission capacity (01 GW each off the coast of Gujarat and Tamil Nadu) shall be developed in the 1st Phase and further 04 GW each off the coast of Gujarat and Tamil Nadu shall be developed subsequently.
 - NIWE to demarcate the offshore sites of 01 GW capacity into 2 x 500 MW blocks each (500 MW for VGF Project and remaining 500 MW for Non-VGF Project) of the coast of Gujarat and Tamil Nadu and finalize the probable coordinates of the offshore pooling substations.
 - MNRE to share with CTUIL the site details with probable coordinates of the offshore substations and commissioning timelines for the above 1GW and the balance offshore wind energy projects.
- Transmission system for integration of 1GW Offshore wind in Gujarat (Subzone B3) was also deliberated in the 22nd CMETS-WR held on 23.10.2023, wherein, NIWE/MNRE were requested to provide the following inputs so that the scheme may be finalized.
 - Providing coordinates of B3-OSS-1 for VGF site (500MW)
 - Ampacity of 220kV export cables (1400sq. mm. or 1600 sq. mm.).
 - Details w.r.t. reactive power compensation (onshore / offshore)
- Subsequently, the matter was deliberated in MNRE in the meeting held on 22.12.2023 for finalization of the specifications of the transmission infrastructure in which following broad decisions were taken:
- The tentative timelines for the offshore wind energy projects are as follows:
 - 500 MW VGF project off-Gujarat coast to be commissioned by March 2028. Tender for the project to be published by March 2024
 - 4 GW non-VGF project off-Tamil Nadu coast to be commissioned by in FY 2029-30. Tender for the projects to be published on 01.02.2024
 - 500 MW VGF project off-Tamil Nadu coast to be commissioned by March 2029. Tender for the project to be published by March 2025.
 - Non-VGF project off-Gujarat coast will be tendered based on the response for the Tamil Nadu non-VGF project
- Offshore substation and subsea transmission line will be planned for the block-edge locations presented by NIWE in order to reduce conflicts with operations of offshore wind power developers and reduce the investment by PGCIL.
- The tentative specifications of the transmission infrastructure were agreed upon, and are as follows:
 - Operating voltage for the substation and the transmission line to be kept 220 kV.

- Substation transformer configuration of 2 x 315 MVA to be used in order to allow for safety margins and evacuation of additional capacity if awarded capacity increases beyond 500 MW
 - 2 x 300 MVA capacity subsea cables to be used for power evacuation
- Based on the above inputs, the Transmission System for Offshore Wind Zone Phase-1 (500 MW VGF on coast of Gujarat for Subzone B3) was discussed and agreed in the 25th CMETS-WR meeting held on 29.01.2024.

Scope:

Transmission System for Offshore Wind Zone Phase-1 (500 MW VGF on coast of Gujarat for Subzone B3):

A. Onwards Transmission System from Onshore Pooling Station

1. Installation of 2x1500MVA, 765/400 kV ICTs at Vataman along with 1x125 MVAR (420kV) Bus Reactor
2. Mahuva Onshore PS (GIS) – Vataman 400 kV D/c line (190 km) (Quad Moose) with 63MVAR & 50MVAR, 420kV switchable line reactors on each ckt at Mahuva & Vataman ends respectively.

Vataman switching S/s has been planned through LILO of Lakadia-Vadodara 765 kV D/c line at Vataman under Khavda Ph-III (7 GW) and is presently under implementation by POWERGRID (under TBCB) with implementation schedule of Dec'25.

B. Onshore Pooling Station

1. Establishment of 2x500 MVA, 400/220kV Mahuva Onshore Pooling Station (GIS) (Mahuva PS) alongwith 1x125 MVAR, 420kV bus reactor (with space provision for upgradation to 765 kV level to cater to future Offshore Wind Projects adjacent to B3, B4, B5 pockets in future)
2. 2 Nos. of 220kV line bays at Mahuva PS (GIS) for termination of B3-OSS-1 – Mahuva Onshore PS 220kV 2xS/c (3 core) cables
3. \pm 300 MVAR STATCOM at 220kV level of Mahuva PS (GIS) with 1 No. of 220 kV bay
4. 220KV, 1x125MVAR Variable Bus Shunt Reactor (with control range between 25 – 125MVAR for each VSR) with 1 No. of 220 kV bay

Future provision (space for) :

- 765/400 kV ICT along with bays- 6 Nos.
- 765 kV line bays along with switchable line reactors – 8 Nos.
- 765 kV Bus Reactor along with bay: 2 Nos.
- 765 kV Sectionalizer: 1 -set
- 400 kV line bays along with switchable line reactors– 8 Nos. (in addition to 2 nos. bays for Mahuva Onshore PS – Vataman 400 kV D/c line)
- 400/220 kV ICT along with bays -7 Nos.
- 400 kV Bus Reactor along with bays: 3 Nos.
- 400 kV Sectionalization bay: 1- set
- 220 kV line bays: 12 Nos.
- 220 kV Sectionalization bay: 1 set
- 220 kV BC and TBC: 1 No.
- STATCOM (\pm 300 MVAR) alongwith associated bay at 220kV - 3 No.

- VSR (1x125MVAR with control range between 25 – 125MVar for each VSR) alongwith associated bay at 220kV – 3No.

C. Offshore Pooling Station

1. Establishment of **2x315MVA**, 220/66kV Gujarat Offshore B3 Sub-Station Station-1 (B3-OSS-1) with 66kV line bays – **9** nos. for RE Interconnection
2. B3-OSS-1 – Mahuva Onshore PS (GIS) 220kV 2xS/c (3 core) cables (35 km*- under sea cable of about 25 km & under ground cable of about 10 km) alongwith associated line bays at both ends (with capacity of 300MVA/ckt at nominal voltage) with 1x50MVar switchable line reactors at B3-OSS-1 end on each cable

Note:

1. *The no. of 220 kV Submarine Cables has been considered assuming capacity of one three core cable as 300MVA.*
2. *Reactive compensation has been worked considering MVar generation of about 3MVar/km by 220 kV Submarine Cable.*
3. ** Distance indicated is beeline length, however, it may change based on actual survey.*

Expected Commissioning Schedule: Mar'28

Tentative Cost: Onshore Portion: Rs. 2186 Cr. & Offshore Portion: Rs. 4000 Cr.

Transmission System for Offshore Wind Zone Phase-2 (500 MW Non- VGF on coast of Gujarat for Subzone B3):

A. Onshore Pooling Station

1. Augmentation of Mahuva Onshore Pooling Station (GIS) by 1x500 MVA, 400/220kV ICT alongwith 1x125 MVAR, 420kV bus reactor
2. 2 Nos. of 220kV line bays at Mahuva PS(GIS) for termination of B3-OSS-1 – Mahuva Onshore PS 220kV 2xS/c (3 core) cables
3. 220KV, 1x125MVAR Variable Bus Shunt Reactor (with control range between 25 – 125MVar for each VSR) with 1 Nos. of 220 kV bay

B. Offshore Pooling Station

3. Establishment of **2x315MVA**, 220/66kV Gujarat Offshore B3 Sub-Station Station-2 (B3-OSS-2) with 66kV line bays – **9** nos. for RE Interconnection
4. B3-OSS-2 – Mahuva Onshore PS (GIS) 220kV 2xS/c (3 core) cables (~50 km*) alongwith associated line bays at both ends (with capacity of 300MVA/ckt at nominal voltage) with 1x50MVar switchable line reactors at B3-OSS-2 end on each cable

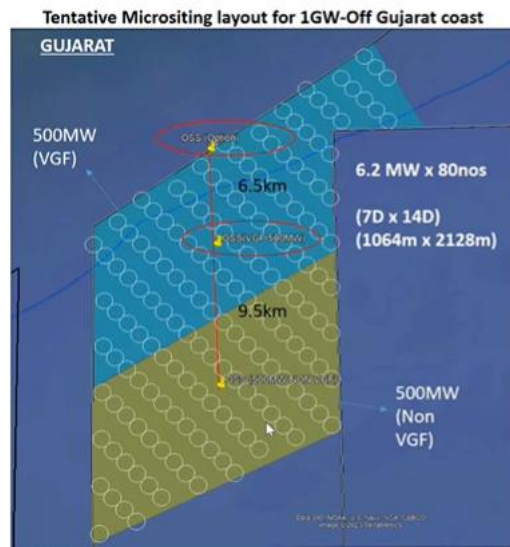
**The cable lengths are tentative and subject to change based on inputs from MNRE sought vide mail dated 06.10.2023.*

Note:

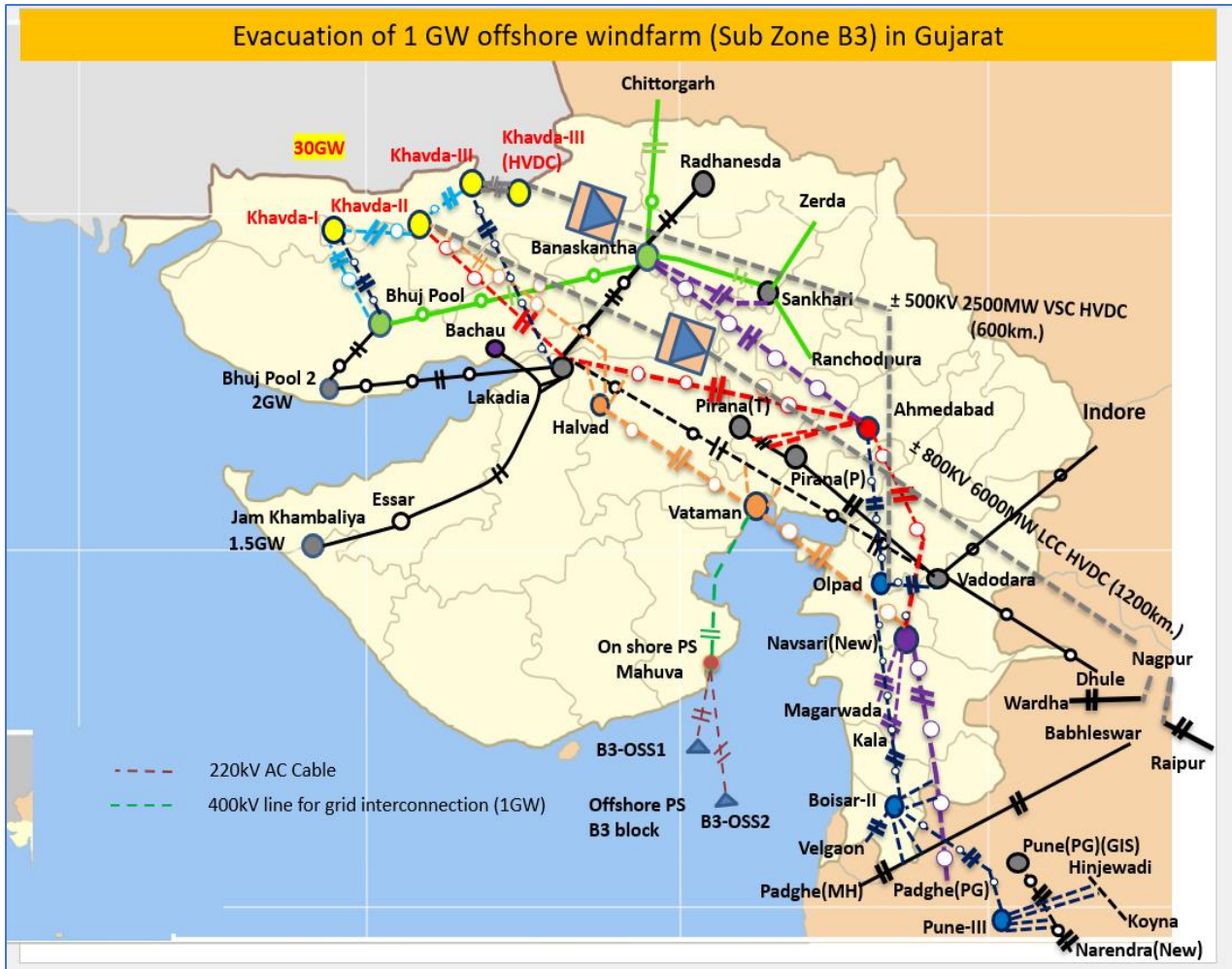
1. *The no. of 220 kV Submarine Cables has been considered assuming capacity of one three core cable as 300MVA.*

2. *Reactive compensation has been worked considering MVar generation of about 3MVar/km by 220 kV Submarine Cable.*

a) **Schematic:**



(Source: NIWE)



(g) Augmentation of Transformation capacity at Jam Khambhaliya PS (JKTL): Part B

Following proposals had been received from GETCO for drawal of power through the ISTS network in vicinity of Jam Khambhaliya PS:

- Installation of 2x500MVA, 400/220kV ICTs at Jam Khambhaliya (on segregated 220kV bus) (under ISTS) and 220 kV D/C Jam Khambhaliya (ISTS) – Kuvadiya line (In-STS): (10-12 km.)
GETCO stated that the 220kV D/c line shall involve 18 months for implementation by STU. However, considering ISTS time-line of ~24 months from approval-to-COD, the line would be matched with 2x500MVA ICTs under ISTS
- LILO of both circuits of 400 kV D/C Jam Khambhaliya – Kalavad line at Babarzar 400 kV substation along with Establishment of 2x500MVA, 400/220kV ICTs at Babarzar. (In-STS):
GETCO stated that the scheme is planned under In-STS GEC-II and may be expected by FY27 (under tenderization)

The above schemes were deliberated in 25th Consultation Meeting for Evolving Transmission Schemes in Western Region held on 29.01.2024. With the above 2x500MVA ICTs for drawal of power by GETCO, the configuration at 220kV level of Jam Khabhaliya PS would be as below:

- 1) 220kV Section 1 (existing) with 4x500MVA ICTs and 7 nos. 220kV bays (existing)

- 2) **220kV Bus Sectionaliser between Section-1 (existing) and Section-2 (new)**
- 3) 220kV Section 2 (New) with proposed 2x500MVA ICTs (under proposed scope) + **1 No. 500MVA ICT (New)** and 3 nos. 220kV bays (2 nos. under proposed scope & 1 no. under applicant scope)
- 4) **220kV Bus Sectionaliser between Section-2 (new) and Section-3 (Proposed above)**
- 5) 220kV Section 3 with New 2x500MVA ICTs and 4 nos. 220kV bays (**Proposed above**)

Here, it was noted that 1 No. 500MVA ICT (7th) on Bus Section-II of Jam Khambhaliya PS has been proposed for RE injection. Now, the last 220kV bus section-3 along with New 2x500MVA ICTs and 4 nos. 220kV bays are required for GETCO drawal. Hence, it was agreed that the entire scope of work may be implemented under same scheme:

Augmentation of Transformation capacity at Jam Khambhaliya PS (JKTL):

Sl. No.	Scope of the Transmission Scheme	Capacity /km
1.	Augmentation of transformation capacity at Jam Khambhaliya PS (GIS) by 1x500MVA, 400/220kV (7 th) ICT terminated on New 220kV bus section-2	500MVA, 400/220kV ICTs: 1 Nos. 400kV ICT bays: 1 No. (TSP to implement complete dia. with the other 400kV bay to be utilized by EETFEL (Bulk consumer)) 220kV ICT bays: 1 No.
2.	Creation of New 220kV Bus Section at Jam Khambhaliya PS (Section 3) (with space for 2 nos. 220kV line bays: future in same GIS hall)	220kV Bus sectionaliser bay - 1 Set (<i>to be kept normally OPEN and may be closed based on system requirement</i>) 220kV BC – 1 No.
3.	Augmentation of transformation capacity at Jam Khambhaliya PS (GIS) by 2x500MVA, 400/220kV ICT (8 th & 9 th) terminated on New 220kV bus section-3	500MVA, 400/220kV ICTs: 2 Nos. 400kV ICT bays: NIL (bays being implemented under Jamnagar scheme, which is currently under tendering, with schedule of Apr/May-26) 220kV ICT bays: 2 Nos.
4.	Implementation of 220kV GIS line bays at Jam Khambhaliya PS for Kuvadla 220kV D/c line	220kV line bay – 2 No. (GIS)

Implementation time-frame: 21 months

(h) Augmentation of transformation capacity at Lakadia PS: Part C

- Para 4.4.5 of the Manual on Transmission Planning Criteria, 2023 published by CEA states as under:
 - “The ‘N-1’ criteria may not be applied to the immediate connectivity system of renewable generations with the ISTS/Intra-STS grid i.e. the line connecting the generation project switchyard to the grid and the step-up transformers at the grid station.

- Provided that, 'N-1' criteria shall be applicable in case of renewable generation projects with storage, which are firm in nature and fully dispatchable.
- Provided that, 'N-1' reliability criteria may be considered for ICTs at the ISTS / STU pooling stations for renewable energy-based generation of more than 1000 MW after considering the capacity factor of renewable generating stations."

In the 24th CMETS-WR meeting, in view of receipt of applications for connectivity under GNA for 1700MW at Lakadia PS in Gujarat (incl. application discussed and agreed in the meeting), 1x500MVA, 400/220kV ICT (5th) was agreed.

Now, in the 25th CMETS-WR, additional applications for 542MW have been received taking the cumulative RE capacity to 2242MW for which 6th 400/220kV, 1x500MVA ICT shall also be required. Considering the rapid pace of applications being received at Lakadia PS, it was agreed to install all remaining ICTs and 220kV bays at Lakadia PS in one go so as to minimize multiple implementation time-lines / co-ordination issues, etc.

In view of the same, the following scope was agreed at Lakadia PS:

Augmentation of transformation capacity at Lakadia PS

Sl. No.	Scope of the Transmission Scheme	Capacity /km
1.	Creation of New 220kV Bus Section at Lakadia PS along with 220kV Sectionalizer arrangement between existing & New 220kV bus	220kV Bus Sectionalizer - 1 set BC – 1 No. TBC – 1 No.
2.	Augmentation of transformation capacity at Lakadia PS by 4x500MVA, 400/220kV ICTs (5 th 6 th , 7 th & 8 th) terminated on new 220kV Bus Section	500MVA, 400/220kV ICTs: 4 No. 400kV ICT bays: 4 Nos. 220kV ICT bays: 4 No. (New Bus Section)
3.	Implementation of 220kV line bay at Lakadia PS for Juniper Green Energy Private Limited (JGEPL) (Appl. No. 2200000376: 300MW)	220kV line bay – 1 No. (New Bus Section)
4.	Implementation of 220kV line bay at Lakadia PS for TEQ Green Power XVI Pvt. Ltd. (TGPXVIPL) (Appl. No. 2200000398: 76MW)	220kV line bay – 1 No. (New Bus Section)
5.	Implementation of 220kV line bay at Lakadia PS for Ganeko Solar Pvt. Ltd. (GSPL) (Appl. No. 2200000458: 290MW)	220kV line bay – 1 No. (New Bus Section)
6.	Implementation of 220kV line bays at Lakadia PS for future RE applicants	220kV line bay – 4 Nos. (New Bus Section)

Sl. No.	Scope of the Transmission Scheme	Capacity /km
7.	Installation of 1x330MVar 765kV Bus Reactor (2nd) along-with associated bay	330MVar, 765kV Bus Reactor: 1 No. 765kV BR bay: 1 No.

Implementation time-frame: 15.02.2026 (subject to minimum schedule of 18 months) for Sl.1, 2, 4, 6 & 7, 30.06.2028 for Sl. 3 & 31.12.2026 for Sl.5

(i) Implementation of 400kV bay at Khavda-I PS (KPS1) for interconnection of RE project of Sarjan Realities Pvt. Ltd. (SRPL) (1150MW)

KPS 1 (Bus Section 1) is under implementation by Khavda Bhuj Transmission Ltd. (KBTL) (a subsidiary of Adani Energy Solutions Ltd.) through TCB Route.

However, KPS1 Augmentation works (Bus Section 2) is under implementation by KPS1 Transmission Ltd. (a subsidiary of Megha Engineering & Infrastructures Ltd.) wherein, 3 nos. 400kV bays at KPS1 (Sec-2) are being implemented, which have been allocated to: AGEL (1000MW), AGEL (1050+250MW) & AGEL (1000MW).

Another 400kV GIS bay is required for enabling connectivity of Sarjan Realities Pvt. Ltd. (SRPL) (1150MW) at 2nd 400 kV bus section of KPS1.

Sl. No.	Scope of the Transmission Scheme	Item Description	Implementation Timeframe.
1.	400kV line bay at Khavda-I PS (KPS1) (GIS) for interconnection of RE project of Sarjan Realities Pvt. Ltd. (1150MW)	• 400 kV GIS line bay – 1no. + 1 no. additional bay for diameter completion at 2 nd 400 kV bus section (refer note a)	28.02.2026 (refer note b)
Total Estimated Cost:			₹ 31.8 Crore

Note:

- In view of GIS substation, one complete 400kV diameter with three Circuit Breakers (one and half switching scheme) shall be implemented at 400kV level for interconnection of RE project in one 400kV bay. Utilization of another 400kV bay of the diameter shall be identified in future.
- Implementing agency shall match the Implementation Timeframe of the subject transmission scheme with commissioning schedule of Khavda Phase-IV transmission system which is expected by 28.02.2026 (i.e., 24 months from the date of SPV transfer which is presently anticipated by Feb'24).

(j) Augmentation of transformation capacity at Bhuj-I PS

In view of receipt of applications for Connectivity for 3,546MW (cumulative), no margins were available for RE injection at Bhuj I PS. Hence, 1x500MVA, 400/220kV ICT (9th) was planned at Bhuj-I PS so as to enable of RE injection along with compliance to N-1 criteria. The scheme was awarded to POWERGRID through RTM for implementation vide CTU OM dated 02.01.2024 with implementation timeframe of 18 months.

<i>Sl. No.</i>	<i>Scope of the Transmission Scheme</i>	<i>Capacity /km</i>	<i>Implementation Timeframe.</i>
1.	Augmentation of transformation capacity at Bhuj-I PS by 1x500MVA, 400/220kV ICT (9 th)	500MVA, 400/220kV ICTs: 1 Nos. 400kV ICT bays: 1 Nos. 220kV ICT bays: 1 Nos.	02.07.2025

Implementation time-frame: 18 months.

(k) Augmentation of transformation capacity at Banaskantha (Raghanesda) PS (GIS)

With the existing 2x500MVA, 400/220kV ICTs, no margin was available for RE injection beyond 1000MW. However, in view of receipt of applications for Connectivity for additional 250MW, 3rd 400/220kV ICT at Banaskantha S/s was planned so as to enable RE injection along with compliance to N-1 criteria. The scheme was discussed in the 25th CMETS-WR held on 29.01.2024.

<i>Sl. No.</i>	<i>Scope of the Transmission Scheme</i>	<i>Capacity /km</i>
1.	Augmentation of transformation capacity at Banaskantha (Raghanesda) PS (GIS) by 1x500MVA 400/220kV ICT (3 rd)	500MVA, 400/220kV ICT: 1 No. 400kV ICT bay: 1 Nos. 220kV ICT bay: 1 No.

Implementation time-frame: 21 months from allocation.

(l) Interconnection of RE developer's DTL at Bay no. 412 of KPS-1 (400kV Bus Section-I)

KPS 1 (Bus Section 1) is under implementation by Khavda Bhuj Transmission Ltd. (KBTL) (a subsidiary of Adani Energy Solutions Ltd.) through TBCB Route where in 3 nos. 400kV bays at KPS1 Sec-1, which have been allocated to: Adani Renewable Energy Holding Four Ltd. (AREH4L) [500MW (appl. no.-1200002437) +2000MW (appl. no.- 1200002678) +1000MW (appl. no.- 1200002679)].

Another 400kV GIS bay is required for enabling connectivity of Adani Green Energy Ltd. (AGEL) (1050MW – appl. no. 1670426092248) at 1st 400 kV bus section of KPS1.

As per the original scope of transmission scheme under implementation by KBTL, in case of GIS Sub-station, GIS duct of the future bay shall be brought outside the GIS hall/building with extension/interface module suitably. In the instant case, future bay at KPS-1 (Section-1) is 412 which has been allocated to AGEL. Accordingly, this scheme has been proposed which includes installation of Line Trap, Surge Arrester, Line CVT, Control & Protection Panel, etc., to complete the balance work of bay no. 412, thereby enabling physical interconnection of AGEL's DTL with KPS-1 (Section-I).

<i>Sl. No.</i>	<i>Scope of the Transmission Scheme</i>	<i>Item Description</i>	<i>Implementation Timeframe.</i>
1.	Implementation of additional line bay equipment including other miscellaneous works required for	As required for completion of scope of the scheme.	25.12.2025 (refer note a)

Sl. No.	Scope of the Transmission Scheme	Item Description	Implementation Timeframe.
	physical interconnection of Dedicated Transmission Line of RE Developer at bay no. 412 of KPS-1 (400kV Bus Section-1)		
Total Estimated Cost:			₹ 4.7 Crore

Note:

- a. Implementing agency shall match the Implementation Timeframe of the subject transmission scheme with commissioning schedule of Khavda Phase-IV transmission system which is expected by 25.12.2025 (i.e., 24 months from the date of SPV transfer which is 26.12.2023).

The scheme was awarded to KBTL through RTM for implementation vide CTU OM dated 15.02.2024 with an implementation timeframe as 25.12.2025.

(m) Interconnection of RE developer's DTL at Bay no. 416 of KPS-2 (400kV Bus Section-I)

KPS 2 is under implementation by KPS2 Transmission Ltd. (KPS2TL) (a subsidiary of Power Grid Corporation of India Ltd.) through TBCB Route where in 2 nos. 400kV bays have been allocated to GIPCL [600MW (appl. no. 1200003371) + 575MW (appl. no. 2200000159)] & GSECL [600MW (appl. no. 1200003331)] at 400kV Bus Section-1 & and 1 no. 400kV line bay has been allocated to NTPC REL [265MW (appl. no. 1200003585) + 100MW (appl. no. 1200003733) + 890MW (appl. no. 1200003953) + 300MW (appl. no. 330700007)] at 400kV Bus Section-2.

Another 400kV GIS bay is required for enabling connectivity of GSECL [1000MW (appl. no. 230700005) + 364MW (appl. no. 2200000048)] at 1st 400 kV bus section of KPS2.

As per the original scope of transmission scheme under implementation by K2TL, in case of GIS Sub-station, GIS duct of the future bay shall be brought outside the GIS hall/building with extension/interface module suitably. In the instant case, future bay at KPS-2 (Section-1) is 416 which has been allocated to GSECL. Accordingly, this scheme has been proposed which includes installation of Line Trap, Surge Arrester, Line CVT, Control & Protection Panel, etc., to complete the balance work of bay no. 416, thereby enabling physical interconnection of GSECL's DTL with KPS-1 (Section-I).

Sl. No.	Scope of the Transmission Scheme	Item Description	Implementation Timeframe.
1.	Implementation of additional line bay equipment including other miscellaneous works required for physical interconnection of Dedicated Transmission Line of RE Developer at bay no. 416 of KPS-2 (400kV Bus Section-1)	As required for completion of scope of the scheme.	28.03.2025 (refer note a)
Total Estimated Cost:			₹ 12.26 Crore

Note:

- a. Implementing agency shall match the Implementation Timeframe of the subject transmission scheme with commissioning schedule of Khavda Phase-II transmission system which is expected by 28.03.2025.

The scheme was awarded to KPS2TL through RTM for implementation vide CTU OM dated 15.02.2024 with an implementation timeframe as 25.12.2025.

3.2.Maharashtra

a) Network Expansion scheme in Western Region to cater to Pumped storage potential near Talegaon (Pune):

- As identified by MOP, a potential of more than 10GW is available for Pumped Storage Plants in Maharashtra in the area between Boisar, Nashik & Pune.
- Applications have already been received from Tata power for Bhivpuri (1150MW) & Shirawata (1980MW) PSPs (3.13 GW). Hence, a new substation in vicinity of Kalamb (nearby Mumbai), which would be optimally distant from all the potential locations, has been planned to cater to the Pumped storage potential envisaged near Pune (more than 10GW). The substation shall have sufficient space for feeding local demand of Mumbai/Ambarnath area.
- Out of various load generation scenarios, Sc-7 (PSP importing) & Sc-5 (PSP injecting) are observed to be extreme cases as far as power flow is concerned. New S/s considered at Kalamb through the LILO of Pune-III – Boisar-II 765kV D/c line is able to meet the following limits:
 - A drawal capacity of nearly 6000MW being N-1 compliant and without causing any over loadings, in the winter solar max scenario (Sc-7). Sc-7 has NR export scenario while all other regions are importing. In solar max (afternoon) scenario, PSPs are assumed to be importing power (pumping mode) so as to provide maximum benefits to ISTS Grid.
 - An injection capacity of nearly 4500MW being N-1 compliant and without causing any over loadings, in the summer evening peak scenario (Sc-5). Sc-5 has SR & WR export scenario while NR & ER are importing. In evening peak scenario, PSPs are assumed to be injecting power into the Grid to meet peak demand.
- The matter was discussed in a meeting held on 15.12.2023 amongst CEA, CTU, GRID-INDIA, MSETCL & TATA POWER as well as in the 24th CMETS-WR meeting held on 28.12.2023 wherein it was decided that the substation may be located at a suitable location in South of Kalamb so that it is located in vicinity of Neral (where 400 kV Padghe – Nagthane D/c, 400 kV Talegaon – Kharghar line and 400 kV Talegaon – Kalwa line are crossing), near TPC's PSPs as well as other upcoming PSPs north of Murbad (like Malshejghat PSP (1500MW) (AGEL) and Kengadi (1550MW), Jalond (2400MW) & Kalu (1150MW) PSPs of NHPC). Further, considering the huge PSP potential in the area, which are likely to tie up power for pumping mode from RE projects located far away, space for establishment of 6000 MW, \pm 800kV South Kalamb (HVDC) [LCC] terminal station (4x1500 MW) may also be kept in the substation so that an HVDC may also be planned at a future date.

Scope:

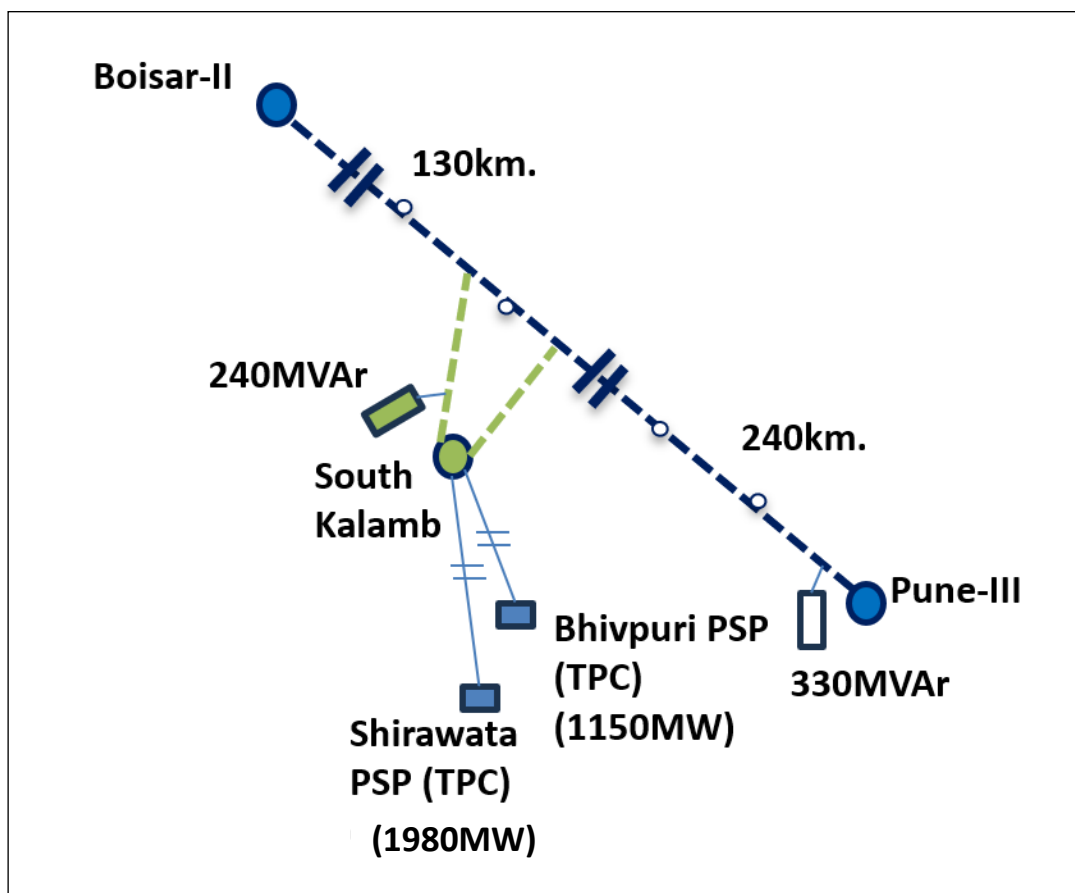
Network Expansion scheme in Western Region to cater to Pumped storage potential near Talegaon(Pune):

Sl. No.	Scope of the Transmission Scheme	Capacity /km
1.	<p>Establishment 4x1500 MVA, 765/400kV Substation near South of Kalamb with 2x330 MVAR, 765 kV bus reactor and 2x125 MVAR, 420 kV bus reactor</p> <p>Future provision (space for):</p> <ul style="list-style-type: none"> ➤ 765/400 kV ICT along with bays- 7 Nos. (4 Nos. in Sec-II & 3 Nos. on Sec-III) ➤ 765 kV line bays along with switchable line reactors – 6 Nos. (4 Nos. on Sec-II & 2 Nos. on Sec-III) ➤ 765 kV Bus Reactor along with bay: 3 Nos. (2 Nos. on Sec-II & 1 No. on Sec-III) ➤ 765 kV Sectionalizer: 2 -sets ➤ 400 kV line bays along with switchable line reactors– 12 Nos. (2 nos. on Sec-I, 6 nos. on Sec-II & 4 nos. on Sec-III) ➤ 400/220 kV ICT along with bays -6 Nos. (on 400kV Sec-III, 3 nos. on 220kV Sec-I & 3 nos. on 220kV Sec-II) ➤ 400 kV Bus Reactor along with bays: 3 Nos. (2 Nos. on Sec-II & 1 No. on Sec-III) ➤ 400 kV Sectionalization bay: 2- set ➤ 220 kV line bays: 12 Nos. (6 nos. on Sec-I & 6 nos. on Sec-II) ➤ 220 kV Sectionalization bay: 1 set ➤ 220 kV BC and TBC: 2 Nos. ➤ Establishment of 6000 MW, \pm 800kV South Kalamb (HVDC) [LCC] terminal station (4x1500 MW) along with associated interconnections with 400kV HVAC Switchyard (2x1500MW on 400kV Sec-I & 2x1500MW on 400kV Sec-II) & all associated equipment (incl. filters)/bus extension, etc. 	<p>765/400 kV, 1500 MVA ICT – 4 Nos. (13x500 MVA single phase units including one spare ICT Unit)</p> <p>765 kV ICT bays – 4 Nos.</p> <p>400 kV ICT bays – 4 Nos.</p> <p>765 kV Line bays – 4 Nos.</p> <p>1x330 MVA, 765 kV bus reactor- 2 Nos. (7x110 MVAR single phase Reactors including one spare Unit for bus /line reactor)</p> <p>765 kV Bus reactor bay – 2 Nos.</p> <p>125 MVA, 420 kV reactor- 2 Nos.</p> <p>400kV Reactor bay- 2 Nos.</p> <p>400kV line bays - 4 Nos. (for interconnection of TPC PSPs)</p>
2.	LILO of Pune-III – Boisar-II 765kV D/c line at South Kalamb S/s with associated bays at South Kalamb S/s	LILO Route length: 40 km (160 ckm.)
3.	Installation of 1x240 MVA switchable line reactor on each ckt at South Kalamb end of Boisar-II – South Kalamb 765 kV D/c line (formed after above LILO)	<p>1x240 MVA, 765 kV switchable line reactor – 2 nos.</p> <p>Switching equipment for 765 kV line reactor – 2 nos.</p>

Implementation Timeframe: 01.01.2028 as per start date of connectivity sought by TPC for Bhivpuri PSP. (Shirawta PSP is targeted by 1st November 2028)

Tentative Cost: Rs. 1921 Crore

Schematic:

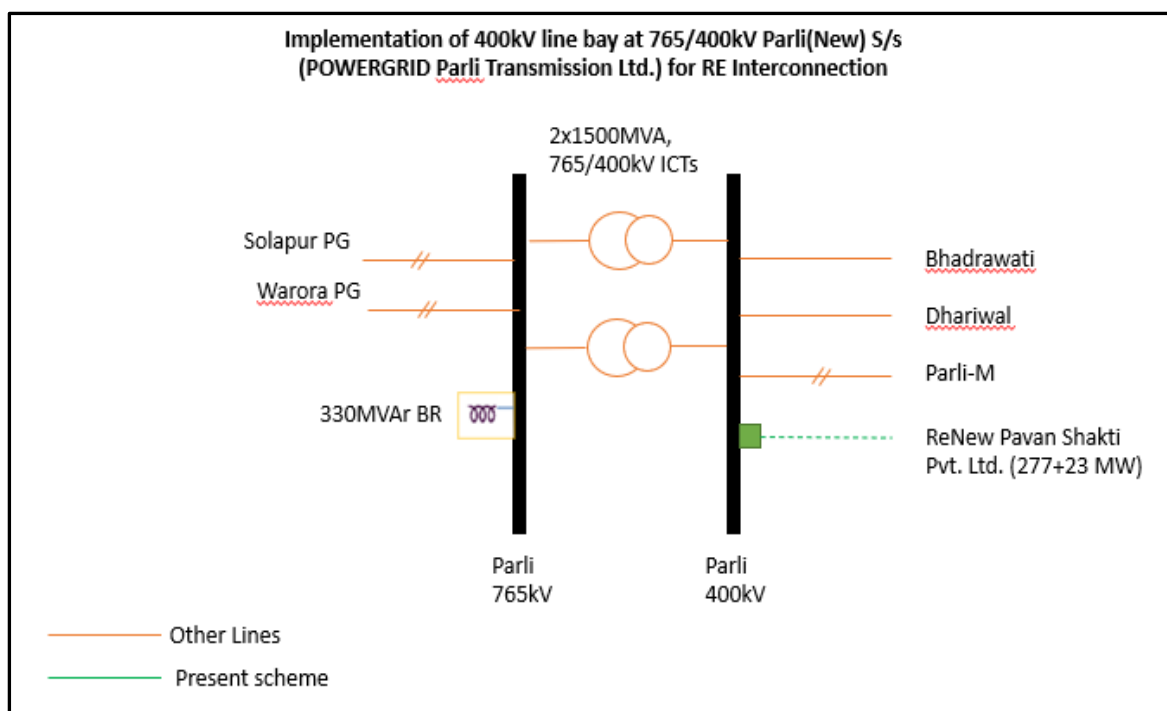


b) Implementation of 400kV line bay at 765/400kV Parli (New) S/s for RE Interconnection.

765/400kV Parli (new) S/s is an existing substation implementation by POWERGRID Parli Transmission Ltd. (a subsidiary of Power Grid Corporation of India Ltd.) through TBCB Route. 400kV line bay allotted to Renew Pawan Shakti Private Limited (RPSPL): Appl. No. 231400018 (277MW) who is sharing the bay with Renew Pawan Shakti Private Limited (RPSPL): Appl. No. 331400012 (23MW) at Parli (New) S/s. The 400kV line bay shall enable evacuation of RE power from various generation projects in Parli area who have applied / shall apply for connectivity under GNA at Parli(New) S/s at 400kV level.

Implementation of 400kV line bay at 765/400kV Parli (New) S/s for RE Interconnection.

<i>Sl. No.</i>	<i>Scope of the Transmission Scheme</i>	<i>Item Descriptions</i>	<i>Implementation Timeframe.</i>
1.	400kV line bay at 765/400kV Parli (New) S/s for interconnection of RE Project.	• 400 kV line bay – 1no.	31.12.2025
Total Estimated Cost:			₹ 18 Crore



c) ICT Augmentation at Boisar (PG) S/s

In view of the upcoming EHV consumers on Boisar (PG) – Nalsopara & Boisar (PG) – Vasai lines and delay in Velgaon S/s, MSETCL vide letter dated 08.11.2023 had requested to implement 1x500MVA, 400/220kV ICT (5th) at Boisar (PG) S/s. Further, the proposed Velgaon S/s is also getting delayed due to non-availability of land. Hence, the 5th ICT was required on urgent basis to retain reliability of power supply besides meeting the N-1 criteria.

Accordingly, the scheme was discussed in the 24th CMETS-WR held on 28.12.2023, wherein after the above deliberations, augmentation of Boisar (PG) S/s by 1x500MVA, 400/220kV ICT (5th) was agreed.

Sl. No.	Scope of the Transmission Scheme	Capacity /km
1.	Augmentation of transformation capacity at Boisar (PG) S/s by 1x500MVA, 400/220kV ICT (5 th)	500MVA, 400/220kV ICTs: 1 No* 400kV ICT bays: 1 No. (GIS)* 220kV ICT bays: 1 No.*

**As per email dated 28.12.2023 from POWERGRID, Space is available at Boisar (PG) S/s for 400/220kV ICT-V. For accommodating the above, 1 no. 400kV GIS Bay (In existing Half Dia of One and Half CB Scheme) and 1 Nos. 220kV Bay (In DMT scheme) need to be constructed.*

Implementation time-frame: 21 months from allocation.

3.3.Madhya Pradesh

a) Transmission System for evacuation of power from Mahan Energen Limited Generating Station in Madhya Pradesh

As per CERC Regulation, 2004/2009, Connectivity has been granted to Mahan Energen Ltd. (Formerly Essar Power MP Ltd) (2x600MW) for 1100MW as per the following details:

- Mahan TPS – Bilaspur PS 400kV D/c (Quad ACSR Moose) line
- LILO of one ckt of 400kV Vindhyachal – Korba STPP at Mahan TPS
- 4 nos. 400kV line bays at Mahan TPS.

The LILO of one ckt. of 400kV Vindhyachal – Korba STPP at Mahan TPS was disconnected as per directions in CERC order dated 01.06.2022 in I.A. No. 4/IA/2022 in Petition No. 92/MP/2021. M/s MEL has opted for conversion to GNA for 1100MW under Regulation 37.6(1) of GNA Regulations, 2022. M/s MEL has also filed an application for grant of Connectivity for balance 100MW under Regulation 4 of GNA Regulations, 2022 for its existing plant.

Subsequently, a meeting was held amongst CEA, CTU, MPPTCL, CSPTCL, EPTCL & MEL on 01.09.2023, wherein, it was decided that M/s MEL was to apply for connectivity for the expansion of Bandhaura Thermal power Plant (2 x 800 MW) (Mahan Expansion project) being developed by Mahan Energen Limited (MEL). In this regard, it is to mention that MEL has filed an application to MP Power Transmission Co. Ltd (MP STU) for connectivity of 1320 MW (Gross) capacity of its Mahan Expansion project with Intra-State Transmission System & balance 280MW (Gross) capacity of the Mahan Expansion project to Inter State Transmission System under GNA.

The matter was discussed in a joint study meeting amongst CEA, CTU, MPPTCL, GRID-INDIA & MEL on 11.12.2023 & 11.01.2024 wherein a number of alternatives were studied and Alternative-V [MP STU proposed system + Mahan (existing bus) – Rewa PS (PG) 400kV D/c line (quad) (Under ISTS) & Mahan - Mahan (Ext) interconnector closed] was agreed as the best option from techno-economic point of view considering distinct advantages over other alternatives studied during the meeting. The matter was discussed and finalized in the 25th CMETS-WR meeting held on 29.01.2024.

Scope:

Transmission System for evacuation of power from Mahan Energen Limited Generating Station in Madhya Pradesh

Sl. No.	Scope of the Transmission Scheme	Capacity /km
1.	Mahan (existing bus) – Rewa PS (PG) 400kV D/c (quad) line	110km.
2.	2 nos. 400kV bays at Rewa PS (PG) for termination of Mahan (existing bus) – Rewa PS (PG) 400kV D/c line (quad) line	400kV bays: 2 Nos.

Note:

- 2 nos. 400kV line bays at MEL (existing) shall be under the scope of MEL
- POWERGRID to provide space at Rewa PS (PG) for scope at Sl. 2

Following transmission system proposed by MPPTCL was deliberated & agreed for evacuation of MP's share of about 1230MW power (1320 MW Gross capacity) from proposed 2x800 MW units of Mahan Expansion project to be developed by MPPTCL by Jan'27 as per PPA signed between MEL & MPPMCL:

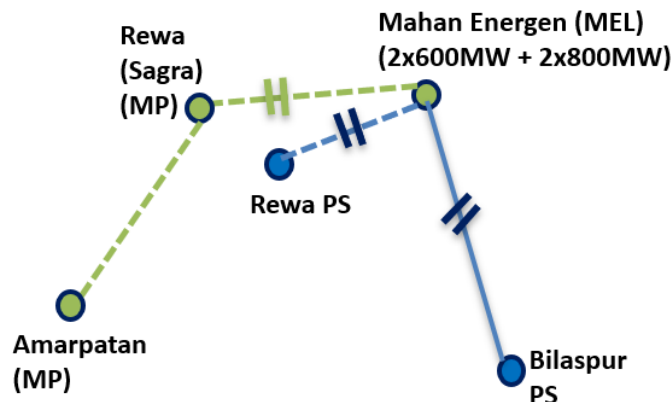
Sl. No.	Transmission Infrastructure	Length/Capacity
1.	Establishment of Rewa (Sagra) 400kV S/s with 2x500MVA,400/220kV and 2x200MVA, 220/132kV ICT	2x500MVA,400/220kV 2x200MVA, 220/132
2.	PTEMPL Switchyard - Rewa(Sagra) 400kV DCDS line(Quad Moose)	150km
3.	LILO of both circuit of Rewa - Sirmour/Bansagar-I 220kV line at Rewa(Sagra) 400kV S/s	10km
4.	Rewa(Sagra) 400kV - Kotar 220kV DCDS line	45km
5.	Rewa(Sagra) 400kV - Rewa(Sagra) 132kV DCDS line (Interconnector) [In case on non-availability of feeder bay at Existing EHV Substation then option for LILO of Existing Line will be explore]	10km
6.	Rewa(Sagra) 400kV - Rewa 132kV DCDS line [In case on non-availability of feeder bay at Existing EHV Substation then option for LILO of Existing Line will be explore]	25km
7.	Rewa(Sagra) 400kV - Mangawan 132kV DCDS line [In case on non-availability of feeder bay at Existing EHV Substation then option for LILO of Existing Line will be explore]	25km
8.	Establishment of Amarpatan 400kV S/s with 2x500MVA,400/220kV and 2x200MVA, 220/132kV ICT	2x500MVA,400/220kV 2x200MVA, 220/132
9.	Rewa(Sagra) - Amarpatan 400kV DCDS line(Quad / Twin Moose)	60km
10.	LILO of both circuit of Maihar - Satna (PGCIL) 220kV line at Amarpatan 400kV S/s	20Km
11.	Amarpatan 400kV - Amarpatan 132kV DCDS line (Interconnector) [In case on non-availability of feeder bay at Existing EHV Substation then option for LILO of Existing Line will be explore]	10km
12.	Amarpatan 400kV - Satna -II 132kV DCDS line	35km
13.	Amarpatan 400kV - Rampur Baghelan 132kV DCDS line [In case on non-availability of feeder bay at Existing EHV Substation then option for LILO of Existing Line will be explore]	25km
14.	Amarpatan 400kV - Unchehra 132kV DCDS line	25km

Note: MPPTCL has stated that the above system may be slightly changed based on feasibility of physical implementation of downstream system and the same shall be intimated from time to time.

Implementation time-frame: 24 months

Tentative Cost: Rs. 558 Crore

Transmission System for evacuation of power from Mahan Energen Limited Generating Station in Madhya Pradesh



b) 400kV line bays & ICT Augmentation at 765/400/220kV Mandsaur S/s in MP

The Mandsaur PS is being set-up with 3x1500MVA, 765/400kV ICTs to enable evacuation of power from 2GW Wind Potential (W/o BESS) identified under 181.5GW REZ potential. The S/s has been approved in the 14th NCT meeting held on 09.06.2023 & Gazette is to be issued with implementation time-frame of 24 months from SPV Transfer. The present application shall result in cumulative injection of 3512MW (incl. 2000MW WEZ) at 400kV level of Mandsaur PS and hence, an additional 1x1500MVA, 765/400kV ICT (4th) is required.

The PSPs of M/s Greenko are tying up power from RE sources and the RE power stored during high RE periods shall be dispatched in conjunction with the 2GW WEZ at Mandsaur PS. Thus, the 4th ICT would be catering to WEZ potential and would also facilitate evacuation of RE power stored in PSP in a reliable manner. Hence, the 1x1500 MVA, 765/400 kV ICT (4th) at Mandsaur PS shall serve both RE projects as well as the subject PSPs (Energy storage).

The scheme was agreed in the 21st CMETS-WR (2nd sitting) meeting held on 29.08.2023. In 17th NCT meeting held on 31.01.2024, it was deliberated that PSPs should operate to store RE power in such a manner so as to ensure optimal loading on 765/400kV ICTs at Mandsaur PS. In this way, the loading on outgoing 765kV lines from Mandsaur PS would also be within limits and PSP would compliment the ISTS Grid and help in maximum RE integration without the need for additional system.

Accordingly, NCT opined that for providing connectivity to PSP of Greenko, augmentation of transformation capacity is not required at Mandsaur S/s as the same can be accommodated within the present scope of works. Further, the 2 nos. 400kV line bays for Greenko may be discussed later as a separate scheme based on its cost.

Scope:

<i>Sl.</i>	<i>Scope of the Transmission Scheme</i>	<i>Capacity /km</i>
1.	Augmentation of transformation capacity at Mandsaur PS by 1x1500 MVA, 765/400 kV ICT (4th) along with associated bays	765/400kV ICT – 1 no. (4 th) 765kV ICT bay – 1No. 400kV ICT bay – 1 No.
2.	400kV line bays at 765/400/220kV Mandsaur S/s for Interconnection of PSP of Greenko MP01 IREP Private Limited	400kV line bay – 2 No.

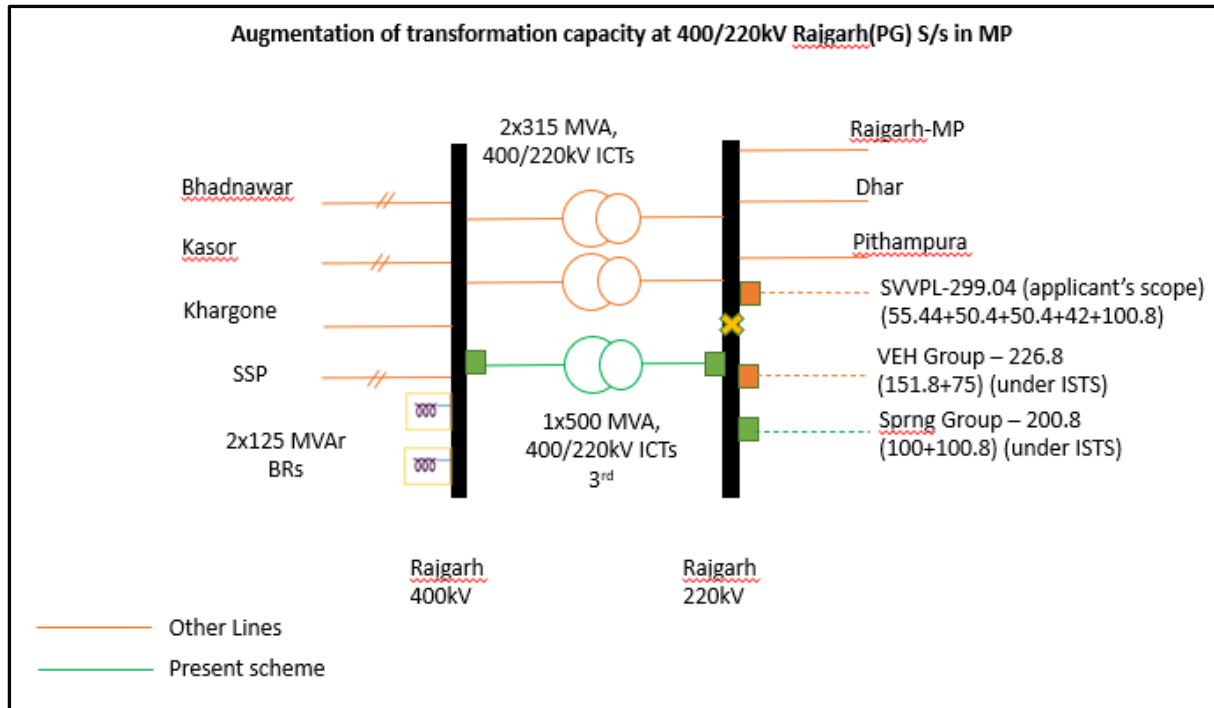
Implementation timeframe: 24 months from date of allocation to implementing agency.

Estimated Cost: Rs. 143 Cr.

c) Augmentation of Transformation Capacity at 400/220kV Rajgarh (PG) S/s in MP by 400/220 kV, 1x500 MVA ICT (3rd)

Due to non-availability of margins for injection beyond 300MW from 220kV level of Rajgarh S/s, the 1x500MVA, 400/220kV ICT-III has been planned on extended 220kV bus (segregated from main bus through bus sectionaliser) so as to enable evacuation of RE power from various generation projects who have applied for connectivity under GNA at Rajgarh S/s directly to 400kV level of Rajgarh S/s. The sectionaliser may also be closed based on system requirement.

<i>Sl. No.</i>	<i>Scope of the Transmission Scheme</i>	<i>Item Description</i>	<i>Implementation Timeframe.</i>
1.	Augmentation of Transformation capacity at 400/220kV Rajgarh S/s by 1x500MVA ICT (3 rd) (terminated on the sectionalized 220kV bus)	<ul style="list-style-type: none"> • 400/220kV, 1x500MVA ICT – 1 No. • 400kV ICT bay – 1 No. (AIS) • 220kV ICT bay – 1 No. (GIS) (on the sectionalized 220kV bus, which is presently under implementation by POWERGRID) • 220 kV GIS duct (m) – 300m. approx. 	31.10.2025 or 21 months from date of award to implementing agency (whichever is later).
2.	Implementation of 220kV GIS line bay at Rajgarh 400/220kV (PG) S/s (on extended bus) for RE Interconnection	<ul style="list-style-type: none"> • 220kV line bay – 1 No. (GIS) (on the sectionalized 220kV bus, which is presently under implementation by POWERGRID) • 220 kV GIS duct (m) – 150m approx. 	31.12.2026 or 21 months from date of award to implementing agency (whichever is later).
Total Estimated Cost:			₹ 71 Crore



The scheme was awarded to POWERGRID through RTM for implementation vide CTU OM dated 15.02.2024 with an implementation timeframe of 21 months from date of award.

d) Augmentation of Transformation Capacity at 400/220kV Rajgarh (PG) S/s in MP by 400/220 kV, 1x500 MVA ICT (4th)

Due to non-availability of margins for injection from 220kV level of Rajgarh S/s, the 1x500MVA, 400/220kV ICT-IV has been planned on extended 220kV bus (segregated from main bus through bus sectionaliser) so as to enable evacuation of RE power from various generation projects which have applied for connectivity under GNA at Rajgarh S/s directly to 400kV level of Rajgarh S/s. The sectionaliser may also be closed based on system requirement.

<i>Sl. No.</i>	<i>Scope of the Transmission Scheme</i>	<i>Capacity /km</i>	<i>Implementation Timeframe.</i>
1.	Augmentation of Transformation capacity at 400/220kV Rajgarh S/s by 1x500MVA ICT (4 th) (terminated on the sectionalized 220kV bus)	400/220kV, 1x500MVA ICT – 1 No. 400kV ICT bay – 1 No. (AIS) 220kV ICT bay – 1 No. (GIS) (on the sectionalized 220kV bus, which is presently under	

<i>Sl. No.</i>	<i>Scope of the Transmission Scheme</i>	<i>Capacity /km</i>	<i>Implementation Timeframe.</i>
		implementation by POWERGRID)	
2.	Implementation of 220kV GIS line bay at Rajgarh 400/220kV (PG) S/s (on extended bus) for RE Interconnection	220kV line bay – 1 No. (GIS) (on the sectionalized 220kV bus, which is presently under implementation by POWERGRID) (for AEPL)	
Total Estimated Cost:			₹ 76 Crore

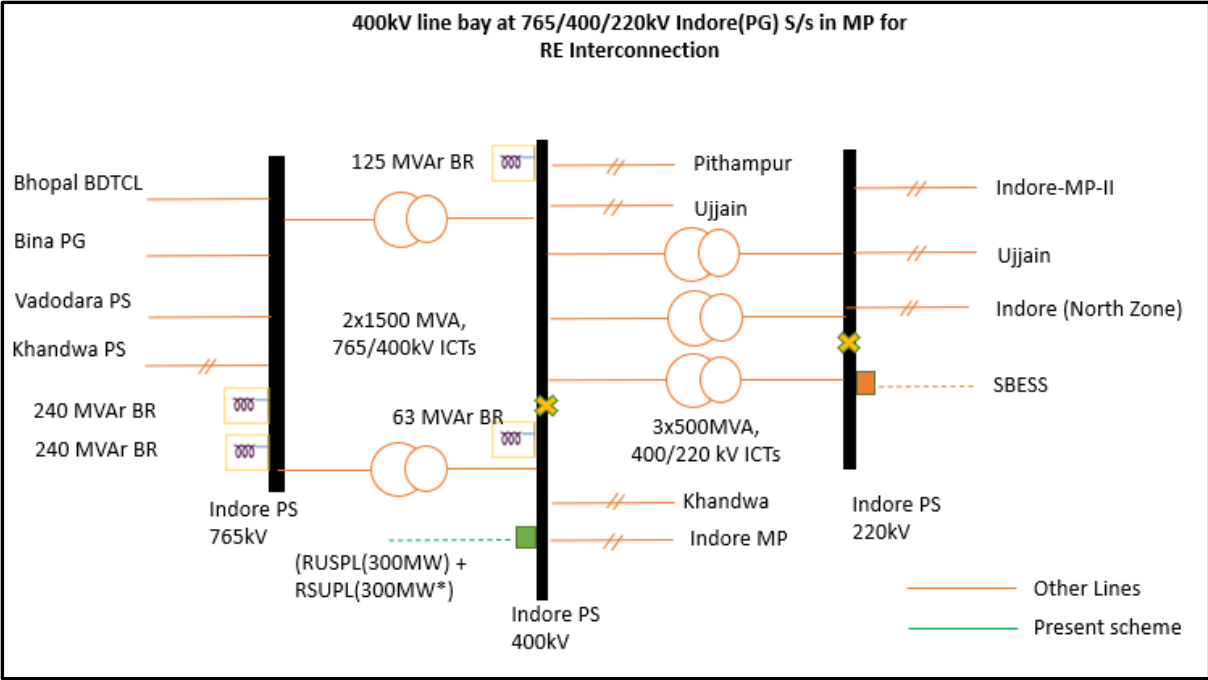
Implementation time-frame: 21 months from SPV transfer.

e) Implementation of 400kV line bay at 765/400/220kV Indore (PG) S/s in MP for RE Interconnection

765/400/220kV Indore S/s is an existing substation implemented by POWERGRID through RTM Route. The proposed system shall enable evacuation of RE power from various generation projects in Indore area which have applied for connectivity under GNA at Indore S/s at 400kV level.

1 no. 400kV bay at Indore (PG) S/s has been allotted to Renew Urja Shachar Pvt. Ltd. (RUSPL) against application No. 2200000070 (300MW). Further, against application No. 2200000298, Renew Samir Urja Private Limited has also been granted Connectivity for 300MW at Indore (PG) S/s through sharing of the bay allotted to M/s RUSPL.

<i>Sl. No.</i>	<i>Scope of the Transmission Scheme</i>	<i>Item Description</i>	<i>Implementation Timeframe.</i>
1.	400kV line bay at 765/400/220kV Indore (PG) for Interconnection of RE project	400kV line bay – 1 No. (On bus section A with Indore & Khandwa lines)	30.06.2025
Total Estimated Cost:			₹ 9 Crore



ISTS Schemes evolved from Sept'23 to Jan'24

4. ISTS Network Expansion Scheme in Southern Region

Various transmission schemes have been discussed/finalized in the Consultative Meeting for Evolution of Transmission System of Southern Region (CMETS-SR) from Sept' 2023 to Jan' 2024. The details of the schemes are summarized below:

4.1. Karnataka

(a) Transmission Scheme for integration of Renewable Energy Zones in Davanagere/Chitradurga, Bellary and Bijapur areas of Karnataka

Govt. of India has set a target of 500 GW generation capacity from non-fossil fuel resources by 2030. In this direction, MNRE has identified addition of 181.5 GW RE Potential in the States of Andhra Pradesh, Telangana, Karnataka, Rajasthan, Madhya Pradesh and Tamil Nadu (Offshore). Out of the identified 181.5 GW Potential, 86 GW RE Potential is identified in the State of Andhra Pradesh, Telangana, Karnataka and Tamil Nadu (Offshore) in Southern Region.

The transmission system for integration of 181.5 GW RE Potential has been identified by CEA and a report on Transmission System for Integration of over 500 GW RE Capacity has been published by CEA on 07.12.2022.

Out of the identified (86 GW) RE Potential in Southern Region, 17 GW has been identified in the State of Karnataka. MNRE have indicated that out of the 17 GW REZ potential in Karnataka, transmission system for evacuation capacity of about 11 GW may be identified considering the Energy Storage System. The details of district wise potential is as below:

District	Potential (GW)		Total (GW)	Dispatch (90% S + 55% W)	BESS	Evacuation capacity to be planned (GW)
	Wind	Solar				
Koppal	2	2	4	2.9	1	2
Gadag	2	2	4	2.9	1	2
Davanagere / Chitradurga	2	2	4	2.9	1	2
Bijapur	2		2	1.1		2
Bellary		1.5	1.5	1.35		1.5
Tumkur		1.5	1.5	1.35		1.5
Total	8	9	17	12.5	3	11

The transmission system for integration of additional RE potential in Koppal-II and Gadag-II area of Karnataka has already been agreed and is under bidding. Further, for optimal utilization of transmission system, interconnection of RE Zones in Karnataka viz. Gadag-II, Davanagere/Chitradurga, Bijapur and Bellary area were planned earlier at Koppal-II PS itself through 400kV lines for further transfer of power beyond Koppal-II PS.

However, CTU has received large number of applications from various RE developers seeking connectivity at Koppal-II PS and Gadag-II PS beyond the planned evacuation capacity and without BESS. Presently, the total connectivity applications granted / agreed for grant at Koppal-II are about

2950 MW and Gadag-II are about 3900 MW which has already surpassed the capacity of evacuation transmission system identified considering the dispatch factors & BESS in CEA's 500 GW report.

Accordingly, it was observed that the transmission system beyond Koppal-II PS for evacuation of power shall be able to cater to the evacuation requirements of connectivity at Gadag-II PS and Koppal-II PS. Further, the interconnection of Davanagere/Chitradurga, Bijapur and Bellary REZs needs to be reviewed and separate transmission system for evacuation of power may be identified. CTU has already received connectivity of about 300 MW at Bijapur PS and 250 MW at Davanagere/Chitradurga.

Presently, Narendra New – Madhugiri 765kV D/c line is under operation at 400kV level. It is proposed to upgrade Narendra New – Madhugiri 765kV D/c line (presently charged at 400kV level) at its rated 765kV voltage level. Further, Davanagere REZ is proposed to be integrated with the grid through LILO of Narendra New – Madhugiri 765kV D/c line at Davanagere/Chitradurga 765/400kV PS. Further, for optimal utilization of transmission system, Bellary REZ is proposed to be integrated with Davanagere/Chitradurga PS through Bellary – Davanagere/Chitradurga PS 400kV (Quad ACSR moose) D/c line. Accordingly, Davanagere/Chitradurga PS is being proposed at 765kV level.

Further, Bijapur REZ is being integrated with existing Raichur New through Bijapur PS – Raichur New 400kV (Quad ACSR moose) D/c line.

The schemes were discussed in the 25th CMETS-SR held on 28.11.2023 wherein constituents requested for joint studies for finalization of the scheme. CTU vide letter dated 01.12.2023 submitted the revised transmissions schemes for SRPC views. The revised transmission schemes were discussed in the 49th SRPC meeting held on 09.12.2023 wherein SRPC decided that physical joint studies may be carried out with SR constituents for finalization of the scheme and thereafter, SRPC views shall be submitted to CTU within 45 days from 01.12.2023 for further approval of the scheme in NCT / MoP. Accordingly, Joint Studies were conducted on 21-22nd December 2023 at Yelahanka, Bengaluru with participation from SRPC, CTUIL, SRLDC, KPTCL, KSEBL, APTRANSCO, TSTRANSCO, TANTRANSCO and TANGEDCO. It was decided during the Joint Study meeting that the ICTs may be taken up for implementation in phased manner. Accordingly, it was suggested that 1 no. of 765/400kV, 1500 MVA ICT and 1 no. of 400/220 kV, 500 MVA ICTs at Davanagere / Chitradurga and 1 nos. of 400/220 kV, 500 MVA ICT at Bellary PS may be considered under second phase. The schemes were agreed by all the Southern Region constituents in the above Joint Study meeting.

Detailed scope of the transmission schemes is as follows :

**(i) Transmission Scheme for integration of Davanagere / Chitradurga REZ in Karnataka
Phase-A**

<i>Sl. No.</i>	<i>Scope of the Transmission Scheme</i>	<i>Capacity /km</i>
1.	Establishment of 765/400kV 3x1500 MVA, 400/220kV 3x500 MVA Pooling Station near Davanagere / Chitradurga, Karnataka with provision of two (2) sections of 4500 MVA each at 400kV level and provision of four (4) sections of 2500 MVA each at 220kV level	<ul style="list-style-type: none"> • 765/400kV, 1500 MVA, ICTs – 3 nos. (10x500 MVA incl. 1 spare unit) • 765kV ICT bays – 3 nos. • 400kV ICT bays – 3 nos. • 400/220kV, 500 MVA, ICTs – 3 nos. • 400kV ICT bays – 3 nos. • 220kV ICT bays – 3 nos.

Sl. No.	Scope of the Transmission Scheme	Capacity /km
	Future Space Provisions: <ul style="list-style-type: none"> • 765/400kV, 1500 MVA, ICTs – 4 nos. • 765kV ICT bays – 4 nos. • 400kV ICT bays – 4 nos. • 400/220kV, 500 MVA, ICTs – 8 nos. • 400kV ICT bays – 8 nos. • 220kV ICT bays – 8 nos. • 765kV line bays – 8 nos. (with provision for SLR) • 400kV line bays – 10 nos. (with provision for SLR) • 220kV line bays – 12 nos. • 220kV Bus Sectionalizer : 2 sets • 220 kV Bus Coupler (BC) Bay – 3 nos. • 220 kV Transfer Bus Coupler (TBC) Bay – 3 nos. • 400kV Bus Sectionalizer : 1 set 	<ul style="list-style-type: none"> • 765kV line bays – 4 nos. (at Davanagere / Chitradurga PS for termination of LILO of Koppal-II-Narendra (New) 765kV D/c line) • 220kV line bays – 6 nos. • 220kV Bus Sectionalizer : 1 set • 220 kV Bus Coupler (BC) Bay – 1 no. • 220 kV Transfer Bus Coupler (TBC) Bay – 1 no.
2.	LILO of Narendra New – Madhugiri 765kV D/c line at Davanagere / Chitradurga 765/400kV PS (~40 km) { with 240 MVar SLR at both ends on Narendra New – Davanagere section (~280 km) and 330 MVar SLR at Davanagere end on Davanagere – Madhugiri section (~200 km)}	~40 km <ul style="list-style-type: none"> • 765 kV, 240 MVar SLR at Davanagere / Chitradurga PS – 2 nos. (7x80 MVar inc. 1 switchable spare unit) • 765 kV, 240 MVar SLR at Narendra New – 2 nos. (7x80 MVar inc. 1 switchable spare unit) • 765 kV, 330 MVar SLR at Davanagere / Chitradurga PS – 2 nos. (6x110 MVar)
3.	2x330 MVar (765kV) bus reactors at Davanagere/Chitradurga PS	<ul style="list-style-type: none"> • 765 kV, 330 MVar Bus Reactor – 2 nos. (7x110 MVar inc. 1 switchable spare unit for both bus reactor and line reactor) • 765 kV Bus Reactor bays – 2 nos.
4.	Upgradation of Narendra New – Madhugiri 765kV D/c line (presently charged at 400kV level) at its rated 765kV voltage level	<ul style="list-style-type: none"> • 765kV line bays – 2 nos. (at Narendra New) • 765kV line bays – 2 nos. (at Madhugiri)
5.	Upgradation of Madhugiri {Tumkur(Vasantnarsapura)} to its rated voltage of 765kV level alongwith 3x1500 MVA, 765/400kV ICTs and 2x330 MVar, 765kV bus reactors #	<ul style="list-style-type: none"> • 765/400kV, 1500 MVA, ICTs – 3 nos. (10x500 MVA incl. 1 spare unit) • 765kV ICT bays – 3 nos. • 400kV ICT bays – 3 nos. • 765 kV, 330 MVar Bus Reactor – 2 nos. {7x110 MVar inc. 1 spare unit} • 765 kV Bus Reactor bays – 2 nos.
6.	400 kV line reactors (80 MVar) on both ends of Narendra New – Madhugiri 765kV D/c line shall be utilized as bus reactors at respective 400kV substations based on availability of bays or may be utilized as line reactor / bus reactor at other line / substation as per requirements.	

Phase-B

<i>Sl. No.</i>	<i>Scope of the Transmission Scheme</i>	<i>Capacity /km</i>
1.	Augmentation of 1x1500 MVA, 765/400kV ICT at Davanagere / Chitradurga PS	<ul style="list-style-type: none"> • 765/400kV, 1500 MVA, ICTs – 1 nos. • 765kV ICT bays – 1 nos. • 400kV ICT bays – 1 nos.
2.	Augmentation of 1x500 MVA, 400/220kV ICT at Davanagere / Chitradurga PS	<ul style="list-style-type: none"> • 400/220kV, 500 MVA, ICTs – 1 nos. • 400kV ICT bays – 1 nos. • 220kV ICT bays – 1 nos.

Upgradation of Madhugiri {Tumkur(Vasantnarsapura)} to its rated 765kv level was earlier allocated to POWERGRID for implementation through RTM route under the scheme “Common transmission system strengthening in Southern Region for enabling evacuation and export of power from Solar & Wind Energy Zones in Southern Region” vide MOP OM No.15/3/2018-Trans-Pt(1) dated 23.01.2020.

Estimated Cost : Rs. 2640 Crore

(ii) Transmission Scheme for integration of Bellary REZ in Karnataka**Phase-A**

<i>Sl. No.</i>	<i>Scope of the Transmission Scheme</i>	<i>Capacity /km</i>
1.	Establishment of 3x500 MVA, 400/220kV Pooling Station near Bellary area (Bellary PS), Karnataka Future Space Provisions: <ul style="list-style-type: none"> • 400/220kV, 500 MVA, ICTs – 8 nos. • 400kV ICT bays – 8 nos. • 220kV ICT bays – 8 nos. • 400kV line bays – 6 nos. (with provision for SLR) • 220kV line bays – 12 nos. • 220kV Sectionalizer : 3 sets • 220 kV Bus Coupler (BC) Bay – 3 nos. • 220 kV Transfer Bus Coupler (TBC) Bay – 3 nos. 	<ul style="list-style-type: none"> • 400/220kV, 500 MVA, ICTs – 3 nos. • 400kV ICT bays – 3 nos. • 220kV ICT bays – 3 nos. • 400kV line bays – 2 nos. (at Bellary PS for termination of Bellary PS – Davanagere / Chitradurga line)) • 220kV line bays – 6 nos. • 220 kV Bus Coupler (BC) Bay – 1 no. • 220 kV Transfer Bus Coupler (TBC) Bay – 1 no.
2.	Bellary PS – Davanagere / Chitradurga 400kV (Quad ACSR moose) D/c line	~100 km <ul style="list-style-type: none"> • 400kV line bays – 2 nos. (at Davanagere / Chitradurga)
3.	2x125MVA 420kV bus reactors at Bellary PS	<ul style="list-style-type: none"> • 420kV, 125 MVA bus reactors – 2 nos. • 420kV, 125 MVA bus reactor bays – 2 nos.

Phase-B

<i>Sl. No.</i>	<i>Scope of the Transmission Scheme</i>	<i>Capacity /km</i>
1.	Augmentation of 1x500 MVA, 400/220kV ICT at Bellary PS	<ul style="list-style-type: none"> • 400/220kV, 500 MVA, ICTs – 1 nos. • 400kV ICT bays – 1 nos. • 220kV ICT bays – 1 nos.

Estimated Cost: Rs. 813 Crore

(iii) Transmission Scheme for integration of Bijapur REZ in Karnataka

Sl. No.	Scope of the Transmission Scheme	Capacity /km
1.	Establishment of 400/220kV 2x500 MVA Pooling Station near Bijapur (Vijayapura), Karnataka Future Space Provisions: <ul style="list-style-type: none"> • 400/220kV, 500 MVA, ICTs – 9 nos. • 400kV ICT bays – 9 nos. • 220kV ICT bays – 9 nos. • 400kV line bays – 6 nos. (with provision for SLR) • 220kV line bays – 14 nos. • 220kV Sectionalizer : 3 sets • 220 kV Bus Coupler (BC) Bay – 3 nos. • 220 kV Transfer Bus Coupler (TBC) Bay – 3 nos. 	<ul style="list-style-type: none"> • 400/220kV, 500 MVA, ICTs – 2 nos. • 400kV ICT bays – 2 nos. • 220kV ICT bays – 2 nos. • 400kV line bays – 2 nos. (at Bijapur PS for termination of Bijapur PS – Raichur New line)) • 220kV line bays – 4 nos. • 220 kV Bus Coupler (BC) Bay – 1 no. • 220 kV Transfer Bus Coupler (TBC) Bay – 1 no.
2.	Bijapur PS – Raichur New 400kV (Quad ACSR moose) D/c line	~150 km <ul style="list-style-type: none"> • 400kV line bays – 2 nos. (at Raichur New)
3.	2x125MVA 420kV bus reactors at Bijapur PS	<ul style="list-style-type: none"> • 420kV, 125 MVA bus reactors – 2 nos. • 420kV, 125 MVA bus reactor bays – 2 nos.

Note : POWERGRID shall provide space for 2 nos. of 400 kV line bays at Raichur New for termination of Bijapur PS – Raichur New 400kV (Quad ACSR moose) D/c line

Estimated Cost : Rs. 896 Crore

Above transmission schemes viz., Transmission Scheme for integration of Davanagere / Chitradurga REZ in Karnataka, Transmission Scheme for integration of Bellary REZ in Karnataka and Transmission Scheme for integration of Bijapur REZ in Karnataka have been forwarded to NCT vide CTU letter dated 19.01.2024 along with SRPC views.

(b) System strengthening at Koppal-II and Gadag-II for integration of RE generation projects

Koppal-II 765/400/220kV PS is being established as part of 500 GW RE capacity by 2030 and presently is under construction with implementation schedule of 24 months i.e. Dec'2025. Presently, 2x1500 MVA, 765/400 kV ICTs, 2x500 MVA, 400/220 kV ICTs and 04 nos. of 220 kV line bays under Koppal-II Phase-A and augmentation with 2x1500 MVA, 765/400 kV ICTs, 2x500 MVA, 400/220 kV ICTs and 04 nos. of 220 kV additional line bays under Koppal-II Phase-B are under implementation.

Gadag-II PS is being established as part of 500 GW RE capacity by 2030 and presently is under construction with implementation schedule of 24 months i.e. Dec'2025. Presently, 2x500 MVA, 400/220 kV ICTs and 04 nos. of 220 kV line bays under Gadag-II Phase-A is under implementation.

CTU has received large number of applications from various RE developers seeking connectivity at Koppal-II PS and Gadag-II PS. Further, as RE potential in Gadag area is being integrated with Koppal-II PS through Gadag-II PS – Koppal-II PS 400kV (Quad Moose) D/c lines and evacuation of power from Gadag-II PS is contingent upon Koppal-II PS. Accordingly, augmentation of transformation capacity at Koppal-II and Gadag-II for evacuation of power from RE generation projects has been

identified in a progressive manner as per the receipt of applications in various CMETS-SR meetings. The details of strengthening is as below:

Koppal-II 765/400/220kV PS

- Augmentation of 1x1500 MVA (5th), 765/400 kV ICT at Koppal-II PS and 1 nos. of 220kV line bays for integration of RE generation projects (agreed in 23rd CMETS-SR held on 29.09.2023)
- Augmentation of additional 3x500 MVA, 400/220kV ICTs (5th, 6th & 7th) and 1x1500 MVA 765/400kV ICT (6th) at Koppal-II PS (agreed in 25th CMETS-SR held on 28.11.2023).
- Augmentation of additional 2x500 MVA, 400/220kV ICTs (8th & 9th), 1x1500 MVA 765/400kV ICT (7th) at Koppal-II PS and 3 nos. of 220kV line bays for integration of RE generation projects (agreed in 27th CMETS-SR held on 30.01.2024)

So far connectivity of about 3769 MW has been granted / agreed for grant at 220kV level of Koppal-II PS.

Gadag-II 400/220kV PS

- Augmentation of 3x500 MVA (3rd, 4th & 5th), 400/220kV transformation capacity at Gadag-II PS and 1 nos. of 400kV line bay & 2 nos. 220kV line bays for integration of RE generation projects (agreed in 23rd CMETS-SR held on 29.09.2023)
- Augmentation of 2x500 MVA (6th & 7th), 400/220kV transformation capacity at Gadag-II PS, Gadag-II PS – Koppal-II PS 400kV (Quad) 2nd D/c line and 1 nos. of 220kV line bay for integration of RE generation projects (agreed in 25th CMETS-SR held on 28.11.2023).
- Augmentation of 2x500 MVA, 400/220kV ICTs (8th & 9th) at Gadag-II PS and 1 nos. of 220kV line bay for integration of RE generation projects (agreed in 27th CMETS-SR held on 30.01.2024).

So far connectivity of about 4926 MW (3476 MW at 220 kV and 1450 MW at 400 kV level) has been granted / agreed for grant at Gadag-II PS.

Details of the scheme is summarized as below :

(i) System strengthening at Koppal-II for integration of RE generation projects

Package	Scope of the Transmission Scheme	Capacity /km	Schedule
A	Augmentation of 1x1500 MVA (5 th), 765/400 kV transformation capacity at Koppal-II PS	<ul style="list-style-type: none"> • 1x1500 MVA, 765/400kV ICT • 765kV ICT bay – 1 No. • 400kV ICT bay – 1 No. 	Dec'25
B	Augmentation of 1x1500 MVA (6 th), 765/400 kV transformation capacity at Koppal-II PS	<ul style="list-style-type: none"> • 1x1500 MVA, 765/400kV ICT • 765kV ICT bay – 1 No. • 400kV ICT bay – 1 No. 	Dec'25
	Augmentation of 3x500 MVA, 400/220kV ICTs (5 th 6 th & 7 th) at Koppal-II PS	<ul style="list-style-type: none"> • 3x500 MVA, 400/220kV ICTs • 400kV ICT bay – 3 Nos. • 220kV ICT bay – 3 Nos. 	Dec'25
	1 no. 220kV line bay at Koppal-II PS for termination of dedicated transmission line	<ul style="list-style-type: none"> • 220kV line bays – 1 Nos. 	01.03.26

Package	Scope of the Transmission Scheme	Capacity /km	Schedule
	of M/s Tata Power Renewable Energy Ltd.		
C	Augmentation of 1x1500 MVA (7 th), 765/400 kV transformation capacity at Koppal-II PS	<ul style="list-style-type: none"> • 1x1500 MVA, 765/400kV ICT • 765kV ICT bay – 1 No. • 400kV ICT bay – 1 No. 	Dec'25
	Augmentation of 2x500 MVA, 400/220kV ICTs (8 th & 9 th) at Koppal-II PS	<ul style="list-style-type: none"> • 2x500 MVA, 400/220kV ICTs • 400kV ICT bay – 2 Nos. • 220kV ICT bay – 2 Nos. 	Dec'25
	2 nos. 220kV line bays at Koppal-II PS for termination of dedicated transmission line of M/s JSP Green Wind 1 Pvt. Ltd. and Gadag Power India Pvt. Ltd.	• 220kV line bays – 2 Nos.	30.12.25
	1 no. 220kV line bay at Koppal-II PS for termination of dedicated transmission line of M/s Clean Renewable Energy Hybrid Two Pvt. Ltd.	• 220kV line bays – 1 Nos.	31.12.26

Estimated cost : Rs. 673 Crore

(ii) System strengthening at Gadag-II for integration of RE generation projects

Package	Scope of the Transmission Scheme	Capacity /km	Schedule
A	Augmentation of 3x500 MVA (3 rd , 4 th & 5 th), 400/220kV transformation capacity at Gadag-II PS	<ul style="list-style-type: none"> • 3x500 MVA, 400/220kV ICTs • 400kV ICT bay – 3 Nos. • 220kV ICT bay – 3 Nos. • 400kV ICT bay – 1 No. 	Dec'25
	1 no. 400kV line bay at Gadag-II PS for termination of dedicated transmission line of M/s Serentica Renewables India Pvt. Ltd.	• 400kV line bays – 1 Nos.	30.12.25
	2 no. 220kV line bays at Gadag-II PS for termination of dedicated transmission line of M/s Tata Power Renewable Energy Ltd. and M/s Avaada Energy Pvt. Ltd.	• 220kV line bays – 2 Nos.	30.12.25
B	Augmentation of 2x500 MVA (6 th & 7 th), 400/220kV transformation capacity at Gadag-II PS	<ul style="list-style-type: none"> • 2x500 MVA, 400/220kV ICTs • 400kV ICT bay – 2 Nos. • 220kV ICT bay – 2 Nos. 	24 months
	Gadag-II PS – Koppal-II PS 400kV (Quad) 2 nd D/c line	~ 45 km <ul style="list-style-type: none"> • 400kV line bays – 2 nos. (at Koppal-II PS) • 400kV line bays – 2 nos. (at Gadag-II PS) 	24 months
	1 nos. 220kV line bay at Gadag-II PS for termination of dedicated transmission line of M/s Renew Vayu Energy Pvt. Ltd.	• 220kV line bays – 1 Nos.	31.03.27

Package	Scope of the Transmission Scheme	Capacity /km	Schedule
C	Augmentation of 2x500 MVA, 400/220kV ICTs (8 th & 9 th) at Gadag-II PS	<ul style="list-style-type: none"> • 2x500 MVA, 400/220kV ICTs • 400kV ICT bay – 2 Nos. • 220kV ICT bay – 2 Nos. 	24 months
	1 nos. 220kV line bay at Gadag-II PS for termination of dedicated transmission line of M/s Green Infra Renewable Projects Ltd.	<ul style="list-style-type: none"> • 220kV line bays – 1 Nos. 	01.06.27

Estimated cost : Rs. 664 Crore

Above transmission schemes viz., System strengthening at Koppal-II for integration of RE generation projects and System strengthening at Gadag-II for integration of RE generation projects have been forwarded for SRPC views vide CTU letter dated 08.02.2024.

(c) Augmentation of transformation capacity by 2x500 MVA (7th & 8th), 400/220 kV ICT at Tumkur PS

During the 23rd CMETS SR held on 29.09.2023, CTU informed that presently, Tumkur (Pavagada) PS is under operation with 5x500 MVA, 400/220kV ICTs. Further, additional 1x500 MVA, 400/220kV ICT(6th) is under implementation and is expected by Dec'23. With grant of Connectivity under GNA to M/s Ircon Renewable Power Ltd. During the 21st CMETS-SR meeting, held on 08.08.2023, the total Connectivity/GNA granted/ agreed for grant at Pavagada PS shall become 3050 MW. IN the meeting it was agreed to grant the Connectivity with augmentation of transformation capacity by 1x500 MVA, 400/220kV ICT(7th). Subsequently, in 22nd CMETS-SR, held on 25.08.2023, it was agreed to grant additional connectivity for 100 MW to SECI at Tumkur PS with 7th ICT.

Further, the Manual on Transmission Planning Criteria, 2023 have come into effect from 01.04.2023 wherein it was specified that N-1 reliability criteria may be considered for ICTs at the ISTS / STU pooling stations for renewable energy based generation of more than 1000 MW after considering the capacity factor of renewable generating stations. With 7x500 MVA, 400/220kV ICTs at Tumkur (Pavagada) PS, the transformation capacity is 3500 MVA; however, connectivity of about 3150 MW has been granted / agreed for grant. Accordingly, for meeting the N-1 reliability criteria, 1x500 MVA, 400/220 kV ICT (8th) at Tumkur (Pavagada) PS is also required.

After detailed deliberations, augmentation of transformation capacity by 2x500 MVA (7th & 8th), 400/220 kV ICT at Tumkur PS was agreed.

Estimated cost : Rs. 116 Crore

(d) Augmentation of transformation capacity by 1x500 MVA (6th), 400/220 kV ICT at Koppal PS

During the 23rd CMETS SR held on 29.09.2023, CTU informed that presently, Koppal PS is under implementation with transformation capacity of 2500 MVA (5x500 MVA, 400/220kV ICTs) and 3x500 MVA ICTs are expected by Oct'23 & 2x500 MVA ICTs are expected by Dec'23. Further, connectivity of 2753.6 MW has been granted/ agreed for grant/ considered for grant at Koppal PS. Accordingly, 1x500 MVA, 400/220kV ICT (6th) is required for integration of RE projects for Connectivity quantum upto 2753.6 MW.

Further, the Manual on Transmission Planning Criteria, 2023 have come into effect from 01.04.2023 wherein it was specified that N-1 reliability criteria may be considered for ICTs at the ISTS / STU pooling stations for renewable energy based generation of more than 1000 MW after considering the capacity factor of renewable generating stations. Accordingly, for meeting the N-1 reliability criteria, 1x500 MVA, 400/220 kV ICT (7th) at Koppal PS is also required.

In view of the above, it was proposed to augment transformation capacity by 2x500 MVA (6th & 7th), 400/220 kV ICTs at Koppal PS.

During the meeting, TANGEDCO informed that considering the dispatch factors and short term over load capacity of the ICTs, 6th & 7th ICTs at Koppal PS are not required even after considering the power factor. ICT augmentation if required may be taken up along with the receipt of applications and same may be associated with the RE generation projects. Without any identified beneficiaries / additional generation, the 6th & 7th ICT will increase the tariff burden on the constituents. In case of delay in RE generation the transmission charges liability may be kept on the RE generators.

CTU informed that during the peak RE season, the dispatch from the Wind & Solar generations is near to 100% and same has been observed in Tuticorin area as well. Keeping above in view and considering the power factor, the 6th ICT alone is also not adequate for accommodating the connectivity of 2753 MW. In case of tripping of one ICT, then there might be chances of cascaded tripping and loss of entire generation at that pooling station. Accordingly, the 6th ICT is required for providing connectivity and 7th ICT is required for meeting the N-1 reliability criteria.

TANGEDCO informed that 6th ICT may be implemented and same may be associated with the RE generation projects and 7th ICT may not be taken up for the time being.

CTU informed that the 6th ICT at Koppal PS may be implemented and same may be associated with the RE generation projects. Further, as Koppal PS is near to commissioning, the generation injection pattern of the RE generation projects may be monitored and based on the injection quantum the 7th ICT may be taken up later as per requirement.

After detailed deliberations, augmentation of transformation capacity by 1x500 MVA (6th), 400/220 kV ICT at Koppal PS was agreed.

Estimated cost : Rs. 58 Crore

(e) Augmentation of transformation capacity by 1x500 MVA (6th), 400/220 kV ICT at Gadag PS

During the 23rd CMETS SR held on 29.09.2023, CTU informed that presently, Gadag PS is under implementation with transformation capacity of 2500 MVA (5x500 MVA, 400/220kV ICTs) and 2x500 MVA ICTs are expected by Dec'23 & 3x500 MVA ICTs are expected by May'24. Further, connectivity of 2385 MW has been granted at Gadag PS which have already crossed the ICT capacity considering the power factor. Further for meeting the N-1 reliability criteria as per CEA's revised Planning Criteria, augmentation of 1x500 MVA, 400/220 kV ICT (6th) at Gadag PS is required.

After detailed deliberations, augmentation of transformation capacity by 1x500 MVA (6th), 400/220 kV ICT at Gadag PS was agreed.

Estimated cost : Rs. 58 Crore

(f) Reconductoring of Somanahalli – Bidadi 400kV D/c line with HTLS conductor

During the 25th CMETS SR held on 28.11.2023, CTU informed that SRLDC, Grid-India in its report for Quarter-02 (Jul'-Sep'22) has highlighted the issue of high loading on Somanahalli – Bidadi 400kV D/c line. The high loading issue was also highlighted during the meeting held on 06.09.2023 CEA, SRPC, CTUIL, SRLDC, APTRANSCO & KPTCL to deliberate on the Intra-State proposals of APTRANSCO and KPTCL. Further, CTU in the ISTS Rolling plan reports for 2027-28 and 2028-29 (Interim) has also highlighted that during peak RE scenario of Karnataka, loading on Somanahalli – Bidadi 400kV D/c line is crossing its thermal rating (850 MVA) under N-1 contingency. Considering the above, it is proposed that reconductoring of the Somanahalli – Bidadi 400kV D/c line with HTLS conductor may be carried out.

During the meeting, SRLDC informed that the transmission line is part of 400 kV ring of Bangalore and high loading of Somanahalli – Bidadi 400kV D/c line is observed in high RE scenario and the same shall increase further with more RE injection in the grid. Accordingly the reconductoring of the subject transmission line may be carried out.

SRPC opined that proposal is acceptable and bay upgradation requirement may also be looked into. CTU informed that the same shall be duly considered while detailing the scope of works for the reconductoring works.

During the meeting POWERGRID informed that, in case of re-conductoring of Transmission line prior to completion of useful life, the part of depreciation for dismantled item (like conductor, hardwares, Insulators etc.) remains un-recovered. In similar cases, CERC at times asked to get consent of beneficiary to bear the cost towards unrecovered depreciation for dismantled items. In this regard, it was informed that upgradation of the transmission line is a technical requirement for the ISTS network. Further approval of the ISTS transmission schemes are accorded by CTU (upto Rs. 100 Crs), NCT (upto Rs. 500 Crs) and the scheme more than Rs. 500 Crs are approved by MoP with recommendation of NCT & views of RPC. However, for specific approval, if any, POWERGRID may refer the matter to SRPC after technical approval of the upgradation schemes by the members in CMETS..

After detailed deliberations, members agreed for the proposal of reconductoring of the Somanahalli – Bidadi 400kV D/c line with HTLS conductor.

4.2. Telangana

(a) Reconductoring of Maheshwaram(PG) – Hyderabad 400kV S/c line with HTLS conductor

During the 25th CMETS SR held on 28.11.2023, CTU informed that as per the ISTS Rolling plan reports for 2027-28 and 2028-29 (Interim), it is observed that the loading on Maheshwaram(PG) – Hyderabad 400kV S/c line is crossing its thermal rating (850 MVA) under N-1 contingency. The high loading is observed during the peak RE time when internal thermal generation of Telangana is low including Ramagundam TPS. Considering the above, it is proposed that reconductoring of Maheshwaram(PG) – Hyderabad 400kV S/c line with HTLS conductor may be carried out.

SRLDC informed that the transmission line is a part of 400 kV ring of Hyderabad and a loading of 550-580 MW is observed in case of non-availability of one of the units of Ramagundam generation. Further, with the proposed series reactor on Maheshwaram – Maheshwaram (PG) 400 kV D/c transmission line, loading on Maheshwaram(PG) – Hyderabad 400kV S/c line shall further enhance.

TSTRANSCO stated that they also recommend the scheme. SRPC also agreed for the proposal. On enquiry from SRPC, it was informed that high line loading has been observed during high RE scenarios under the ISTS Rolling plan report.

During the meeting POWERGRID informed that, in case of re-conductoring of Transmission line prior to completion of useful life, the part of depreciation for dismantled item (like conductor, hardwares, Insulators etc.) remains un recovered. In similar cases, CERC at times asked to get consent of beneficiary to bear the cost towards unrecovered depreciation for dismantled items. In this regard, it was informed that upgradation of the transmission line is a technical requirement for the ISTS network. Further approval of the ISTS transmission schemes are accorded by CTU (upto Rs. 100 Crs), NCT (upto Rs. 500 Crs) and the scheme more than Rs. 500 Crs are approved by MoP with recommendation of NCT & views of RPC. However, for specific approval, if any, POWERGRID may refer the matter to SRPC after technical approval of the upgradation schemes by the members in CMETS.

After detailed deliberations, members agreed for the proposal of reconductoring of the Maheshwaram(PG) – Hyderabad 400kV S/c line with HTLS conductor.

4.3. Andhra Pradesh

(a) Transmission system for grant of GNA to Green Hydrogen/ Ammonia In Kakinada area, Andhra Pradesh

During the 27th CMETS SR, CTU informed that M/s AM Green Ammonia (India) Private Limited [as an eligible entity under Regulation 17.1 (iii)] has applied for GNA as Bulk Consumer for 700MW (Within Region: 0MW & Outside Region: 700MW) seeking connectivity/GNA at Vemagiri 765/400 kV SS in Andhra Pradesh with start and end date as 01-07-2026 & 30-06-2050 respectively.

It was also informed that AM Green Ammonia (India) Private Limited vide email dated 20.01.2024 has indicated that they are in the process of developing a 2 MPTA Green Ammonia Project in Kakinada, Andhra Pradesh in phased manner. The total drawl requirement for the entire Green Ammonia Kakinada project capacity is 3370 MW. The details of the phased development are as follows:

Phase	Capacity (MW)
Phase I	700
Phase II	700
Phase III	1310
Phase IV	660

Accordingly, they have requested to plan the power drawl arrangement for full capacity, with first phase development requiring 700 MW GNA-RE by July 2026.

It was further informed that a meeting was held on 19.10.2023 chaired by Hon'ble Minister with Green Hydrogen stakeholders/association, wherein it was instructed that developers shall share the details of year-wise planned Green Ammonia / Green Methanol capacities and corresponding drawl capacities desired at different locations. Hon'ble minister also instructed that this information should be shared with CTU for planning the required substation capacities at these specified locations. MNRE vide letter dated 01.11.2023 has forwarded the consolidated information of the planned projects and drawl requirements of various developers.

In this regard, a meeting was convened by CEA with Green Hydrogen/ Green Ammonia manufacturers to access the year wise electricity demand for proper planning of transmission system. In Kakinada Area, about 6000 MW demand has been envisaged for the Green Hydrogen/ Green Ammonia projects. The details of the phased development are as follows:

Year	Cumulative Electricity Demand (MW)
By 2027	1775
By 2028	3275
By 2029	4665
By 2030	6015

In view of the upcoming Green Hydrogen/ Green Ammonia plants/industries, planning of transmission system has been done for delivery of power to potential Green Hydrogen/Ammonia manufacturing sites. Following transmission system has been identified by CEA for supply of power at Kakainada for about 6000 MW power drawl by potential Green Hydrogen/Ammonia industries.

Proposed Transmission network (for meeting electricity demand upto 1500 MW)

- Establishment of Kakinada 765/400 kV, 3x1500 MVA S/s
- LILO of Vemagiri – Srikakulam 765 kV D/c line at Kakinada S/s

Proposed Transmission network (for meeting electricity demand upto 6015 MW) - To be planned based on the visibility of applications from manufacturers - Subsequent augmentation

- Angul – Srikakulam 765 kV 2nd D/c line
- Establishment of Khammam 765/400 kV, 3x1500 MVA substation
- Warangal – Khammam – Vemagiri 765 kV D/c line

Accordingly, as per the envisaged electricity demand in Kakinada area and drawl requirement for the Green Ammonia Kakinada project capacity shared by AMGAIPL, above identified transmission system for supply of power to Green Hydrogen/Ammonia industries in Kakinada area may be taken-up in a phased manner. GNA of 700 MW to AMGREL may be granted with first phase of the identified transmission system i.e., Establishment of Kakinada 765/400 kV, 3x1500 MVA S/s and LILO of Vemagiri – Srikakulam 765 kV D/c line at Kakinada S/s.

APTRANSCO stated that whether the power requirement will be constant load or based on availability of generation. Towards this, AMGAIPL clarified that the same shall be constant load met through RTC power.

SRLDC stated that presently, limiting constraints are seen on Angul-Srikakulam 765 kV D/c line for import ATC-TTC of Southern Region. With above the phased-wise implementation of transmission system for grant of GNA of 700 MW, Angul-Srikakulam 765 kV D/c line shall be further loaded and appropriate planning is required for timely redressal of the limiting constraints. In this regard, CTU stated that as per the deliberations in the SRPC meeting, data has been sought from SR constituents regarding their demad projects by 2030. Based on the same, transmission system adequacy shall be accessed in the joint studies to be carried out with SR constituents and any system strengthening required for the same including identification of additional inter-regional links shall also carried out as part of the joint studies. It was again requested that pending data may be furnished by all the SR constituents so that joint studies may be carried out.

After detailed deliberations, it was agreed to grant GNA to M/s AM Green Ammonia (India) Private Limited for 700 MW with the following transmission system :

Connectivity/GNA Transmission system for M/s AM Green Ammonia (India) Private Limited (application no. 2200000433 for 700 MW)

i. Dedicated Connectivity Tr. System

- Pooling Station of M/s AM Green Ammonia (India) Private Limited – Kakinada PS 400 kV D/c line along with line bays at both ends – **under the scope of applicant**

ii. Associated Transmission System for GNA: Nil

iii. Common Transmission system required for effectiveness of connectivity/GNA (augmentation other than ATS) :

- Establishment of Kakinada 765/400 kV, 2x1500 MVA S/s
- LILO of Vemagiri – Srikakulam 765 kV D/c line at Kakinada S/s

Start date of Connectivity/GNA : 31.08.2026 (tentative) with the availability of common transmission system required for effectiveness of Connectivity/ GNA.

(b) Scheme to bypass NGR to use Switchable Line Reactor as Bus Reactor for transmission lines being implemented by WKTL under the scheme “Additional inter-Regional AC link for import into Southern Region i.e. Warora – Warangal and Chilakaluripeta - Hyderabad - Kurnool 765kV link”

During the 23rd CMETS SR held on 29.09.2023, CTU informed that the transmission scheme “Additional inter-Regional AC link for import into Southern Region i.e. Warora – Warangal and Chilakaluripeta - Hyderabad - Kurnool 765kV link” was agreed in the 39th and 37th meeting of the SCPSPSR held on 28-29 December, 2015 and 31.07.2014 respectively. The transmission system is under implementation by M/s Warora-Kurnool Transmission Limited (WKTL) and the details of the broad transmission system is given below:

1. Establishment of 765/400kV substations at Warangal (New) with 2x1500 MVA transformers and 2x240 MVAR bus reactors.
2. Warangal (New) – Warangal (Existing) 400 kV (quad) D/c line.
3. Warangal (New) – Hyderabad 765 kV D/c line with 240 MVAR switchable line reactor at Warangal end of each circuit.
4. Hyderabad – Kurnool 765 kV D/c line with 240 MVAR switchable line reactor at Kurnool end of each circuit.
5. Warora Pool – Warangal (New) 765 kV D/c line with 240 MVAR switchable line reactor at both ends of each circuit.
6. Warangal (New) – Chilakaluripeta 765kV D/c line with 240 MVAR switchable line reactor at both ends of each circuit.
7. 240 MVA Switchable line reactors at Warora Pool end in each circuit of Warora Pool – Rajnandgaon 765 kV D/c line.

SRLDC, GRID-INDIA in its operational feedback has suggested to implement NGR bypass arrangement for switchable line reactors to use them as bus reactor, in case of outage of line. Further, during the 3rd SRPC(TP) meeting held on 24.08.2021, SRLDC informed that if a line is taken out of

service, switching of line reactor as bus reactor would be helpful in controlling the grid voltage. However, it was noticed that in some TBCB projects NGR bypass arrangement is not implemented. It was suggested that NGR bypass arrangement should be implemented for all the planned and upcoming schemes.

Further, SRLDC, GRID-INDIA vide email dated 08.08.2023 has informed that as per present arrangement, NGR bypass arrangement has not been provided for the any of the transmission lines covered under the above scheme and WKTL vide email dated 07.08.2023 has confirmed the same. It was requested to consider the implementation of NGR bypass arrangement on the above mentioned transmission lines.

Accordingly, it is proposed to implement NGR bypass scheme with suitable arrangement for the following lines:

1. Warangal (New) – Hyderabad 765 kV D/c line with 240 MVAR switchable line reactor at Warangal end of each circuit.
2. Hyderabad – Kurnool 765 kV D/c line with 240 MVAR switchable line reactor at Kurnool end of each circuit.
3. Warora Pool – Warangal (New) 765 kV D/c line with 240 MVAR switchable line reactor at both ends of each circuit.
4. Warangal (New) – Chilakaluripeta 765kV D/c line with 240 MVAR switchable line reactor at both ends of each circuit.

CTU informed that the transmission scheme was awarded through TBCB route during 2016 and NGR bypass arrangement was not specified in the RfP documents, accordingly, the TSP has not implemented the same. However, for the transmission schemes which were planned subsequently, NGR bypass scheme with suitable arrangement is being specified in the RfP documents. Further, the cost of the NGR bypass scheme is very minimal.

SRLDC stated that NGR bypass scheme is required.

TANGEDCO stated that as this NGR bypass scheme is to be done by the TSP, this should be without prejudice to the TSA entered between the LTTCs & TSPs for the scheme “Additional inter-Regional AC link for import into Southern Region i.e. Warora – Warangal and Chilakaluripeta - Hyderabad - Kurnool 765kV link”.

CTU clarified that this NGR bypass scheme shall not have any impact on the implementation timelines of the scheme “Additional inter-Regional AC link for import into Southern Region i.e. Warora – Warangal and Chilakaluripeta - Hyderabad - Kurnool 765kV link”.

After detailed deliberations, implementation NGR bypass scheme with suitable arrangement for the following lines was agreed:

1. Warangal (New) – Hyderabad 765 kV D/c line with 240 MVAR switchable line reactor at Warangal end of each circuit.
2. Hyderabad – Kurnool 765 kV D/c line with 240 MVAR switchable line reactor at Kurnool end of each circuit.
3. Warora Pool – Warangal (New) 765 kV D/c line with 240 MVAR switchable line reactor at both ends of each circuit.
4. Warangal (New) – Chilakaluripeta 765kV D/c line with 240 MVAR switchable line reactor at both ends of each circuit.

(c) Augmentation of 1x500 MVA, 400/220 kV ICT (5th) at NP Kunta Pooling Station

During the 27th CMETS SR held on 30.1.2024, CTU informed that presently, NP Kunta PS is under operation with 4x500 MVA, 400/220kV ICTs. Connectivity of about 1600 MW was granted at NP Kunta. Further, during the 26th CMETS-SR held on 29.12.2023, connectivity of 100 MW to M/s First Energy Pvt. Ltd. was agreed for grant with the 1x500 MVA, 400/220 kV ICT (5th) considering N-1 contingency planning criteria. With this the total Connectivity/GNA granted/ agreed for grant at NP Kunta PS shall become 1700 MW.

In view of the above, augmentation of 1x500 MVA, 400/220 kV ICT (5th) at NP Kunta Pooling Station is being taken up for implementation.

Estimated cost : Rs. 52 Crore

4.4. Tamil Nadu**(a) ISTS Network Expansion scheme “Transmission System for evacuation of power from Kudankulam 3 & 4”**

LTA application was received from M/s NPCIL in the month of May’22 for transfer of power from Kudankulam Nuclear Power Plant – 3 & 4 (2x1000 MW) to Southern Region beneficiaries on target basis. The LTA application of NPCIL was discussed in the 8th CMETS-SR meeting held on 28.06.2022, wherein it was decided that analysis for requirement of LTA transmission system shall be carried out in the Joint Study meeting of Southern Regional constituents. Accordingly, comprehensive transmission system was finalized in the joint study meeting held on 30th June to 02nd July, 2022, at SRPC, Bengaluru and the same was subsequently discussed in the 9th CMETS-SR held on 29.07.2022, 10th CMETS-SR held on 26.08.2022 and 11th CMETS-SR held on 29.09.2022. In the meantime, CTU has received the Connectivity application from M/s NPCIL for KNPP Units 5 & 6 in Sept’22 which was discussed in 12th CMETS-SR held on 17.10.2022. However, the transmission system for KNPP - 3 & 4 and KNPP - 5 & 6 could not be finalized due to various reasons viz lack of firm allocations from KNPP-3&4, lack of clarity on space availability of bays at both KNPP - 3 & 4 and KNPP - 5 & 6 generation switchyards etc.

Therefore, proposal for transmission system requirement for evacuation of power from KNPP unit 3 & 4 and KNPP unit 5 & 6 was again taken-up during Joint Study meeting of Southern Regional constituents held on 21st Feb to 23rd Feb 2023 at SRPC, Bengaluru. During the Joint Study meeting, TANTRANSCO informed that MoP has not considered their request for 100 % share allocation from Unit - 3&4 to the State of Tamil Nadu. However, TANTRANSCO is trying for maximum allocation from units 3 & 4 (2x1000 MW) and units 5 & 6 (2x1000 MW) of Kudankulam NPP. Further Govt. of India has notified policy on 19.07.2022 for implementation of intra-state transmission lines for drawl of its share allocation from CPSE generating stations mentions that “in case the State, where the CPSE generating Station is located, needs to draw the free power / their share from the generating station, they can plan and build the Intra State transmission lines of required capacity at their own cost. This will relieve them from using the ISTS network for drawal of their share and thus, will not have the burden of paying the ISTS charges”.

During the Joint Study meeting various alternatives were analyzed and after detailed studies & deliberations, following transmission system was finalized among Southern Region constituents for KNPP unit 3 & 4 and KNPP unit 5 & 6:

Transmission System requirement for evacuation of power from Kudankulam Unit - 3 & 4 (2x1000 MW)

- KNPP 3&4 – Tuticorin-II GIS PS 400kV (quad) D/c line (~120 km) **{Line & bays at Tuticorin-II GIS under ISTS scope and bays at KNPP under NPCIL scope}**
- KNPP 3&4 – Samugarangapuram (TN) 400kV (quad) D/c line (~30 km) **{Line & bays at Samugarangapuram (TN) under TANTRANSCO scope and bays at KNPP 3&4 under NPCIL scope}**
- Shifting of one circuit of KNPP 1&2 – Tirunelveli 400kV (quad) D/c line to KKNP 3&4 to form KKNP 3&4 – Tirunelveli 400kV (quad) S/c line **{under NPCIL scope}**
- Interconnection between KNPP 1&2 and KNPP 3&4 generation switchyards through laying of 400kV overhead transmission line or cable and to be kept open under normal operating conditions **{NPCIL scope}**
- 2x125 MVar (420kV) bus reactors at KNPP - 3&4 **{NPCIL scope}**
- Upgradation of Tuticorin PS - Salem 765kV D/c line (presently charged at 400kV level) at its rated 765kV voltage level with 1x330 MVar switchable Line Reactor on both ends of each circuit **{ISTS scope}**
- Upgradation of Tuticorin PS to its rated voltage of 765kV level along with 3x1500 MVA, 765/400kV ICTs and 2x330 MVar, 765kV bus reactors **{ISTS scope}**
- Upgradation of Dharmapuri (Salem New) to its rated voltage of 765kV level along with 3x1500 MVA, 765/400kV ICTs and 2x330 MVar, 765kV bus reactors **{ISTS scope}**
- Separate arrangement for auxiliary power supply at 230kV level one from KNPP 1 & 2 and other from independent source of TANTRANSCO substation **{NPCIL scope}**

Transmission System requirement for evacuation of power from Kudankulam Unit - 5 & 6 (2x1000 MW)

- Interconnection of KNPP-3&4 and KNPP-5&6 switchyards with 400kV quad D/c line **{NPCIL scope}**
- Shifting of KNPP-3&4 – Tuticorin-II GIS 400kV (quad) D/c line to KNPP-5&6 to form KNPP-5&6 – Tuticorin-II GIS 400kV (quad) D/c line and with provision of SLR at terminating bays of KNPP-5&6 **{NPCIL scope}**
- KNPP-5&6 – Virudhanagar (TN) 400kV (quad) D/c line with 80 MVAR SLR in each circuit at KNPP-5&6 (~170 km) **{Line along with reactor at KNPP-5 & 6 and line bays at Virudhanagar under scope of TANTRANSCO and Line bays & bays for switchable Line Reactor at KNPP-5&6 under NPCIL scope}**
- 3x125 MVar (420kV) bus reactors at KNPP - 5&6 **{NPCIL scope}**
- Separate arrangement for auxiliary power supply at 230kV level one from KNPP-3 & 4 and other from independent source of TANTRANSCO substation **{NPCIL scope}**

The identified comprehensive transmission system for evacuation & supply of power from Kudankulam Unit-3&4 and Unit-5&6 to target beneficiaries in Southern Region was to be implemented under ISTS and TANTRANSCO. Since, the scope of works under ISTS out of the identified Transmission System was more than Rs. 500 Crs, same was submitted for SRPC views vide CTU letter dated 28.02.2023. The transmission scheme was discussed in the 45th SRPC held on 04.03.2023 and recommended for consideration of NCT. Same was communicated vide SRPC letter dated 03.04.2023.

Subsequently, with the effectiveness of the CERC GNA Regulations 2022, NPCIL opted for transition for Kudankulam Unit - 3 & 4 (2x1000 MW). However, NPCIL did not opted for transition for

Kudankulam Unit - 5 & 6 (2x1000 MW). Transition of connectivity granted to NPCIL for KNPP U-3&4 (2x1000 MW) under GNA Regulations was discussed in the 22nd CMETS-SR held on 25.08.2023 wherein above transmission system requirements for KNPP-3&4 was deliberated and agreed.

Subsequently, TANGEDCO vide letter dated 21.10.2023 submitted that “Upgradation of Tuticorin PS - Salem 765kV D/c line” was approved in the Joint Studies considering both KKNPP Unit 3&4 as well as Unit-5&6, however in the present scenario when only Unit-3&4 are being taken-up, upgradation of the corridor is not required. System studies in this regard were also submitted by TANGEDCO. Based on the observations received from TANGEDCO and change in scenario of the generations likely to be available in the timeframe of KNPP-3&4 with the transition under GNA Regulations, system studies were carried out by CTUIL for 2026-27 time frame for grant of connectivity under the GNA Regulations to NPCIL for Unit-3&4. The transmission scheme was discussed in the 25th CMETS-SR held on 28.11.2023 wherein it was agreed that upgradation of Tuticorin PS - Salem 765kV D/c line (presently charged at 400kV level) at its rated 765kV voltage level may not be considered for grant of connectivity under the GNA regulations to NPCIL for KNPP-3&4. Same may be taken-up subsequently as per requirements, as and when depending on the visibility of generation in the Tuticorin Area.

Accordingly, following transmission system was agreed for grant of connectivity under the GNA Regulations to NPCIL for KKNPP U-3 & 4 :

Grant of Connectivity under GNA Regulations for KNPP Unit-3 :

Connectivity Transmission system under GNA for KNPP Unit-3:

I. Dedicated Connectivity Tr. System

- Interconnection between KKNPP 1&2 and KKNPP 3&4 generation switchyards through laying of 400kV overhead transmission line or cable and to be kept open under normal operating conditions {NPCIL scope}
- Shifting of one circuit of KKNPP 1&2 – Tirunelveli 400kV (quad) D/c line to KKNPP 3&4 to form KKNPP 3&4 – Tirunelveli 400kV (quad) S/c line {NPCIL scope}
- 2x125 MVar (420kV) bus reactors at KKNPP - 3&4 {NPCIL scope}
- Separate arrangement for auxiliary power supply at 230kV level one from KKNPP 1 & 2 and other from independent source of TANTRANSCO substation {NPCIL scope}

II. Associated Transmission System for GNA:

- KKNPP 3&4 – Tuticorin-II GIS PS 400kV (quad) D/c line (~120 km) {Line along with bays at Tuticorin-II GIS under ISTS scope and bays at KKNPP under NPCIL scope}

III. Augmentation (other than ATS) :

Common Transmission system required for effectiveness of connectivity/ GNA (System strengthening without ATS):

- ISTS Network Expansion scheme in Western Region & Southern Region for export of surplus power during high RE scenario in Southern Region.

Transmission scheme for evacuation of power under STU:

- KKNPP 3&4 – Samugarangapuram (TN) 400kV (quad) D/c line (~30 km) {Line along with bays at Samugarangapuram (TN) under TANTRANSCO scope and bays at KKNPP 3&4 under NPCIL scope}

Start date of Connectivity : 31.12.2026 with the availability of Associated Transmission System and common transmission system required for effectiveness of GNA

Grant of Connectivity under GNA Regulations for KNPP Unit-4 :

- **Connectivity Transmission system under GNA for KNPP Unit-4:** Same as Connectivity Transmission system under GNA for KNPP Unit-3

Start date of Connectivity : 31.08.2027 with the availability of Associated Transmission System and common transmission system required for effectiveness of GNA

The SRPC has already recommended the comprehensive transmission system for KNPP-3&4 and KNPP-5&6, however the transmission system has been modified in view of the transition opted by NPCIL and has been finalized in the CMETS.

CTU vide letter dated 01.12.2023 submitted the revised transmission scheme (under ISTS) for SRPC views. The revised transmission scheme was discussed and agreed in the 49th SRPC meeting held on 09.12.2023. SRPC vide letter dated 12.01.2024 has forwarded the views on the scheme.

Details of the modified transmission system under ISTS is given below:

Transmission System under ISTS for evacuation of power from Kudankulam Unit - 3 & 4 (2x1000 MW)

Sl. No.	Scope of the Transmission Scheme	Capacity / km
1.	KNPP 3&4 – Tuticorin-II GIS PS 400kV (quad) D/c line (~120 km) {Line & bays at Tuticorin-II GIS under ISTS scope and bays at KNPP under NPCIL scope}	~120 km • 400kV GIS line bays at Tuticorin-II GIS – 2 nos.

Estimated cost : Rs. 510 Crore

Above transmission scheme viz., Transmission System under ISTS for evacuation of power from Kudankulam Unit - 3 & 4 (2x1000 MW) has been forwarded to NCT vide CTU letter dated 19.01.2024.

(b) Augmentation of additional 315 MVA ICT (3rd) at Neyveli TPS-II generation switchyard

During the 26th CMETS SR held on 29.12.2024, CTU informed that presently 2x250 MVA, 400/230/33kV ICTs are under operation at Neyveli TPS-II generation switchyard. The existing ICTs are heavily loaded and are not meeting the N-1 contingency criteria. The issue of high loading of Neyveli TS-II ICTs were deliberated in various Sub Committee of SRPC, TCC and SRPC meetings. During the 48th SRPC meeting held on 13.10.2023, NLCIL informed that it has decided to install one 315 MVA, 400/230kV ICT (3rd) by reorganizing and making available some space outside TPS-II switchyard. It was also informed that approval for 315 MVA additional ICT at Salem bay at Neyveli switchyard is in the advance stage. After detailed deliberations in the meeting, SRPC had agreed that as NLCIL is in the advanced stage of approval etc., they may go ahead with the proposal of 315 MVA additional ICT at Neyveli and necessary approval from CTUIL would be obtained.

Subsequently, NLCIL vide letter dated 05.12.2023 informed that as per the deliberations of the SRPC meeting, it is proposed to install a 315 MVA, 400/230kV ICT (3rd) at Neyveli TPS-II switchyard to

mitigate the loading on existing ICTs utilizing the 400kV spare bay no. 410 and 230kV NNTPP-II feeder bay no. 215 (which is kept idle charged for load flow management). It is also communicated that NLCIL has already obtained internal approval from competent authority for procurement of 315 MVA ICT. In view of the above, NLCIL requested to approve the proposal for regularization of installation of 315 MVA,400/230kV ICT (3rd) at Neyveli TPS-II switchyard.

SRLDC stated that ICT will help in reducing loadings, however, for integration of ICT one of the 400 kV bay, available out of 02 nos. of bays after bypassing of Neyveli-TS2 – NNTPS 400 kV S/c line and Neyveli-TS2 – Salem 400 kV S/c line at Neyveli-TS2 to form Salem – NNTPS 400 kV S/c line. As per earlier agreed plan 400 kV D/c line from Cuddalore (TNEB) was to be terminated at Neyveli-TS2 at these bays. With integration of ICT in one bay, only one bay will be available at Neyveli-TS2 to termination of 400 kV line. further, one of the line is being used for termination of ICT at 230 kV bay. The arrangement shall result in high loading in 230 kV lines forming triangle between Cuddalore, Neyveli TNEB and Neyveli-TS2. It may require reconductoring of the 230 kV lines.

Towards same, Neyveli representative stated that sufficient space is available at Neyveli-TS2 for implementation of additional 02 nos. of line bays are available, through extension of switchyard, for termination of planned Cuddalore 400 kV D/c line. Regarding identification of agency/ entity responsible for implementation of bays at Neyveli-TS 2 for implementation of Neyveli-TS2 – Cuddalore 400 kV D/c line, it was agreed that the matter may be discussed and finalized between TANTRANSCO/TANGEDCO and Neyveli itself. Regarding requirement of reconductoring, it was agreed that TANTRANSCO may review the requirement after study analysis.

After detailed deliberations, augmentation of 1x315 MVA, 400/230 kV ICT (3rd ICT) at Neyveli TS-II was regularised and Neyveli may go ahead with implementation of the ICT.

(c) Augmentation of 2x500 MVA, 400/230 kV transformation capacity (3rd & 4th ICTs) at Karur PS

During the 27th CMETS SR held on 30.01.2024, CTU informed that presently, Karur PS is under operation with 2x500 MVA, 400/230kV ICTs. Connectivity for 618 MW has been granted/ agreed for grant at Karur PS. Further, Connectivity of 300 MW has been agreed for grant to M/s JSP Green Wind 1 Private Limited at Karur PS in the existing margins in the 27th CMETS-SR held on 30.01.2024 (MoM awaited).

Further, connectivity of 100 MW & 93.6 MW to M/s First Energy Pvt. Ltd. & M/s Tata Power Renewable Energy Ltd. respectively has been agreed for grant at Karur PS during the above meeting with the availability of additional 2x500 MVA 400/230 kV ICTs (3rd & 4th). With this the total connectivity granted at Karur PS shall be about 1112 MW. Accordingly, 3rd ICT is required for providing connectivity to RE generation projects and 4th ICT is required for meeting the N-1 contingency criteria.

After detailed deliberations Augmentation of 2x500 MVA, 400/230 kV transformation capacity (3rd & 4th ICTs) at Karur PS was agreed.

Estimated cost : Rs 115 Crore

5. ISTS Network Expansion Scheme in Northern Region

Various transmission schemes have been discussed/finalized in the Consultative Meeting for Evolution of Transmission System of Northern Region (CMETS-NR) from Aug 2023 to Jan 2024. The details of the schemes are summarized below:

5.1. Rajasthan

(a) Augmentation of 400/220 kV, 1x500 MVA (4 th) ICT at 400/220kV Kankroli substation

It was informed that, at present, 400/220 kV Kankroli(PG) S/s is having transformation capacity of 3x315 MVA 400/220 kV ICTs and Connectivity was earlier granted to M/s Hindustan Zinc Limited as a Bulk Consumer during the 14th CMETS-NR meeting held on 23/12/2022.

Further during the 17th CMETS-NR meeting held on 31/03/2023, two nos. of LTA applications from M/s Serentica Renewables India 4 Private Limited, for 100 MW each, with injection point as Kallam substation (WR), for which M/s HZL was the drawee entity (as a Bulk Consumer) at Kankroli ISTS 400/220 kV substation were also discussed. In the meeting it was deliberated that based on the NRLDC inputs & CTUIL studies, considering the peak load of Kankroli complex, loading of Kankroli ICTs are observed to be N-1 non-compliant with drawl of above load (200 MW) and need of 1 No. of 500 MVA ICT (4th) ICT augmentation at Kankroli S/s for such drawl of power emerged.

In above meeting, following transmission system was agreed for drawl of power of 200 MW:

- 1x500 MVA.400/220kV ICT (4th) at Kankroli S/s along with associated 220kV bay
- Shifting of existing 50 MVAr Bus reactor [so as to accommodate ICT] and development of bay for reactor
- Extension of 220 kV side of ICT through 220kV Cable/GIB

Subsequently, in the 19 th Consultation meeting for Evolving Transmission Schemes in NR held on 31.05.23, GNA for 200 MW (drawl of power from Kankroli (PG) S/s was agreed for grant to M/s HZL, upon completion of GNA Transition process as per the GNA Regulations. In the meeting it was deliberated that as per the present studies, 140 MW (out of 200MW load of M/s HZL) may be drawn with the existing transmission system and for the balance (60 MW) of quantum, 1x500 MVA.400/220kV ICT (4th) at Kankroli S/s shall be required. Accordingly, M/s HZL informed that they may seek effectiveness of GNA for Part quantum in future (as per GNA regulation), based on availability of margin at that time without availability of 4th 400/220 ICT at Kankroli. However, full GNA quantum shall be made effective only with the commissioning of required 1 No. of 400/220 kV ICT at Kankroli (ISTS) S/s (GNARE schedule of M/s HZL: Jul'24). Implementation of above ICT needs to be taken after completion of GNA transition process of M/s HZL.

RVPN vide letter 27.06.23 submitted the intra state proposal to CEA/CTU for creation of 220 kV GSS Nathdwara (Upgradation) substation along with associated transmission system incl. Nathdwara – Kankroli (PG) 220kV D/c line. Regarding this, CTU informed that, with agreed grant to M/s HZL, there will be no additional margin available in Kankroli (PG) ICTs for drawl of power and ICTs may become

N-1 non-compliant in peak load condition (in Kankroli complex), therefore augmentation of ICT is also required for transfer of power to Nathdwara S/s through 220kV Nathdwara -Kankroli D/c line.

Further, CTU also requested RVPN to provide firm schedule of above intra state scheme so that approval of 400/220kV Kankroli ICT may be taken up. CEA in consultation with CTU & Grid-India agreed for the proposal and same was communicated vide CEA letter to RVPN on 31.08.23. In the letter it was also informed that RVPN shall furnish the firm schedule for implementation of above proposal so that 400/220 kV, 500MVA ICT augmentation (4th) at Kankroli (PGCIL) substation may be taken up accordingly.

RVPN vide letter dated 05.09.23 informed that tender for implementation of 220kV GSS Nathdwara (upgradation) along with its associated transmission system have been floated. The techno commercial bids shall be opened on 05.09.23 and the completion period is 18 months from the date of LOA. RVPN may update the status of award.

In 23 nd CMETS-NR meeting held on 29.08.23, GNA application of M/s HZL was deliberated. In the meeting it was decided that as the ICT augmentation at Kankroli(PG) shall cater to load of HZL as well as future incremental drawl requirement of RVPN from existing as well as future(Nathdwara)system, the augmentation of ICT shall be considered as common augmentation and shall be under ISTS

In view of above deliberations, following ICT augmentation scheme was proposed in ISTS:

- 1x500 MVA.400/220kV ICT (4th) at Kankroli S/s along with associated 220kV bay
- Shifting of existing 50 MVAr Bus reactor [so as to accommodate ICT] and development of bay for reactor
- Extension of 220 kV side of ICT through 220kV Cable/GIB

RVPN informed that for the Nathdwara transmission system tender (completion schedule is 18 months from award), Technical bids were opened on 5th Sep 2023 and the price bids are expected to be opened shortly and the. CTUIL informed that the implementation of ICT at Kankroli shall also take minimum 18 months from award. RVPN opined that since the award of Nathdwara system may take some time, it is recommended to consider Kankroli ICT for implementation after Nathdwara is awarded. RVPN informed that they will be in a position to confirm the same in first week of October'23. CTUIL asked RVPN to inform the updated status at the earliest as ICT is required both for HZL as well as Nathdwara drawl

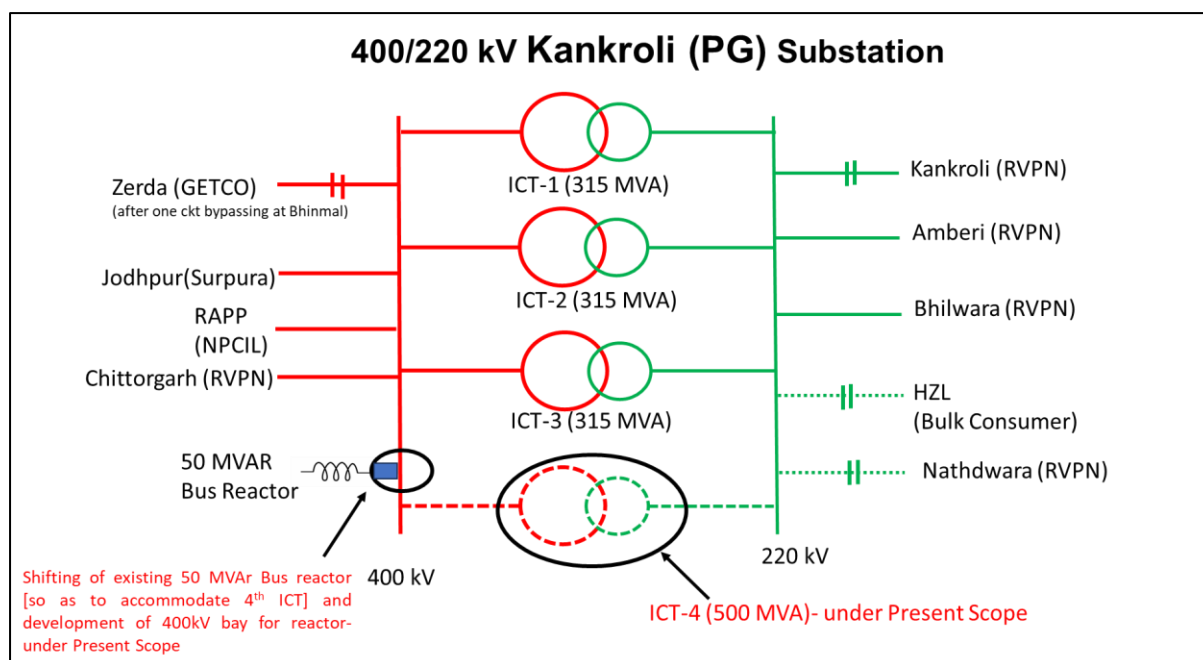
Grid India stated that technically the proposal is in order. Accordingly, it was decided that implementation of ICT shall be taken up upon award of Nathdwara system by RVPN or submission of requisite Conn BGs by HZL for transition of 200 MW application as bulk consumer whichever is earlier.

RVPN also asked about the financial implications of the ICT augmentation at Kankroli as it shall cater to load of HZL as well as RVPN. Regarding this, CTUIL informed that treatment shall be as per the sharing regulations.

In view of above deliberations, following ICT augmentation scheme was agreed under ISTS:

Detailed scope of work for implementation:

Sl. No.	Scope of the Transmission Scheme	Capacity/km
1	Augmentation of 1x500 MVA 400/220 kV ICT(4th) at Kankroli (PG) S/s along with associated 220 kV transformer bay* *incl. extension of 220 kV side of ICT through 220 kV Cable/GIB	500 MVA, 400/220 kV ICT- 1 no. 220 kV ICT bay – 1 no.
2	Shifting of existing 50 MVAR Bus reactor [so as to accommodate 4th ICT] and development of 400kV bay for reactor	400kV bay for existing 50 MVAR Bus Reactor – 1 no.
Total Estimated Cost: INR 59.55 Cr		



(b) Requirement of one set of Bus Sectionalizer at 220kV level of 400/220kV Fatehgarh-IV PS (Section-1)

It was deliberated that transmission system for evacuation of power from REZ in Rajasthan (20GW) under Phase-III was discussed in 3rd meeting of NRPC(TP) held on 19.02.2021. The scheme was recommended for implementation through TBCB in the 5th meeting of NCT held on 25.08.2021 and 02.09.2021. The modified Ph-III, Part A1 scheme comprised of 400/220kV 5x500MVA ICTs and 7 nos. of 220kV line bays for RE connectivity in the present scheme.

At present 2345 MW connectivity on 7 nos. of 220kV line bays were granted/agreed for grant at 220kV level of Fatehgarh-IV (Sec-1) (under implementation in Ph-III Part A1 scheme). In view of technical limitation on onward evacuation system through 400 kV Fatehgarh-IV- Fatehgarh-III (twin HLTS) D/c line (min. 2100 MVA/ckt), 2025 MW capacity (on 6 nos. of 220kV line bays) shall be evacuated through Phase-III scheme (Part A1 and other Ph-III elements) and balance 320MW capacity on 7th 220kV line bay shall be evacuated through Fatehgarh-IV (Sec-2) & associated transmission system as part of Ph-IV (Part-2 :5.5GW) scheme, which was recently approved in 14th NCT meeting. Considering above a bus sectionalizer is required at 220kV level of 400/220kV Fatehgarh-IV PS (Section-1) for reliable evacuation of RE power from Fatehgarh-IV PS (Sec-1).

CEA enquired about evacuation of power from generation project in case the generation granted connectivity at 7th bay comes up before Fatehgarh-IV PS (Sec-2) & its onward system. Regarding this, CTUIL informed that for the generation project to be granted connectivity at 7th 220kV bay, the transmission system for Connectivity under GNA shall include Fatehgarh-IV (Sec-II) & associated Phase-IV (Part-2) transmission system. Therefore, the evacuation in case of early commissioning of generation project shall be as per 22.4 of GNA Regulations through deemed T-GNA from Section-I and associated Ph-III System subject to availability of margins.

In view of above deliberations, following ISTS scheme was agreed:

- One set of bus sectionalizer at 220kV level of 400/220kV Fatehgarh-IV PS (Section-1)

Scope of work along with tentative Cost and Implementation time-frame

Sl. No.	Scope of the Transmission Scheme	Capacity/km	Implementation timeframe
1	One set of bus sectionalizer at 220kV level of 400/220kV Fatehgarh-IV PS (Section-1)	220 kV Bus sectionalizer – 1 no.	01/02/25
Total Estimated Cost:			INR 11.74 Crore

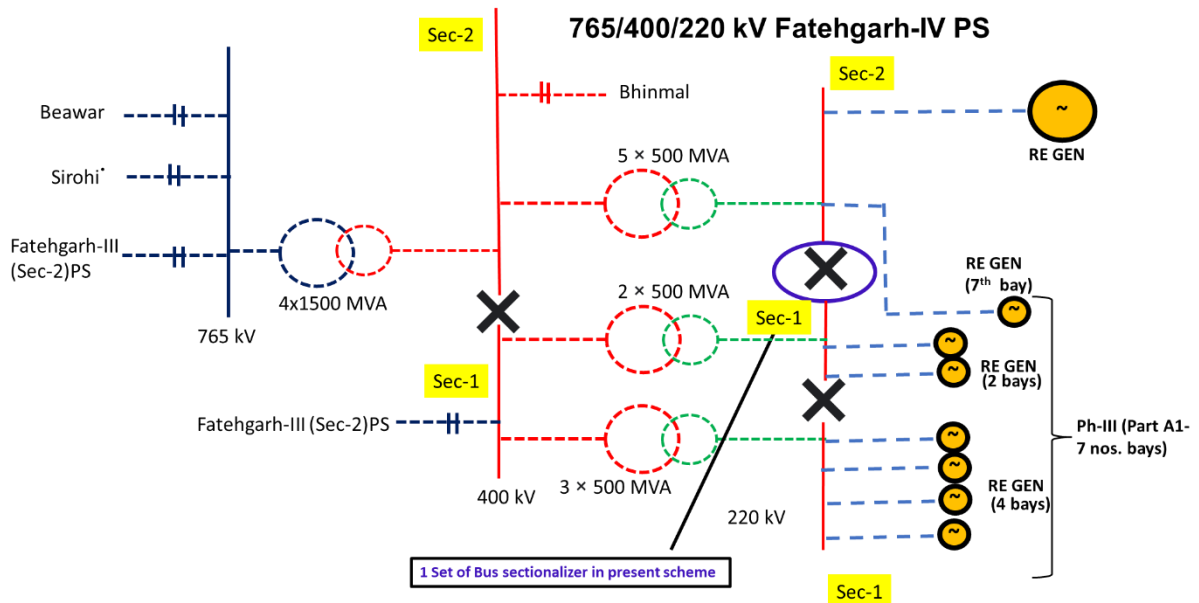


Fig : Schematic of 765/400/220kV Fatehgarh-IV S/s

(c) Requirement of 1x80 MVar (1-Ph) spare reactor unit at Beawar S/s under Rajasthan REZ Ph-IV (Part-2 :5.5 GW) (Jaisalmer/ Barmer Complex): Part D scheme

It was informed that Transmission system for Renewable Energy Zones in Rajasthan Ph-IV(Part-2 :5.5GW) scheme was approved in the 14th NCT held on 09.06.2023. Part-D of this scheme involves implementation of Beawar- Mandsaur PS 765 kV D/c line along with 240 MVAR switchable line reactor for each circuit at each end. 765/400kV Beawar substation is being established under Phase-III Part-F scheme along associated with 330 MVar line reactor(s) & bus reactors. As there is no 80MVar spare Reactor (1-ph) available at Beawar substation in Ph-III Part-F scheme, it was proposed to consider 1x80 MVar (1-ph) spare Reactor at Beawar end under Ph-IV Part-D scheme. Same was agreed in the meeting

(d) Transmission system strengthening to facilitate evacuation of power from Bhadla/Bikaner complex

It was deliberated that comprehensive Transmission scheme for evacuation of power from Rajasthan REZ Ph-IV (Part-1) (Bikaner Complex) is under implementation for power transfer of 7.7GW incl. 4GW from Bikaner-III PS. The scheme comprises 765kV EHVAC corridor from Bikaner-III PS towards load centers of Delhi/UP. As part of the above scheme, 765 kV Bikaner-III -Neemrana 2xD/c and Neemrana-II – Bareilly (PG) D/c lines are being implemented.

Further, as part of Rajasthan REZ Ph-III (20GW) Transmission scheme, Bhadla-III & Ramgarh PS are being established for integration of 6.5GW & 2.9 GW RE potential respectively. Ramgarh PS is also being inter-connected with Bhadla-III for evacuation of RE power. In order to facilitate evacuation of 9.4GW RE power from Ramgarh/Bhadla-III PS (6.5GW+2.9GW) from Bhadla-III onwards, 765kV Bhadla-III - Sikar-II D/c line with implementation schedule of Mar'25 [for about 2.9GW power transfer requirement] as well as 6GW HVDC corridor (+800kV Bhadla (HVDC) -Fatehpur (HVDC)) with

implementation schedule of Feb'28 (Pole-1) & Aug'28 (Pole-2) is being implemented as part of Ph-III scheme

Accordingly, in 19th CMETS-NR meeting, 765kV Bhadla-III - Bikaner-III D/c line was agreed to meet evacuation requirement from Bhadla-III PS onwards for some RE generators coming up in 2025-26 as well as Optimal utilization of EHVAC transmission system beyond Bikaner-III PS while providing flexibility of power transfer from Bhadla/Bikaner RE clusters. The scheme is under bidding.

To facilitate above evacuation of power as well as to meet N-1 criteria (beyond 765kV Bareilly S/s), additional 400 kV corridor i.e. 400kV Bareilly(765/400kV) – Bareilly(PG) D/c line (Quad) (2nd) along with augmentation with 1x1500 MVA, 765/400 kV ICT at Bareilly (765/400kV) S/s (3rd) is proposed. The above strengthening scheme is also included as part of connectivity system of various RE applications granted at Bikaner-III.

CEA agreed for the proposal, however they enquired about short circuit of 400kV Bareilly(765/400kV) & Bareilly(PG) S/s. CTU stated that short circuit level of 400kV Bareilly(765/400kV) is about 52kA (designed capacity:50 kA) & 400kV Bareilly(PG) S/s is about 51kA (designed capacity: 40 kA), however with above proposed scheme short circuit level increase marginally (1-2kA) on both the substations. CTU stated that to reduce short circuit level of various substation in NR, wherein short circuit level is already high (from designed capacity), measures will be taken as part of comprehensive scheme in a phased manner. Grid India stated that scheme is agreeable and they do not have any comment on above scheme.

It was stated that POWERGRID vide mail 21.01.23 confirmed the space availability for 765/400kV ICT (3rd) at Bareilly (PG) (765/400kV) as well as 2 nos. of 400kV line bays each at Bareilly (PG) (765/400kV) and Bareilly (PG) (400kV). In view of that following transmission system strengthening was agreed to facilitate evacuation of power as well as to meet N-1 criteria (beyond 765kV Bareilly) in ISTS

- 400 kV Bareilly(765/400kV) – Bareilly(PG) D/c line (Quad) (2nd) (~2 km)
- Augmentation with 1x1500 MVA, 765/400 kV ICT(3rd) at Bareilly (765/400kV) S/s

Implementation Schedule: 18 months from allocation

(e) Additional Transmission system for evacuation of power from Bhadla-III PS as part of Rajasthan REZ Phase-III scheme (20GW)

It was stated that, Transmission System requirement for additional 20 GW REZ in Northern Region (Phase-III) was approved in 5th NCT meeting held on 25.08.21 & 02.09.21. As part of the above scheme, establishment of 765/400/220kV Bhadla-III PS (765/400kV : 2x1500MVA, 400/220kV : 3x500MVA) was approved in Phase-III Part B1 package, which is under implementation. Further, 7x500MVA ICTs (incl. 10 nos. of 220kV line bays & 220kV sectionalizer was also approved) under RTM in Phase-III Part B1 package with following condition.

- The implementation of number of 220 kV bays and 400/220 kV transformers to be taken up based on receipt of stage-II connectivity and commensurate LTA respectively (beyond 1500 MW at Bhadla-III).
- 220 kV line bays and Transformer augmentations shall be reviewed based on stage-II connectivity at 220 kV voltage level and LTA applications respectively.

Further, connectivity application of about 7GW (against potential of 6.5GW) is already received at Bhadla-III PS, out of which 6.5GW is already granted/agreed for grant. Out of above RE application of about 3GW (400kV - 1GW, 220kV- 2GW) is granted through EHVAC system (Sch. Progressively from Mar'25) and balance 3.5GW is being granted on HVDC system (Expected Sch.: Feb'28) at Bhadla-III PS.

It was stated that with fulfilment of connectivity grant process (Intimation, BGs etc.), total 5 nos. of 400/220kV ICTs are required, out of which 3 nos. ICTs already under implementation (Ph-III Part B1). Therefore balance 2 nos. ICTs (4th & 5th) are required with 18 months schedule considering RE generation schedule. Further total 4 nos. of 765/400kV ICTs are also required, out of which 2 nos. 765/400kV ICTs (Ph-III Part B1) are already under implementation. Additionally, 2 nos. of 765/400kV ICTs (3rd & 4th) are required (ICT-3:18 months (best effort Jun'25) & ICT-4: Dec'25) considering about 3-3.5GW power evacuation requirement from envisaged Bhadla-III PSas well as power flow through 400kV Fatehgarh-III- Bhadla-III PS D/c line. The above ICTs (765/400kV & 400/220kV) at Bhadla-III are also considered as part of connectivity transmission system for RE projects. Additionally, total 5 nos. of 220kV line bays are already under implementation in ISTS (Ph-III Part B1) which is sufficient at present.

CEA enquired about utilization of 765/400kV ICTs (3rd & 4th) after commissioning of Bhadla-Fatehpur HVDC System. CTU stated that due to time gap (about 3 years) in implementation time of EHVAC and HVDC system, ICTs would be required. Optimal utilization of 765/400kV ICTs may be planned with other future RE schemes from Bhadla-IV PS or other system strengthening schemes. CEA enquired that whether more power can be evacuated from Bhadla-III PS beyond 6.5GW identified potential. CTU stated that beyond 6.5GW, connectivity will be granted at Bhadla-IV PS on HVDC system for which system is under planning. It is not recommended to inject more generation at Bhadla-III PS, due to very less margin availability in Bhadla-III onwards EHVAC system. CEA & Grid-India agreed for proposal.

SECI enquired that balance potential of Ramgarh PS (2.2GW) may be evacuated to EHVAC system in place of HVDC. CTU stated that Common transmission corridors were planned for Ramgarh (2.9GW) and Bhadla-III (6.5GW) RE potential as part of integrated transmission planning. In order to facilitate evacuation of RE power from Ramgarh/Bhadla-III PS, EHVAC system towards Sikar-II S/s & and 6GW HVDC corridor (Bhadla-Fatehpur) is being implemented as part of Ph-III scheme. The common transmission system for evacuation of power to various RE developers were allotted based on application priority combinedly to Ramgarh & Bhadla-III PS applicants. SECI requested that additional EHVAC corridor may be planned for evacuation of 2.2GW RE potential. In view of deliberations held in the meeting, following transmission system is agreed in ISTS

1. Augmentation of 2x500 MVA (4th & 5th) 400/220 kV ICTs at Bhadla-III PS
2. 220 kV bus sectionalizer (1 set) along with 220kV BC (1 no.) bay and 220kV TBC (1 no.) bay at Bhadla-III PS
3. Augmentation of 2x1500 MVA 765/400kV (3rd & 4th) ICTs at Bhadla-III PS

Implementation Schedule: 18 months from allocation (for S.No 1 & 2) For S.No. 3: ICT-3 : 18 months from allocation (Best effort: Jun'25), ICT-4 : Dec'25 (30.12.25)

(f) Augmentation of 5th ICT at Fatehgarh-III PS(Section-1)

It was deliberated that Transmission System Strengthening for potential solar energy zones Phase-II in Northern Region for 8.1 GW was discussed and agreed in the 5th Meeting of Northern Region Standing Committee on Transmission (NRSCT) held on 13.09.2019. Subsequently, the scheme was approved in the 6th meeting of National Committee on Transmission (NCT) held on 30.09.2019. As part the above scheme, Ph-II Part-A involved establishment of 4x500 MVA Ramgarh PS (now Fatehgarh-III PS (sec-1)) along with 400 kV D/c lines towards Fatehgarh-II PS & Jaisalmer-II (RVPN) S/s.

Subsequently, as part of Transmission system for evacuation of power from REZ in Rajasthan under Phase-III(20GW), augmentation of 5th ICT at Fatehgarh-III PS(Sec-1) was discussed and agreed in the 3rd NRPC(TP) held on 19.02.2021. Further, the 5th ICT at Fatehgarh-III PS(Sec-1) was taken up for discussion and approval in the 5th NCT meeting held on 25.08.2021 and 02.09.2021 as part of Ph-III Part-J scheme.

However, in the 5th NCT meeting, it was opined that one of the pilot project of Battery Storage System of 250 MW is being planned at perspective location near Fatehgarh-3, therefore there might be a possibility that the 5th ICT of 500 MVA at Fatehgarh-III PS(Sec1) may not be required and hence this item needs to be reviewed. Accordingly, the Augmentation of ICT(5th) at Fatehgarh-III PS (Sec1) was deferred in the 5th NCT meeting.

Subsequently, in the manual on Transmission Planning Criteria 2023 by CEA published in March 2023, it is mentioned that 'N-1' reliability criteria may be considered for ICTs at the ISTS /STU pooling stations for renewable energy based generation of more than 1000 MW after considering the capacity factor of renewable generating stations.

Cumulative connectivity quantum of 2280 MW was granted at Fatehgarh-III PS(Sec-1). Recently, 300 MW has been surrendered in GNA Transition process. The remaining connectivity granted at Fatehgarh-III PS is 1980 MW. Therefore, to satisfy N-1 reliability criteria at 400/220 kV Fatehgarh-III PS(Section-1), it is necessary to take up augmentation of 5th ICT at Fatehgarh-III PS(Sec-1) is required.

Further, in the meeting for reallocation of connectivity bays in NR held on 20.06.2023, it was decided that in order to ensure N-1 compliance as per planning criteria 2023, the 220 kV line bay which is surrendered under GNA transition(300 MW) at Fatehgarh-III PS(Sec-1) shall not be granted to any other RE applicant and instead shall be utilized by upcoming pilot BESS project (2x250 MW) at Fatehgarh-III PS which is under implementation M/s JSW. However, despite interconnection of BESS, for N-1 compliance there is a need of 400/220 kV 500 MVA 5th ICT at Fatehgarh-III PS(Sec-1).

The Fatehgarh-III PS(Section-1) is currently under advanced stage of implementation by POWERGRID(TBCB) & is expected to be commissioned progressively from Aug'23. As per the latest JCC minutes, 1980 MW of generation projects granted connectivity at Fatehgarh-III PS(Section-1) are expected to be commissioned progressively from Sep'23. In view of the above, implementation of 5th ICT at Fatehgarh-III PS(Sec-1) is to be taken up on urgent basis to meet the N-1 compliance as per CEA Transmission Planning Criteria 2023.

In meeting SECI queried that requirement of Augmentation of 5th ICT at Fatehgarh-III PS(Section-1) is due to BESS. CTU stated that this ICT augmentation is not for BESS, it is for requirement to meet the N-1 compliance as per CEA Transmission Planning Criteria 2023. SECI also queried regarding 220kV line bays for this ICT augmentation, CTU stated that for this ICT augmentation requires separate transformer bays. In view of above deliberations, following ISTS scheme was agreed.

SECI enquired about revision of RE capacity of 1980MW from earlier granted 2280MW capacity at Fatehgarh-III PS(Section-1). CTU stated that earlier 2280MW connectivity allocated to RE applicants at Fatehgarh-III PS(Section-1) against potential of 1.98GW in PhII. However, in view of surrendered capacity (300MW) at Fatehgarh-III PS(Section-1) and new N-1 compliance requirement as per CEA Transmission Planning Criteria 2023, RE connectivity at Fatehgarh-III PS(Section-1) allocated to 1980MW.

In view of above deliberations, following ISTS scheme was agreed:

- Augmentation of 400/220 kV ,1x500 MVA (5th) ICT at Fatehgarh-III PS(Section-1) along with transformer bays

Scope of work along with tentative Cost and Implementation time-frame

Sl. No.	Scope of the Transmission Scheme	Capacity/km	Implementation timeframe
1	Augmentation with 400/220kV, 1x500MVA Transformer at Fatehgarh-III PS (5th ICT at Section-1) along with associated transformer bays* *1 no. of 400kV (AIS) (including associated tie bay) and 1 no. of 220kV (AIS) transformer bay	<ul style="list-style-type: none"> • 500 MVA 400/220 kV ICT – 1 no. • 400 kV ICT bay (including associated tie bay) – 1 no. • 220 kV ICT bay – 1 no 	18 months from the date of issue of OM by CTUIL
Total Estimated Cost:			INR 58.18 Crore

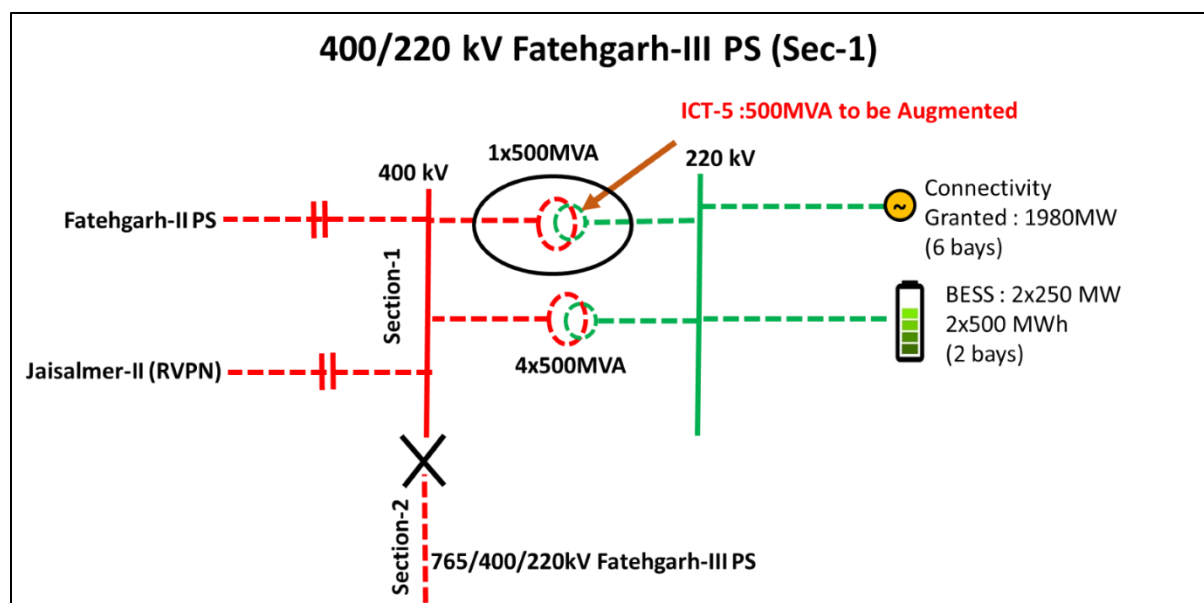


Fig : Schematic of 400/220kV Fatehgarh-III PS (Sec-I)

(g) Requirement of one set of Bus Sectionalizer at 400kV level of 400/220kV Bikaner-II PS

It was informed that Transmission system strengthening scheme for evacuation of power from solar energy zones in Rajasthan (8.1 GW) under Phase-II” was discussed in 4th meeting of NRST held on 25.07.2019 and recommended for implementation through TBCB in the 6th meeting of erstwhile NCT held on 30.09.2019. As part of above , Ph-II, Part F scheme was modified in 4th NCT meeting held on 20.01.20 and 28.01.20 (deletion of 400/220 kV ICTs at Bikaner-II PS from approved scope).

Subsequently 2 nos. of 500MVA ICTs (1st & 2nd) and 1 no. of 500 MVA ICT (3rd) at Bikaner-II PS was allocated in RTM to M/s POWERGRID Bikaner Transmission System Limited (PBTSL) for implementation vide CTU OM dated 16.11.21 and 08.06.23 respectively. Further, Augmentation by 400/220 kV, 5x500 MVA ICT (4th to 8th) at Bikaner-II PS was agreed for implementation as part of transmission system for evacuation of power from Rajasthan REZ Ph-IV (Part-1) (Bikaner Complex)-Part E and same was allocated to M/s PBTSL vide CTU OM dated 15.11.22 (based on NCT letter dated 15.11.22). As per above NCT letter, above ICTs were to be taken up for evacuation requirement beyond 2000 MW at 220 kV level of Bikaner-II PS, with implementation timeframe matching with schedule of RE generation or 18 months from date of allocation, whichever is later. Subsequently, CTU vide mail 13.06.23 informed to POWERGRID for take up implementation of 5x500 MVA ICTs (4th to 8th) at Bikaner-II PS with implementation schedule of Dec’24 (4th to 7th) and Jan’25 (8th) after meeting the requirement specified in NCT letter dated 15.11.22.

POWERGRID vide letter dated 27.06.23 informed that 400kV bus sectionalizer (bays 428 &429) at Bikaner-II PS may be required after ICT-5 for taking up implementation of ICT-6th to 8th. It was also informed that in absence of 400kV bus sectionalizer bays, integration of existing 400kV section bus bar protection system & new bus bar protection system shall not be feasible. In view of the above, one set of sectionalizer at 400kV level of 400/220kV Bikaner-II PS is required.

Further, it was deliberated that tie one no. of 400kV tie bay (associated with 400/220kV ICT-4) shall also be required.

In view of above deliberations, following ISTS scheme was agreed:

- One set of bus sectionalizer at 400kV level of 400/220kV Bikaner-II PS
- One no. of 400kV tie bay (associated with 400/220kV ICT-4 as per approved SLD)

Scope of work along with tentative Cost and Implementation time-frame

Sl. No.	Scope of the Transmission Scheme	Capacity/km	Implementation timeframe
1	<ul style="list-style-type: none"> • One set of bus sectionalizer at 400kV level of 400/220kV BikanerII PS • One no. of 400kV tie bay (associated with 400/220kV ICT4) 	<ul style="list-style-type: none"> • 400 kV Bus sectionalizer– 1 no. • 400kV tie bay–1 no 	Matching with implementation of 400/220kV ICTs (4th to 7th) i.e., Dec’24
Total Estimated Cost:			INR 28 Crore

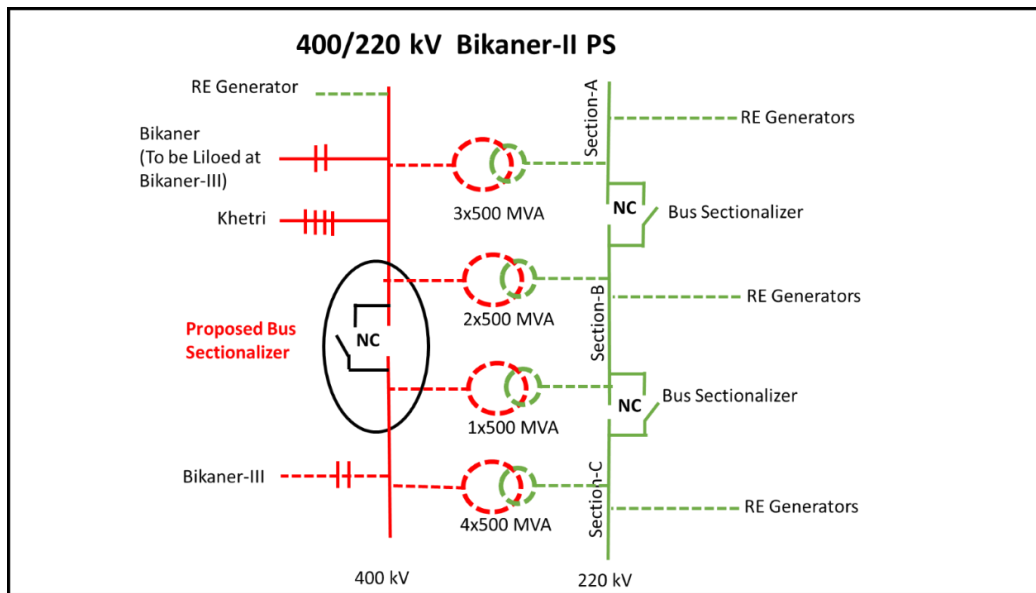


Fig : Schematic of 400/220kV Bikaner-II PS

(h) Requirement of one set of Bus Sectionalizer at 220kV level of 400/220kV Fatehgarh-IV PS (Section-1)

It was deliberated that transmission system for evacuation of power from REZ in Rajasthan (20GW) under Phase-III was discussed in 3rd meeting of NRPC(TP) held on 19.02.2021. The scheme was recommended for implementation through TBCB in the 5th meeting of NCT held on 25.08.2021 and 02.09.2021. The modified Ph-III, Part A1 scheme comprised of 400/220kV 5x500MVA ICTs and 7 nos. of 220kV line bays for RE connectivity in the present scheme.

At present 2345 MW connectivity on 7 nos. of 220kV line bays were granted/agreed for grant at 220kV level of Fatehgarh-IV (Sec-1) (under implementation in Ph-III Part A1 scheme). In view of technical limitation on onward evacuation system through 400 kV Fatehgarh-IV- Fatehgarh-III (twin HLTS) D/c line (min. 2100 MVA/ckt), 2025 MW capacity (on 6 nos. of 220kV line bays) shall be evacuated through Phase-III scheme (Part A1 and other Ph-III elements) and balance 320MW capacity on 7th 220kV line bay shall be evacuated through Fatehgarh-IV (Sec-2) & associated transmission system as part of Ph-IV (Part-2 :5.5GW) scheme, which was recently approved in 14th NCT meeting. Considering above a bus sectionalizer is required at 220kV level of 400/220kV Fatehgarh-IV PS (Section-1) for reliable evacuation of RE power from Fatehgarh-IV PS (Sec-1).

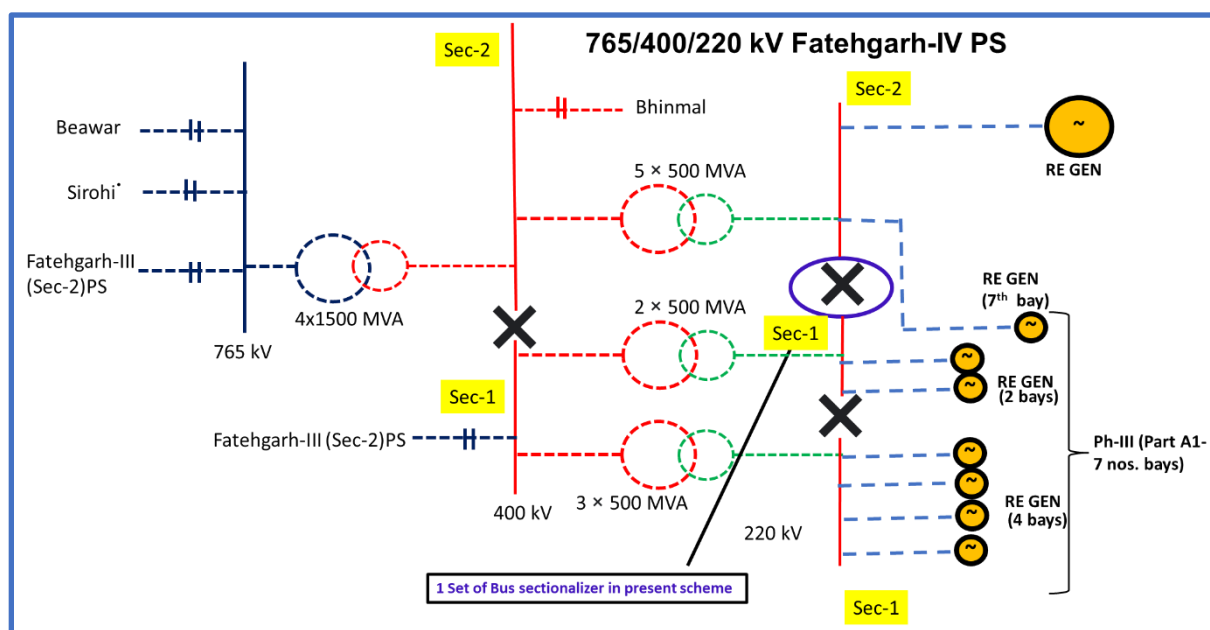
CEA enquired about evacuation of power from generation project in case the generation granted connectivity at 7th bay comes up before Fatehgarh-IV PS (Sec-2) & its onward system. Regarding this, CTUIL informed that for the generation project to be granted connectivity at 7th 220kV bay, the transmission system for Connectivity under GNA shall include Fatehgarh-IV (Sec-II) & associated Phase-IV (Part-2) transmission system. Therefore, the evacuation in case of early commissioning of generation project shall be as per 22.4 of GNA Regulations through deemed T-GNA from Section-I and associated Ph-III System subject to availability of margins.

In view of above deliberations, following ISTS scheme was agreed:

- One set of bus sectionalizer at 220kV level of 400/220kV Fatehgarh-IV PS (Section-1)

Scope of work along with tentative Cost and Implementation time-frame

Sl. No.	Scope of the Transmission Scheme	Capacity/km	Implementation timeframe
1	One set of bus sectionalizer at 220kV level of 400/220kV Fatehgarh-IV PS (Section-1)	220 kV Bus sectionalizer – 1 no.	01/02/25
Total Estimated Cost:			INR 11.74 Crore

**Fig : Schematic of 765/400/220kV Fatehgarh-IV S/s**

- (i) **Transmission system for evacuation of power from Bikaner & Fatehgarh/Barmer Complex as part of Rajasthan REZ Ph-IV (Part-3a :2.4GW) and REZ Ph-IV (Part-4 :3.5GW) respectively**

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

S.No	Transmission Scheme	RE Potential	Status
A	Under Bidding/ Approved		
1	Rajasthan REZ Ph-IV (Part-1 :7.7GW) (Bikaner Complex)	14 GW (Solar 14GW, BESS:6GW) Bikaner-II : 3.7GW Bikaner-III: 4GW	Awarded
2	Rajasthan REZ Ph-IV (Part-2 :5.5GW) (Jaisalmer/Barmer Complex)	5.5GW (Solar) Fatehgarh-IV: 4 GW Barmer-I: 1.5 GW	Under Bidding
3	Rajasthan REZ Ph-IV (Part-3 :3.6GW) (Bikaner Complex)	3.6 GW (Solar) Bikaner-IV:3.6GW	Under approval with NCT
B	Planned/Under Planning		
1	Rajasthan REZ Ph-IV (Part-3a :2.4GW) (Bikaner Complex)	2.4 GW (Solar) Bikaner-IV : 2.4GW	Scheme planned for 2026-27 time frame (EHVAC)-Present proposal
2	Rajasthan REZ Ph-IV (Part-4 :3.5GW) (Jaisalmer/Barmer Complex)	3.5 GW (Solar) Fatehgarh-IV: 1 GW Barmer-I: 2.5 GW	
3	Rajasthan REZ Ph-IV (Part-5 : 6GW) (Barmer Complex)	6 GW (Solar) Barmer-II : 6GW	Scheme planned for 2029 time frame (HVDC)
4	Rajasthan REZ Ph-IV (Part-6 : 6GW) (Bhadla/Bikaner Complex)	6 GW (Solar) Bhadla-IV: 2 GW Bikaner-V: 4 GW*	

**SECI to confirm total RE potential at Bikaner-V*

(j) Rajasthan REZ Ph-IV (Part-3a :2.4GW) (Bikaner Complex)

It was deliberated that Transmission scheme is evolved for about 7.7GW (Solar) in Bikaner complex (14 GW potential along with 6 GW BESS) in Rajasthan for RE potential identified at Bikaner complex as part of committee report. However, no application of BESS (linked with RE) against envisaged 6GW was received. Accordingly, RE potential of about 7.7GW (in place of 14GW) can be evacuated from planned system (Ph-IV scheme) from Bikaner complex (Bikaner-II(3.7 GW) & Bikaner-III(4 GW)).

Further, In the Joint study meetings held on 18.10.23 & 23.10.23, Transmission system for evacuation of power from Bikaner Complex as part of Rajasthan REZ Ph-IV (Part-3 :3.6GW (Total 6 GW)) was discussed. In the meetings, two alternatives were deliberated

- Bikaner-IV- Siwani 765kV D/c line & onwards 400kV transmission system from Siwani S/s
- Bikaner-IV- Churu- Siwani 765kV D/c line & onwards 400kV transmission system from Siwani S/s along with LILO of one ckt of 765 kV Sikar-II (PG) -Khetri (PG) D/c line at Churu S/s and Churu-Fatehabad (PG) 400 kV D/c line.

In above meetings, Grid-India opined that in case of direct interconnection of Bikaner-IV to Siwani i.e. not considering 765/400kV Churu in between and onward transmission system, the Transmission system is kind of radial system connected with RE generation pocket and poses stability issues in various operational scenarios in future. Grid-India also emphasized that some margin should be kept in planning studies for operational scenarios. Further, the angular difference (>30 degrees) in N-1-1 /N-2 may cause problems in synchronization of lines after corridor outage. The proposed system is stable and well interconnected with Grid provides reliable power evacuation under various operational scenarios

CEA stated that N-1-1 or N-2 is a rare contingency and deliberations are required on N-1-1/N-2 compliance in planning studies as it may incur additional investment for strengthening of transmission system.

The scheme was further deliberated in 25thCMETS-NR meeting held on 31.10.23. In the meeting, CEA opined that Bikaner-IV S/s is planned for 6GW evacuation and at present direct interconnection between Bikaner-IV and Siwani is to be planned in first phase (3GW) and 765/400kV Churu S/s along with associated transmission scheme may be taken up in later stage while planning of balance 3 GW transmission scheme. Grid-India further emphasized that in case Churu S/s to be taken up at later stage of planning, 765kV Bikaner-IV-Siwani D/c line may not able to synchronize after corridor outage (765kV Bikaner-IV-Siwani D/c line) due to higher angular difference (>30 degrees) in N-1-1/N-2 in peak solar hours. Grid-India stated that due to potential delays in the restoration of the 765 kV Bikaner-IV to Siwani D/c line, synchronization of lines might not be feasible during peak solar hours. Instead, this process might need to be deferred to non-solar hours, which would entail running the system in a depleted condition for several hours.

In view of deliberations held in 25th CMETS-NR meeting, following transmission scheme was agreed in CMETS-NR meeting for evacuation of power from Rajasthan REZ Ph-IV (Part-3) [Bikaner IV :3.6GW]

Bikaner-IV: 3.6GW (Solar)

- Establishment of 4x1500 MVA, 765/400 kV & 4x500 MVA, 400/220 kV Bikaner-IV Pooling Station along with 2x240 MVar (765kV) & 2x125 MVar (420kV) Bus Reactors at a suitable location near Bikaner
- STATCOM (2x±300MVar) along with MSC (4x125 MVar) & MSR (2x125 MVar) along with 2 nos. 400kV line bays at Bikaner-IV PS
- 220kV line bays (5 nos.) for RE connectivity at Bikaner-IV PS
- 400kV line bays (1 no.) for RE connectivity at Bikaner-IV PS
- 220kV Sectionalization bay (1 set) along with BC (2 nos.) and 220 kV TBC (2 nos.) at Bikaner-IV PS
- 400kV Sectionalization bay (1 set) at Bikaner-IV PS
- LILO of one ckt of 765 kV Bikaner-III -Neemrana-II D/c line (2nd) at Bikaner-IV PS (~20 km) along with 330 MVAR switchable line reactor at Bikaner-IV PS end of 765 kV Bikaner-IV -Neemrana-II line (formed after LILO)
- Establishment of 765/400 kV, 2x1500 MVA S/s at suitable location near Churu along with 2x240 MVar (765kV) Bus Reactor & 2x125 MVar (420kV) Bus Reactor
- Bikaner-IV PS – Churu 765 kV D/c line along with 240 MVar switchable line reactor for each circuit at Bikaner-IV PS end (~180 km)
- LILO of one ckt of 765 kV Sikar-II (PG) -Khetri (PG) D/c line at Churu S/s (~90 km)
- Churu – Fatehabad (PG) 400 kV D/c line (Quad) along with 63 MVar switchable line reactor for each circuit at Churu S/s end (~150 km)
- Establishment of 765/400 kV, 3x1500 MVA S/s at suitable location near Siwani (Distt. Bhiwani) along with 2x240 MVar (765kV) Bus Reactor & 2x125 MVar (420kV) Bus Reactor*
- Siwani – Churu 765 kV D/c line (~95 km)
- Siwani – Jind (PG) 400 kV D/c line (Quad Moose) (~110 km)
- Siwani – Patran (Indi Grid) 400 kV D/c line (Quad) (~160 km) (400kV GIS duct :700m) along with 80 MVar switchable line reactor for each circuit at Siwani S/s end

Subsequently, Joint Study Meeting(s) were held in virtual mode on 28.12.23 with SECI, CEA, GRID-INDIA, RVPN, UPPTCL and other STUs of Northern region to finalize the Transmission system for evacuation of power from Bikaner & Fatehgarh/Barmer Complex as part of Rajasthan REZ Ph-IV (Part-3a :2.4GW) and REZ Ph-IV (Part-4 :3.5GW) respectively

Gist of discussion in Joint study meeting held on 28.12.23

As discussed earlier, Transmission scheme was evolved and approved in 25th CMETS-NR meeting for about 3.6 GW (Solar) as part of Rajasthan REZ Ph-IV (Part-3 :3.6GW) (Bikaner Complex) for injection at Bikaner-IV in Rajasthan. At present connectivity of about 6 GW is already agreed/received against its total potential (6GW) and more applications are expected due to land availability and being outside of GIB area.

It was stated that for balance 2.4GW capacity (thus makes total capacity of 6 GW at Bikaner-IV PS), EHVAC evacuation system is planned for comprising Bikaner-IV PS – Churu 765 kV D/c line (2nd) line and LILO of 2nd ckt of 765 kV Sikar-II (PG) -Khetri (PG) D/c line at Churu S/s. For onward dispersal of power, Siwani – Sonipat (PG) 400 kV D/c line (Quad) is also planned.

For EHVAC system, studies were carried out in 2026-27 time frame in solar maximized scenario and Study files for solar maximized scenario was shared on 20.12.23 with all constituents. Considering grant of connectivity to new RE generators in Bikaner complex as well as for evacuation of power beyond Bikaner complex, following transmission scheme is proposed for evacuation of power from Rajasthan REZ Ph-IV (Part-3a :2.4GW) [Bikaner complex]. Details of proposed EHVAC scheme is as under

➤ **Transmission system for evacuation of power from Bikaner Complex as part of Rajasthan REZ Ph-IV (Part-3a :2.4GW)**

In the above meeting following transmission system was proposed for evacuation of power from Rajasthan REZ Ph-IV (Part-3a :2.4GW) for evacuation of power from Bikaner complex

Bikaner-IV: 2.4GW (Solar)

- Augmentation of 1x1500 MVA(5th), 765/400 kV ICT at Bikaner-IV Pooling Station
- Augmentation of 3x500 MVA (5th to 7th), 400/220 kV ICT at Bikaner-IV Pooling Station[#]
- 220kV line bays (3 nos.) for RE connectivity at Bikaner-IV PS[#]
- Bikaner-IV PS – Churu 765 kV D/c line (2nd) along with 240 MVA_r switchable line reactor for each circuit at Bikaner-IV PS end (~175 km)
- LILO of other ckt of 765 kV Sikar-II (PG) -Khetri (PG) D/c line at Churu S/s* (~80 km)
- Augmentation of 765/400 kV, 1x1500 MVA ICT (4th) at Siwani S/s
- Siwani – Sonipat (PG) 400 kV D/c line (Quad Moose) (~150 km) along with 63 MVA_r switchable line reactor for each circuit at Siwani S/s end

****one ckt is already LILOed as part of Rajasthan REZ Ph-IV (Part-3 :3.6GW) scheme)***

To be finalized as per application received

In the meeting, CEA stated that with Phase-IV Part 3a (2.4GW) proposed scheme, there will be no requirement of 765/400kV Churu S/s & associated interconnections, which were earlier agreed in 25th CMETS-NR meeting as part of Phase-IV Part 3 (3.6GW) scheme. CEA stated that in the earlier agreed Phase-IV Part 3 (3.6 GW) scheme, Churu S/s & associated transmission scheme (LILO of one ckt of 765 kV Sikar-II (PG) -Khetri (PG) D/c line at Churu S/s and Churu- Fatehabad (PG) 400 kV D/c line) was considered to address issue on synchronization of line after corridor outage (765kV Bikaner-IV-Siwani D/c line) in N-1-1/N-2 in peak solar hours as emphasized by Grid-India. CEA stated that in place of Bikaner-IV – Churu D/c line, a parallel corridor towards Siwani S/s i.e. 765kV Bikaner-IV-Siwani D/c line may be considered for additional 2.4GW evacuation of power as part of scheme. With the above parallel 765kV corridor i.e. 765kV Bikaner-IV – Siwani D/c line, angular stability issue under N-1-1 contingency will be resolved as 4 nos. of 765kV circuits are available towards Siwani S/s. Further in future, if there is requirement of establishment of Churu S/s, Bikaner-IV – Siwani D/c line may be LILOed at Churu S/s.

It was deliberated that Transmission system for evacuation of power from Bikaner Complex as part of Rajasthan REZ Ph-IV (Part-3 :3.6GW) is being taken up for approval in next NCT. In view of that both the schemes viz Ph-IV: Part 3 (3.6GW) & Ph-IV: Part 3a (2.4GW)) may be considered comprehensively for 6GW evacuation.

CTU stated that Rajasthan REZ Ph-IV (Part-3 :3.6GW) is already approved in 25th CMETS-NR meeting held in Oct'23 and change in earlier agreed scheme (3.6GW) will delay the implementation timeline for 3-4 months and may impact the evacuation of RE generation from Bikaner-IV PS. CTU also stated that in 26th CMETS-NR meeting, SECI vide mail 07.12.23 informed that South West Churu has solar potential & therefore considering solar potential at Churu as indicated by SECI, 220kV future scope was retained at Churu S/s as earlier agreed in 25th CMETS-NR meeting. CTU stated that they will review the proposal based on CEA observations and deliberations in meeting and evaluate various alternatives (with and without Churu S/s) in a comprehensive manner. Accordingly, the scheme will be further deliberated and finalized in next Joint study meeting.

Gist of discussion in Joint study meeting held on 09.01.24

In view of the above deliberations, CTU re-examined the proposals and shared the study files along with two alternatives ;

- **Alternative-1 :** Bikaner-IV- Churu- Siwani 765kV D/c & Bikaner-IV- Siwani 765kV D/c & associated transmission interconnection at Churu S/s i.e. LILO of one ckt of 765 kV Sikar-II (PG) -Khetri (PG) D/c line at Churu S/s and Churu- Fatehabad (PG) 400 kV D/c line & onwards 400kV transmission system from Siwani S/s (Towards Jind, Patran, Sonipat)
- **Alternative-2:** Bikaner-IV- Siwani 765kV 2xD/c line & onwards 400kV transmission system from Siwani S/s (Towards Jind, Patran, Fatehabad, Sonipat)

It was stated that recently additional margin of about 600MW (over 4GW planned capacity) was released at Bikaner-III PS, with Bikaner-IV transmission system. In the earlier agreed system (LILO of one ckt of 765 kV Bikaner-III -Neemrana-II D/c line at Bikaner-IV PS), 765/400kV ICTs at Bikaner-III PS and Bikaner (PG) is higher in N-1 contingency. Space is not available for augmentation of new at 765/400kV ICT (5th) at Bikaner (PG) and 765/400kV ICT (7th) at Bikaner-III PS. Therefore, in place of LILO of one ckt of 765 kV Bikaner-III -Neemrana-II D/c line at Bikaner-IV PS, LILO of both ckts of 400kV Bikaner II- Bikaner-III D/c line (Quad) at Bikaner-IV is proposed which will relieve the above ICT loadings and increase the operational margin on above ICTs. Additionally STATCOM at Siwani (+300MVAR) is proposed in Alternative-2 to mitigate low voltage issue.

Further, Observations were received on 04.01.24 from Grid-India and CEA on both the alternatives for transmission system for evacuation of power from Bikaner complex as part of Rajasthan REZ Ph-IV (Part-3). Major observations are as under

➤ **Grid-India Observations/Comments**

- During peak solar period, voltages at Siwani (730kV) and Bikaner-IV (740kV) are very low even after taking B/Rs out. If line reactors are to be taken out of service for maintaining voltages, the same needs to be mentioned along with the scheme.
- Considering the identified solar potential at Churu by SECI, establishment of Churu substation will help in tapping the solar generation in that complex. CTUIL may clarify its plan and the timelines for establishing the ISTS Churu substation, if the same is not being taken up right now.

Additionally, Grid-India in 25th CMETS-NR meeting opined that in case of direct interconnection of Bikaner-IV to Siwani i.e. not considering 765/400kV Churu in between and onward transmission system, the Transmission system is kind of radial system connected with RE generation pocket and poses stability issues in various operational scenarios in future. Further Grid-India also requested to share Study cases for off peak scenarios. Other study related comments received from Grid-India was also deliberated in above Joint study meeting

➤ **CEA Observations/Comments**

- Power flow in both the alternatives seems to be in order. Transmission system requirement is less in Alt 2. This would result in saving of hundreds of crore.
- In Alt 2, with Bikaner-IV- Siwani 765 kV 2xD/c line, issue of synchronization of line after corridor outage (765 kV Bikaner-IV-Siwani D/c line) in N-1-1/N-2 in peak solar hours as highlighted by Grid-India gets resolved.
- As intimated by CTUIL, connectivity applications of 5.4 GW RE has already been received against potential of 6 GW. Therefore, a comprehensive scheme for 6 GW RE evacuation could be implemented.
- In view of the above, Alt 2 seems to be preferable at present. Churu substation could be implemented in future, if required, with LILO of Bikaner-IV- Siwani 765 kV line to cater to the potential in Churu district.

CTU analyzed both the alternatives with above changes and observations are as under :

- Estimated Cost of scheme is about 12% lower (about Rs 1200 Cr) in Alt-2 than Alt-1
- In Alt-2, due to longer line length, under N-1 contingency of 765kV Bikaner-IV-Siwani, voltage dipping will be higher (about 10kV than Alt-1) and in the range of 730-740kV considering STATCOM at Bikaner-IV under various operating scenario. In above scenario STATCOM (+300MVar) at Siwani may also be required (in case of operational difficulty of line reactors switching on EHVAC lines in RE pockets).
- With Alt-2, Churu Substation may be planned with future transmission proposals i.e. Bikaner-V, other strengthening schemes based on requirement. Therefore, RE evacuation from Churu S/s will only be possible at later stage (beyond 2027) in Alt-2.
- Comprehensive scheme for 6GW will be implemented with tentative timeline of Sep'26 in Alt-2, however in Alt-1 tentative timeline for part scheme (3.6GW) was Jul'26

Revised study files with proposed changes (LILO of both ckts of 400kV Bikaner II- Bikaner-III D/c line at Bikaner-IV PS in place of LILO of one ckt of 765 kV Bikaner-III -Neemrana-II D/c line at Bikaner-IV PS & Siwani STATCOM (in Alt-2)) was circulated on 06.05.24 along with study plots.

SECI stated that Churu complex was not identified in solar potential zone as part of 500GW report and thereafter potential was indicated only because the substation was planned as part of agreed Bikaner-IV transmission scheme (3.6GW), however no response from RE developers is yet received to assess & harness RE potential at Churu complex. CTU stated that in above case till no confirmation received from SECI, RE potential at Churu will not be considered and may be evolved based on SECI inputs at later stage.

Grid-India stated that in June solar scenario studies, Punjab/Haryana load pf is considered near to 0.99 which is very optimistic. However, in real time they have faced voltage dipping issues in Punjab and Haryana intra state network and interstate network (incident to intra state) due to high reactive power drawl in paddy season. This Intra state reactive support may further reduce in paddy season due to envisaged hydro generation from J&K/HP and solar generation from Rajasthan.

CTU enquired to Grid-India about capacitive support by STUs/DISCOMs in real time to improve load pf and mitigate voltage dipping issues in peak loading season. Grid-India stated that in real time capacitor bank support is available in Punjab, however in Haryana low voltage issue still persists in June-July peak loading season. CTU stated that in the integrated planning of transmission system, reactive power (MVar) drawl/absorption requirement at load end to be compensated at intra state network level only and ISTS system is not supposed to be planned to compensate MVar injection/drawl from intra state network under various operating scenario as it will also increase losses due to MVar flow to downstream network from upstream network which is not desirable. In view of that load pf ($>0.98\text{pf}$) may be maintained by STUs/DISCOMs specially in Punjab & Haryana through new capacitor banks, if required and also provide progress of installing new capacitors in monthly OCC/NRPC meetings.

Considering above, it was decided that STUs specially Haryana may assess the reactive compensation requirement for peak load season in next 2-3 years and may take necessary actions to maintain pf and mitigating low voltage issues in intra state network. HVPN told that they have planned capacitor banks installation at downstream network.

Grid-India highlighted the voltage dipping issue at Siwani substation ($\sim 730\text{kV}$) in N-1 contingency. The voltage will further decreases to 725kV , with no STATCOM reactive support (STATCOM support reserved for dynamic support only). CEA stated that line reactors on EHVAC lines can be switched off during low voltage as it will give direct relief to improve voltage to $15\text{-}20\text{kV}$, however operational difficulties in switching on/off of line reactors may be deliberated. Further $\pm 600\text{MVar}$ STATCOM at Siwani S/s may be considered (earlier $\pm 300\text{MVar}$ proposed in scheme) along with MSC/MSR to provide voltage support. Grid-India stated that earlier, voltage in Fatehgarh complex was observed up to 720kV in peak solar hours and under such condition, sequential line reactor switching was carried out in for volage control, however they have faced resistance from TSPs regarding line reactor switching and line opening for voltage control. In view of that provision of switching of line reactors may be clearly stipulated in the RfP of proposed scheme.

CEA stated that line reactor switching in RE pockets is in general operational requirement and need not to be specific for one scheme and should be carried out in real time as per Grid requirement. CTU stated that presently as per IEC standard followed for breaker duty cycle, class M2 circuit breakers i.e frequently operated CBs for special service requirements and designed so as to meet only limited maintenance is mechanical type tested for 10,000 operations, however whenever such line reactor

switching issue is raised by TSP in future, it should come with proper reasoning & justification from TSP side.

Grid-India stated that in steady state study file, STATCOMs along with MSC/MSR may be kept off for worst scenario (reserved for dynamic range). To mitigate low voltage issues without STATCOM support, line reactors to be switched off as per requirement. CTU stated that in base case voltage at Siwani S/s is about 733kV and in N-1 contingency of one ckt of Bikaner-IV-Siwani 2xD/c lines, voltage may further reduce to 728kV. In above scenario, voltage will be improved to 740kV considering STATCOM (at Bikaner-IV and Siwani) and 748kV with STATCOM+MSC at Bikaner-IV & Siwani S/s. However, in case STATCOM along with MSCs is kept off as suggested by Grid-India and line reactor switching is carried out, it will further improve the voltage of Siwani S/s by 750kV (line reactors on other 3 ckts of 765kV Bikaner-IV-Siwani kept off). In view of that it is recommended that steady state voltage to be maintained over 750kV in planning files considering line reactor switching (760kV at Siwani S/s in present case with line reactor on 765kV Bikaner-IV -Siwani kept off). Accordingly, it was decided by CEA, CTU & Grid-India that line reactor switching may be carried out in a sequential manner in RE pockets for better voltage control.

CTU stated that in Feb solar maximized scenario, loading of 400kV RAPP- Shujalpur D/c line is critical (about 950MW) in N-1 contingency. To relieve loading of above line, EHVAC corridor from RAPP generating station or other transmission corridor in parallel to above line is to be planned. In 500GW report also, 765kV Ajmer-Kota-Shujalpur transmission corridor was planned to integrate RE complexes of Ajmer. In view of that, it was decided that loading of above line will be reviewed with progress of RE generation projects at Rajasthan and planning to be carried out in next phase to relieve loading on above line. Grid-India & CEA agreed for the same.

Grid-India enquired that timeline for implementation of two nos. of Bikaner-IV-Siwani D/c lines will be same or different. CEA stated that scheme will be segregated in various packages and efforts to be made that all the packages are implemented simultaneously with implementation timeline decided in NCT meeting. Grid-India stated that as per past experiences, there will be always some mismatch (up to 6 months) in implementation time of two parallel double ckt corridors from same RE pooling stations. In such situation, in the event of only one corridor i.e. 765kV Bikaner-IV-Siwani D/c is commissioned and 2nd 765kV D/c gets delayed, RE generation of 2-3GW may only be evacuated in base case with one D/c and in N-1 contingency, however in N-1-1 contingency, restoration of line becomes delayed in solar peak hours and shall impact the RE generation.

CTU stated that considering HVPNL existing & proposed interconnections, interconnections as well as GNA granted to bulk consumer for 100MW GNA at 220kV Jind(PG), 400/220kV ICTs (3x500 MVA) at Jind(PG) are critically loaded in N-1 contingency. Grid-India stated that at present 400/220kV Jind(PG) S/s has 2x500MVA ICTs & 4 nos. of 220kV interconnections whereas 3rd ICT (500MVA) in ISTS by POWERGRID and 4 nos. of STU feeders are under implementation by HVPNL. At present loading on 2x500MVA ICT is about 500MW (peak) and in view of that ICT augmentation at Jind may considered at later stage with commissioning of HVPNL interconnections & 400/220kV ICT (3rd) at Jind(PG). HVPNL stated that 400kV Munakh S/s for power evacuation of YTPP (800MW) is under planning. Additionally, 640MVA load will be envisaged progressively from 2027 by IOCL. Accordingly, requirements will be assessed based on Grid-India operational feedback report and loading diversion in planning studies considering HVPNL proposal for evacuation of power from YTPP generation (800MW). CEA agreed for the same.

Further in 27th CMETS-NR meeting, RVPN stated that they do not have any drawl requirement in future from proposed Merta-2 S/s, however as informed earlier in joint study meeting, in view of envisaged RE potential in Nagaur distt., space provision to be kept for 220kV scope i.e. 400/220kV ICTs., 220 kV line bays for drawl & 220kV Sectionalization bay for RE injection.

Subsequently, off peak file was circulated on 12.01.24 to all stakeholders. Considering grant of connectivity to RE generators in Bikaner complex as well as for evacuation of power beyond above complex, following transmission scheme was agreed in Joint study meetings (28.12.23 & 09.01.24) as well as in 27th CMETS-NR meeting held on 10.01.24 as part of Rajasthan REZ Ph-IV (Part-3 : 6 GW) system

**Transmission system for evacuation of power from Rajasthan REZ Ph-IV (Part-3 : 6GW)
Bikaner-IV: 6 GW (Solar)**

- Establishment of 6x1500 MVA, 765/400 kV & 6x500 MVA, 400/220 kV Bikaner-IV Pooling Station along with 2x240 MVA_r (765kV) & 2x125 MVA_r (420kV) Bus Reactors at a suitable location near Bikaner *

Future provisions at Bikaner-IV PS (excl. scope for present scheme): Space for

- 765 kV line bays along with switchable line reactors – 6 nos.
- 765kV Bus Reactor along with bay: 1 no.
- 400 kV line bays along with switchable line reactor –4 nos.
- 400 kV line bays–2 nos.
- 400/220kV ICT along with bays -4 nos.
- 400 kV Bus Reactor along with bay: 1 no.
- 400kV Sectionalizer bay: 2 sets
- 220 kV line bays for connectivity of RE Applications -5 nos.
- 220kV Sectionalizer bay: 2 sets
- 220 kV BC (2 nos.) bays and 220 kV TBC (2 nos.) bays

****along with provision of 80MVA_r spare reactor (Single phase) & 500MVA spare transformer unit (Single phase)***

- 220kV line bays (6 nos.) for RE connectivity at Bikaner-IV PS
- 400kV line bays (3 no.) for RE connectivity at Bikaner-IV PS
- 220kV Sectionalizer bay (1 set) along with BC (2 nos.) bays and 220 kV TBC (2 nos.) bays at Bikaner-IV PS
- 400kV Sectionalizer bay (1 set) at Bikaner-IV PS
- STATCOM (2x±300MVA_r) along with MSC (4x125 MVA_r) & MSR (2x125 MVA_r) along with 2 nos. 400kV bays at Bikaner-IV PS
- LILO of both ckts of 400kV Bikaner II PS- Bikaner III PS (Quad) direct line at Bikaner-IV PS (~20kms)
- Establishment of 765/400 kV, 6x1500 MVA S/s at suitable location near Siwani (Distt. Bhiwani) along with 2x240 MVA_r (765kV) Bus Reactor & 2x125 MVA_r (420kV) Bus Reactor*

Future provisions at Siwani S/s (excl. scope for present scheme): Space for

- 765 kV line bays along with switchable line reactors – 6
 - 765kV Bus Reactor along with bay: 1 nos.
 - 400 kV line bays along with switchable line reactor –4
 - 400 kV Bus Reactor along with bays: 1 no.
 - 400kV Sectionalizer bay: 1 set
- *along with provision of 80MVAR spare reactor (Single phase) & 500MVA spare transformer unit (Single phase)**
- Bikaner-IV PS – Siwani 765 kV 2xD/c line along with 240 MVAR switchable line reactor for each circuit at each end (~260 km)
 - Siwani – Jind (PG) 400 kV D/c line (Quad) (~110 km)
 - Siwani – Patran (Indi Grid) 400 kV D/c line (Quad) (~160 km) (400kV GIS duct :700m) along with 80 MVAR switchable line reactor for each circuit at Siwani S/s end
 - Siwani – Fatehabad (PG) 400 kV D/c line (Quad) (~80 km)
 - Siwani – Sonipat (PG) 400 kV D/c line (Quad) (~150 km) along with 63 MVAR switchable line reactor for each circuit at Siwani S/s end
 - STATCOM (2x±300MVAR) along with MSC (4x125 MVAR) & MSR (2x125 MVAR) along with 2 nos. 400kV bays at Siwani S/s
 - 400kV Sectionalizer bay (1 set) at at Siwani S/s

It was stated that for evacuation of power beyond 6GW from Bikaner-IV PS, HVDC from Bikaner complex is planned. For additional power transfer from Bikaner complex, a new substation at suitable location in Bikaner i.e. Bikaner-V is planned. In meeting, CTU enquired **SECI to conform RE potential for Bikaner-V PS** as 14 GW evacuation system is already planned from Bikaner complex (Bikaner-II/III:8GW, Bikaner-IV: 6GW) against 14 GW potential (along with 6 GW BESS) in Rajasthan for RE potential identified at Bikaner complex as part of committee report.

SECI stated that potential identified in Bikaner complex (incl. 6GW BESS which has not yet come up) as part of 500GW report is already considered for planning (Bikaner-II/III/IV). CTU stated that transmission system requirements (with ATS/Without ATS) for connectivity to various RE developers granted at Bikaner-V PS depends on RE potential qualification which impact BGs applicability to RE developers under GNA regulation. Further, intimation to be issued in a timebound manner as per GNA regulation timelines for RE application granted connectivity at Bikaner-V PS. Therefore RE capacity along with potential qualification at Bikaner-V or any other such locations may be expedited by SECI in consultation with MNRE

SECI stated that Bikaner-V station cannot be considered alone for decision of RE potential and it may be considered in totality for all such new potential locations. SECI stated that they have already communicated to RE developers for such information and once data is received from RE developers, SECI will discuss it with MNRE. Subsequently, MNRE will consult all the stakeholders and requirement may be firmed up based on views of MNRE to take up part system for one or two locations immediately or in totality for all such potential locations. CTU suggested that total RE capacity along with its potential qualification at Bikaner-V may be finalized within 2-3 weeks. SECI stated that they will expedite the process and discuss the matter with MNRE and revert on the same.

Further as part of 75GW REZ in Rajasthan (as part of 500GW report), 5 GW potential (3GW solar, 2 GW wind) along with net dispatch of 2GW considering 2GW BESS was considered at Bhadla complex (Bhadla-IV: 2GW). A comprehensive HVDC scheme is planned for 6GW evacuation from Bikaner-V (4GW) and Bhadla-IV (2GW) PS towards Baripada in Orissa (ER) through HVDC system, for which studies is undergoing for 2029 timeframe and will be taken up in Joint study meeting. However grant of connectivity shall depend on application received at Bikaner-V & Bhadla-IV which may differ than Bikaner-V (4GW) & Bhadla-IV (2GW). Details of broad scheme is as under

(k) Proposed Transmission system for evacuation of power from Rajasthan REZ Ph-IV (Part-6 :6 GW) [Bhadla/Bikaner Complex]

Bhadla-IV: 2 GW (Solar), Bikaner-V : 4GW (Solar)*

- Establishment of 6000 MW, ± 800 kV Merta (HVDC) [LCC] terminal station (4x1500 MW) in Merta-II substation
 - 400/33 kV, 2x50 MVA transformers for exclusively supplying auxiliary power to HVDC terminal.
 - 400kV bus sectionaliser -2 nos (1 Set) at Merta-II (HVDC) station
- Establishment of 765/400kV, 4x1500 MVA S/s & 400/220kV 4x500MVA pooling station at suitable location near Bikaner (Bikaner-V PS) along with 2x125 MVar & 2x240 MVar bus reactor

Future provisions

Space for

- 765/400kV ICTs along with bays- 2
 - 765 kV line bays along with switchable line reactors – 10
 - 765kV Bus Reactor along with bay: 1 nos.
 - 400 kV line bays along with switchable line reactor –10
 - 400kv line bays : 4 nos.
 - 400 kV Bus Reactor along with bays: 1 no.
 - 400kV Sectionalization bay: 2 sets
 - 400/220kV ICT along with bays -6 nos.
 - 220 kV line bays - 10 nos.
 - 220kV Sectionalization bay: 3 sets
- *along with provision of 80-MVar spare reactor (Single phase) & 500MVA spare transformer unit (Single phase)*
- 220kV line bays (4 nos.) for RE connectivity at Bikaner-V PS
 - Bikaner-V PS – Merta-2 765KV D/c line (~ 200kms) along with 240 MVar switchable line reactor for each circuit at each end of Bikaner-V PS – Merta-2 765KV D/c line
 - Establishment of 765/400kV, 3x1500 MVA S/s & 400/220kV 3x500MVA pooling station at suitable location near Bhadla (Bhadla-IV PS) along with 2x125 MVar & 2x240 MVar bus reactor

Future provisions

Space for

- 765/400kV ICTs along with bays- 3
 - 765 kV line bays along with switchable line reactors – 10
 - 765kV Bus Reactor along with bay: 1 nos.
 - 400 kV line bays along with switchable line reactor –10
 - 400kv line bays : 4 nos.
 - 400 kV Bus Reactor along with bays: 1 no.
 - 400kV Sectionalization bay: 2 sets
 - 400/220kV ICT along with bays -7 nos.
 - 220 kV line bays - 10 nos.
 - 220kV Sectionalization bay: 3 sets
-
- Bhadla-IV PS – Merta-II 765KV D/c line (~ 250kms) along with 240 MVar switchable line reactor for each circuit at each end of Bhadla-IV PS – Merta-2 765KV D/c line
 - Augmentation of 765/400 kV, 3x1500 MVA ICTs at Merta-II S/s
 - 6000 MW, ± 800 kV Merta (HVDC) [LCC] terminal station (4x1500 MW)
 - Establishment of 6000 MW, ± 800 kV Baripada (HVDC) [LCC] terminal station (4x1500 MW) at suitable location near Baripada (Distt. Mayurbhanj)
 - ± 800 kV HVDC line (Hexa lapwing) between Merta-II (HVDC) & Baripada (HVDC) (with Dedicated Metallic Return) - 1600 km

EHVAC system beyond Baripada (HVDC) S/s is under planning.

** Evacuation capacity among Bikaner-V and Bhadla-IV may vary depend on application received at Bikaner-V and Bhadla-IV*

(I) Rajasthan REZ Ph-IV (Part-4 :3.5GW) (Jaisalmer/Barmer Complex)

Joint Study Meeting(s) were held in virtual mode on 28.12.23 with SECI, CEA, GRID-INDIA, RVPN, UPPTCL and other STUs of Northern region to finalize the Transmission system for evacuation of power from Bikaner & Fatehgarh/Barmer Complex as part of Rajasthan REZ Ph-IV (Part-3a :2.4GW) and REZ Ph-IV (Part-4 :3.5GW) respectively. Details of deliberations for Transmission system for evacuation of power from Bikaner & Fatehgarh/Barmer Complex as part of Rajasthan REZ Ph-IV (Part-4 :3.5GW) is as under

Gist of discussion in 1st Joint study meeting held on 28.12.23

It was informed that as part of Renewable Energy Zones (REZs) identified by MNRE/SECI with a total capacity of 75 GW REZs in Rajasthan, evacuation system for 13GW was planned at Fatehgarh (5GW) & Barmer (8GW) complex. Transmission scheme for Rajasthan REZ Ph-IV (Part-2:5.5GW) (Jaisalmer/Barmer Complex) was approved in 14th NCT meeting for injection at Fatehgarh-IV PS (4GW) & Barmer-I PS (1.5GW) in Rajasthan and under bidding.

At present connectivity of about 9 GW capacity is already granted/received. For evacuation of power beyond 5.5GW from Fatehgarh-IV PS/Barmer-I PS, hybrid transmission system (EHVAC (3.5GW)+HVDC(6GW)) from Fatehgarh/Barmer complex is planned. Studies were

carried out in 2026-27 time frame in solar maximized scenario for EHVAC system and Study files for solar maximized scenario was shared on 20.12.23 with all constituents.

It was stated in meeting that the EHVAC evacuation system comprises 3.5 GW capacity transmission system from Fatehgarh-IV/Barmer-I (thus making total planned capacity of 9GW (5.5GW+3.5GW)) and 6GW HVDC system from Barmer-II PS (new pooling station is being established as part of HVDC scheme). The 6GW HVDC scheme comprises Barmer-II to Suitable locations in WR/SR through HVDC system.

In the joint study meeting, CTU stated that as per committee report Barmer-II PS was planned for 6GW RE potential (2GW BESS capacity) with 4GW evacuation capacity. In 25th CMETS-NR meeting, SECI informed that at present there is no clear visibility for RE projects with BESS before 2027 as award process will take time (1-2 years). In view of that 3.5GW RE potential (solar) remains untapped due to non-materialisation of BESS capacity (Barmer-I : 1.5GW+Barmer-II: 2GW) in Barmer complex.

Details of RE potential considered in Fatehgarh/Barmer complex is under:

**Subject to inputs from MNRE/SECI for enhancement of RE potential at Barmer-II PS*

S.No	Transmission Scheme	RE Potential	Cumulative RE Potential
1	Rajasthan REZ Ph-IV (Part-2:5.5GW) (Jaisalmer/Barmer Complex) EHVAC system -Under Bidding	5.5GW (Solar) Fatehgarh-IV: 4 GW Barmer-I: 1.5 GW	5.5GW (Solar) Fatehgarh-IV: 4 GW Barmer-I: 1.5 GW
2	Rajasthan REZ Ph-IV (Part-4:3.5GW) (Jaisalmer/Barmer Complex) EHVAC system-Present proposal	3.5 GW (Solar) Fatehgarh-IV: 1 GW Barmer-I: 2.5 GW	9GW (Solar) Fatehgarh-IV: 5 GW Barmer-I: 4 GW
3	Rajasthan REZ Ph-IV (Part-5 : 6GW) (Barmer Complex) HVDC system towards WR/WR-SR	6 GW (Solar) Barmer-II : 6 GW*	15 GW (Solar) Fatehgarh-IV: 5 GW Barmer-I: 4 GW Barmer-II: 6 GW*

In the joint study meeting as well as in present CMETS meeting, CTU stated that as per committee report Barmer-II PS was planned for 6GW RE potential with 4GW evacuation capacity considering 2GW BESS capacity. SECI informed that total RE potential identified at Barmer complex is 13GW considering BESS of 3.5GW capacity. SECI reiterated that at present there is no clear visibility for RE projects with BESS in Rajasthan and therefore transmission system to be planned for 13 GW RE potential (solar) from Barmer complex due to non-materialization of BESS capacity. CTU stated that 4GW EHVAC system is already planned from Barmer-I PS and with 6GW RE potential considered at Barmer-II PS, transmission system for balance 3GW RE potential will be planned at later stage from new pooling station envisaged in Barmer complex

Accordingly, based on inputs from SECI it was decided in the meeting that total 6GW RE potential may be considered for planning of transmission scheme from Barmer-II PS.

In the Joint study meeting held on 28.12.2023, following transmission system for evacuation of power from Fatehgarh/Barmer Complex as part of Rajasthan REZ Ph-IV (Part-4 :3.5GW) was proposed

Fatehgarh-IV: 1 GW (Solar), Barmer-I :2.5GW (Solar)

- Establishment of 765/400kV, 2x1500 MVA S/s at suitable location near Merta (Merta-II Substation) along with 2x125 MVar & 2x240 MVar bus reactor at Merta-II* S/s
- STATCOM (2x±300MVar) along with MSC (4x125 MVar) & MSR (2x125 MVar) along with 2 nos. 400kV line bays at Barmer-I PS
- Augmentation with 765/400 kV, 2x1500 MVA Transformer (4th & 5th) at Barmer-I PS
- Augmentation of 3x500 MVA (3rd to 5th), 400/220 kV ICT at Barmer-I PS
- 220kV line bays (4 nos.) for RE connectivity at Barmer-I PS
- 220kV Sectionalization bay (1 set) along with BC (1 nos.) and 220 kV TBC (1 nos.) at Barmer-I PS
- Fatehgarh-IV PS – Barmer-I PS 400kV D/c line (Quad) (~40km)
- Barmer-I PS – Merta-II 765 kV D/c line along with 240 MVar switchable line reactor for each circuit at each end of Barmer-I PS – Merta-II 765 kV D/c line (~320 km)
- Merta-II – Beawar 400 kV D/c line (Quad) (~55 km)
- Merta-II – Dausa 765 kV D/c line along with 240 MVar switchable line reactor for each circuit at each end of Merta-II – Dausa 765 kV D/c line line (~250 km)
- Establishment of 765/400kV, 2x1500 MVA S/s at suitable location near Ghiror (Distt. Mainpuri) along with 2x125 MVar & 2x240 MVar bus reactor at Ghiror S/s (UP)
- Dausa - Ghiror 765 kV D/c line along with 240 MVar switchable line reactor for each circuit at each end of Dausa - Ghiror 765 kV D/c line (~285 km)
- LILO of both ckt of 765 kV Aligarh (PG) -Orai (PG) D/c line (~40 km) at Ghiror S/s along with 240 MVar switchable line reactor for each circuit at Ghiror S/s end of 765 kV Ghiror - Orai D/c line
- LILO of one ckt of 765kV Agra (PG) – Fatehpur(PG) 765kV D/c line at Ghiror along with 240 MVar switchable line reactor at Ghiror S/s end of 765 kV Ghiror -Fatehpur line (~40 kms)

In above meeting, Grid-India enquired about installation of STATCOMs at new pooling stations in Bikaner and Fatehgarh/Barmer complex. CTU stated that at present 3 nos. STATCOMs are already operational at Fatehgarh-II, Bhadla-II & Bikaner-II and 2 nos. STATCOMs at Ramgarh and Fatehgarh-III are under implementation. Additionally, 3 nos. STATCOMs at Bikaner-IV, Siwani and Barmer-I is

also planned in proposed schemes (Ph-IV: Part 3 & 4). Additionally, space provision to be kept STATCOM at Merta-II, & Ghiror S/s as part of future scope.

Grid-India stated that proposal is in order, however 400/220kV ICTs (2x315MVA) at Agra (PG) is critically loaded in N-1 contingency. CTU stated that with proposed scheme there is marginally increment (~5MW) in 400/220kV ICT loading in Agra. CTU stated that space is not available for installation of 3rd ICT at Agra(PG) S/s, therefore replacement of ICTs may be considered in future based on real time loadings.

CTU stated that in the present proposal they have optimally utilized the Aligarh-Orai and Fatehpur - Agra high capacity 765kV corridors as the loadings of lines are less in solar maximized scenario. 765/400kV Orai Substation is well connected with WR Grid and Power from 765/400kV Orai shall be dispersed to load centres of WR through various high capacity lines. CTU stated that they are planning to interconnect proposed Ghiror S/s to nearby UPPTCL substation i.e. 400/220kV Firozabad at 400kV level as part of present scheme. CTU requested UPPTCL to provide space availability for 2 nos. of 400kv line bays at Firozabad S/s. This will also relieve the loading of Agra ICTs and increase resiliency of system. UPPTCL agreed for the same.

UPPTCL requested that studies may be performed with Bhadla-Fatehpur HVDC system to check loadings with proposed system. CTU stated that Bhadla-Fatehpur system is under bidding with scheduled implementation Feb'28 (Pole-1) and therefore not considered in studies, however they will carry out sensitivity case considering HVDC system and commensurate RE generation and will provide to UPPTCL. Same was provided to UPPTCL on 02.01.24.

CEA stated that proposal in order however, studies may be reviewed with UP intra state transmission system and associated RE generation in GEC-II. CTU agreed for the same. CTU enquired SECI and UPPTCL for envisaged RE potential in Bundelkhand region. UPPTCL stated that UPNEDA communicated 10GW RE potential in Bundelkhand region (UP), out of which UPPTCL has planned transmission scheme for evacuation of 4GW solar in intra state and transmission scheme is already approved in GEC-II. CTU stated that they have also received 1200MW solar application in Bundelkhand region for injection at Orai S/s which will be discussed in ensuing CMETS-NR meeting. It was stated that the above 4GW potential (out of 10GW potential) is part of 500GW report, however balance 6GW potential as indicated by UPNEDA is not part of 500GW report, therefore UPPTCL may provide communication to CEA/CTU in 2-3 days, so that same can be forwarded to SECI for evaluation of developable RE potential in this region. UPPTCL agreed for the same.

Further, UPPTCL informed in the meeting that space is available for 2 nos. of 400kV line bays at Firozabad S/s however, they will re-confirm the same after verification. Prima facie loading of 400kV Ghiror- Firozabad D/c line was observed to be in order. In view of that CTU included 400kV Ghiror- Firozabad as part of proposed Transmission system for evacuation of power from Rajasthan REZ Ph-IV (Part-4 :3.5 GW) [Fatehgarh/Barmer] Complex. This will also relieve the loading at Agra ICTs and increase resiliency of the system.

Revised study files with proposed changes (considering 400kV Ghiror- Firozabad D/c line & Barmer-I STATCOM as part of proposed scheme) and considering UP intra state solar generation and associated transmission scheme (GEC-II) was circulated on 01.05.24 along with study plots.

Gist of discussion in Joint study meeting held on 09.01.24

CTU stated that in Joint study meeting held on 28.12.23, Transmission system for evacuation of power from Fatehgarh/Barmer Complex as part of Rajasthan REZ Ph-IV (Part-4 :3.5GW) was in-principally agreed. Grid-India also stated that the surplus power in NR and WR during solar peak period is flowing towards ER and high loading is observed in 765 kV Ranchi - Dharamjaygarh line and other EHV lines towards ER with higher angular separation after N-1. Due to high loading, low voltages observed in ER region on various EHVAC buses.

CTU stated that based on Grid-India observations, in revised studies, Guzuwaka HVDC is already reversed (1000MW) towards ER and Talchar-Kolar capacity is also kept minimum in forward direction (600-700MW). This will relieve loading of various WR-ER corridors incl. 765kV Ranchi – Dharamjaygarh D/c up to a certain extent. The files were already sent to other regional planning groups (CTU) to review loadings (ER-WR) commensurate to envisaged thermal generation in both the regions.

CTU stated the loading of some of WR-ER corridors are in general high and with proposed scheme (Rajasthan Ph-IV (Part-4 :3.5 GW)), there is marginal increment on above Inter regional links in winter solar maximized scenario. In the next phase of studies (2028-29) with proposed HVDC corridors from NR to ER and NR to WR, loadings will be reviewed, and measures will be taken if required. Grid-India & CEA agreed for the same

CTU enquired about RE potential at Ghiror complex for provision of 220kV scope at Ghiror S/s. SECI replied that solar irradiation level at Ghiror complex is less and at present they are not anticipating RE applications for injection at Ghiror. In view of that it was decided that 220kV future scope shall not be considered at Ghiror for RE injection.

UPPTCL informed that space is available at 400kV Firozabad S/s for interconnection of proposed 400kV Ghiror – Firozabad D/c line and power flow is in order on the above line. CTU requested UPPTCL to provide the above information in the mail at the earliest. Regarding RE potential in Bundelkhand region, UPPTCL stated that they have received inputs from UPNEDA however UPPTCL sought some clarifications as well as some additional inputs from UPNEDA. CTU requested UPPTCL to provide the same at the earliest. Further CTU enquired for drawl requirement at Merta-II and Ghiror S/s. UPPTCL stated that in view of growing load of UP, space provision may be kept for future drawl requirement at Ghiror S/s, however they will confirm the same on mail. RVPN stated that they will revert with the drawl requirement at Mera-II S/s. No other comments were received from any Stakeholders. Revised study files with proposed changes in Ph-IV (Part-3: 6GW) and incorporating stakeholder comments on all India LGB, study files were circulated on 06.05.24 along with study plots.

As discussed earlier, off peak file were circulated on 12.01.24 to all stakeholders and based on voltages specially in Ghiror complex, reactive compensation was reviewed. Considering grant of connectivity to new RE generators in Fatehgarh/Barmer complex as well as for evacuation of power beyond Fatehgarh-IV PS/Barmer-I PS following transmission scheme is proposed as agreed in joint study meeting for evacuation of power from Rajasthan REZ Ph-IV (Part-4: 3.5GW) [Jaisalmer/Barmer Complex]

(m) Transmission system for evacuation of power from Rajasthan REZ Ph-IV (Part-4 :3.5 GW) [Fatehgarh/Barmer] Complex

Fatehgarh-IV: 1 GW (Solar), Barmer-I :2.5GW (Solar)

- Establishment of 765/400kV, 2x1500 MVA S/s at suitable location near Merta (Merta-II Substation) along with 2x125 MVar & 2x240 MVar bus reactor at Merta-II* S/s

Future provisions at Merta-II S/s(excl. scope for present scheme): Space for

- 765/400kV ICTs along with bays- 4
- 765 kV line bays along with switchable line reactors – 8
- 765kV Bus Reactor along with bay: 1 nos.
- 400 kV line bays along with switchable line reactor –8
- 400 kV line bays – 2 nos.
- 400 kV Bus Reactor along with bays: 1 no.
- 400kV Sectionalizer bay: 2 sets
- 400/220kV ICT along with bays -6 nos.
- 220 kV line bays for RE injection -8 nos.
- 220kV Sectionalizer bay: 2 set
- 220 kV BC (3 nos.) bays and 220 kV TBC (3 nos.) bays
- 6000 MW, ± 800 kV Merta (HVDC) [LCC] terminal station (4x1500 MW) along with bays
- STATCOM (2x ± 300 MVar, 4x125MVar MSC, 2x125MVar MSR) along with 400kV bays (2 nos.)

****along with provision of 80-MVar & 110MVar spare reactors (Single phase) & 500MVA spare transformer unit (Single phase)***

- STATCOM (2x ± 300 MVar) along with MSC (4x125 MVar) & MSR (2x125 MVar) along with 2 nos. 400kV bays at Barmer-I PS
- Augmentation with 765/400 kV, 2x1500 MVA Transformer (4th & 5th) at Barmer-I PS
- Augmentation of 5x500 MVA (5th to 9th), 400/220 kV ICTs at Barmer-I PS
- 220kV line bays (6 nos.) for RE connectivity at Barmer-I PS
- 220kV Sectionalizer bay (1 set) along with 220 kV BC (1 nos.) bay and 220 kV TBC (1 nos.) bay at Barmer-I PS
- 400kV Sectionalizer bay (1 set) at Barmer-I S/s
- Fatehgarh-IV PS (Sec-2) – Barmer-I PS 400kV D/c line (Quad) (~25km)
- Barmer-I PS – Merta-II 765 kV D/c line along with 240 MVar switchable line reactor at Barmer-I PS end and 330MVar switchable line reactor at Merta-II PS end for each circuit of Barmer-I PS – Merta-II 765 kV D/c line (~320 km)
- Merta-II – Beawar 400 kV D/c line (Quad) (~55 km)
- Merta-II – Dausa 765 kV D/c line along with 240 MVar switchable line reactor for each circuit at each end of Merta-II – Dausa 765 kV D/c line line (~250 km)
- Establishment of 765/400kV, 2x1500 MVA S/s at suitable location near Ghiror (Distt. Mainpuri) along with 2x125 MVar & 2x240 MVar bus reactor at Ghiror S/s (UP)

Future provisions at Ghiror S/s (excl. scope for present scheme): Space for**

- 765/400kV ICTs along with bays- 4
- 765 kV line bays along with switchable line reactors – 6
- 765kV Bus Reactor along with bay: 1 nos.
- 400 kV line bays along with switchable line reactor –6

- 400 kV Bus Reactor along with bays: 1 no.
- 400kV Sectionalizer bay: 1 set
- 400/220kV ICT along with bays -4 nos.
- 220 kV line bays for drawl -6 nos.
- 220kV Sectionalizer bay: 1 set
- 220 kV BC (2 nos.) bay and 220 kV TBC (2 nos.) bay
- STATCOM (2x±300MVA, 4x125MVA MSC, 2x125MVA MSR) along with 400kV bays (2 nos.)

****along with provision of 80MVA spare reactor (Single phase) & 500MVA spare transformer unit (Single phase)***

*****Drawl requirement at Ghiror S/s to be confirmed by UPPTCL, accordingly future scope will be finalized***

- Dausa - Ghiror 765 kV D/c line along with 240 MVA switchable line reactor for each circuit at each end of Dausa - Ghiror 765 kV D/c line (~285 km)
- LILO of both ckt of 765 kV Aligarh (PG) -Orai (PG) D/c line (~40 km) at Ghiror S/s along with 240 MVA switchable line reactor for each circuit at Ghiror S/s end of 765 kV Ghiror -Orai D/c line
- LILO of one ckt of 765kV Agra (PG) – Fatehpur(PG) 765kV D/c line at Ghiror along with 240 MVA switchable line reactor at Ghiror S/s end of 765 kV Ghiror -Fatehpur line (~40 kms)
- 400kV Ghiror-Firozabad (UPPTCL) D/c line (Quad) (~40 kms)

As deliberated earlier, HVDC system is to be planned for additional 6GW at Barmer complex with 2029 implementation schedule. Studies for HVDC scheme is undergoing and will be taken up in next Joint study meeting. Details of broad HVDC scheme is as under:

(n) Proposed Transmission system for evacuation of power from Rajasthan REZ Ph-IV (Part-5 :6 GW) [Barmer Complex] Barmer-II : 6GW (Solar)

- Establishment of 400/220kV, 4x500MVA S/s at suitable location near Barmer (Barmer-II Substation) along with 2x125 MVA bus reactor

Future provisions at Barmer-II S/s:

Space for

- 400 kV line bays along with switchable line reactor –6
- 400 kV line bays –4
- 400 kV Bus Reactor along with bays: 1 no.
- 400/220 kV ICT along with bays -10 Nos.
- 400 kV Sectionalization bays: 2 sets
- 220 kV line bays for connectivity of RE Applications -15 Nos.
- 220kV Sectionalization bay: 3 sets
- 220 kV BC (4 Nos.) & TBC (4 Nos.)
- 220kV line bays (4 nos.) for RE connectivity at Barmer-II PS
- Barmer-I PS – Barmer-II PS 400kV D/c line (Quad)

- Establishment of 6000 MW, ± 800 kV Barmer-II (HVDC) [LCC] terminal station (4x1500 MW) at a suitable location near Barmer-II substation
 - 400/33 kV, 2x50 MVA transformers for exclusively supplying auxiliary power to HVDC terminal.
 - 400kV bus sectionaliser -2 nos (1 Set) at Barmer-II (HVDC) station
- Establishment of 6000 MW, ± 800 kV (HVDC) [LCC] terminal station (4x1500 MW) at suitable location in WR/SR or 2 nos. 3000MW, ± 800 kV (HVDC) [LCC] terminal stations (Multi terminal) at suitable location(s) in WR/SR
- ± 800 kV HVDC line (Hexa lapwing) between Barmer-II (HVDC) & WR /SR (HVDC) (with Dedicated Metallic Return)
- Associated EHVAC system strengthening in WR/SR

Exact HVDC terminal points in WR/WR-SR boundary are proposed to be identified based on detailed system studies involving stakeholders from NR, WR & SR. Decision on HVDC technology i.e. LCC/ VSC will be carried out at later stage during joint study meeting

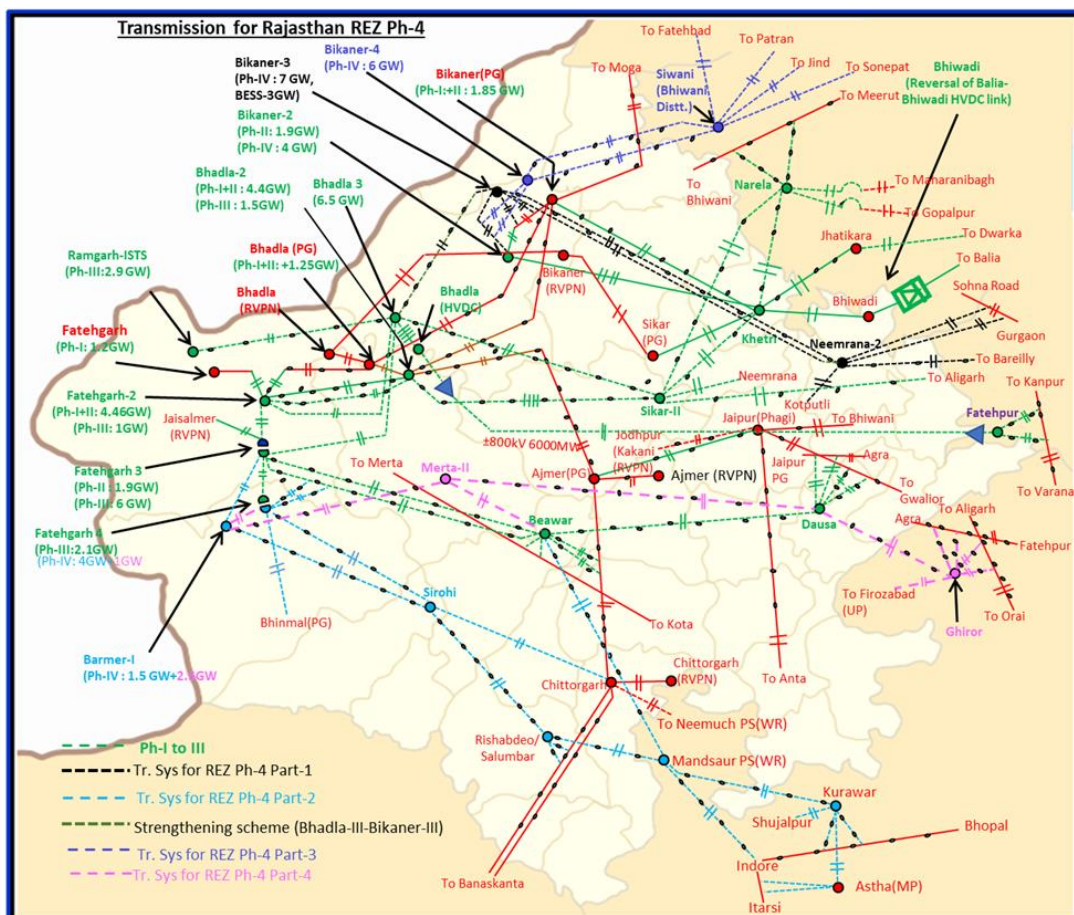


Fig: Transmission system for Rajasthan REZ Ph-IV (Part-3: 6GW) [Bikaner Complex] and Rajasthan REZ Ph-IV (Part-4 :3.5GW) [Fatehgarh/Barmer complex]

5.2. Jammu & Kashmir

(a) Transmission system scheme for Ratle HEP (850MW)

It was deliberated that in 3rd Consultation meeting for Evolving Transmission Schemes in NR held on 28/01/2022, connectivity system for Ratle HEP (850MW) was deliberated. In the meeting, It was informed that the transmission system for evacuation of Ratle HEP (850 MW) was discussed and agreed during the 4th NRPC(TP) meeting held on 05/10/2021 & 12/10/2021 wherein it was deliberated that Ratle HEP (850 MW) is a Run of River scheme located on river Chenab, in Kishtwar District of Jammu & Kashmir, with design overload of 10% and its completion schedule is Feb/March 2026. It was also agreed that Ratle HEP is approx. 20 km from Kishtwar PS, therefore, it can be directly connected with Kishtwar PS with 400 kV D/c line with high capacity conductor. During the above meeting, it was deliberated that RHPCL shall explore the possibility of single-phase units of either 125 MVAR bus reactor or 80 MVAR reactor in case of transportation constraints.

In this meeting, RHPCL informed that they have already awarded 1x125 MVA Bus Reactor at generation switchyard, wherein, supply of 1-phase or 3-phase units is left to the EPC contractor's scope. Accordingly in 3rd CMETS-NR meeting, it was decided to grant connectivity to RHPCL for Ratle HEP (850 MW) through following transmission system for Connectivity:

- Ratle HEP - Kishtwar (GIS) PS 400 kV D/c line (line suitable for carrying around 935 MW on each circuit at nominal voltage) along with 2 nos. of 400kV bays at Kishtwar S/s - To be implemented by the applicant (RHPCL)
- 125 MVAR, 420 kV bus reactor at Ratle HEP - To be implemented by applicant (RHPCL)
- Establishment of 400 kV Kishtwar (GIS) PS by LILO of one circuit of Kishenpur – Dulhasti 400kV D/c (Quad) line (Single Circuit Strung) and 125 MVAR Bus reactor at Kishtwar (GIS) PS– being implemented under ISTS

In 3rd NRPC-TP meeting it was also deliberated that outlet beyond Dulhasti is Dulhasti-Kishenpur 400kV line which is a single circuit line, the amount of power that can be exported/imported is limited. Hence, Dulhasti - Ratle section would be optimized to the extent possible. bay rating at Dulhasti is 2000A, which is further reduced to 700/800A due to reduced capacity of XLPE/OIL cable for connection of line to GIS bus at Dulhasti end.

In view of above a meeting was conveyed on 13.09.23 by CEA and CTU with NHPC to discuss upon feasibility for upgradation of switchgear equipment's incl. cable at 400kV Dulhasti switchyard as well as reconductoring of part system of 400kV Dulhasti-Kishtwar line. In the meeting, it was decided that NHPC shall explore the feasibility for upgradation of the switchgear and cables at Dulhasti substation to rating of 3150 A. NHPC may also explore the option of replacement of cables with GIB bus duct. The same would be intimated to CEA within one month.

NHPC vide mail dated 16.10.23 informed that GIS bay equipment installed at Dulhasti Power Station have a rating of 2000A. As suggested, complete replacement of GIS system would be required to accommodate requisite 3150 A. Accordingly, the existing rating of GIS busbar and associated switchgear like CB, CT, ES/ISO etc. needs to be uprated to 3150 A from 2000A. The compatibility issue of New GIS with old GIS will attract huge financial implication. It is envisaged that the space for

the complete GIS compatible for 3150A may be required more than that of existing one and may not be feasible to comfortably accommodate within the existing underground space. Further, the existing items of pothead yard like wave traps, Isolators etc. also needs to be replaced which has an additional cost implication.

Further NHPC informed that there are two 400 kV cables (Line-1 is oil filled and Line-2 XLPE insulation) of 630 Sq.mm each are used for Power evacuation from Dulhasti GIS which can carry approx. 700-800A. As suggested, the replacement of cables with GIB bus duct may not be feasible at Dulhasti Power Station considering the constraints of cable tunnel space.

Considering the above facts, the uprating of all the above items will require significant Prolonged outages of generating units causing Generation and PAF Loss which will attract huge financial loss on account of loss of generation. Further, equipment replacement cost would also put an additional financial implication. In view of above factors, it is not possible to uprate the existing systems at Dulhasti Power station from 2000 A to 3150 A.

In view of above constraints, various other options were carried out and studies were reviewed. In the revised proposal, LILO of 400 kV Kishenpur- Dulhasti line (2nd ckt) at Kishtwar S/s (one ckt already LILOed as part of Pakaldul transmission system) along with Reconductoring of 400 kV Kishenpur-Kishtwar line (formed after LILO of Kishenpur- Dulhasti line at Kishtwar S/s) is proposed. In the revised scheme, there will be no requirement of space for installation of new GIS equipment and replacement of cables at Dulhasti switchyard for time being. Study files were also circulated on 24.11.23.

In the CMETS meeting it was stated that as part of transmission scheme, 400kV Kishenpur-Samba D/c line(Quad) line is proposed. Due to higher loading on 400/220kV ICTs as well as space constraint at Kishenpur S/s, bypassing of 400kV Kishtwar – Kishenpur line (Quad) at Kishenpur and connecting it with one of the circuit of Kishenpur-Samba 400kV D/c line (Quad) (thus forming 400kV Kishtwar-Samba (Quad) direct line (one ckt) & Kishenpur- Samba (Quad) (other ckt) line) is proposed. Further 4 nos. of bays shall be vacated at Samba S/s through bypassing both ckts of 400kV Kishenpur – Samba D/c line (Twin) & 400 kV Samba – Jalandhar D/c line (Twin) at Samba and connecting them together to form Kishenpur– Jalandhar D/c direct line (Twin). These bays will be utilized in present scheme through Kishenpur-Samba D/c line(Quad) line (one ckt bypassed at Kishenpur) & 400kV Samba-Jalandhar D/c line(Quad) line.

In view of space constraint for 400kV bays at Jalandhar S/s as well as higher loading on 400/220kV ICTs, bypassing 400kV Jalandhar – Nakodar line (Quad) at Jalandhar and connecting it with one of the circuit of Samba-Jalandhar 400kV D/c line (Quad) is proposed (forming Samba –Nakodar direct line). The vacated bay at Jalandhar S/s will be utilized for termination of another circuit of 400 kV Samba - Jalandhar D/c line (Quad).

It was deliberated that CTU vide mail 20.11.23 to POWERGRID requested information regarding maximum rating of the HTLS conductor suitable for Reconductoring of 400 kV Kishenpur-Kishtwar line (Twin Zebra), considering altitude and the bundle size of the line. It was also requested that POWERGRID may confirm the feasibility of the line bay upgradation requirements at Kishenpur Substation pertaining to the above line. In this regard POWERGRID vide mail 08.12.23 informed that 400 kV Kishenpur-Dulhasti line (Twin Zebra) line has bay equipment rating of 2000A (CB,CT, Isolator). In view of that bays upgradation is also required with Reconductoring of 400 kV Kishenpur-

Kishtwar line (Zebra). Conductor configuration for reconductoring of 400 kV Kishenpur-Kishtwar line will be finalized based on POWERGRID inputs.

In the latest JCC meeting, M/s RHPCL informed commission schedule for their 850MW (4x205+1x30MW) HEP project, progressively from May'26. Further in the present meeting, M/s RHPCL confirmed the commissioning schedule of generation project progressively from May'26. It was also requested that M/s RHPCL may also confirm generation schedule through mail/letter.

Grid-India in the meeting as well as in mail 04.12.23 queried about expected timelines of other HEP in the area such as Kiru, Kawar, Kirthai-I, Kirthai-II etc. as maximum of nearly 4000MW could be evacuated through 3 outgoing lines from Kishtwar i.e. 2 lines to Kishenpur and one line to Samba.

CTUIL informed that at present connectivity application received at Reoli Dugli, Purthi, Bardang and Dugar HEPs with schedule progressively from 2029, however no application is yet to received from Kiru, Kawar, Kirthai-I and Kirthai-II HEPs.

For evacuation of power from Reoli Dugli, Purthi and Bardang HEPs, separate high capacity transmission system will be planned and based on studies, connectivity of above high capacity corridor with Kishtwar S/s (via Dugar HEP) will be finalized.

Grid-India also stated that fault level at Kishtwar & Kishenpur also need to checked after the proposed interconnections. Based on the fault level assessments & transmission plan, switchgear rating may be selected. From the studies it is emerged that with Ratle HEP, fault level of Kishtwar S/s is about 23kA (designed capacity:50KA) and Kishenpur S/s is about 37kA (designed capacity: 40kA) which is within limits.

Further Grid-India stated that the requirement of line reactors for lines such as 400kV Kishtwar-Kishenpur (132km) and 400kV Kishtwar-Samba (160km) may be studied given the persistent issues of high voltage in hydro complex in winter months during off-peak hours. CTU informed that requirement of line reactor will be reviewed considering space availability. Accordingly, CTU analyzed the reactive compensation requirement, however feasibility for installation of line reactors along with space confirmation from POWERGRID & Sterlite is awaited. Same will be intimated in next CMETS-NR meeting.

Grid-India also mentioned in mail that the bay allocation of feeders at Kishtwar station is very important & incomer and outgoing feeders need to be kept in same diameter. PSTCL stated that they are planning to establish new substation at 400kV Wadala Granthian for which LILO of 400kV Jalandhar-Samba is under planning. CTU stated that at present with proposed scheme 400kV Samba-Jalandhar (Twin) (after bypassing above line will be Kishenpur-Samba (Twin)) and 400kV Samba-Jalandhar (Quad) line will be available for LILO in 2026-27 timeframe. In view of that PSTCL may carried out the studies for both the alternatives and share with CEA & CTU. PSTCL agreed for the same.

in view of above, following ISTS transmission scheme is agreed for evacuation of power for Ratle HEP (850MW):

Common Transmission system for Connectivity under GNA (under ISTS) :

Sl. No.	Description of Transmission Element	capacity/km
1	400 kV Kishenpur-Samba D/c line (Quad) (2nd)	Length -35 km (Quad)
2	Bypassing of 400kV Kishtwar – Kishenpur line (Quad) (Under implementation as part of Pakaldul transmission scheme) at Kishenpur and connecting it with one of the circuit of Kishenpur-Samba 400kV D/c line(Quad), thus forming 400kV Kishtwar - Samba (Quad) direct line (one ckt)	
3	Bypassing both ckts of 400kV Kishenpur – Samba D/c line (Twin) & 400 kV Samba – Jalandhar D/c line (Twin) at Samba and connecting them together to form Kishenpur– Jalandhar D/c direct line (Twin)	
4	Bay upgradation works (2000A to 3150A) at Samba end for Kishenpur – Samba D/c line (Twin) & 400 kV Samba – Jalandhar D/c line (Twin)	
5	400kV Samba- Jalandhar D/c line(Quad) (only one circuit is to be terminated at Jalandhar while second circuit would be connected to bypassed circuit of Jalandhar – Nakodar 400kV D/c line)	Line Length -135 km
6	Bypassing 400kV Jalandhar – Nakodar line (Quad) at Jalandhar and connecting it with one of the circuit of Samba-Jalandhar 400kV D/c line(Quad Moose), thus forming Samba –Nakodar line	
7	LILLO of 400 kV Kishenpur- Dulhasti line (Twin Zebra) at Kishtwar S/s (one ckt already LILLOed as part of Pakaldul transmission system)	
8	Reconductoring of 400 kV Kishenpur-Kishtwar line (Twin HTLS) (minimum 2100 MVA capacity) (formed after LILLO of Kishenpur-Dulhasti line at Kishtwar S/s) along with bay upgradation works (2000A to 3150A) at Kishenpur end for above line	LILLO Length- 10kms

*** Conductor configuration for reconductoring of 400 kV Kishenpur-Kishtwar line will be finalized based on POWERGRID inputs. Line reactors will be finalized based on POWERGRID/Sterlite inputs**

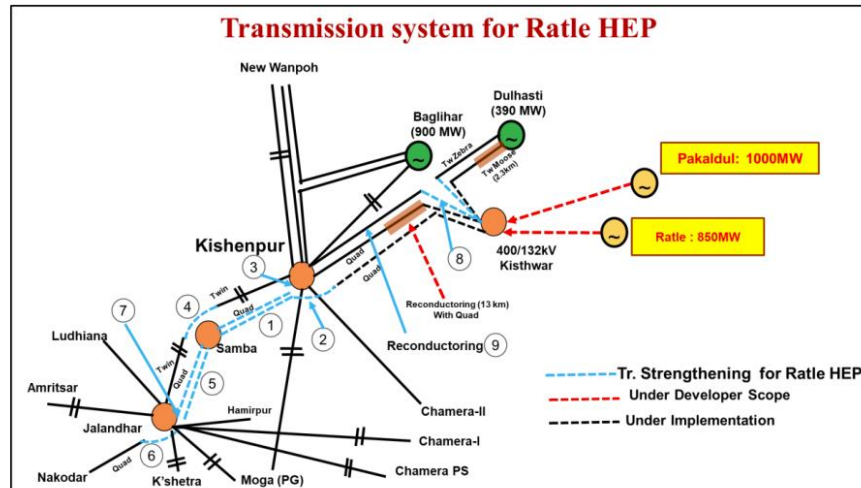


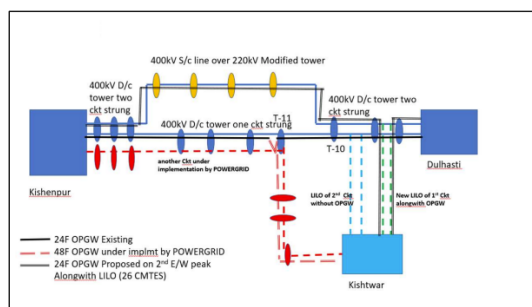
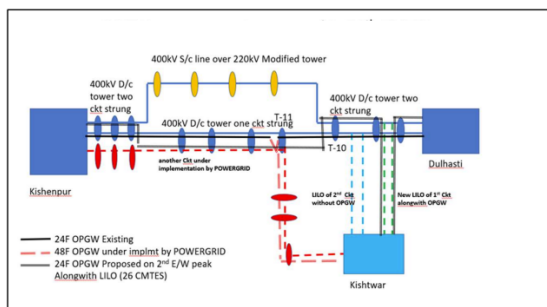
Fig: Transmission scheme for Ratle HEP (Scheme S.No. as mentioned above is indicated near each element in diagram)

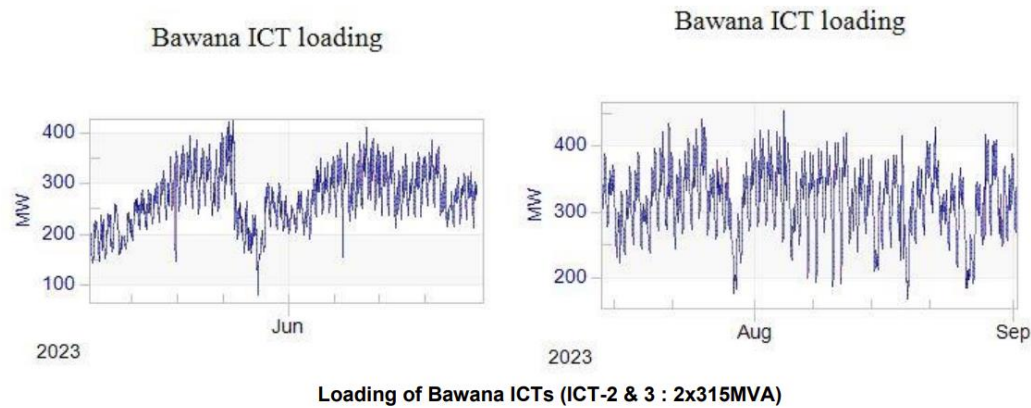
It was stated that OPGW installation on 2nd E/W peak of 400kV Kishenpur-Dulhasti existing line (120 kms.) (Circuit-1) along with LILO portion (2nd LILO at Kishtwar) was deliberated in the 26th CMTES-NR meeting. OPGW on 1st E/W peak is already available. This arrangement shall provide redundant communication to Dulhasti & Kishtwar stations which are presently connected / to be connected on single path only which are critical in view of Pakaldul & Ratle Generation to be evacuated from Dulhasti & Kishtwar S/s. Proposed OPGW arrangement is demonstrated at Fig-1.

Feasibility of OPGW installation on 400kV S/c line (Circuit-1) strung over modified 220kV towers for providing redundant communication to Dulhasti Station was also deliberated in the 2nd / 3rd ISTS Communication Planning Meeting (CPM) of NR, 22nd & 23rd NRPC TeST sub-committee meeting and in 57th NRPC. In the 23rd NRPC TeST meeting POWERGRID stated that OPGW installation is not feasible on this line due to tower strengthening not feasible.

In 27th CMETS-NR meeting POWERGRID representatives informed that reconductoring scope is also involved in the scheme on the 400kV Kishenpur-Dulhasti existing line (120 kms) Ckt-1. During reconductoring work OPGW can be installed on this line as sag can be relaxed during installation which shall remove hindrance of tower strengthening due to OPGW installation. Further this will also create diverse physical path in line with CEA Manual of Communication Planning. The modified scheme is presented in the Fig-2. After the deliberation, all members agreed to the proposal.

This proposal shall be made part of Transmission scheme and to be put up for approval in NCT along with LILO of 400 kV KishenpurDulhasti line at Kishtwar S/s as per MoP "Guidelines on Planning of Communication System for Inter-State Transmission System (ISTS)" under Category (A). Proposed OPGW Diagrams are as under:





Therefore, replacement of both the ICTs (ICT-2 & 3) is required to ensure N-1 compliance. CTU also stated that establishment of 400/220kV Tikrikhurd Substation along with LILO of 400kV Bawana-Mandola D/c line were earlier approved in 2nd Meeting of NRPC-TP held on 1.09.2020, however the scheme is not yet awarded by DTL. It is requested that DTL may expedite the implementation of Tikrikhurd Substation as it will relieve the loading on Bawana ICTs in future. As per discussion with DTL, ICT-3 (315MVA) along with bays is owned by POWERGRID as part of ISTS scheme. In view of that the proposal need to be taken up in ensuing CMETS-NR meeting.

CEA vide letter dated 18.09.23 informed that replacement of both the 400/220 kV, 315 MVA ICTs (ICT-2 & 3) with 500 MVA ICTs is required to ensure 'N-1' compliance, out of which, replacement of ICT-2 is already planned by DTL. In view of the above, proposal submitted by DTL for replacement of 400/220 kV, 315 MVA ICT (ICT-3), is generally in order.

CTU vide mail 11.09.23 requested POWERGRID to provide information regarding year of make for ICT-3 (315MVA) and, its remaining useful life (ICT & associated bays) as well as healthiness of above transformer (Residual Life Assessment Studies if any).

POWERGRID vide email dated 18.09.2023 and letter dated 03.10.23 informed that 400/220/33 kV, 315 MVA ICT-3 along with associated bays (owned by POWERGRID) at Bawana substation was commissioned in June'1997. The equipment of associated bays of said ICT at Bawana have been replaced under ADD CAP (CB, CT & relays). Remaining bay equipment i.e. Isolators, CTs, Surge Arrestors are being replaced under ADD CAP 2019-2024. It is further to mention that ICT (BHEL make) which was commissioned in Jun'1997 was failed in Sep'18 and new ICT (Siemens make, YO - 2011) was commissioned in Nov'2018 in place of failed BHEL make ICT. The present ICT is in healthy condition and may be kept as regional spare. Grid-India stated that POWERGRID may inform OCC for above 315MVA ICT to be used as regional spare.

Grid-India & CEA in the meeting agreed for the proposal and emphasized on urgent requirement of replacement of both the ICTs (ICT-2 in Intra state and ICT-3 in Inter state) at Bawana S/s. DTL agreed for the requirement of ICT-3 (ISTS). CEA and CTU also stated that DTL may also expedite the replacement of ICT-2 (315 MVA with 500MVA), for N-1 compliance at Bawana S/s. DTL agreed for the same.

In view of above deliberations, following ICT augmentation scheme is agreed in ISTS:

- Replacement of 400/220/33 kV, 1x315 MVA (3rd) ICT (ICT-3) to 500 MVA at 400/220 kV Bawana (DTL) S/s

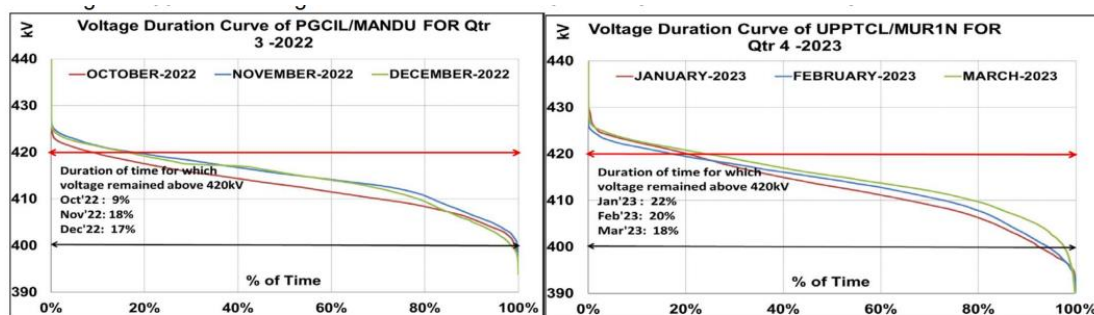
5.4.Uttar Pradesh

(a) Replacement of existing 420kV 50MVAR Bus Reactors at Mandola & Muradnagar substation with 125MVAR bus reactor

It was stated that POWERGRID vide letter dated 30.10.23 informed that 400/220kV Mandola substation in NR-I was commissioned in 1990 and 50MVAR Bus reactor (BHEL make, 3-phase) on this substation was commissioned in 1991. Due to the ageing of reactor, frequent leakages have been observed despite all preventive measures/overhauling of the reactor. The furan value of the reactor is also in increasing trend and present value is 2.4PPM. As reactor has already completed more than 32 years of service life and any major maintenance may not be enough to ensure further reliable & longer service period

In the above letter, it was also mentioned that apart from the above, 01 no. 420kV, 50MVAR Bus reactor (3x16.67 MVAR, CGL make 1 phase unit, DOCO - 1988) was commissioned at Muradnagar substation of UPPTCL (owned by POWERGRID). Frequent oil leakages and deteriorated oil parameters along with high vibrations have been observed in these units. This reactor is also not reliable and is vulnerable to fail due to its ageing. Further any major maintenance may not be enough to ensure further reliable & longer service period. As the system fault level at both the substations have increased over a period of time (more than 30 years), therefore bus reactors of 50 MVAR may not be adequate at both stations (Mandola & Muradnagar). POWERGRID requested to review the augmentation of above said bus reactors for better voltage regulation.

In Grid India operational feedback report FY 2022-23(Q3) also, it was mentioned that voltage at 400kV Mandola remains more than 420kV for 9-18% of time and 415kV and above for about 40% of time. Similarly from operational feedback report FY 2022-23(Q4) it emerged that voltage at 400kV Muradnagar remains more than 420kV for 18-22% of time and 415kV and above for about 40% of time



Voltage duration curve of 400kV Mandola & Muradnagar for 2022-23 (Source: Grid-India)

Grid-India stated that voltage on 400kV Mandola and Muradnagar S/s remains high in various operational scenarios and already highlighted in Grid-India operational feedback report, so proposal is agreeable to them. CEA also agreed for the proposal.

POWERGRID suggested that proposal will be considered in ADD CAP in taken up in NRPC meeting. CTU stated that POWERGRID may send proposal to NRPC for its approval in ensuing NRPC meeting.

From Grid-India operational feedback as well as inputs received from POWERGRID, it was decided in the meeting that it is technically recommended to replace 50MVar bus reactor each at Mandola (PG) & Muradnagar (UPPTCL) with 125MVar (420kV) bus reactor.

5.5.Haryana

(a) Reconductoring of 220 kV Hisar (PG) - Hisar (IA) D/c line

It was deliberated that in 3rd NRPC-TP meeting held on 19.02.21, HVPNL's proposal of creation of 220 kV Chickenwas substation by LILO of both circuits of 220 kV Hisar (PG) to Fatehabad (HVPNL) D/c line was deliberated. In above agenda, Grid- India expressed concern on the high loading of 220 kV Hisar (PG) - Hisar (IA) D/c line and asked HVPNL to explore measures to relieve loadings of these lines. HVPNL agreed to the same.

Further, in the 54th NRPC meeting held on 31.05.22 it was desired that HVPNL will take up the matter with CTU/CEA for reconductoring of 220 kV Hisar (PG) - Hisar (IA) D/c line and Connector to be replaced at Hisar (IA) end.. Further, HVPNL vide letter dated 21.09.22 has suggested that 220 kV Hisar (PG) Hisar (IA) D/c line may be augmented with high performance conductor and matter of augmentation may be taken up with POWERGRID being the custodian of above line.

It was informed that Grid-India vide mail 21.06.22 shared the loading data of past one year (Jun'21-Jun'22)

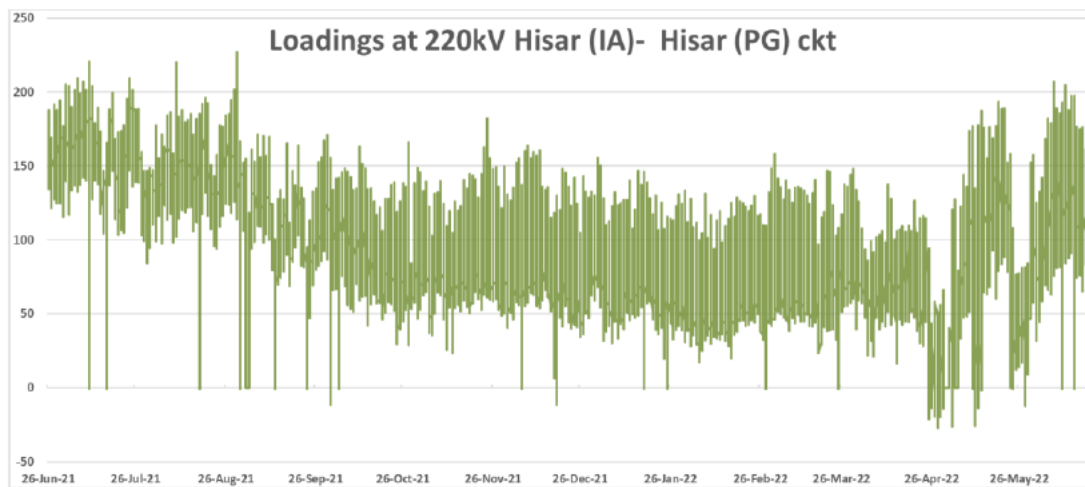


Fig : Transmission system for evacuation of power from Shongtong HEP (450MW) and Tidong HEP (150 MW)

CTU vide mail 03.02.23 to CEA & Grid-India informed that as per the loading pattern of 220kV Hisar(PG)-Hisar IA-Hisar (BBMB) D/c line also , it is seen that loading of Hisar (PG) - Hisar (IA) is high and may not fulfill N-1 Criteria. Further, in the 62th NRPC meeting held on 31.01.23, NRLDC agenda for high loading of Hisar (PG) - Hisar (IA) was also deliberated and it was decided to resolve the above issue. In view of that, CTU requested in above mail to convene a joint meeting with

HVPN/POWERGRID/Grid-India to discuss and finalize on possible alternatives (Reconductoring/ load diversion/220kV new interconnection) to resolve above high loading issue.

Subsequently a joint meeting was held on 20.03.2023 to discuss transmission related issues in Haryana incl. high loading issue of 220 kV Hisar (PG) - Hisar (IA) D/c line. In the meeting, Reconductoring of 220 kV Hisar (PG) - Hisar (IA) D/c line with HTLS conductor was agreed. In the meeting, it was decided that POWERGRID will intimate the type of HTLS conductor which can be implemented on existing towers of 220 kV Hisar (PG) - Hisar (IA) D/c line within two weeks. It was also decided that HVPNL will carry out the augmentation of line bay equipment at 220kV Hisar (IA) substation in the matching time frame of reconductoring of the 220 kV Hisar (PG) - Hisar (IA) D/c line.

Subsequently, POWERGRID vide mail 25.05.23 informed to CTU that they need the Conductor Ampacity requirement for the subject line for deciding the technical parameters for HTLS conductor which is suitable for existing towers. CTU in reply vide mail 02.06.23 informed that from the loading data of one year (Jun'21-Jun'22), it is observed that maximum loading on 220 kV Hisar (PG) – Hisar(IA) D/c Line is about 225MW/ckt (under n-1 contingency loading may increase to 365MW). Considering above historical loading data, minimum conductor ampacity required to be about 1000 Ampere/ckt (about 381MW/ckt) for reconductoring of above 220kV line.

POWERGRID vide mail 09.06.23 mentioned that reconductoring of existing transmission line having ACSR Zebra conductor is feasible with HTLS conductor (equivalent to Zebra) to meet 1000 ampere current requirement with existing tower design.

CTU enquired HVPNL to update the status of measures taken to relieve the high loading on 220kV Hisar (IA) - Hisar (BBMB) D/c line (HVPNL).

Grid-India informed that reconductoring of above line with HTLS conductor of minimum 1000 ampere current requirement is adequate, however HVPN views may be taken for any future drawl requirement. HVPNL informed that at present, no future load is envisaged for drawl of power from Hisar (PG) substation.

POWERGRID informed that upto 1000 Ampere requirement, ACSS/GAP conductor were used in past for reconductoring of 220kV lines and same can be used for upto 1100 Ampere loading requirement. For requirement for more than 1100 Amperes, composite core type conductor is suitable due to sag limitation, however same is costlier (about 3 times) than ACSS/GAP conductor. CTU enquired about thermal capacity of ACSS/GAP type HTLS conductor available for more than 1000 Ampere (say 1050 A) with ACSS configuration.

POWERGRID stated that in the past they had the latest design of 1092 Ampacity conductor so 1050 Ampere HTLS conductor can be designed for reconductoring of above line. CTU stated that with 1050 Ampere (about 400MW/ckt) HTLS conductor shall further provide additional margin on 220 kV Hisar (PG) - Hisar (IA) D/c line to meet the future demand. Grid-India agreed for the same.

CTU stated that HVPNL to carry out the necessary bay equipment upgradation works at 220kV Hisar (IA) end in the matching time frame of reconductoring of the 220 kV Hisar (PG) - Hisar (IA) D/c line. HVPNL stated that at present Bay equipment are designed with 1250 ampere rating at Hisar (IA) end, but conductor need be changed for tie bay. Additionally, the CT ratio needs to be checked and changed accordingly from 800 ampere to 1200 ampere. HVPN stated that they will do detailed analysis in

consultation with design team to upgrade the bays equipment's at Hisar (IA) end in coordination with implementing agency for reconductoring works.

Further in the earlier joint meeting, it was deliberated that HVPNL will examine the issue of high loading (of similar order as 220kV Hisar(PG) – Hisar(IA) D/c line) on Hisar (IA) - Hisar (BBMB) 220 kV D/ c line and plan adequate measures to relieve loading on the line.

In above Joint meeting HVPNL informed that Zebra conductor may be used for above line, however after the detailed analysis it emerged that 220 kV Hisar (IA) - Hisar (BBMB) D/ c line is already augmented in 2009 with INVAR conductor. Loading on above line is also significantly reduced with implementation of 400kV Bhiwani (PG) - Bhiwani line. CTU enquired about Ampacity of augmented conductor of Hisar (IA) - Hisar (BBMB) 220 kV D/ c line. HVPNL informed that INVAR conductor (TASCR) in above line is designed for 150 degree with about 960 Ampere capacity.

Grid-India informed that in past during high demand season (Jun-Aug), in the event of shutdown of one ckt of Hisar (IA) - Hisar (BBMB) 220 kV D/c line, SLDC instructed to take other ckt out of service also due to very high loading. Grid-India stated that with INVAR conductor, other ckt can carry the load in the event of shutdown of one ckt. HVPNL concurred on the same.

CTU requested HVPNL to re-check bay equipment rating at Hisar (IA) & Hisar (BBMB) end for Hisar (IA) - Hisar (BBMB) 220 kV D/c line for optimal utilization of above line and take the necessary action in case of upgradation requirement & also send a confirmation to CEA & CTU in this regard.

In view of above following ISTS transmission strengthening scheme was agreed in the meeting

- Reconductoring of 220 kV Hisar (PG) - Hisar (IA) D/c line (Single Zebra) with HTLS conductor (with minimum 1050Ampere/ckt requirement) along with bay equipment upgradation at 220kV Hisar (PG) end

Scope of work along with tentative Cost and Implementation time-frame

Sl. No.	Scope of the Transmission Scheme	Capacity/km	Implementation timeframe
1	Reconductoring of 220 kV Hisar (PG) - Hisar (IA) D/c line (Single Zebra) with HTLS conductor (with minimum 1050 Ampere/ckt requirement)	14km	18 months from the date of issuance of OM by CTUIL
2	Bay equipment upgradation at 220kV Hisar (PG) end		
Total Estimated Cost:			INR 30.72 Crore

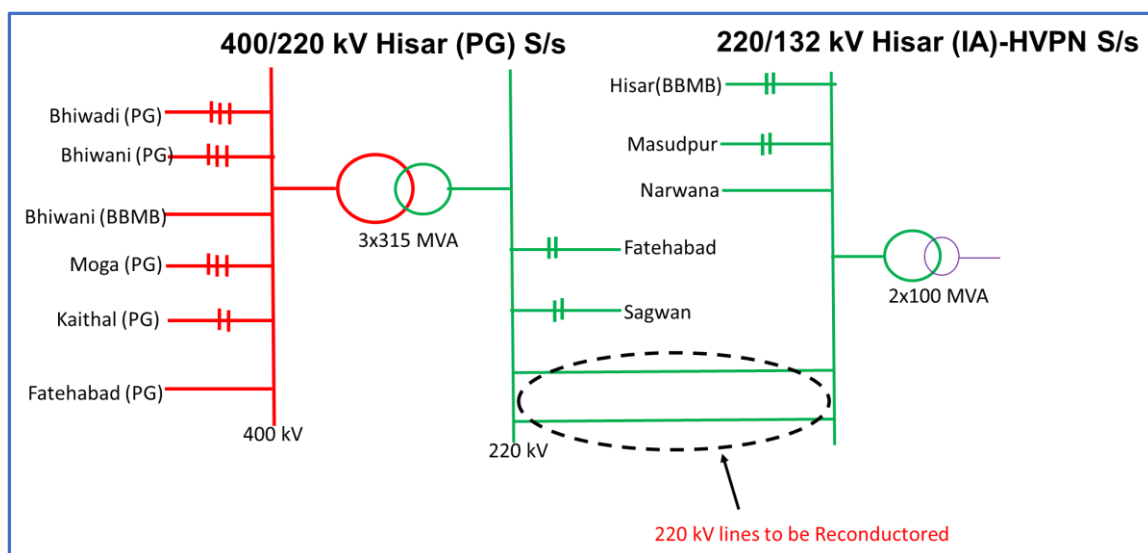


Fig : Schematic of 765/400/220kV Hisar (PG) S/s

This scheme approved in 20th CMETS-NR meeting held on 30.06.23. Further scheme approved in 16th meeting of CTU Committee on transmission projects (CCTP) for implementation.