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सत्यमेव जयते
Ministry of Power
Government of India

Transmission System for Integration of over 500 GW RE Capacity by 2030

Central Electricity Authority

December 2022

Contents

Executive Summary

Transmission System for Integration of over 500 GW RE Capacity by 2030

As of 31st October 2022, the installed electricity generating capacity in the country was 409 GW including 166 GW of RE generating capacity (including large hydro), which is about 40% of the total installed electricity generating capacity in the country. India has envisaged to increase the non-fossil fuel based installed electricity generation capacity to 500 GW by 2030.

For enabling growth of Renewable Energy (RE) capacity, areas which have high solar and wind energy potential, needs to be connected to Inter-State Transmission System (ISTS), so that the power generated could be evacuated to the load centres. The gestation period of wind and solar based generation projects being much less than the gestation period of associated transmission system, hence the transmission system has to be planned well in advance.

As a significant step towards successfully achieving the planned RE capacity by 2030, transmission system has been planned for about 537 GW of RE capacity as detailed below:

Category	Capacity (MW)
RE Capacity already Commissioned (as on 31.10.2022)	1,65,943
66.5 GW RE capacity to be integrated to ISTS network (8.861 GW RE capacity already commissioned and included in Sl. No. 1 above)	57,639
Additional RE capacity totaling to 236.58 GW (55.08 GW + 181.5 GW) to be integrated to ISTS network	2,36,580
Margin already available in ISTS sub-stations which can be used for integration of RE capacity	33,658
Balance RE capacity to be integrated to intra-state system under Green Energy Corridor – I (GEC-I) Scheme	7,000
RE capacity to be integrated to intra-state system under Green Energy Corridor - II (GEC-II) Scheme	19,431
Additional Hydro Capacity likely by 2030	16,673
Total (RE)	**5,36,924**

Transmission system has been planned for major RE potential zones like Leh RE park in Ladakh; Fatehgarh, Bhadla, Bikaner in Rajasthan; Khavda RE park in Gujarat; Anantapur, Kurnool RE Zones in Andhra Pradesh; and offshore wind farms in Tamil Nadu and Gujarat etc.

The Report "Transmission System for Integration of over 500 GW RE Capacity by 2030" portrays the broad transmission system roadmap for reliable integration of 537 GW RE capacity by the year 2030.

The transmission schemes have been planned considering energy storage, so as to meet the requirement of Round-the-Clock (RTC) power. Several HVDC transmission corridors have also been planned for the evacuation of power from large RE potential Zones.

The length of the transmission lines and sub-station capacity planned under ISTS for integration of additional wind and solar capacity by 2030 has been estimated as 50,890 ckm and 4,33,575 MVA respectively at an estimated cost of Rs 2,44,200 crores.

The present inter-regional transmission capacity is 1,12,250 MW. With the additional inter-regional transmission corridors under implementation/planned, the cumulative inter-regional transmission capacity is likely to be about 1,50,000 MW in 2030.

Transmission System for Integration of over 500 GW RE Capacity by 2030

1.0 Introduction

The installed electricity generating capacity in the country is 409 GW comprising of 166 GW RE generating capacity (including large hydro), which is about 40% of the total installed electricity generating capacity. India has envisaged to increase the non-fossil fuel based installed electricity generation capacity to 500 GW by the year 2030.

For enabling growth of Renewable Energy (RE) capacity, areas which have high solar and wind energy potential, needs to be connected to Inter-State Transmission System (ISTS), so that the power generated could be evacuated to the load centres. As the gestation period of wind and solar based electricity generation projects is much less than the gestation period of transmission system, it needs to be planned in advance. As a major step towards achievement of the goal of 500 GW RE capacity, ISTS network has been planned for the projected RE capacity addition by the year 2030.

2.0 Transmission System for RE capacity by 2030

Transmission system has been planned for 537 GW RE capacity likely by the year 2030 as detailed below:

Sl. No.	Category	Capacity (MW)
1	RE Capacity already Commissioned (as on 31.10.2022)	1,65,943
2	66.5 GW RE capacity to be integrated to ISTS network (8.861 GW RE capacity already commissioned and included in Sl. No. 1 above)	57,639
3	Additional RE capacity totaling to 236.58 GW (55.08 GW + 181.5 GW) to be integrated to ISTS network	2,36,580
4	Margin already available in ISTS sub-stations which can be used for integration of RE capacity	33,658
5	Balance RE capacity to be integrated to intra-state system under Green Energy Corridor – I (GEC-I) Scheme	7,000
6	RE capacity to be integrated to intra-state system under Green Energy Corridor - II (GEC-II) Scheme	19,431
7	Additional Hydro Capacity likely by 2030	16,673
	Total (RE)	**5,36,924**

2.1 RE Installed Capacity in the country

Installed Power Generating Capacity in the country as on 31st October 2022, was 409 GW, which comprised of 166 GW RE capacity as detailed below:

	RE Installed Capacity (MW) as on 31.10.2022
Hydro	46,850.18
Wind	41,843.98
Solar	61,624.27
Small Hydro	4,923.50
Bio Power	10,700.84
Total	**1,65,942.77**

3.0 Transmission system for 66.5 GW ISTS connected RE capacity

The RE installed capacity target of 175 GW by the year 2022 comprises of 66.5 GW RE capacity to be connected to ISTS network. State - wise bifurcation of potential RE zones totaling to 66.5 GW is given below:

Potential RE Zones	
State/District	**Total Capacity (GW)**
Rajasthan	
Fatehgarh-I	1.2
Fatehgarh-II	4.5
Fatehgarh-III	1.9
Bhadla	1.05
Bhadla-II	3.55
Bikaner (PG)	1.85
Bikaner-II	2.95
Intra- State	3
Sub total	**20**
Andhra Pradesh	
Kurnool	5.5
Anantapur	2.5
Sub total	**8**
Karnataka	
Gadag	2.5
Bidar	2.5
Koppal	2.5
Sub total	**7.5**

Potential RE Zones	
State/District	**Total Capacity (GW)**
Tamil Nadu	
Karur	2.5
Tirunelveli	0.5
Sub total	**3**
Gujarat	
Khavda	10.5
Dwarka/Jam Khambaliya	1.5
Bhuj-II	2
Lakadiya	2
Sub total	**16**
Maharashtra	
Solapur	2.5
Wardha	2.5
Osmanabad/Kallam	1
Intra State	1
Sub total	**7**
Madhya Pradesh	
Rajgarh	2.5
Chhatarpur	1.5
Neemuch	1
Sub total	**5**
Total	**66.5**

Transmission system for integration of 66.5 GW RE capacity has already been planned. Part of the transmission system has been commissioned and rest is under various stages of implementation/bidding. Status of the transmission schemes is given below:

Sl. No.	Status of transmission schemes	Locations	RE capacity to be evacuated (GW)
1	Commissioned	a) Bhadla (1.05) & II (2.5) - 3.55 GW	12.9
		b) Fatehgarh-I (1.2) & II (2.3) - 3.5 GW	
		c) Bikaner (PG) - 1.85 GW	
		d) Jam Khambaliya- 1.5 GW	
		e) Bhuj-II - 2 GW	
		f) Tirunelveli- 0.5 GW	
2	Under Construction	a) Bhadla-II - 1.05 GW	19.1 (slated for commissioning in the timeframe of December, 22 to November, 23)

Sl. No.	Status of transmission schemes	Locations	RE capacity to be evacuated (GW)
		b) Fatehgarh-II - 2.2 GW	
		c) Bikaner-II - 2.95 GW	
		d) Fatehgarh-III (erstwhile Ramgarh)- 1.9 GW	
		e) Khavda PS1 - 3 GW	
		f) Osmanabad - 1 GW	
		g) Rajgarh - 1.5 GW	
		h) Neemuch - 1 GW	
		i) Koppal - 2.5 GW	
		j) Gadag - 1 GW	
		k) Karur - 1 GW	
3	Under Tendering	a) Khavda PS2 & PS3 - 5 GW	8
		b) Gadag - 1.5 GW	
		c) Chhatarpur- 1.5 GW	
4	Schemes being taken up for bidding/ implementation	a) Anantapur - 3.5 GW	10.5
		b) Kurnool - 4.5 GW	
		c) Bidar- 2.5 GW	
5	Other planned transmission schemes	a) Lakadia - 2 GW	9.5
		b) Solapur - 2.5 GW	
		c) Wardha - 2.5 GW	
		d) Khavda - 2.5 GW	
6	Schemes whose Phase-I is under implementation and Phase-II is to be notified based on progress of Phase-I	a) Rajgarh - 1 GW	2.5
		b) Karur - 1.5 GW	
7	Schemes planned under intra-state	a) Rajasthan – 3 GW	4
		b) Maharashtra – 1 GW	
	Total		**66.5**

Details of the transmission schemes under construction, under tendering, to be taken up for implementation/bidding, other planned transmission schemes etc. (Sl. No. 2 to 6 in the above table) is given at **Annex-IA.**

In addition to the 66.5 GW RE capacity, transmission system has been planned for 236.58 GW (55.08 GW+181.5 GW) RE capacity which is discussed in subsequent paras.

4.0 Transmission system for 55.08 GW ISTS connected RE capacity

State - wise bifurcation of 55.08 GW RE potential is given below:

Potential RE Zones	
State/District	**Total Capacity (GW)**
Rajasthan	
Fatehgarh	9.1
Bhadla	8
Ramgarh	2.9
Sub total	**20**
Ladakh	
Leh	13
Sub total	**13**
Gujarat	
Khavda	17.2
Dholera	4
Sub total	**21.2**
Himachal Pradesh	
Kaza	0.88
Sub total	**0.88**
Total	**55.08**

Transmission system for 55.08 GW RE capacity has already been planned and status of the transmission schemes is given below:

Transmission scheme	RE capacity (GW)	Status of Transmission Scheme
Transmission schemes for 20 GW RE capacity in Rajasthan under Phase III	14	Transmission schemes are under bidding.
	6	The transmission scheme comprises of 6000 MW, + 800 kV HVDC system between Bhadla-III and Fatehpur. The scheme has been recommended by NCT in its 9th meeting held on 28.09.2022. Subse-quent activities are in progress for initiating bidding of the scheme.
Transmission scheme for 13 GW Leh RE park	13	The transmission scheme comprises of + 350 kV, 5000 MW VSC based HVDC link from Pang to Kaithal. Scheme allocated to Powergrid in January 2022, for implementation through RTM route.
Transmission scheme for 880 MW Kaza Solar Park, Himachal Pradesh	0.88	Transmission system planned. To be taken up for implementation in matching timeframe of RE Generation
Transmission scheme for additional 17.2 GW RE capacity from Khav-da and 4 GW RE capacity from Dholera, Gujarat	21.2	Transmission system planned. To be taken up for implementation in matching timeframe of RE Generation
Total	**55.08**	

Details of the transmission schemes is given at **Annex-IB.**

5.0 Transmission system for 181.5 GW ISTS connected RE capacity

5.1 Background

Ministry of Power vide letter No. 15-3/2017-Trans (Part 1) dated 7th December, 2021 (attached as **Annex-II**), had constituted a 'Committee on Transmission Planning for RE' under the Chairmanship of Chairperson, CEA, for planning of requisite Inter State Transmission System required for having the targeted RE capacity by 2030.

5.2 Additional RE potential Zones identified for development by the year 2030

MNRE/SECI have identified Renewable Energy Zones (REZs) totaling to 181.5 GW for likely benefits by the year 2030. These REZ's are located in eight states as detailed below:

Sl. No.	State	Wind (GW)	Solar (GW)	Total (GW)	Remarks
1	Rajasthan	15	60	75	45 GW (15 GW Wind & 30 GW solar in GIB Zone)
2	Andhra Pradesh	18	33	51	
3	Karnataka	8	9	17	
4	Tamil Nadu	5		5	Offshore wind
5	Telangana	3	10	13	
6	Madhya Pradesh	2	6	8	
7	Gujarat	5		5	Offshore wind
8	Maharashtra	2	5.5	7.5	
	Total	**58**	**123.5**	**181.5**	

The potential RE zones in different states totaling to 181.5 GW is depicted in Figure 1.

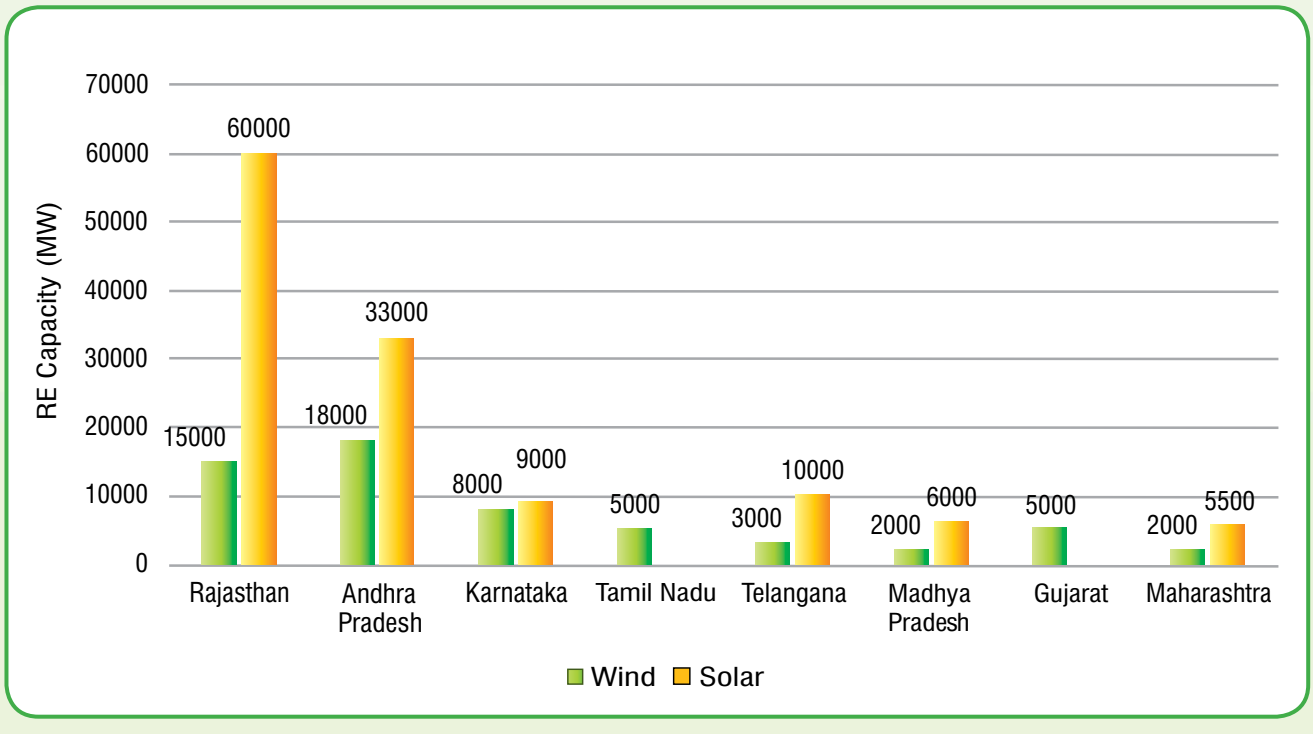

Fig 1: Potential RE zones identified by MNRE/SECI

District-wise breakup of identified potential RE Zones is given below:

State	District	Potential (GW)	
		Wind	Solar
Rajasthan (75 GW)	Sanchore, Sirohi, Jalor, Pali, Ajmer, Bikaner, Nagaur		30
	Barmer, Jaisalmer, Jodhpur (GIB Zone)	15	30
Andhra Pradesh (51 GW)	Anantapur	10	10
	Kurnool	8	8
	Kurnool		7
	Kadapa		8
Karnataka (17 GW)	Koppal	2	2
	Gadag	2	2
	Davangere/Chitradurga	2	2
	Bijapur	2	
	Bellary		1.5
	Tumkur		1.5
Tamil Nadu (5 GW)	off-shore	5	
Telangana (13 GW)	Rangareddy	1	2.5
	Medak	1	2.5
	Nizamabad	1	2.5
	Karimnagar		2.5
Madhya Pradesh (8 GW)	Neemuch	2	
	Morena		3.9
	Sagar		1.5
	Khandwa		0.6
Gujarat (5 GW)	off-shore	5	
Maharashtra (7.5 GW)	Dhule	1	1
	Osmanabad & Parli	1	1
	Sholapur		1
	Location to be firmed up		2.5
Total		**58**	**123.5**

RE Potential in GIB zone: In Rajasthan, out of total identified RE potential zones of 75 GW, 45 GW RE potential zones (30 GW Solar & 15 GW Wind) lie in the GIB area in Barmer, Jaisalmer & Jodhpur Districts.

5.3 Phasing of RE Potential Zones

Out of 181.5 GW RE capacity, 56 GW RE capacity is likely to be commissioned by March 2025, 62.1 GW RE capacity is likely to be commissioned by December 2027 and 63.4 GW RE capacity is likely to be commissioned by December 2030. Tentative phasing of 181.5 GW RE capacity is given below:

	Phase I (by March, 2025)		Phase II (by December 2027)		Phase III (by December 2030)		Total	
	Wind (GW)	Solar (GW)	Wind (GW)	Solar (GW)	Wind (GW)	Solar (GW)	Wind (GW)	Solar (GW)
Rajasthan	6	13	5	20	4	27	15	60
Madhya Pradesh	2	0	0	3.1	0	2.9	2	6
Maharashtra	2	3	0	0	0	2.5	2	5.5
Gujarat (off-shore wind)			2		3		5	0
Andhra Pradesh	4	8	7	11.5	7	13.5	18	33
Telangana	3	2	0	7.5	0	0.5	3	10
Karnataka	7	6	1	3	0	0	8	9
Tamil Nadu (off-shore wind)			2		3		5	0
Total	**24**	**32**	**17**	**45.1**	**17**	**46.4**	**58**	**123.5**
Total (S+W)		**56**		**62.1**		**63.4**		**181.5**

Pooling station-wise phasing of RE capacity is given at **Annex- III.**

5.4 Transmission scheme for RE Potential Zones in Northern Region (75 GW)

- MNRE/SECI has identified 75 GW potential REZs in Northern Region in the state of Rajasthan, comprising of 15 GW Wind and 60 GW Solar potential.
- 30 GW of Solar potential zones have been identified in the districts of Bikaner, Jalore, Sanchore, Sirohi, Pali, Ajmer, and Nagaur.
- 45 GW (30 GW Solar and 15 GW Wind) hybrid potential zones have been identified in Jodhpur, Jaisalmer and Barmer districts of Rajasthan.
- Details of the identified RE potential zones along with likely storage to be installed and the requirement of evacuation system is given below:

State/District	Pooling Station	Identified Potential (GW)		Maximum Dispatch (GW)	BESS (GW) (to be set up by RE generators)	Evacuation System (GW)
		Wind	Solar			
Bikaner	Bikaner-II	0	7	7	3	4
	Bikaner-III	0	7	7	3	4
Jalore	Jalore	0	3	3	1	2
Sanchore	Sanchore	0	3	3	1	2
Sirohi	Sirohi	0	3	3	1	2
Pali	Pali	0	3	3	1	2
Ajmer	Ajmer	0	2	2	0	2
Nagaur	Nagaur	0	2	2	0	2
Jodhpur	Bhadla-IV	2	3	4	2	2

State/District	Pooling Station	Identified Potential (GW)		Maximum Dispatch (GW)	BESS (GW) (to be set up by RE generators)	Evacuation System (GW)
		Wind	Solar			
Jaisalmer	Ramgarh	4	6	8	3	5
	Fatehgarh-IV	6	6	9	4	5
Barmer	Barmer-I	3	4	5.5	1.5	4
	Barmer-II	0	6	6	2	4
Intra-State	Jaisalmer/ Jodhpur	0	5	5	0	5
Sub Total (Rajasthan)		15	60	67.5	22.5	45
Total (Northern Region)		**15**	**60**	**67.5**	**22.5**	**45**

Note: 5 GW RE capacity to be integrated to intra-state network of RVPN for which transmission system is being planned by RVPN.

5.4.1 Transmission Schemes for evacuation of power from Rajasthan REZ in Bikaner, Jalore, Sanchore, Sirohi, Pali, Ajmer and Nagaur

i) Bikaner-II (7 GW Solar & 3 GW BESS), Bikaner-III (7 GW Solar & 3 GW BESS)

- Establishment of 6x1500 MVA, 765/400 kV & 5x500 MVA, 400/220 kV Bikaner-III Pooling Station along with 2x330 MVAr (765 kV) Bus Reactor & 2x125 MVAr (420 kV) Bus Reactor at a suitable locations near Bikaner (2 GW injection at 220 kV level and 2 GW injection at 400 kV level)
- Augmentation by 400/220 kV, 5x500 MVA ICT at Bikaner-II PS (2 GW injection at 220 kV level and 2 GW injection at 400 kV level)
- LILO of both ckts of Bikaner (PG)-Bikaner-II 400 kV D/c line at Bikaner-III PS (~20 km)
- Bikaner-II PS – Bikaner-III PS 400 kV D/c line (Quad Moose equivalent) (~30 km)
- Bikaner-III PS – Bhadla-III PS 400 kV D/c line (Quad Moose equivalent) (~200 km)
- Augmentation by 765/400 kV, 1x1500MVA ICT (4th) at Bikaner (PG)
- Establishment of 765/400 kV, 4x1500 MVA Neemrana-II S/s along with 2x330 MVAr (765 kV) Bus Reactor & 2x125 MVAr (420kV) Bus Reactor at a suitable location near Neemrana.
- Bikaner-III - Neemrana-II 765 kV 2xD/c line (~350 km) along with 330 MVAr switchable line reactor for each circuit at each end
- Neemrana-II- Bareilly (PG) 765 kV D/c line (~350 km) along with 330 MVAr switchable line reactor for each circuit at each end
- Neemrana-II -Kotputli 400 kV D/c line (Quad Moose equivalent) (~70 km)
- Augmentation by 400/220 kV, 1x500 MVA (3rd) ICT at Kotputli (PG)
- LILO of both ckts of Sohna Road (GPTL)-Manesar (PG) D/c line at Neemrana-II S/s (~85 km)

ii) Jalore (3 GW Solar & 1 GW BESS), Sirohi (3 GW Solar & 1 GW BESS), Sanchore (3 GW Solar & 1 GW BESS) & Pali (3 GW Solar & 1 GW BESS)

- Establishment of 4x1500 MVA, 765/400 kV, 3x500 MVA, 400/220 kV Pooling Station along with 2x330 MVAr (765 kV) Bus Reactor & 2x125 MVAr (420kV) Bus Reactor near Jalore (1 GW injection at 220 kV level and 1 GW injection at 400 kV level)

- Establishment of 3x500 MVA, 400/220 kV Pooling Station near Sirohi along with 2x125 MVAr (420kV) Bus Reactor (1 GW injection at 220 kV level and 1 GW injection at 400 kV level)
- Establishment of 3x500 MVA, 400/220 kV Pooling Station along with 2x125 MVAr (420 kV) Bus Reactor near Sanchore (1 GW injection at 220 kV level and 1 GW injection at 400 kV level)
- Establishment of 3x1500 MVA, 765/400 kV Pooling Station along with 2x330 MVAr (765 kV) Bus Reactor & 2x125 MVAr (420 kV) Bus Reactor near Pindwara
- LILO of both circuits of Banaskantha – Chittorgarh 765 kV D/c line at Pindwara
- Jalore-Chittorgarh 400 kV D/c line along with 80 MVAr switchable line reactor for each circuit at each end (Quad Moose equivalent) (~200 km)
- Jalore – Pindwara 765 kV D/c line along with 240 MVAr switchable line reactor for each circuit at Pindwara end (~100 km)
- Sanchore – Pindwara 400 kV D/c Line (Quad Moose equivalent) (~150 km)
- Sirohi - Pindwara 400 kV D/c Line (Quad Moose equivalent) (~30 km)
- Pindwara – Prantij (GETCO) 400 kV D/c line (Quad Moose equivalent) (~170 km) with 50MVAr switchable line reactor for each circuit at each end
- LILO of Soja – Wanakbori 400 kV 2nd line at Prantij(GETCO) S/s
- Pindwara – Ahmedabad 765 kV D/c line along with 240 MVAr switchable line reactor for each circuit at each end (~250 km)
- Chittorgarh –Neemuch-II 765 kV D/c line (~ 120 km)
- Establishment of 3x500 MVA, 400/220 kV Pali Pooling Station along with 2x125 MVAr (420kV) Bus Reactor (1 GW injection at 220 kV level and 1 GW injection at 400 kV level)
- Pali – Jalore 400 kV D/c line (Quad Moose equivalent) (~120 km)

iii) Ajmer (2 GW Solar) & Nagaur (2 GW Solar)

- Establishment of 4x1500 MVA, 765/400 kV & 3x500 MVA, 400/220 kV Ajmer (New) Pooling Station along with 2x330 MVAr (765 kV) Bus Reactor & 2x125 MVAr (420kV) Bus Reactor (1 GW injection at 220 kV level and 1 GW injection at 400 kV level)
- Establishment of 3x500 MVA, 400/220 kV Nagaur Pooling Station along with 2x125 MVAr (420kV) Bus Reactor (1 GW injection at 220 kV level and 1 GW injection at 400 kV level)
- Ajmer (New) – Beawar 400 kV D/c line (Quad Moose equivalent) (~50 km)
- Nagaur – Ajmer (New) 400 kV D/c line (Quad Moose equivalent) (~120 km)
- Establishment of 765/400 kV, 2x1500 MVA Kota (New) Pooling Station along with 2x330 MVAr (765 kV) Bus Reactor & 2x125 MVAr (420kV) Bus Reactor
- Establishment of 765/400 kV, 2x1500 MVA Shujalpur (New) Pooling Station along with 2x330 MVAr (765 kV) Bus Reactor & 2x125 MVAr (420kV) Bus Reactor
- 765 kV Ajmer (New) - Kota (New) D/c line (~200 km) along with 240 MVAr switchable line reactor for each circuit at each end
- Kota (New) – Kota (PG) 400 kV D/c line (Quad Moose equivalent) (~50 km)
- Kota (New) - Shujalpur(New) 765 kV D/c line (~250 km) along with 240 MVAr switchable line reactor for each circuit at each end
- Shujalpur (New) – Shujalpur 400 kV (Quad Moose equivalent) D/c line (~50 km)

- LILO of 765 kV Bina-Indore S/c line at Shujalpur(new) S/s(~30 km)
- Shujalpur (New) — Bhopal (Sterlite) 765 kV D/c line (~90 km)

5.4.2 Transmission Schemes for evacuation of power from Rajasthan REZ in Jaisalmer (Ramgarh: 4 GW Wind, 6 GW Solar, 3 GW BESS; Fatehgarh-IV: 6 GW Wind, 6 GW Solar, 4 GW BESS), Jodhpur (Bhadla-IV: 2 GW Wind, 3 GW Solar, 2 GW BESS) & Barmer (Barmer I: 3 GW Wind, 4 GW Solar, 1.5 GW BESS; Barmer II: 6 GW Solar, 2 GW BESS)

i) Ramgarh (4 GW Wind, 6 GW Solar & 3 GW BESS), Distt. Jaisalmer

- Augmentation by 4x1500MVA, 765/400 kV ICTs at Ramgarh PS
- Augmentation by 400/220 kV, 6x500 MVA ICTs at Ramgarh PS (2.5 GW injection at 220 kV level and 2.5 GW injection at 400 kV level)*
- Establishment of 2x1500 MVA, 765/400 kV S/s along with 2x330 MVAr (765 kV) Bus Reactor & 2x125 MVAr (420kV) Bus Reactor near Hanumangarh in Rajasthan
- Establishment of 3x1500 MVA, 765/400 kV S/s along with 2x330 MVAr (765 kV) Bus Reactor & 2x125 MVAr (420kV) Bus Reactor near Sangrur in Punjab
- Ramgarh PS- Bhadla-III PS 765 kV D/c line (2nd) along with 240 MVAr switchable line reactor for each circuit at each end (~200 km)
- Bhadla-III PS – Hamumangarh 765 kV D/c line along with 330 MVAr switchable line reactor for each circuit at each end (~300 km)
- Hamumangarh - Sangrur 765 kV D/c line along with 240 MVAr switchable line reactor for each circuit at each end (~200 km)
- Hanumangarh – Fatehabad 400 kV D/c line along with 80 MVAr switchable line reactor for each circuit at Hanumangarh end (Quad Moose equivalent) (~130 km)
- LILO of both circuits of Patiala- Patran 400 kV D/c line at Sangrur S/s(~40 km)
- LILO of Kurukshetra – Jallandhar/Dhanansu 400 kV line at Sangrur S/s (~40 km)

*Already planned capacity at Ramgarh PS: 3x1500 MVA, 765/400 kV, 2x500 MVA, 400/220 kV with 1 GW injection at 220 kV level and about 1.9 GW injection at 400 kV level) along with 2x240 MVAr (765 kV) Bus Reactor & 2x125 MVAr (420 kV) Bus Reactor

ii) Fatehgarh-IV (6 GW Wind, 6 GW Solar & 4 GW BESS), Distt. Jaisalmer

- Establishment of 5x1500 MVA, 765/400 kV & 6x500 MVA, 400/220 kV Fatehgarh- IV (Section-2) Pooling Station along with 2x330 MVAr (765 kV) Bus Reactor & 2x125 MVAr (420kV) Bus Reactor (2.5 GW injection at 220 kV level and 2.5 GW injection at 400 kV level)
- Fatehgarh-IV (Section-2) PS - Jalore 765 kV D/c line along with 240 MVAr switchable line reactor for each circuit at Jalore end (~200 km)
- LILO of both ckts of 2nd D/c 765 kV Fatehgarh-III-Beawar 2xD/c line at Fatehgarh-IV (Section-2) PS
- Augmentation by 1x1500 MVA, 765/400 kV ICT at Fatehgarh-II PS (7th)
- Augmentation by 1x1500 MVA, 765/400 kV ICT at Fatehgarh-III PS (7th)
- Establishment of 2x1500 MVA, 765/400 kV Santrampur S/s along with 2x330 MVAr (765 kV) Bus Reactor & 2x125 MVAr (420kV) Bus Reactor
- Beawar-Chittorgarh 765 kV D/c line(2nd) along with 240 MVAr switchable line reactor for each circuit at each end (~200 km)

- Beawar- Neemuch-II 765 kV D/c line along with 240 MVAr switchable line reactor for each circuit at each end (~200 km)
- Neemuch-II - Santrampur 765 kV D/c line along with 240 MVAr switchable line reactors for each circuit at each end (~260 km)
- Santrampur -Dhule(BDTCL) 765 kV D/c line along with 330 MVAr switchable line reactor for each circuit at each end (~300 km)
- Establishment of 3x1500 MVA, 765/400 kV & 4x500 MVA, 400/220 kV Boisar-II S/s along with 2x330 MVAr (765 kV) Bus Reactor & 2x125 MVAr (420kV) Bus Reactor
- Dhule(BDTCL)- Boisar-II 765 kV D/c line along with 330 MVAr switchable line reactor for each circuit at each end (~300 km)
- Boisar-II – Velgaon(MSETCL) 400 kV D/c (Quad Moose equivalent) line (~50km.) (Additional 400 kV as well as 220 kV outlets shall be planned in coordination with MSETCL)
- LILO of Navsari(New) – Padghe 765 kV D/c line at Boisar-II (~20 km)
- Santrampur – Asoj 400 kV D/c line along with 80 MVAr switchable line reactor for each circuit at Santrampur end (~150 km)*
- Fatehgarh-IV (Section-2) PS – Barmer-II 400 kV D/c line (Quad Moose equivalent) (~30 km)
- Bhinmal-Fatehgarh-IV (Section-2) PS 400 kV D/c line (Quad Moose equivalent) (200 km)

*Issue of high fault level at Asoj to be resolved in coordination with GETCO

iii) Bhadla-IV (2 GW Wind, 3 GW Solar & 2 GW BESS), Distt. Jodhpur

- Establishment of 3x500 MVA, 400/220 kV Bhadla- IV Pooling Station along with 2x125 MVAr (420kV) Bus Reactor (1 GW injection at 220 kV level and 1 GW injection at 400 kV level)
- Bhadla-IV – Bhadla-III 400 kV D/c line (Quad Moose Equivalent) (~30 km)
- Augmentation by 1x1500MVA, 765/400 kV ICT (3rd) at Bhadla-III PS

iv) Barmer-I (3 GW Wind, 4 GW Solar & 1.5 GW BESS)

- Establishment of 3x1500 MVA, 765/400 kV & 5x500 MVA, 400/220 kV Barmer-I Pooling Station along with 2x330 MVAr (765 kV) Bus Reactor & 2x125 MVAr (420kV) Bus Reactor (2 GW injection at 220 kV level and 2 GW injection at 400 kV level)
- Barmer-I – Jalore 765 kV D/c line along with 240 MVAr switchable line reactor for each circuit at Jalore end (~160km)
- Jalore – Pindwara 765 kV D/c line (2nd) along with 240 MVAr switchable line reactor for each circuit at Jalore end (~100 km)

v) Barmer-II (6 GW Solar, 2 GW BESS)

- Establishment of 5x500 MVA, 400/220 kV Barmer-II Pooling Station along with 2x125 MVAr (420kV) Bus Reactor (2 GW injection at 220 kV level and 2 GW injection at 400 kV level)
- Barmer-I - Barmer-II 400 kV D/c Line (Quad Moose equivalent) (~30 km)
- Barmer-II -Barmer-II (HVDC) 400 kV 2xD/c line (Quad Moose equivalent) (~20 km)

Common HVDC system for Fatehgarh-IV, Barmer-I and Barmer-II

- 6000MW, ±800 kV HVDC terminal station at a suitable location near Barmer-II [Barmer-II (HVDC)] #
- 6000MW, ±800 kV HVDC terminal station at a suitable location near Jabalpur#
- Establishment of 5x1500MVA, 765/400 kV ICT at pooling station at suitable location near Jabalpur along with 2x330MVAr (765 kV) bus reactor#

- ±800kV HVDC line between Barmer-II (HVDC)and Jabalpur PS# (~1100 km)
- Jabalpur(HVDC)-Jabalpur Pool 765 kV 2xD/c line(~50 km)
- Jabalpur Pool – Jabalpur (PG) 400 kV (2nd) D/c line (~20 km) ^

 # The HVDC system to be developed initially for 6000 MW with a provision for upgradation to 8000 MW based on the future requirements. The type of HVDC (VSC or LCC), requirement of reactive power support etc. would be decided at the time of implementation based on the system requirement.

^ Suitable scheme to control fault level at Jabalpur Pool/ Jabalpur (PG) S/s to be planned for fault level control.

Note: For the planned transmission schemes in Northern Region, dynamic compensation requirement like STATCOMs, Synchronous Condensers etc. would be identified separately based on the detailed reactive power planning studies and the Short Circuit Ratios (SCRs) at different locations. Requirement of Synchronous condensers based on inertia considerations will also be assessed based on detailed studies.

Transmission system for identified potential RE zones in Rajasthan is depicted in Figure 2.

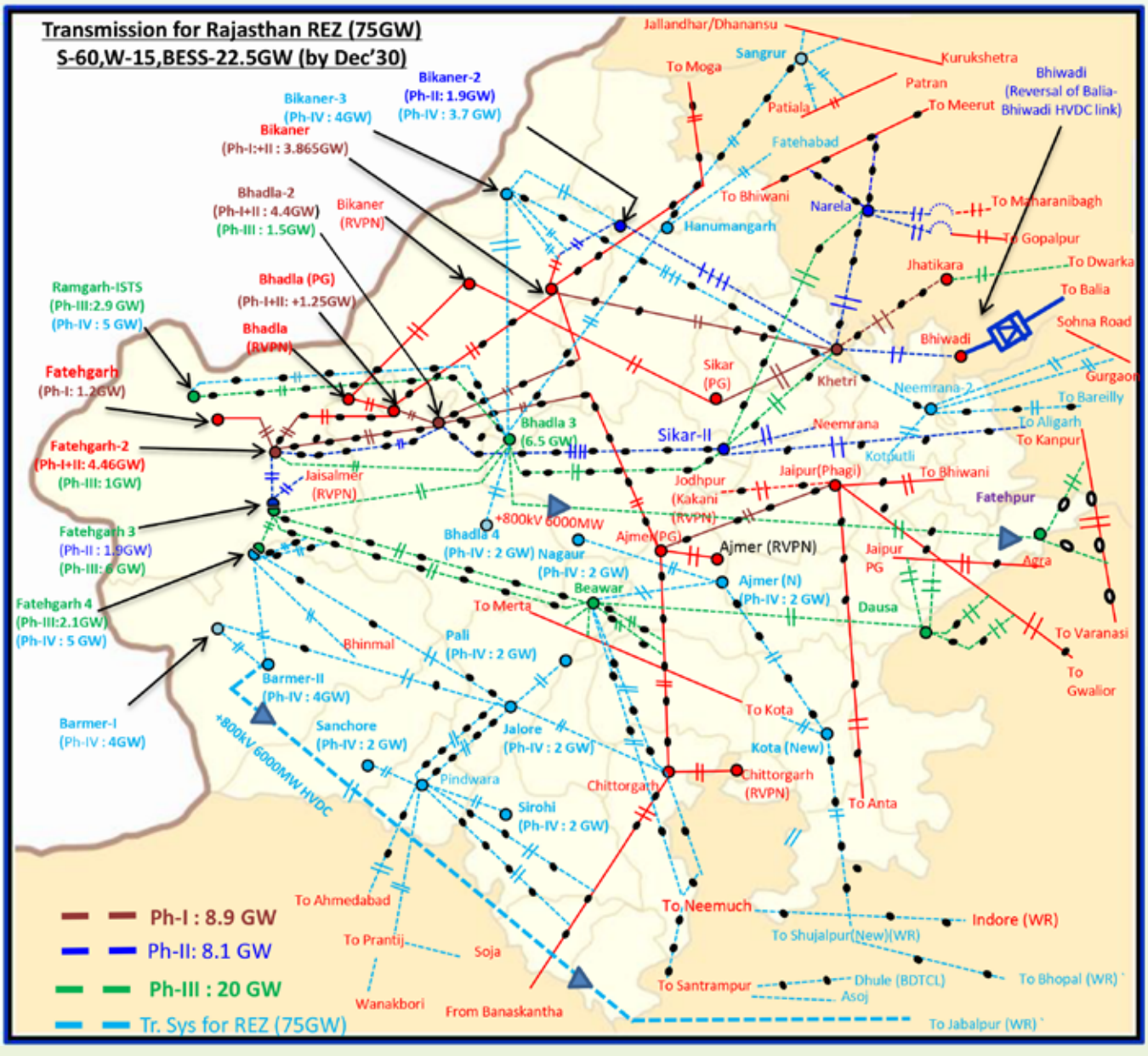

Fig. 2: Transmission system for identified potential RE zones in Rajasthan

Tentative phasing of transmission system is given at **Annex- IV.**

5.5 Transmission schemes for RE Potential Zones in Western Region (20.5 GW)

- MNRE/SECI has identified 20.5 GW potential REZs (9 GW Wind & 11.5 GW Solar) in Western Region.
- Details of the identified RE potential zones along with likely storage to be installed and the requirement of evacuation system is given below:

State/District	Pooling Station	Identified Potential (GW)		Maximum Dispatch (GW)	BESS (GW) (to be set up by RE generators)	Evacuation System (GW)
		Wind	Solar			
Gujarat						
Off-shore	Mahuva / Ubhrat	5	0	5	0	5
Maharashtra						
Sholapur	Sholapur	0	1	1	0.5	0.5
Dhule	Dhule	1	1	1.5	0.3	1.2
Kallam	Kallam/Parli	1	1	1.5	0.3	1.2
Location to be firmed up*		0	2.5	2.5	0	2.5
Sub Total (Maharashtra)		**2**	**5.5**	**6.5**	**1.1**	**5.4**
Madhya Pradesh						
Neemuch	Neemuch	2	0	2	0	2
Sagar	Sagar		1.5	1.5	0	1.5
Morena	Morena	0	3.9	3.9	0	3.9
Khandwa	Khandwa		0.6	0.6	0	0.6
Sub Total (Madhya Pradesh)		**2**	**6**	**8**	**0**	**8**
Total (Western Region)		**9**	**11.5**	**19.5**	**1.1**	**18.4**

* Transmission system would be planned once the location of RE potential zone is firmed up by SECI/MNRE

5.5.1 Transmission Schemes for 5 GW Off-shore Wind farm in Gujarat

Offshore Wind (Mahuva / Ubhrat): 5 GW Offshore Wind

a) For 3.7 GW (B3 Pocket: 1 GW, B4 Pocket: 1.11 GW & B5 Pocket: 1.59 GW)

- Establishment of 9x500 MVA, 400/220 kV Mahuva Onshore Pooling Station (Mahuva PS) (with space provision for upgradation to 765 kV level so as to cater to future Offshore Wind Projects adjacent to B3, B4, B5 pockets in future)
- Off Shore Sub-Station (OSS) B3 – Mahuva Onshore PS 220 kV 2xS/c Submarine cable (~45 km)
- Off Shore Sub-Station (OSS) B4 – Mahuva Onshore PS 220 kV 3xS/c cables (~44 km)
- Off Shore Sub-Station (OSS) B5 – Mahuva Onshore PS 220 kV 4xS/c cables (~45 km)
- Mahuva Onshore PS – Vataman* 400 kV T/c line (Out of 2xD/c line, one D/c strung as S/c) (190 km) (Quad Moose) with 63MVAr & 50MVAr, 420kV switchable line reactors on each ckt at Mahuva & Vataman ends respectively
- Installation of 4x1500MVA, 765/400 kV ICTs at Vataman* along with 2x125 MVAr (420kV) Bus Reactor
- Suitable Static Compensation / Dynamic Compensation with Mechanical Switched Reactor (MSR)

Note: *Vataman S/s has been planned through LILO of Lakadia-Vadodara 765 kV D/c line at Vataman with Khavda Ph-III (7 GW) and Dholera (Ph-I: 2GW)

b) For 1.24 GW (B6 Pocket)

- Establishment of 4x500 MVA, 400/220 kV Ubhrat Onshore Pooling Station (Ubhrat PS) (with space provision for upgradation to 765 kV level so as to cater to future Offshore Wind Projects adjacent to B6 pocket)
- Off Shore Sub-Station (OSS) B6 – Ubhrat Onshore PS 220 kV 3xS/c cables (~55 km)
- Ubhrat Onshore PS – Vapi 400 kV D/c line (100km) (Quad Moose) with 50MVAr, 420kV switchable line reactors on each ckt at Ubhrat Onshore PS end
- Suitable Static Compensation / Dynamic Compensation with MSR

Note:

1. *The no. of 220 kV Submarine Cables has been considered assuming capacity of one three phase cable as 500 MW. However, the requirement of cables (single phase or three phase and its voltage class) would be further firmed up while detailing the scheme.*
2. *Exact Reactive compensation to be worked out based on data being received from submarine cable manufactures pertaining to MVAr generation from the cables.*

Transmission system for off-shore wind potential zones in Gujarat is depicted in Figure 3.

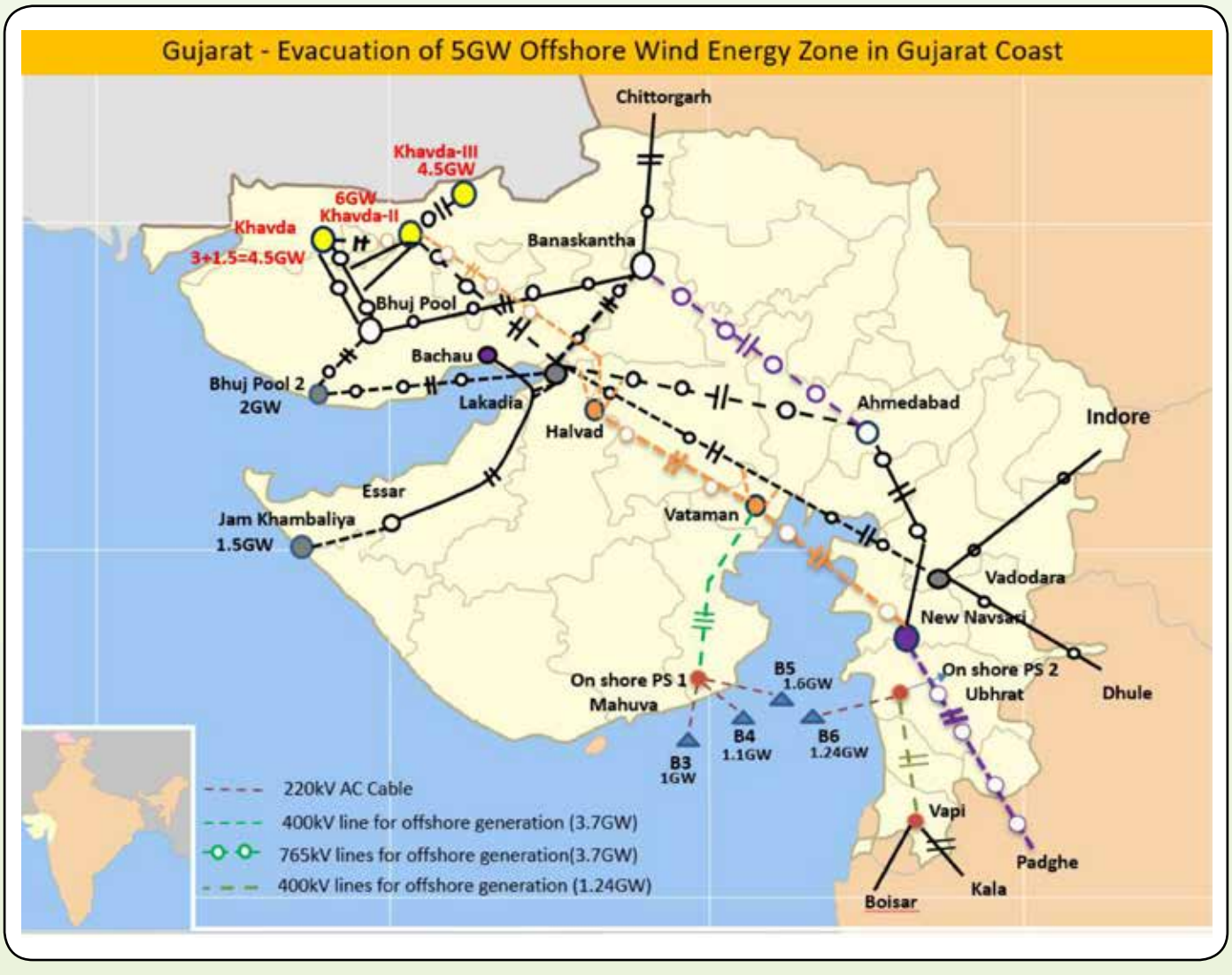

Fig. 3: Transmission system for off-shore wind potential zones in Gujarat

5.5.2 Transmission Schemes for evacuation of power from 7.5 GW REZ in Maharashtra at Sholapur, Dhule, Kallam & additional locations to be firmed up (2 GW Wind, 5.5 GW Solar)

- MNRE/SECI has identified 7.5 GW RE potential (2 GW Wind & 5.5 GW Solar) in Maharashtra.
- Details of the identified RE potential zones along with likely storage to be installed and the requirement of evacuation system is given below:

State/District	Pooling Station	Identified Potential (GW)		Maximum Dispatch (GW)	BESS (GW) (to be set up by RE generators)	Evacuation System (GW)
		Wind	Solar			
Maharashtra						
Sholapur	Sholapur	0	1	1	0.5	0.5
Dhule	Dhule	1	1	1.5	0.3	1.2
Kallam	Kallam	1	1	1.5	0.3	1.2
Location to be firmed up*		0	2.5	2.5	0	2.5
Sub Total (Maharashtra)		**2**	**5.5**	**6.5**	**1.1**	**5.4**

* Transmission system would be planned once the location of RE potential zone is firmed up by SECI/MNRE

i) Solapur: (1 GW Solar, 0.5 GW BESS)

- Direct interconnection at 400 kV Solapur (PG) S/s.

ii) Dhule: (1 GW Solar, 1 GW Wind, 0.3 GW BESS)

- Establishment of 4x500 MVA, 400/220 kV Pooling Station near Dhule along with 2x125 MVAr (420kV) Bus Reactor
- Dhule PS – Dhule (TBCB) 400 kV D/c Line (Quad Moose) (60 km)

iii) Kallam/Parli: (1 GW Solar, 1 GW Wind, 0.3 GW BESS)

0.3 GW at Parli:

- Direct interconnection at 220 kV level of 400/220 kV Parli (PG) S/s

0.7 GW at Parli (New):

- Direct interconnection at 400 kV level of 765/400 kV Parli (New) S/s

1 GW at Kallam:

- Augmentation of Kallam Pooling Station by 2x500 MVA, 400/220 kV ICT
- 1x125 MVAr bus reactor (2nd) at Kallam PS

Transmission system for potential RE zones in Maharashtra is depicted in Figure 4.

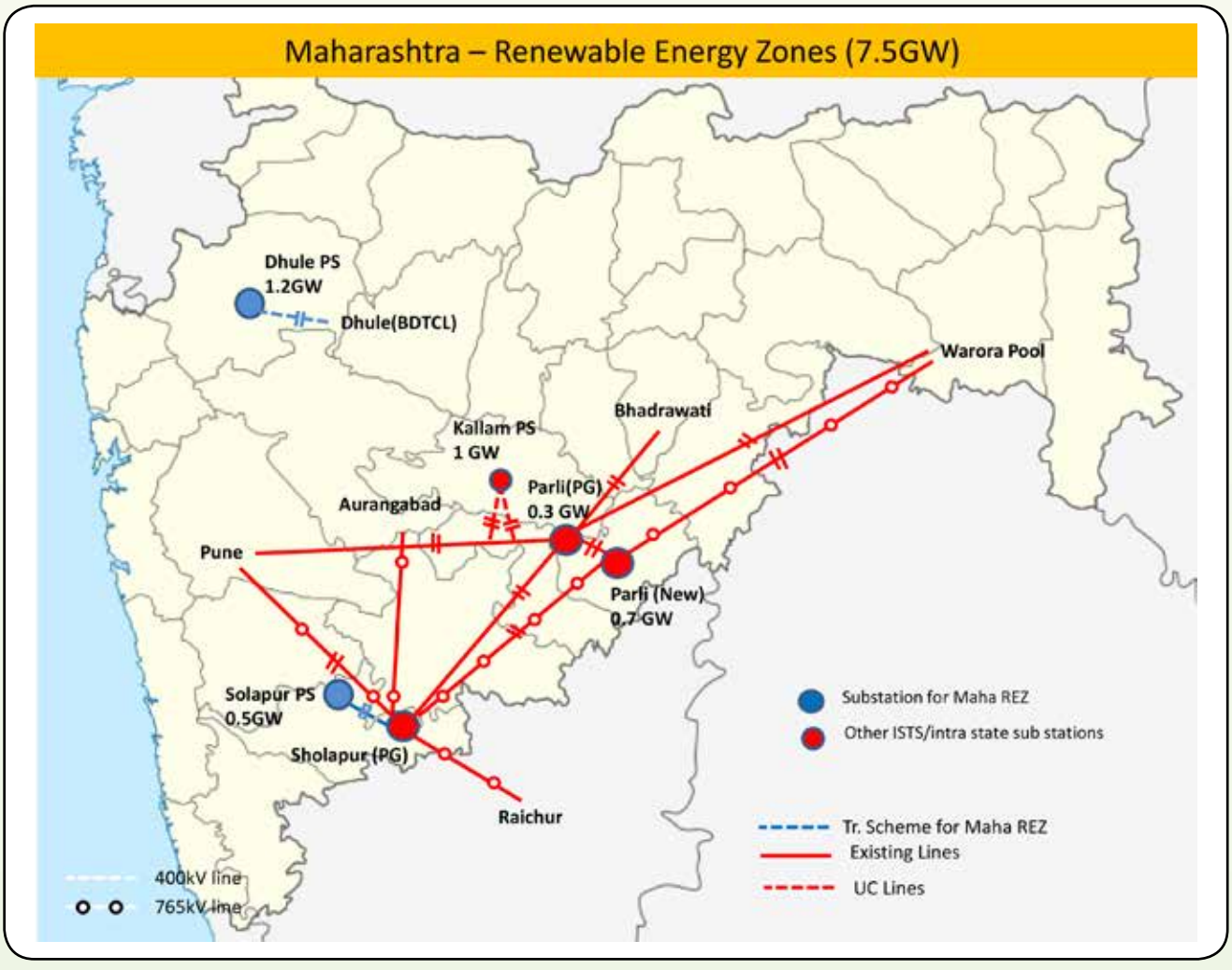

Fig. 4: Transmission system for potential RE Zones in Maharashtra

5.5.3 Transmission Scheme for evacuation of power from 8 GW REZ (2 GW Wind, 6 GW Solar) in Madhya Pradesh at Neemuch, Sagar, Morena & Khandwa

- MNRE/SECI has identified 8 GW RE potential (2 GW Wind & 6 GW Solar) in Madhya Pradesh.
- Details of the identified RE potential zones along with likely storage to be installed and the requirement of evacuation system is given below:

State/District	Pooling Station	Identified Potential (GW)		Maximum Dispatch (GW)	BESS (GW) (to be set up by RE generators)	Evacuation System (GW)
		Wind	Solar			
Madhya Pradesh						
Neemuch	Neemuch	2	0	2	0	2
Sagar	Sagar		1.5	1.5	0	1.5
Morena	Morena	0	3.9	3.9	0	3.9
Khandwa	Khandwa		0.6	0.6	0	0.6
Sub Total (Madhya Pradesh)		**2**	**6**	**8**	**0**	**8**

i) Neemuch: 2 GW Wind

- Establishment of 2x1500 MVA 765/400 kV, 4x500 MVA, 400/220 kV Neemuch-II PS along with 2x330 MVAr (765 kV) Bus Reactor and 1x125 MVAr (420 kV) Bus Reactor

- Neemuch-II PS – Indore 765 kV D/c line (250 km) with 240 MVAr, 765 kV switchable line reactors on each ckt at Neemuch & Indore ends respectively
- Augmentation of 765/400 kV transformation capacity at Indore Substation by 1x1500 MVA ICT (3rd) on Section-A.

  Further, Neemuch-II may be interconnected to Chittorgarh S/s in future so as to establish Indore – Neemuch-II – Chittorgarh 765 kV D/c corridor.

ii) Morena: 3.9 GW Solar

- Establishment of 9x500 MVA, 400/220 kV Pooling Station along with 2x125 MVAr (420 kV) Bus Reactor near Morena
- Morena PS – Morena (TBCB) 400 kV D/c (quad) line (~50 km)
- Morena PS – South Gwalior (near Datia)* 400 kV D/c (quad moose) line (~100 km) with 50 MVAr switchable line reactors on each ckt at Morena PS end

*A new 765/400/220 kV S/s is being planned south of Gwalior so as to cater to increase in demand in the area. The same is proposed to be utilized for evacuation of power from Morena (3.9 GW) Solar Park

iii) Sagar: 1.5 GW Solar

- Establishment of 4x500 MVA, 400/220 kV Sagar PS along with 2x125 MVAr (420kV) Bus Reactor
- Sagar – Damoh(PG) 400 kV D/c (quad moose) line (~80km)

iv) Khandwa: 0.6 GW Solar

- To be integrated at existing Khandwa(PG) 400/220 kV S/s (Madhya Pradesh is planning to connect the RE capacity to intra-state system)

Transmission system for potential RE zones in Madhya Pradesh is depicted in Figure 5.

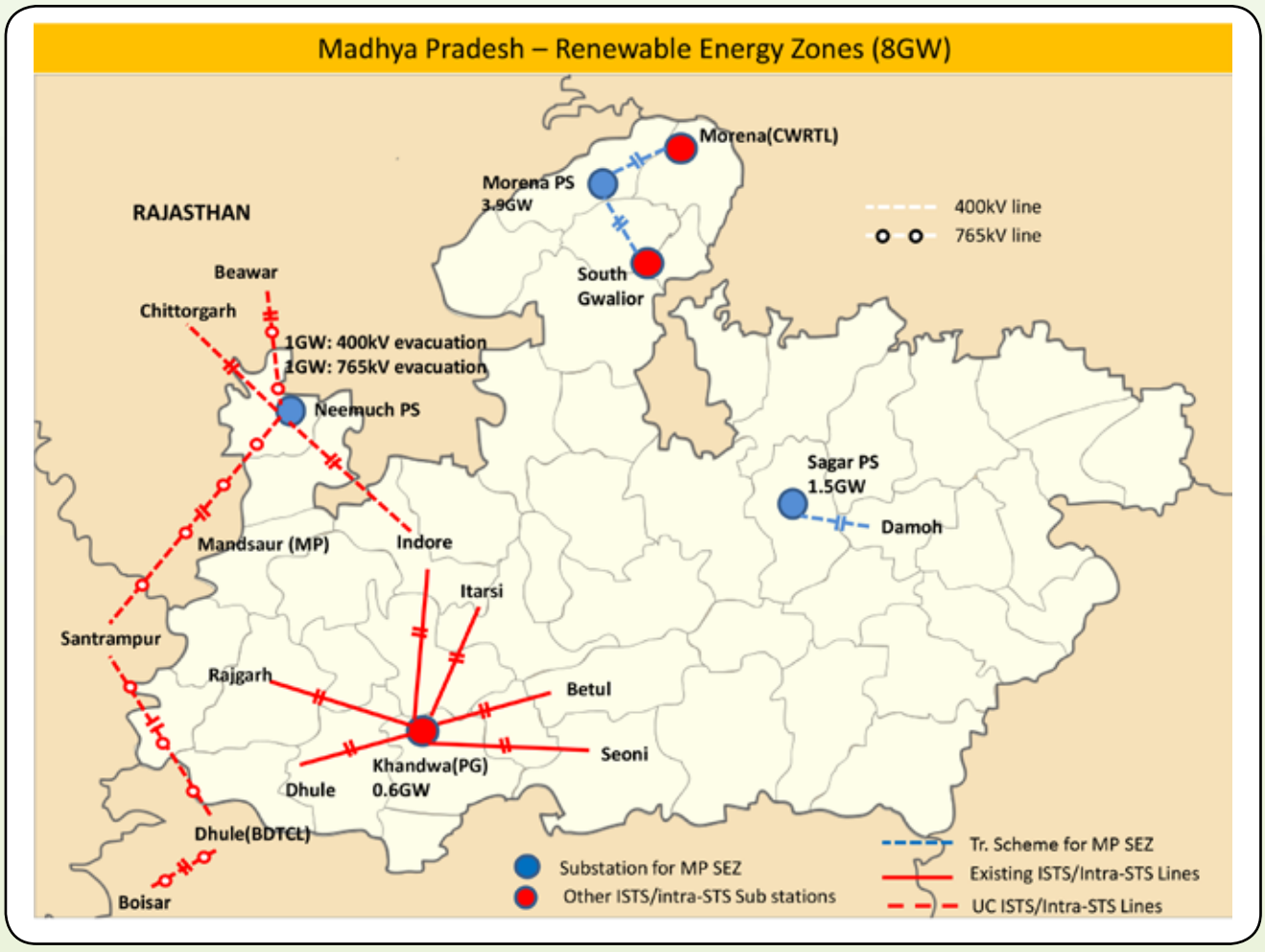

Fig. 5: Transmission system for potential RE Zones in Madhya Pradesh

Tentative phasing of transmission system is given at **Annex-IV.**

Note: *For the planned transmission schemes in Western Region, dynamic compensation requirement like STATCOMs, Synchronous Condensers etc. would be identified separately based on the detailed reactive power planning studies and the Short Circuit Ratios (SCRs) at different locations. Requirement of Synchronous condensers based on inertia considerations will also be assessed based on detailed studies.*

5.6 Transmission schemes for RE Potential Zones in Southern Region (86 GW)

- MNRE/SECI has identified 86 GW potential REZs (34 GW Wind & 52 GW Solar) in Southern Region.
- Details of the identified RE potential zones along with likely storage to be installed and the requirement of evacuation system is given below:

State/District	Pooling Station	Identified Potential (GW)		Maximum Dispatch (GW)	BESS (GW) (to be set up by RE generators)	Evacuation System (GW)
		Wind	Solar			
Andhra Pradesh						
Anantapur	Anantapur, Anantapur-II	10	10	15	5	10
Kurnool	Kurnool-IV, Kurnool-V	8	15	18	6	12
Kadapa	Kadapa-II	0	8	8	3	5
Sub Total (Andhra Pradesh)		**18**	**33**	**41**	**14**	**27**
Karnataka						
Koppal	Koppal-II	2	2	3	1	2
Gadag	Gadag-II	2	2	3	1	2
Devanagere/ Chitragurga	Devanagere/ Chitragurga	2	2	3	1	2
Bijapur	Bijapur	2	0	2		2
Bellary	Bellary	0	1.5	1.5		1.5
Tumkur	Tumkur-II	0	1.5	1.5		1.5
Sub Total (Karnataka)		**8**	**9**	**14**	**3**	**11**
Telangana						
Rangareddy	Rangareddy	1	2.5	3	1	2
Medak	Medak	1	2.5	3	1	2
Nizamabad	Nizamabad-II	1	2.5	3	1	2
Karimnagar	Karimnagar	0	2.5	2.5	0	2.5
Sub Total (Telangana)		**3**	**10**	**11.5**	**3**	**8.5**
Tamil Nadu						
Avaraikulam, Tirunelveli (Off-shore)	Avaraikulam, Tirinelveli	5	0	5	0	5
Total (Southern Region)		**34**	**52**	**71.5**	**20**	**51.5**

5.6.1 Transmission System for 51 GW REZ (18 GW Wind & 33 GW Solar) in Andhra Pradesh

- MNRE/SECI has identified 51 GW RE potential (18 GW Wind & 33 GW Solar) in Andhra Pradesh.
- Details of the identified RE potential zones along with likely storage to be installed and the requirement of evacuation system is given below:

State/District	Pooling Station	Identified Potential (GW)		Maximum Dispatch (GW)	BESS (GW) (to be set up by RE generators)	Evacuation System (GW)
		Wind	Solar			
Andhra Pradesh						
Kurnool	Kurnool-IV, Kurnool-V	8	15	18	6	12
Anantapur	Anantapur, Anantapur-II	10	10	15	5	10
Kadapa	Kadapa-II	0	8	8	3	5
Sub Total (Andhra Pradesh)		**18**	**33**	**41**	**14**	**27**

i) Transmission System for integration of Kurnool REZ-I (7.5 GW Solar, 4 GW Wind, 3 GW BESS)

- Establishment of 5x1500 MVA, 765/400 & 7x500 MVA, 400/220 kV Kurnool-IV Pooling Station near Kurnool, Andhra Pradesh along with 2x330 MVAr (765 kV) & 2x125 MVAr (400 kV) bus reactors at Kurnool-IV PS (3 GW injection at 220 kV level and 3 GW injection at 400 kV level)
- Kurnool-IV – Kurnool-III PS 765 kV D/c line (~100 km)
- Kurnool-IV – Bidar PS 765 kV D/c line with 240 MVAr SLR at both ends (~280 km)

ii) Transmission System for integration of Kurnool REZ-II (7.5 GW Solar, 4 GW Wind, 3 GW BESS)

- Establishment of 5x1500 MVA, 765/400 kV & 7x500 MVA, 400/220 kV Kurnool-V Pooling Station near Kurnool, Andhra Pradesh along with 2x330 MVAr (765 kV) & 2x125 MVAr (400 kV) bus reactors at Kurnool-V PS (3 GW injection at 220 kV level and 3 GW injection at 400 kV level)
- Kurnool-V – Chilakaluripeta 765 kV D/c line with 330 MVAr SLR at Kurnool-V PS end (~210 km)
- Kurnool-V – Kurnool-IV 765 kV D/c line (~100 km)
- Chilakaluripeta – Podili 400 kV (quad) D/c line (~100 km)
- Augmentation by 2x1500 MVA, 765/400 kV ICTs at Chilakaluripeta 765/400 kV substation
- Augmentation by 2x1500 MVA, 765/400 kV ICTs at Maheshwaram 765/400 kV substation

iii) Transmission System for integration of Anantapur REZ (8 GW Solar, 8 GW Wind, 4 GW BESS)

- Establishment of 6x1500 MVA, 765/400 kV & 9x500 MVA, 400/220 kV Anantapur-II Pooling Station near Kurnool, Andhra Pradesh along with 2x330 MVAr (765 kV) & 2x125 MVAr (400 kV) bus reactors at Anantapur-II PS (4 GW injection at 220 kV level and 4 GW injection at 400 kV level)
- Anantapur-II – Cuddapah 765 kV D/c line with 240 MVAr SLR at Anantapur-II PS (~250 km)
- Anantapur-II – Kurnool-V PS 765 kV D/c line (~100 km)

iv) Transmission System for integration of Anantapur REZ (2 GW Solar, 2 GW Wind, 1 GW BESS integrated with already planned Anantpur pooling station under 66.5 GW)

- Augmentation by 3x500 MVA, 400/220 kV ICTs at Anantapur PS (Additional 1 GW injection at 220 kV level and 1 GW injection at 400 kV level)

v) Transmission System for integration of Kadapa REZ (8 GW Solar, 3 GW BESS)

- Establishment of 4x1500 MVA, 765/400 kV & 6x500 MVA, 400/220 kV Pooling Station near Kadapa (Kadapa II PS), Andhra Pradesh along with 2x330 MVAr (765 kV) & 2x125 MVAr (400 kV) bus reactors at Kadapa-II PS (2.5 GW injection at 220 kV level and 2.5 GW injection at 400 kV level)
- LILO of both circuits of Anantapur-II – Cuddapah 765 kV D/c line at Kadapa-II PS (~10 km)
- Kadapa-II PS – Thiruvalam 765 kV D/c line with 240 MVAr SLR at both ends (~250 km)

Transmission system for potential RE zones in Andhra Pradesh is depicted in Figure 6.

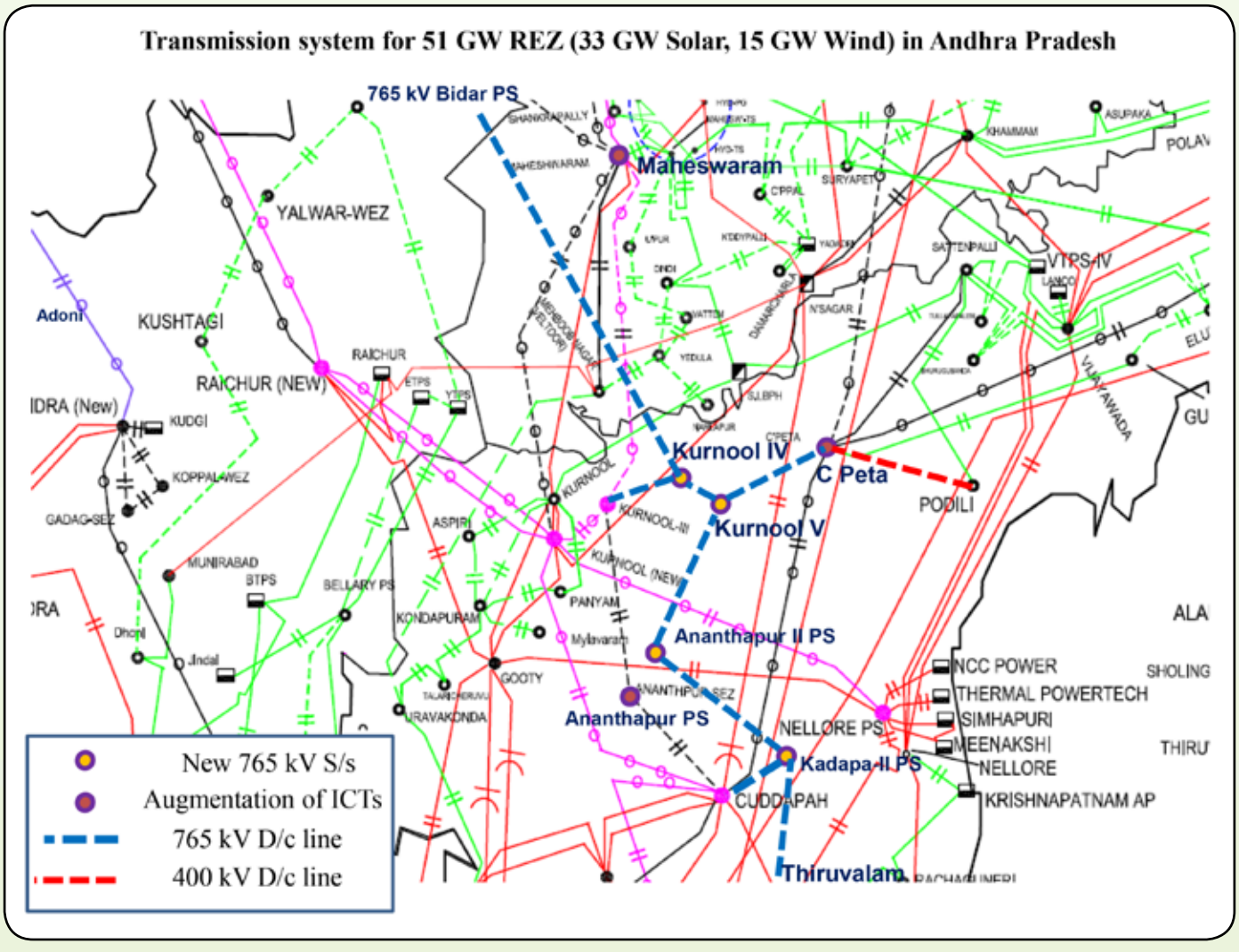

Fig. 6: Transmission system for potential RE Zones in Andhra Pradesh

5.6.2 Transmission System for 17 GW REZ (8 GW Wind & 9 GW Solar) in Karnataka

- MNRE/SECI has identified 17 GW RE potential (8 GW Wind & 9 GW Solar) in Karnataka.
- Details of the identified RE potential zones along with likely storage to be installed and the requirement of evacuation system is given below:

State/District	Pooling Station	Identified Potential (GW)		Maximum Dispatch (GW)	BESS (GW) (to be set up by RE generators)	Evacuation System (GW)
		Wind	Solar			
Karnataka						
Koppal	Koppal-II	2	2	3	1	2
Gadag	Gadag-II	2	2	3	1	2
Devanagere/ Chitragurga	Devanagere/ Chitragurga	2	2	3	1	2
Bijapur	Bijapur	2	0	2		2
Bellary	Bellary	0	1.5	1.5		1.5
Tumkur	Tumkur-II	0	1.5	1.5		1.5
Sub Total (Karnataka)		**8**	**9**	**14**	**3**	**11**

i) Transmission System for integration of Koppal REZ (2 GW Wind, 2 GW Solar, 1 GW BESS)

- Establishment of 6x1500 MVA, 765/400 kV & 3x500 MVA, 400/220 kV Koppal-II Pooling Station near Koppal, Karnataka along with 2x330 MVAr (765 kV) & 2x125MVAr (400 kV) bus reactors at Koppal-II PS (1 GW injection at 220 kV level and 1 GW injection at 400 kV level)
- Koppal-II PS – Narendra (New) 765 kV D/c line with 330 MVAr SLR at Koppal-II PS end (~150 km)
- Koppal-II PS – Raichur 765 kV D/c line with 330 MVAr SLR at Koppal-II PS end (~190 km)

ii) Transmission System for integration of Gadag REZ (2 GW Wind, 2 GW Solar, 1 GW Storage)

- Establishment of 3x500 MVA, 400/220 kV Gadag-II Pooling Station near Gadag, Karnataka along with 2x125 MVAr 420kV bus reactors at Gadag-II PS (1 GW injection at 220 kV level and 1 GW injection at 400 kV level)
- Gadag-II PS – Koppal-II PS 400 kV (Quad Moose equivalent) D/c line (~65km)

iii) Transmission System for integration of Devanagere/Chitragurga REZ (2 GW Wind, 2 GW Solar, 1 GW BESS)

- Establishment of 3x500 MVA, 400/220 kV Devanagere / Chitragurga Pooling Station near Devanagere/ Chitragurga, Karnataka along with 2x125 MVAr 420 kV bus reactors at Devanagere / Chitragurga PS (1 GW injection at 220 kV level and 1 GW injection at 400 kV level)
- Devanagere / Chitragurga PS – Koppal-II PS 400 kV (Quad Moose equivalent) D/c line (~100 km)

iv) Transmission System for integration of Bijapur REZ (2 GW Wind)

- Establishment of 3x500 MVA, 400/220 kV Bijapur Pooling Station near Bijapur (Vijayapura), Karnataka along with 2x125 MVAr, 400 kV bus reactors at Bijapur PS (1 GW injection at 220 kV level and 1 GW injection at 400 kV level)
- Bijapur PS – Koppal-II PS 400 kV (Quad Moose equivalent) D/c line (~100 km)

v) Transmission System for integration of Tumkur REZ (1.5 GW Solar)

- Establishment of 4x500 MVA, 400/220 kV Tumkur-II Pooling Station near Tumkur, Karnataka along with 2x125 MVAr 400 kV bus reactors at Tumkur-II PS
- Tumkur-II PS – Tumkur(Pavagada) 400 kV (Quad Moose equivalent) D/c line (~100 km)

vi) Transmission System for integration of Bellary REZ (1.5 GW Solar)

- Establishment of 4x500 MVA, 400/220 kV Bellary Pooling Station near Bellary, Karnataka along with 2x125 MVAr 400 kV bus reactors at Bellary PS
- Bellary PS – Koppal-II PS 400 kV (Quad Moose equivalent) D/c line (~100 km)

Transmission system for potential RE zones in Karnataka is depicted in Figure 7.

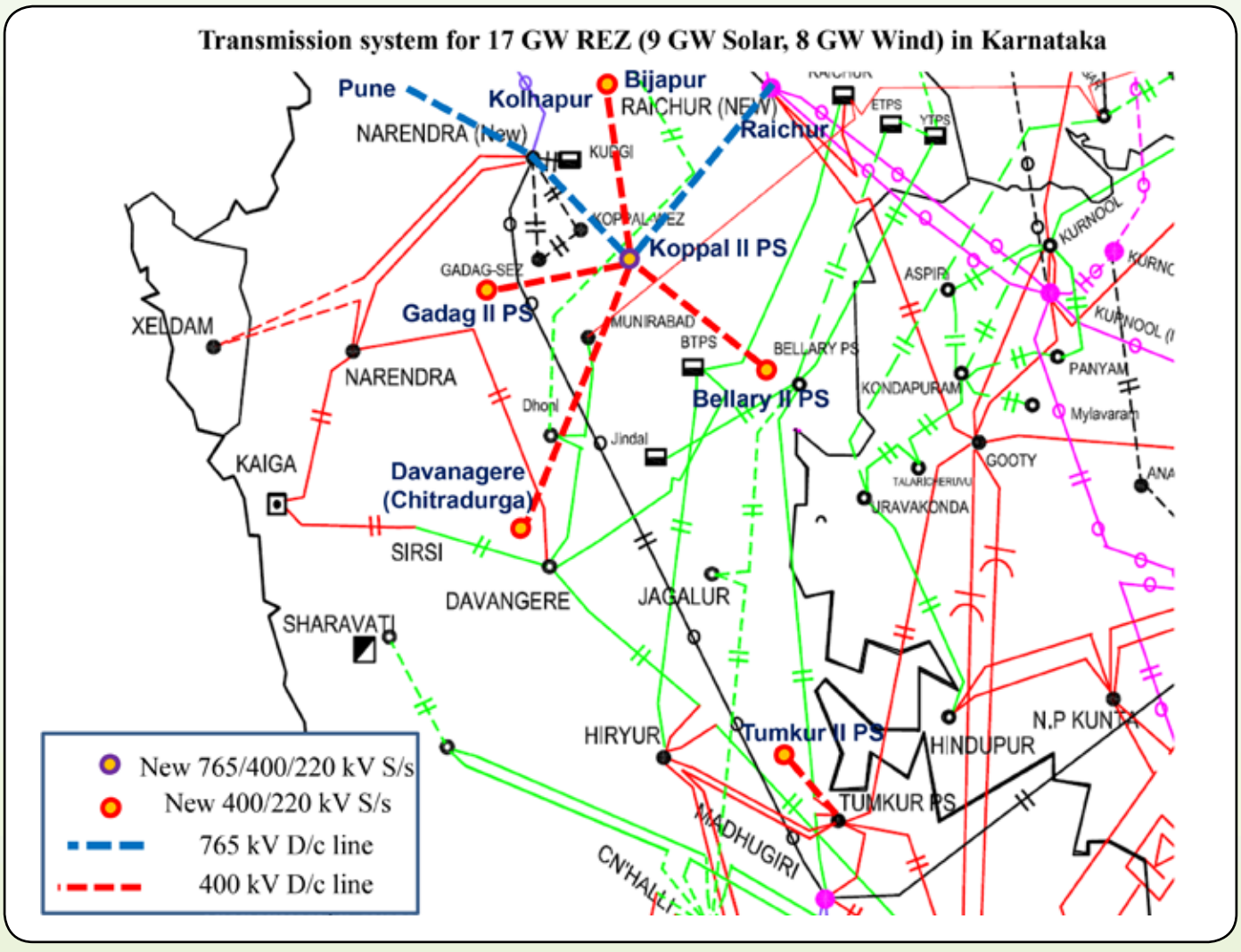

Fig. 7: Transmission system for potential RE Zones in Karnataka

5.6.3 Transmission System for 13 GW REZ (3 GW Wind & 10 GW Solar) in Telangana

- MNRE/SECI has identified 13 GW REZ potential (3 GW Wind and 10 GW solar) in Telangana.
- Details of the identified RE potential zones along with likely storage to be installed and the requirement of evacuation system is given below:

State/District	Pooling Station	Identified Potential (GW)		Maximum Dispatch (GW)	BESS (GW) (to be set up by RE generators)	Evacuation System (GW)
		Wind	Solar			
Telangana						
Rangareddy	Rangareddy	1	2.5	3	1	2
Medak	Medak	1	2.5	3	1	2
Nizamabad	Nizamabad-II	1	2.5	3	1	2
Karimnagar	Karimnagar	0	2.5	2.5		2.5
Sub Total (Telangana)		**3**	**10**	**11.5**	**3**	**8.5**

i) Transmission System for integration of Nizamabad REZ (1 GW Wind, 2.5 GW Solar, 1 GW BESS)

- Establishment of 6x1500 MVA, 765/400 kV & 3x500 MVA, 400/220 kV Pooling Station near Nizamabad (Nizamabad-II) along with 2x330 MVAr (765 kV) & 2x125 MVAr (400 kV) bus reactors at Nizamabad-II PS (1 GW injection at 220 kV level and 1 GW injection at 400 kV level)
- Augmentation by 1x1500 MVA, 765/400 kV ICT at Nizamabad (PG) S/s
- Nizamabad-II PS – Nizamabad(PG) 765 kV 2x D/c line (~30 km)
- Nizamabad-II PS – Warangal (New) 765 kV D/c line with 330 MVAr SLR at Nizamabad-II PS (~180 km)

ii) Transmission System for integration of Medak REZ (1 GW Wind, 2.5 GW Solar, 1 GW BESS)

- Establishment of 3x500 MVA, 400/220 kV Pooling Station near Medak (Medak PS) along with 2x125 MVAr bus reactors at Medak PS (1 GW injection at 220 kV level and 1 GW injection at 400 kV level)
- Medak PS – Nizamabad-II 400 kV (Quad Moose equivalent) D/c line (~60 km)

iii) Transmission System for integration of Rangareddy REZ (1 GW Wind, 2.5 GW Solar, 1 GW BESS)

- Establishment of 3x500 MVA, 400/220 kV Rangareddy Pooling Station near Rangareddy along with 2x125 MVAr bus reactors at Rangareddy PS (1 GW injection at 220 kV level and 1 GW injection at 400 kV level)
- Rangareddy PS – Nizamabad-II 400 kV (Quad Moose equivalent) D/c line with 80 MVAr SLR at Rangareddy PS (~155 km)

iv) Transmission System for integration of Karimnagar REZ (2.5 GW Solar)

- Establishment of 4x500 MVA, 400/220 kV Pooling Station near Karimnagar (Karimnagar PS) along with 2x125 MVAr bus reactors at Karimnagar PS (1.5 GW injection at 220 kV level and 1 GW injection at 400 kV level)
- Karimnagar PS – Nizamabad-II 400 kV (Quad) D/c line (~100 km)

Transmission system for potential RE zones in Telangana is depicted in Figure 8.

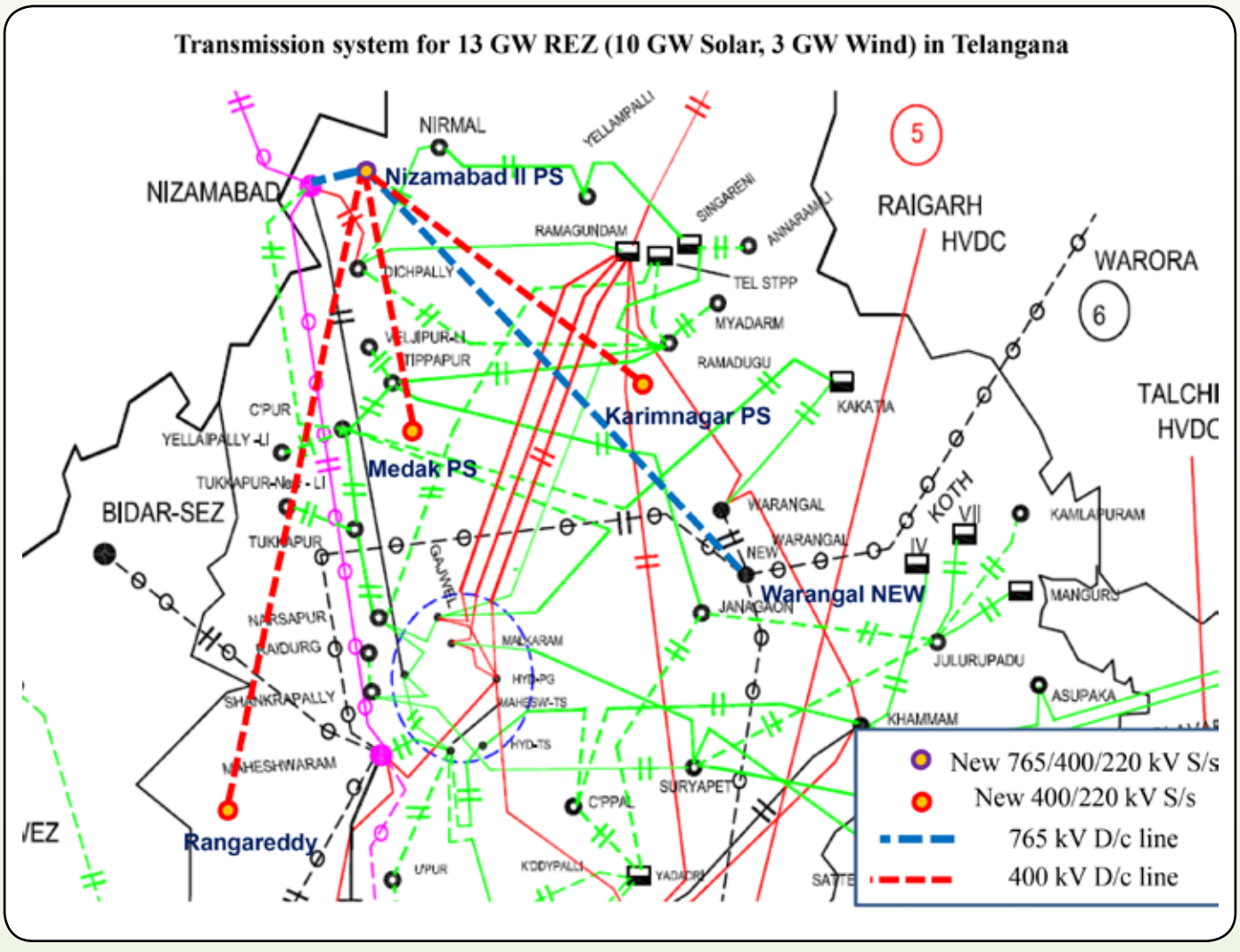

Fig. 8: Transmission system for potential RE Zones in Telangana

5.6.4 Transmission System for 5 GW Offshore wind farm (Sub Zone B1 to B4 & G1 to G3) in Tamil Nadu

Prioritized Offshore Wind Zone

Sub Zone ID	OSS ID	Capacity (MW)
B1	OSS B1	912
B2	OSS B2	828
B3	OSS B3	705
B4	OSS B4	809
G1	OSS G1	655
G2	OSS G2	555
G3	OSS G3	878

A. Onshore pooling station and Transmission System from Onshore Pooling Station

- Establishment of 12x500 MVA, 400/230 kV Onshore Pooling Station near Avaraikulam, Tirunelveli District in Tamil Nadu
- Avaraikulam Onshore PS – Pugalur (HVDC) 400 kV D/c line (Quad Moose equivalent) with 125 MVAr switchable reactors at both ends (300 km)
- Avaraikulam Onshore PS – Tuticorin PS 400 kV D/c line (Quad Moose equivalent) (100 km)
- Suitable Static Compensation / Dynamic Compensation with MSR

B. Transmission System for integration of Offshore Wind Farms with Onshore PS

- OSS B1 – Avaraikulam Onshore PS 230 kV 2xS/c Submarine cable (30 km)
- OSS B2 – Avaraikulam Onshore PS 230 kV 2xS/c Submarine cable (35 km)
- OSS B3 – Avaraikulam Onshore PS 230 kV 2xS/c Submarine cable (41 km)
- OSS B4 – Avaraikulam Onshore PS 230 kV 2xS/c Submarine cable (43 km)
- OSS G1 – Avaraikulam Onshore PS 230 kV 2xS/c Submarine cable (40 km)
- OSS G2 – Avaraikulam Onshore PS 230 kV S/c Submarine cable (35 km)
- OSS G3 – Avaraikulam Onshore PS 230 kV 2xS/c Submarine cable (36 km)

Note:

1. The number of 230 kV submarine Cables has been considered assuming capacity of one three phase cable as 500 MW. However, the requirement of cables (single phase or three phase and its voltage class) would be further firmed up while detailing the scheme.

2. Reactive compensation to be worked out based on data being received from submarine cable manufactures pertaining to MVAr generation from the cables.

Transmission system planned for off-shore wind potential in Tamil Nadu is depicted in Figure 9.

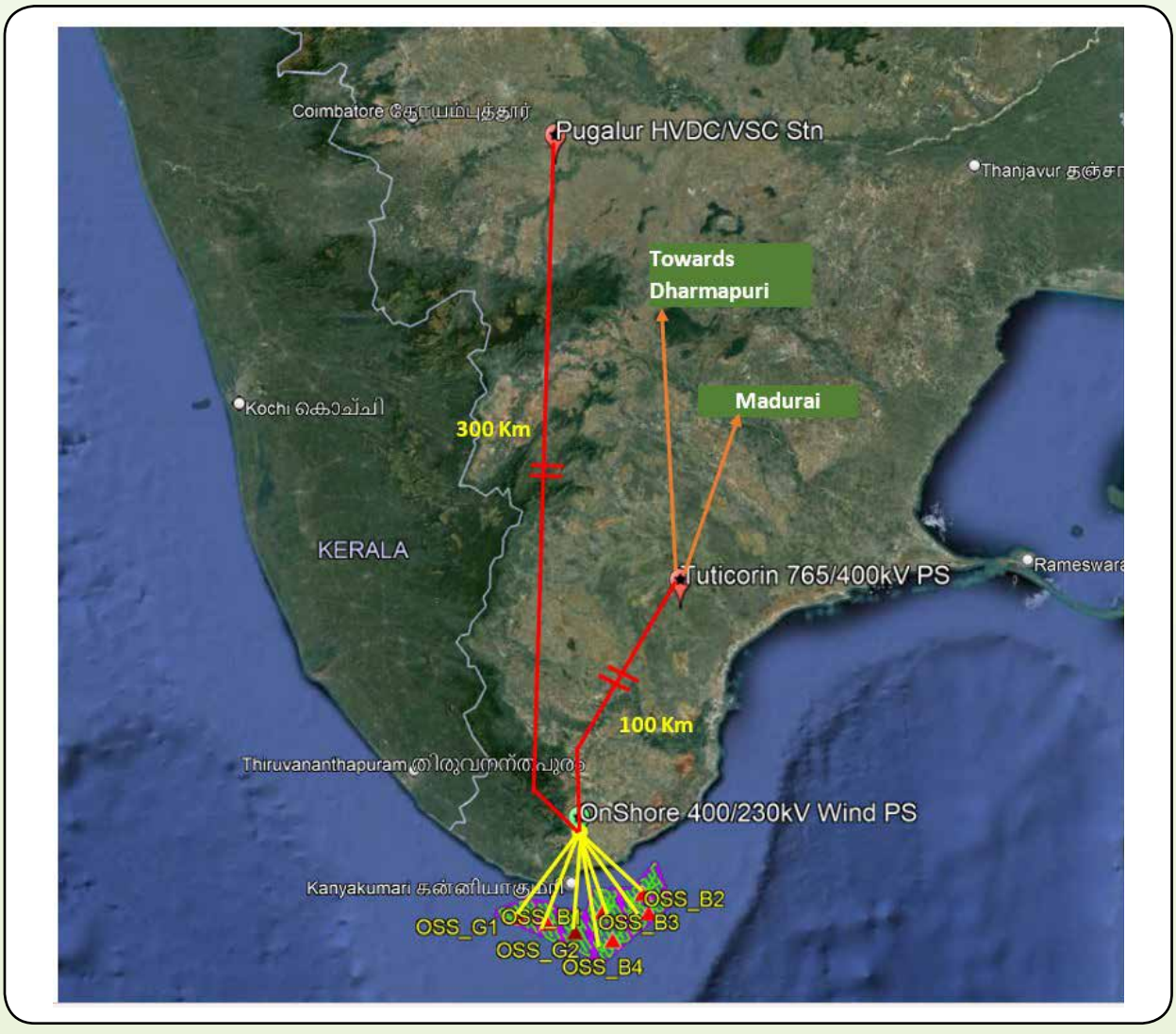

Fig 9: Transmission system for off-shore wind potential zones in Tamil Nadu

Tentative phasing of transmission system is given at **Annex -IV.**

Note: For the planned transmission schemes in Southern Region, dynamic compensation requirement like STATCOMs, Synchronous Condensers etc. would be identified separately based on the detailed reactive power planning studies and the Short Circuit Ratios (SCRs) at different locations. Requirement of Synchronous condensers based on inertia considerations will also be assessed based on detailed studies.

5.7 Status of transmission schemes planned for 181.5 GW RE capacity

Out of the transmission schemes planned for 181.5 GW RE capacity, transmission schemes for Bikaner-II, Bikaner-III RE Zones in Rajasthan, Koppal-II, Gadag-II RE Zones in Karnataka and Kallam in Maharashtra have already been recommended by NCT. These transmission schemes would be taken up for bidding/ implementation. Transmission schemes for other potential RE Zones would be taken up subsequently.

6.0 Ckm and MVA capacity likely by 2030

6.1 Existing ckm and MVA capacity

Total ckm of transmission lines and transformation capacity in the country (as on 31.10.2022) is given below:

	±800 kV	±500 kV	±320 kV	765 kV	400 kV	220 kV	Total
Transmission Lines (ckm)	9655	9432	288	51938	196138	196307	**463758**
Sub-station capacity (MVA)	18000	13500	2000	267700	408933	434974	**1145107**

6.2 Additional ckm and MVA capacity likely by 2030

The tentative additional ckm and MVA capacity under ISTS, required for integration of additional RE capacity by 2030 is given below:

	±800 kV	±350 kV	765 kV	400 kV	220 kV cable	Total	Total
Transmission Lines (ckm)	6200	1920	25960	15758	1052	50890	**463758**
Sub-station capacity (MVA)	20000	5000	274500	134075	0	433575	**1145107**

Note:

i) The additional ckm & MVA capacity includes the ISTS transmission schemes for (a) 66.5 GW RE capacity (excluding commissioned transmission schemes) (b) 55.08 GW RE capacity and (c) 181.5 GW RE capacity

(It excludes transmission system for 9 GW RE capacity to be integrated to intra-state network and 2.5 GW RE capacity for which location is yet to be identified)

ii) 220 kV cable is for connecting offshore wind farm to on shore pooing station.

iii) Additional 220 kV and below system would be under intra-state network or dedicated transmission system for connectivity of RE generators to ISTS pooling station.

7.0 Tentative cost of additional transmission system

Tentative cost of the Inter State Transmission System (ISTS) for integration of 10 GW off-shore wind capacity is Rs. 28,100 Crores and the tentative cost of Inter State Transmission System for integration of other wind and solar capacity is Rs. 2,16,100 Crores. Total cost works out to Rs. 2,44,200 Crores. Details are given in the following table:

	RE Capacity (GW) (A)	BESS@(GW) (B)	Requirement of Transmission system (GW) (C=A-B)	Tentative cost of transmission system (₹ Cr.)@(D)	Average Cost of Transmission system(₹ Lakh/ MW)(=D/C)
On-shore RE Capacity (Wind & Solar)	268.68	51.5	217.18	216100	99.5
Offshore RE Capacity (Wind)	10	0	10	28100	281
Total RE capacity*	**278.68**	**51.5**	**227.18**	**244200**	**107.5**

Note:

The tentative cost includes the cost of ISTS transmission schemes for (i) 66.5 GW RE capacity (excluding commissioned transmission schemes and associated RE capacity) (ii) 55.08 GW RE capacity and (iii) 181.5 GW RE capacity

(The cost excludes transmission system for 9 GW RE capacity to be integrated to intra-state network and 2.5 GW RE capacity for which location is yet to be identified)

@ BESS will generally be a set up by RE generation developers to meet the requirement of RTC power. The requirement of BESS with projected RE capacity of 537 GW by 2030 is 51.5 GW, which includes BESS capacity of 43.6 GW associated with 181.5 GW RE capacity.

8.0 Financing of Transmission system

The transmission schemes have been planned for evacuation of power from RE generation projects. Hence, for establishment of the planned transmission schemes, Government may provide some Central Financial Assistance (CFA) along with low cost financing from multi-lateral agencies in line with the Green Energy Corridor Schemes.

9.0 Margin already available in ISTS network which can be used for integration of additional RE capacity

About 33,658 MW margin is already available in existing/under construction ISTS substations which can be used for RE integration. Region-wise summary of margin available in ISTS Sub-stations is given below:

Region	Additional Margin in existing / UC system		
	220 kV level	400 kV level	Total
Northern	1650	3600	**5250**
Western	2228	7400	**9628**
Southern	2930	2700	**5630**
Eastern	8250	4900	**13150**
Total	**15058**	**18600**	**33658**

State-wise details are given in **Annex – V.** (Source: CTUIL)

10.0 RE capacity to be integrated to intra-state system under Green Energy Corridor (GEC) I & II Schemes

Under the Green Energy Corridor-I (GEC-I) scheme, about 24 GW of RE capacity was planned to be integrated to intra-state network, out of which about 7 GW of RE capacity is yet to be commissioned. Most of the transmission schemes under GEC-I have been commissioned and balance transmission schemes are likely to be commissioned by March, 2023.

About 19.4 GW RE capacity is planned to be integrated to intra-state system under Green Energy Corridor-II (GEC-II) Scheme. State-wise details are given below:

Sl. No.	State	RE capacity under GEC-II Scheme (MW)
1.	Himachal Pradesh	317
2.	Rajasthan	4023
3.	Uttar Pradesh	4000
4.	Gujarat	4000
5.	Karnataka	2639
6.	Tamil Nadu	4000
7.	Kerala	452
	Total	**19431**

DPR of the transmission schemes have already been prepared by the respective states. The GEC II scheme has been approved at an estimated project cost of Rs. 12,031.33 Crore with Central Financial Assistance (CFA) @ 33 % of the project cost i.e. Rs. 3970.34 crore. The balance 67% of the project cost is available as loan.

States are preparing the packages and are in process of issuing tenders for implementing the transmission schemes.

(Source: MNRE)

11.0 Transmission system for additional RE Potential Zones to cater to the requirement of Green Hydrogen production

To cater to additional electricity demand on account of 10 million tonne per annum Green Hydrogen production by 2030, additional RE capacity would be required. It is estimated that the green hydrogen production would be close to major ports and end-use industries such as fertilizers, refineries, steel plants etc. MNRE is in the process of identifying the additional RE Potential Zones for setting up the RE generation capacity as well as the location of potential sites for manufacturing of Green Hydrogen and Green Ammonia.

For initial projects of green hydrogen production, the planned transmission system will be adequate. With the progress of green hydrogen production and visibility of additional RE potential zones, transmission system would be further planned.

12.0 Transmission plan for additional Hydro Electric Projects likely by 2030

Installed capacity of hydroelectric projects in the country is 46,850.18 GW (as on 31st October, 2022). Transmission system has been planned for about 16,673 MW additional hydro capacity likely to be commissioned by 2030.

Details of additional hydroelectric projects along with broad transmission system for the projects likely to be integrated to ISTS network is given at **Annex – VI.**

13.0 Additional Inter-regional corridors by 2030

The present inter-regional transmission capacity is 112,250 MW. Following additional inter-regional corridors are under construction/ planned for integration of additional RE capacity by 2030.

- Warora (Pool)- Warangal 765 kV D/c line
- LILO of one circuit of Narendra – Narendra (New) 765 kV D/c line at Xeldem
- Neemuch PS – Chhittorgarh (PG) S/s 400 kV D/C line
- Narendra (New)- Pune 765 kV D/c line
- Jeypore- Jagdalpur 400 kV D/c line

- Chittorgarh (Rajasthan) – Neemuch-II (MP) 765 kV D/c line
- Pindwara (Rajasthan) - Ahmedabad (Gujarat) 765 kV D/c line
- Pindwara (Rajasthan) - Prantij (Gujarat) 400 kV D/c line
- Beawar (Rajasthan) – Neemuch-II (MP) 765 kV D/c line
- Kota (Rajasthan) - Shujalpur (MP) 765 kV D/c line
- Barmer-II (Rajasthan) – Jabalpur (MP) 800 kV HVDC line

With the additional inter-regional corridors under implementation/planned, the inter-regional capacity is likely to be 149,850 MW in 2030 as detailed below.

Inter-regional capacity	Capacity (MW)
West-East	22790
West - North	62720
West - South	28120
North-East	22530
South-East	7830
East-North East	2860
North East- North	3000
Total	**149850**

14.0 Additional HVDC corridors by 2030

The following HVDC corridors have been planned for integration of additional RE capacity by 2030:

- ±800 kV Bhadla-III - Fatehpur HVDC line
- ±350kV Pang - Kaithal HVDC line
- ±800kV Barmer-II - Jabalpur HVDC line
- ±800kV Khavda - Aurangabad HVDC line

15.0 Conclusion

Transmission system has been planned for about 537 GW RE capacity by 2030. The transmission plan is a major step towards achievement of Government's energy transition goal. The transmission schemes are under various stages of implementation. Some schemes have been commissioned, some are under construction and some other schemes are under bidding process. Other planned transmission schemes would be taken up progressively for implementation commensurate with the RE capacity. Additional transmission system would be planned based on the progress of Green Hydrogen manufacturing and with visibility of additional RE potential sites.

Annex-IA

Details of transmission schemes for 66.5 GW RE Capacity

(Other than the commissioned transmission schemes)

A. Transmission Schemes under construction

Sl. No.	Transmission scheme	Broad Transmission System
1.	Transmission system for evacuation of power from RE projects in Rajgarh (2500 MW) SEZ in Madhya Pradesh - Phase-I: 1500	Establishment of 400/220 kV, 3x500 MVA Pachora SEZ PP
		Pachora SEZ PP -Bhopal (Sterlite) 400 kV D/c line (Quad/ HTLS) along with 80MVAr switchable line reactors on each circuit at Pachora end
2.	Transmission Scheme for evacuation of power from Solar Energy Zones (SEZs) in Rajasthan (8.1 GW) under Phase-II-Part A	Establishment of 400/220 kV, 4x500 MVA Fatehgarh-III PS
		Fatehgarh-III PS – Fatehgarh-II PS 400 kV D/c line
		Fatehgarh-III PS – Jaisalmer-II (RVPN) 400 kV D/c line (Twin HTLS)
3.	Transmission Scheme for evacuation of power from Solar Energy Zones (SEZs) in Rajasthan (8.1 GW) under Phase-II-Part A1	Augmentation by 765/400 kV, 1500 MVA ICT (5th) at Fatehgarh-II PS
4.	Transmission Scheme for evacuation of power from Solar Energy Zones (SEZs) in Rajasthan (8.1 GW) under Phase-II-Part B	Fatehgarh-II PS – Bhadla-II PS 765 kV D/c line (2nd)
		1x240 MVAr Switchable line reactor for each circuit at each end of Fatehgarh-II – Bhadla-II 765 kV D/c line (2nd)
5.	Transmission Scheme for evacuation of power from Solar Energy Zones (SEZs) in Rajasthan (8.1 GW) under Phase-II-Part B1	Augmentation by 765/400 kV, 1500 MVA ICT (6th) at Fatehgarh-II PS
		Augmentation by 400/220 kV, 4x500 MVA ICT (6th to 9th) at Fatehgarh-II PS with suitable Bus sectionalisation at 400 and 220 kV level.
		Augmentation by 400/220 kV, 3x500 MVA ICT (6th to 8th) at Bhadla-II PS with suitable Bus sectionalisation at 400 and 220 kV level.
		Augmentation by 765/400 kV, 1x1500 MVA ICT (4th) at Bhadla-II PS.
		± 2x300 MVAr, 4x125 MVAr MSC, 2x125 MVAr MSR STATCOM at Fatehgarh-II S/s
		± 2x300 MVAr, 4x125 MVAr MSC, 2x125 MVAr MSR STATCOM at Bhadla-II S/s
6.	Transmission Scheme for evacuation of power from Solar Energy Zones (SEZs) in Rajasthan (8.1 GW) under Phase-II-Part C	Establishment of 765/400 kV, 2x1500 MVA Sikar – II
		Bhadla-II PS – Sikar-II 765 kV D/c line
		1x330 MVAr switchable line reactor for each circuit at Sikar-II end of Bhadla-II PS – Sikar-II 765 kV D/c line
		1x240MVAr switchable line reactor for each circuit at Bhadla-II end of Bhadla-II PS – Sikar-II 765 kV D/c line
		Sikar-II – Neemrana 400 kV D/c line
7.	Transmission Scheme for evacuation of power from Solar Energy Zones (SEZs) in Rajasthan (8.1 GW) under Phase-II-Part D	Sikar-II – Aligarh 765 kV D/c line along with 1x330 MVAr switchable line reactor for each circuit at each end of Sikar-II – Aligarh 765 kV D/c line
8.	Transmission Scheme for evacuation of power from Solar Energy Zones (SEZs) in Rajasthan (8.1 GW) under Phase-II-Part F	Establishment of 400 kV Switching Station at Bikaner –II PS

Sl. No.	Transmission scheme	Broad Transmission System
		Bikaner-II PS – Khetri 400 kV 2xD/c line (Twin HTLS) along with 1x80 MVAr fixed line reactor on each circuit at Khetri end of Bikaner-II – Khetri 400 kV 2xD/c Line
		Khetri- Bhiwadi 400 kV D/c line
		± 300 MVAr, 2x125 MVAr MSC, 1x125 MVAr MSR STATCOM at Bikaner–II S/s
9.	Transmission Scheme for evacuation of power from Solar Energy Zones (SEZs) in Rajasthan (8.1 GW) under Phase-II-Part F1	Removal of LILO of one circuit of Bhadla-Bikaner (RVPN) 400 kV D/c(Quad) line at Bikaner (PG). Extension of above LILO section from Bikaner(PG) up to Bikaner-II PS to form Bikaner-II PS – Bikaner (PG) 400 kV D/c(Quad) line
10.	Transmission Scheme for evacuation of power from Solar Energy Zones (SEZs) in Rajasthan (8.1 GW) under Phase-II-Part G	Establishment of 765/400 kV, 3x1500 MVA GIS substation at Narela
		Khetri – Narela 765 kV D/c line along with 1x330 MVAr Switchable line reactor for each circuit at Narela end of Khetri – Narela 765 kV D/c line
		LILO of 765 kV Meerut-Bhiwani S/c line at Narela
11.	Transmission Scheme for evacuation of power from Solar Energy Zones (SEZs) in Rajasthan (8.1 GW) under Phase-II-Part G1	Removal of LILO of Bawana – Mandola 400 kV D/c (Quad) line at Maharani Bagh /Gopalpur S/s. Extension of above LILO section from Maharani Bagh / Gopalpur upto Narela S/s so as to form Maharanibagh – Narela 400 kV D/c (Quad) and Maharanibagh - Gopalpur - Narela 400 kV D/c (Quad) lines
12.	Transmission scheme for evacuation of 1000 MW from Gadag SEZ Part A Phase-I	Establishment of 400/220 kV, 2x500 MVA Gadag Pooling Station
		Gadag PS-Narendra (New) 400 kV D/C line
13.	Evacuation of power from RE sources in Koppal Wind Energy Zone (Karnataka) (2500MW)	Establishment of 400/220 kV, 5x500 MVA Koppal Pooling Station
		Koppal PS-Narendra (New) 400 kV D/c line
		2x125 MVAr 420 kV Bus Reactors at Koppal PS
14.	Transmission system for evacuation of power from RE projects in Osmanabad area (1 GW) in Maharashtra	Establishment of 2x500 MVA, 400/220 kV Kallam PS
		LILO of both circuits of Parli(PG) – Pune(GIS) 400 kV D/c line at Kallam PS
		50 MVAr switchable line reactor with 400 ohms NGR at Kallam PS end of Kallam – Pune (GIS) 400 kV D/c line
15.	Transmission scheme for evacuation of 3 GW RE injection at Khavda Pooling Station 1 (KPS 1) under Phase I	Establishment of 3x1500 MVA, 765/400 kV and 2x500 MVA, 400/220 kV Khavda Pooling Station 1 (GIS), KPS1
		Khavda PS1 (GIS) – Bhuj PS 765 kV D/c line.
16.	Transmission system for evacuation of power from Neemuch SEZ (1000 MW)	Establishment of 2x500 MVA, 400/220 kV Neemuch
		Neemuch PS – Chhittorgarh (PG) S/s 400 kV D/C line
		Neemuch PS- Mandsaur S/s 400 kV D/c line
17.	Transmission Scheme for Evacuation of power from RE sources in Karur/Tirrupur Wind Energy Zone (Tamil Nadu) (1000 MW)- Phase I	Establishment of 2x500 MVA, 400/230 kV Karur PS
		LILO of both circuits of Pugalur – Pugalur (HVDC) 400 kV D/c line at Karur PS

B. Transmission Schemes under Tendering

Sl. No.	Transmission scheme	Broad Transmission System
1.	Transmission Scheme for evacuation of power from Solar Energy Zones (SEZs) in Rajasthan (8.1 GW) under Phase-II-Part E	Bhadla-II PS – Sikar-II 765 kV D/c line (2nd)
		1x330 MVAr switchable line reactor for each circuit at Sikar-II end of Bhadla-II PS – Sikar-II 765 kV D/c line
		1x240 MVAr switchable line reactor for each circuit at Bhadla-II end of Bhadla-II PS – Sikar-II 765 kV D/c line
2.	Establishment of Khavda Pooling Station-2 (KPS2) in Khavda RE Park	Establishment of 765/400 kV, 4 x1500 MVA KPS-2
3.	Establishment of Khavda Pooling Station-3 (KPS3) in Khavda RE Park	Establishment of 765/400 kV, 3 x1500 MVA KPS-3
		KPS3- KPS2 765 kV D/c line
4.	Transmission scheme for injection beyond 3 GW RE power at Khavda PS1 (KPS1)	Augmentation of KPS1 by 4x1500 MVA ICTs
		KPS1-KPS2 765 kV D/C line
5.	Transmission scheme for evacuation of 4.5 GW RE injection at Khavda P.S. under Phase-II – Part A	KPS2 (GIS) – Lakadia 765 kV D/C line with 330 MVAr switchable line reactors at KPS2 end
6.	Transmission scheme for evacuation of 4.5 GW RE injection at Khavda P.S. under Phase-II – Part B	Lakadia PS – Ahmedabad 765 kV D/c line with 240 MVAR switchable line reactors on both ends
7.	Transmission scheme for evacuation of 4.5 GW RE injection at Khavda P.S. under Phase-II – Part C	Ahmedabad – South Gujarat/Navsari (New) 765 kV D/c line with 240 MVAr switchable line reactor at both ends
8.	Transmission scheme for evacuation of 4.5 GW RE injection at Khavda P.S. under Phase-II – Part D	LILO of Pirana (PG) – Pirana (T) 400 kV D/c line at Ahmedabad S/s with twin HTLS conductor along with reconductoring of Pirana (PG) – Pirana(T) line with twin HTLS conductor
9.	Transmission Network Expansion in Gujarat associated with integration of RE projects from Khavda Potential RE zone	Banaskantha – Ahmedabad 765 kV D/c line with 330 MVAr, 765 kV Switchable line reactor on each ckt at Ahmedabad S/s end.
10.	Transmission system for evacuation of power from Chhatarpur SEZ (1500 MW)	Establishment of 3x500 MVA, 400/220 kV Pooling Station at Chhatarpur
		LILO of Satna - Bina 400 kV (1st) D/c line at Chhatarpur PS
11.	Transmission scheme for evacuation of 1500 MW from Gadag SEZ under Part A Phase- II	400/220 kV, 3x500 MVA ICT Augmentation at Gadag Pooling Station
		Gadag PS - Koppal PS 400 kV D/c line

C. Transmission Schemes being taken up for implementation/bidding

Sl. No.	Transmission scheme	Broad Transmission System
1.	Transmission scheme for Solar Energy Zone in Anantapur (Anantapur) (2500 MW) and Kurnool (1000 MW), Andhra Pradesh	Establishment of 400/220 kV, 7x500 MVA pooling station at suitable border location between Anantapur & Kurnool Distt
		Anantapur PS-Kurnool-III PS 400 kV D/c line
		Anantapur PS-Cuddapah 400 kV D/c Line
2.	Transmission Scheme for Solar Energy Zone in Bidar (2500 MW), Karanataka	Establishment of 3x1500 MVA, 765/400 kV & 5x500 MVA 400/220 kV station at suitable location near Bidar
		Bidar PS – Maheshwaram (PG) 765 kV D/C line
3.	Transmission Scheme for evacuation of power from RE sources in Kurnool Wind Energy Zone (3000 MW)/ Solar Energy Zone (AP) (1500MW) - Part-A & B	Establishment of 765/400/220 kV 3x1500 MVA, 9x500 MVA Pooling station at suitable location in Kurnool Distt (Kurnool-III)
		Kurnool –III PS – Kurnool (New) 765 kV D/c line
		Kurnool –III PS – Maheshwaram (PG) 765 kV D/c Line

D. Other planned transmission schemes

Sl. No.	Transmission scheme	Broad Transmission System
1.	Transmission system for evacuation of power from RE projects in Solapur (1000 MW under Ph-I & 500 MW under Ph-II) SEZ in Maharashtra.	Establishment of 400/220 kV, 2x500 MVA at Solapur PS
		Solapur PS - Solapur (PG) 400 kV D/c line (twin HTLS) (with minimum capacity of 2100 MVA/ckt at nominal voltage)
2.	400 kV line bay at Solapur (PG) for St-II connectivity to M/s Toramba (Solapur: 1000 MW)	1 nos. of 400 kV bay at Solapur (PG) for St-II connectivity to M/s Toramba
3.	Transmission system for evacuation of power from RE projects in Wardha (2500 MW) SEZ in Maharastra	Establishment of 400/220 kV, 5x500 MVA Wardha SEZ PP
		LILO of Wardha - Warora Pool 400 kV D/c (Quad) line at Wardha SEZ PP
4.	Augmentation of transformation capacity at Lakadia PS for providing connectivity to RE projects (2000 MW)	Establishment of 4x500 MVA, 400/220 kV ICTs at Lakadia PS (GIS)
5.	Augmentation of transformation capacity at Khavda PS (2500 MW)	Augmentation by 765/400 kV, 2x1500 MVA ICT's at KPS1or KPS2 or KPS3 (depending upon connectivity applied by RE generator)

E. Schemes whose Phase- I is under implementation and Phase-II is to be notified based on progress of Phase-I:

Sl. No.	Transmission scheme	Broad Transmission System
1.	Transmission system for evacuation of power from RE projects in Rajgarh (2500 MW) SEZ in Madhya Pradesh - Phase-II: 1000 MW	400/220 kV, 2x500 MVA ICT augmentation at Pachora PS
		Pachora SEZ PP – Shujalpur 400 kV D/c line (Quad/ HTLS) (with minimum capacity of 2100 MVA/ckt at nominal voltage)
2.	Transmission Scheme for Evacuation of power from RE sources in Karur/ Tiruppur Wind Energy Zone (Tamil Nadu) (1500MW) under Phase-II	Augmentation by 3x500 MVA, 400/230 kV ICTs at Karur PS

Annex-IB

Details of Transmission schemes for 55.08 GW RE capacity

A. Transmission system for evacuation of power from REZ in Rajasthan (20 GW) under Phase III:

Sl. No.	Transmission scheme	Broad Transmission System
	Schemes under Bidding	
1.	Transmission system for evacuation of power from REZ in Rajasthan (20 GW) under Phase III - Part A1	Establishment of 2x500 MVA, 400/220 kV pooling station at Fatehgarh-IV
		Fatehgarh-IV - Fatehgarh-III 400 kV D/c line
2.	Transmission system for evacuation of power from REZ in Rajasthan (20 GW) under Phase III - Part A3	Fatehgarh-III- Bhadla-III 400 kV D/c line along with 50 MVAr Switchable line reactor for each circuit at both ends of Fatehgarh-III- Bhadla-III 400 kV D/c line
3.	Transmission system for evacuation of power from REZ in Rajasthan (20 GW) under Phase III - Part B1	Establishment of 2x1500 MVA, 765/400 kV & 3x500 MVA, 400/220 kV pooling station at Bhadla-III
		Fatehgarh-II – Bhadla-III 400 kV D/c line along with 50 MVAr Switchable line reactor for each circuit at both ends of Fatehgarh-II- Bhadla-III, 400 kV D/c line
		Bhadla-III – Sikar-II 765 kV D/c line along with 330 MVAr Switchable line reactor for each circuit at each end of Bhadla-III – Sikar-II 765 kV D/c line
4.	Transmission system for evacuation of power from REZ in Rajasthan (20 GW) under Phase III - Part C1	Establishment of 2x1500 MVA, 765/400 kV & 2x500 MVA, 400/220 kV pooling station at Ramgarh
		Ramgarh – Bhadla-III, 765 kV D/c line along with 240 MVAr switchable line reactor for each circuit at Ramgarh end of Ramgarh – Bhadla-III, 765 kV D/c line
5.	Transmission system for evacuation of power from REZ in Rajasthan (20 GW) under Phase III - Part D	Sikar-II – Khetri 765 kV D/c line
		Sikar-II – Narela 765 kV D/c line along with 240 MVAr Switchable line reactor for each circuit at each end of Sikar-II – Narela 765 kV D/c line
		Jhatikara – Dwarka 400 kV D/c line
6.	Transmission system for evacuation of power from REZ in Rajasthan (20 GW) under Phase III - Part F	Establishment of 2x1500 MVA, 765/400 kV Substation at suitable location near Beawar
		LILO of both circuit of Ajmer-Chittorgarh 765 kV D/c line at Beawar
		LILO of 400 kV Kota – Merta line at Beawar
		Fatehgarh-III – Beawar 765 kV D/c line along with 330 MVAr Switchable line reactor for each circuit at each end of Fatehgarh-III–Beawar 765 kV D/c line
7.	Transmission system for evacuation of power from REZ in Rajasthan (20 GW) under Phase III - Part G	Fatehgarh-III – Beawar 765 kV D/c (2nd) line along with 330 MVAr Switchable line reactor for each circuit at each end of Fatehgarh-III–Beawar 765 kV D/c line

8.	Transmission system for evacuation of power from REZ in Rajasthan (20 GW) under Phase III - Part H	Establishment of 2x1500 MVA, 765/400 kV substation at suitable location near Dausa
		LILO of both circuits of Jaipur (Phagi)-Gwalior 765 kV D/c line at Dausa along with 240 MVAr Switchable line reactor for each circuit at Dausa end of Dausa – Gwalior 765 kV D/c line
		LILO of both circuits of Agra – Jaipur (South) 400 kV D/c line at Dausa along with 50 MVAr Switchable line reactor for each circuit at Dausa end of Dausa – Agra 400 kV D/c line
		Beawar – Dausa 765 kV D/c line along with 240 MVAr Switchable line reactor for each circuit at each end
	Schemes under Implementation	
9.	Transmission system for evacuation of power from REZ in Rajasthan (20 GW) under Phase-III Part E1	Establishment of 3x1500 MVA 765/400 kV & 3x500 MVA 400/220 kV pooling station at Fatehgarh-III (new section)
10.	Transmission system for evacuation of power from REZ in Rajasthan (20GW) under Phase-III Part J	Augmentation by 1x500 MVA, 400/220 kV ICT (10th) at Fatehgarh-II PS
		Augmentation by 1x1500 MVA, 765/400 kV ICT (5th) at Bhadla-II PS
		Augmentation by 1x1500 MVA, 765/400 kV ICT (3rd) at Bikaner (PG)
		Augmentation by 1x1500 MVA, 765/400 kV ICT (3rd) at Jhatikara Substation (Bamnoli/Dwarka section)
	Scheme recently recommended by NCT and being taken up for bidding	
11.	Transmission system for evacuation of power from REZ in Rajasthan (20 GW) under Phase III - Part I	Establishment of 6000 MW, ± 800 kV Bhadla (HVDC) [LCC] terminal station (4x1500 MW) at a suitable location near Bhadla-III substation
		Establishment of 6000 MW, ±800 kV Fatehpur (HVDC) [LCC] terminal station (4x1500 MW) at suitable location near Fatehpur (UP)
		Bhadla-III – Bhadla (HVDC) 400 kV 2xD/c line
		±800 kV HVDC line between Bhadla (HVDC) & Fatehpur (HVDC)
		Establishment of 5x1500 MVA, 765/400 kV ICTs at Fatehpur (HVDC)
		LILO of both ckts of 765 kV Varanasi – Kanpur (GIS) D/c line at Fatehpur
	Other transmission schemes planned	
12.	Transmission system for evacuation of power from REZ in Rajasthan (20 GW) under Phase III –Part C3	Ramgarh S/s : STATCOM :± 2x300MVAr, 4x125 MVAr MSC, 2x125 MVAr MSR
13.	Transmission system for evacuation of power from REZ in Rajasthan (20 GW) under Phase-III: Part E3	Fatehgarh-III S/s : STATCOM : ±2x300 MVAr, 4x125 MVAr MSC, 2x125 MVAr MSR
14.	Augmentation by 1x1500MVA, 765/400 kV ICT at Kanpur (GIS) substation	Augmentation by 1x1500MVA, 765/400 kV ICT at Kanpur (GIS) substation
15.	Transmission system for evacuation of power from REZ in Rajasthan (20 GW) under Phase-III Part A2	Augmentation by 3x500 MVA, 400/220 kV ICT's at Fatehgarh-IV
16.	Transmission system for evacuation of power from REZ in Rajasthan (20 GW) under Phase-III Part B2	Augmentation by 7x500 MVA, 400/220 kV ICT's at Bhadla-III
17.	Transmission system for evacuation of power from REZ in Rajasthan (20 GW) under Phase-III Part C2	Augmentation by 1x1500 MVA, 765/400 kV ICT's at Ramgarh
18.	Transmission system for evacuation of power from REZ in Rajasthan (20 GW) under Phase-III Part E2	Augmentation by 3x1500 MVA, 765/400 kV & 2x500 MVA, 400/220 kV ICT's at Fatehgarh-III (new section)

B. Transmission Scheme for Leh RE park (9 GW Solar & 4 GW Wind)

Sl. No.	Transmission scheme	Broad Transmission System
1.	Transmission system for evacuation of RE power from renewable energy parks in Leh (5 GW Leh - Kaithal transmission corridor)	Pooling point in Pang (Leh) : ±350 kV, 2 nos. of 2500 MW HVDC terminal
		Pooling point in Kaithal (Haryana): ±350 kV, 2 nos. of 2500 MW HVDC terminal
		HVDC Line (OHL and UG Cable): 480 kms of ±350kV HVDC line between Pang & Kaithal PS
		(i) Kaithal - Bahadurgarh (PG) 400 kV D/C line (ii) Kaithal - Modipuram (Meerut) (UPPTCL) 765 kV D/C line along with 1x240 MVAr switchable line reactor on each circuit at Kaithal end (iii) 3 Nos. of 765/400/33 kV, 1500 MVA ICTs along with associated bays at Kaithal (iv) Augmentation by 765/400 kV, 1500 MVA ICT at Bhiwani S/s (v) 2 Nos. of 400/220/33 kV 315 MVA ICTs along with associated bays at Pang
		220 kV Pang – Leh (Phyang) (PG) S/c line
		BESS of suitable size (1 GWh: 250 MW x 4 hr)*

**Total 12 GWh BESS is envisaged at Leh, out of which 1 GWh BESS has been planned as transmission element and balance 11 GWh BESS would be installed as a part of RE generation projects.*

The transmission scheme has been awarded to Powergrid for implementation through RTM Route.

C. Transmission Scheme for Kaza Solar Park (0.88 GW)

Sl. No.	Transmission scheme	Broad Transmission System
1.	Transmission system for evacuation of power from Kaza Solar Power Project (880 MW)	Establishment of 3x315 MVA, 400/132 kV Kaza PS (GIS)
		Kaza-Wangtoo (HPPTCL) 400 kV D/c line
		Wangtoo (HPPTCL) - Panchkula (PG) 400 kV D/c line

D. Transmission System for Khavda RE Park (17.2 GW)

Sl. No.	Transmission scheme	Broad Transmission System
1.	Transmission scheme for evacuation of 17.2 GW RE capacity from Khavda RE Park	Establishment of 765 kV switching station at Halvad
		KPS2- Halvad 765 kV D/c line along with 240 MVAr Switchable line reactor for each circuit at each end
		LILO of both circuits of Lakadia – Ahmedabad 765 kV D/c line at Halvad
		240 MVAr 765 kV switchable line reactor on each ckt at Halvad end of Halvad – Ahmedabad 765 kV D/c line
		Establishment of 765 kV switching station near Vataman
		Halvad – Vataman 765 kV D/c line along with 330 MVAr Switchable line reactor for each circuit at Halvad end
		LILO of both circuits of Lakadia – Vadodara 765 kV D/c line at Vataman 765 kV switching station
		Vataman switching station – Navsari (New) 765 kV D/c line along with 330 MVAr Switchable line reactor for each circuit at Vatman end
		HVDC terminals of ±800 kV, 8000 MW at Khavda end and Aurngabad end each
		Khavda – Aurangabad 8000MW, ±800kV HVDC line
		7 Nos. of 765/400 kV, 1500 MVA Transformers along with associated bays at Aurngabad HVDC
		Aurangabad HVDC – Aurangabad 765 kV 2xD/c line
		Khavda II PS - Lakadia 765 kV 2nd D/c line along with 240 MVAr Switchable line reactor for each circuit at Khavda II PS end
		Augmentation of transformation capacity at KPS2 & KPS 3

E. Transmission Scheme for Dholera RE Park (4 GW):

Sl. No.	Transmission scheme	Broad Transmission System
1.	Transmission system for evacuation of power from Dholera UMSP	Establishment of 4x1500MVA, 765/400 kV Dholera Pooling Station
		Dholera PS – Vataman switching station 765 kV D/C line

Annex-II

Ministry of Power
Letter No. 15-3/2017-Trans (Part 1) Dated 7th December, 2021 regarding Constitution of Committee on Transmission Planning for RE

No. 15-3/2017-Trans (Part I)
Government of India
Ministry of Power
****

Shram Shakti Bhawan, Rafi Marg,
New Delhi-1, Dated 7th December, 2021

OFFICE MEMORANDUM

Subject: Constitution of Committee on Transmission Planning for Renewable Energy (RE)

In order to achieve the commitment made in terms of Nationally Determined Contributions (NDCs), as one of the significant steps, India has pledged before the global community to increase India's non fossil fuel energy capacity to 500 GW by 2030. For enabling growth of Renewable Energy (RE) capacity, areas which have high solar/wind energy potential, as identified by Ministry of New and Renewable Energy (MNRE), need to be connected to Inter State Transmission System (ISTS), so that the RE capacity can come up there and the target of having 500 GW non fossil fuel capacity by 2030 can be achieved. This is a national mission as a part of the country's energy transition goal.

2. In this regard, the undersigned is directed to convey the approval of the competent Authority for constitution of a Committee on Transmission Planning for RE under the Chairmanship of Chairperson, Central Electricity Authority for planning the requisite Inter State Transmission System required for having the targeted RE capacity by 2030, with the following composition:

1	Chairperson, Central Electricity Authority	Chairman
2	Managing Director, Solar Energy Corporation of India Ltd	Member Convenor
3	CMD, Power Grid Corporation of India Ltd	Member
4	COO, Central Transmission Utility	Member
5	CMD, POSOCO	Member
6	Director General, National Institute of Solar Energy	Member
7	Director General, National Institute of Wind Energy	Member

3. The Committee may co-opt any other Member, as deemed fit. The Committee will consult the transmission planning agencies and prepare a report on Inter State Transmission System required for having the targeted RE capacity by 2030.

4. The Committee will submit their report to the Ministry within 3 months from the date of Notification.

(Bihari Lal)
Under Secretary to the Government of India
Tele: 011 23325242

To
1. Chairperson, Central Electricity Authority (CEA), R.K. Puram, New Delhi
2. Managing Director, Solar Energy Corporation of India Ltd. (SECI), New Delhi.
3. CMD, Power Grid Corporation of India Ltd. (PGCIL), Gurugram
4. CMD, POSOCO, Katwaria Sarai, New Delhi
5. COO, Central Transmission Utility of India Ltd, Gurugram
6. Director General, National Institute of Solar Energy, Gurugram
7. Director General, National Institute of Wind Energy, Chennai

Copy to :
1. Sr. PPS to Secretary(MNRE)
2. Sr. PPS to Secretary(Power)
3. PPS to JS(Trans)/PS to Dir. (PG), Ministry of Power.

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Annex-III

Tentative pooling station-wise phasing of 181.5 GW RE capacity

State	Pooling Station	Potential			Phase I (by March, 2025)			Phase II by December 2027)			Phase III (by December, 2030)		
		Wind (GW)	Solar (GW)	Total (GW)	Wind (GW)	Solar (GW)	Total (GW)	Wind (GW)	Solar (GW)	Total (GW)	Wind (GW)	Solar (GW)	Total (GW)
Rajasthan	Bikaner-II	0	7	7	0	4	4		2	2	0	1	1
Rajasthan	Bikaner-III	0	7	7	0	3	3	0	2	2	0	2	2
Rajasthan	Fatehgarh-IV	6	6	12	2	1	3	2	2	4	2	3	5
Rajasthan	Ramgarh	4	6	10	2	1	3	1	2	3	1	3	4
Rajasthan	Jalore	0	3	3					1	1	0	2	2
Rajasthan	Sanchore	0	3	3					1	1	0	2	2
Rajasthan	Sirohi	0	3	3					1	1	0	2	2
Rajasthan	Pali	0	3	3					0	0	0	3	3
Rajasthan	Ajmer	0	2	2					1	1	0	1	1
Rajasthan	Nagaur	0	2	2					1	1	0	1	1
Rajasthan	Bhadla-IV	2	3	5				1	1	2	1	2	3
Rajasthan	Barmer-I	3	4	7	2	2	4	1	1	2	0	1	1
Rajasthan	Barmer-II	0	6	6				0	3	3	0	3	3
Rajasthan	Jaisalmer/ Jodhpur (Intra-State)	0	5	5	0	2	2	0	2	2	0	1	1
Maharashtra	Sholapur	0	1	1		1	1		0	0	0	0	0
Maharashtra	Dhule	1	1	2	1	1	2	0	0	0	0	0	0
Maharashtra	Osmanabad & Parli	1	1	2	1	1	2			0	0	0	0
Maharashtra	Location to be firmed up		2.5	2.5						0	0	2.5	2.5
Madhya Pradesh	Neemuch	2	0	2	2		2			0	0	0	0
Madhya Pradesh	Morena		3.9	3.9					2.5	2.5	0	1.4	1.4
Madhya Pradesh	Sagar		1.5	1.5						0	0	1.5	1.5
Madhya Pradesh	Khandwa	0	0.6	0.6					0.6	0.6	0	0	0
Gujarat	off shore	5		5				2		2	3		3
Andhra Pradesh	Anantapur	10	10	20	2	5.5	7.5	4	1	5	4	3.5	7.5
Andhra Pradesh	Kurnool	8	15	23	2	2.5	4.5	3	6.5	9.5	3	6	9
Andhra Pradesh	Kadapa	0	8	8			0		4	4	0	4	4
Telangana	Nizamabad II	1	2.5	3.5	1	1	2		1.5	1.5	0	0	0
Telangana	Rangareddy	1	2.5	3.5	1	0.5	1.5		2	2	0		0
Telangana	Medak	1	2.5	3.5	1	0.5	1.5		2	2	0	0	0
Telangana	Karimnagar	0	2.5	2.5			0		2	2	0	0.5	0.5

State	Pooling Station	Potential			Phase I (by March, 2025)			Phase II by December 2027)			Phase III (by December, 2030)		
		Wind (GW)	Solar (GW)	Total (GW)	Wind (GW)	Solar (GW)	Total (GW)	Wind (GW)	Solar (GW)	Total (GW)	Wind (GW)	Solar (GW)	Total (GW)
Karnataka	Koppal II	2	2	4	2	2	4			0	0	0	0
Karnataka	Gadag II	2	2	4	2	2	4			0	0	0	0
Karnataka	Devanagere/ Chitragurga	2	2	4	2	2	4			0	0	0	0
Karnataka	Bijapur	2	0	2	1		1	1		1	0	0	0
Karnataka	Bellary	0	1.5	1.5			0		1.5	1.5	0	0	0
Karnataka	Tumkur	0	1.5	1.5			0		1.5	1.5	0	0	0
Tamil Nadu	off shore	5		5			0	2		2	3	0	3
Total		**58**	**123.5**	**181.5**	**24**	**32**	**56**	**17**	**45.1**	**62.1**	**17**	**46.4**	**63.4**

Note: Transmission system for 181.5 GW RE capacity has been planned considering 43.6 GW BESS to be set up by RE generation developers (tentative phasing of BESS is 4.1 GW in Phase I, 19.5 GW in Phase II & 20 GW in Phase III).

Annex-IV

Tentative Phasing of Transmission system for integration of 181.5 GW RE capacity

A. Phasing of transmission system for integration of 75 GW RE capacity in Northern Region

- MNRE/SECI has identified 75 GW potential REZs (15 GW Wind & 60 GW Solar) in Northern Region. The details of identified potential REZs along with tentative phasing is given below:

Pooling Station	Potential			Phase I (by March, 2025)			Phase II (by December 2027)			Phase III (by December, 2030)		
	Wind (GW)	Solar (GW)	Total (GW)	Wind (GW)	Solar (GW)	Total (GW)	Wind (GW)	Solar (GW)	Total (GW)	Wind (GW)	Solar (GW)	Total (GW)
Bikaner-II	0	7	7	0	4	4	0	2	2	0	1	1
Bikaner-III	0	7	7	0	3	3	0	2	2	0	2	2
Fatehgarh-IV	6	6	12	2	1	3	2	2	4	2	3	5
Ramgarh	4	6	10	2	1	3	1	2	3	1	3	4
Jalore	0	3	3	0	0	0	0	1	1	0	2	2
Sanchore	0	3	3	0	0	0	0	1	1	0	2	2
Sirohi	0	3	3	0	0	0	0	1	1	0	2	2
Pali	0	3	3	0	0	0	0	0	0	0	3	3
Ajmer	0	2	2	0	0	0	0	1	1	0	1	1
Nagaur	0	2	2	0	0	0	0	1	1	0	1	1
Bhadla-IV	2	3	5	0	0	0	1	1	2	1	2	3
Barmer-I	3	4	7	2	2	4	1	1	2	0	1	1
Barmer-II	0	6	6	0	0	0	0	3	3	0	3	3
Jaisalmer/ Jodhpur (Intra-State)	0	5	5	0	2	2	0	2	2	0	1	1
Total	**15**	**60**	**75**	**6**	**13**	**19**	**5**	**20**	**25**	**4**	**27**	**31**

Note: *Transmission system for 75 GW RE capacity in NR has been planned considering 22.5 GW BESS to be set up by RE generation developers (with tentative phasing of 10.04 GW in Phase II & 12.46 GW in Phase III).*

Phase-I: 19 GW (13 GW Solar, 6 GW Wind)

Pooling Station	Potential				Phase I (by March, 2025)			
	Wind (GW)	Solar (GW)	Total (GW)	BESS (GW)	Wind (GW)	Solar (GW)	Total (GW)	BESS (GW)
Bikaner-II	0	7	7	3	0	4	4	0
Bikaner-III	0	7	7	3	0	3	3	0
Fatehgarh-IV	6	6	12	4	2	1	3	0
Ramgarh	4	6	10	3	2	1	3	0
Jalore	0	3	3	1	0	0	0	0
Sanchore	0	3	3	1	0	0	0	0
Sirohi	0	3	3	1	0	0	0	0
Pali	0	3	3	1	0	0	0	0
Ajmer	0	2	2	0	0	0	0	0
Nagaur	0	2	2	0	0	0	0	0
Bhadla-IV	2	3	5	2	0	0	0	0
Barmer-I	3	4	7	1.5	2	2	4	0
Barmer-II	0	6	6	2	0	0	0	0
Jaisalmer/ Jodhpur (Intra-State)	0	5	5	0	0	2	2	0
Total	**15**	**60**	**75**	**22.5**	**6**	**13**	**19**	**0**

1. Bikaner Complex: 7 GW

Bikaner-II (4 GW Solar), Bikaner-III (3 GW Solar)

- Establishment of 6x1500 MVA, 765/400 kV & 4x500 MVA, 400/220 kV Bikaner-III Pooling Station along with 2x330 MVAr (765 kV) Bus Reactor & 2x125 MVAr (400 kV) Bus Reactor at a suitable location near Bikaner
- LILO of both ckts of Bikaner (PG)-Bikaner-II 400 kV D/c line at Bikaner-III PS (~20 km)
- Bikaner-II PS – Bikaner-III PS 400 kV D/c line (Quad Moose equivalent) (~30 km)
- Establishment of 765/400 kV, 4x1500 MVA Neemrana-II S/s along with 2x330 MVAr (765 kV) Bus Reactor & 2x125 MVAr (400 kV) Bus Reactor at a suitable location near Neemrana
- Bikaner-III – Neemrana-II 765 kV 2xD/c line (~350 km) along with 330 MVAr switchable line reactor for each circuit at each end
- Neemrana-II- Bareilly(PG) 765 kV D/c line (~350 km) along with 330 MVAr switchable line reactor for each circuit at each end
- LILO of both ckts of 400 kV Sohna Road(GPTL)- Manesar (PG) D/c line at Neemrana-II S/s (~85 km)
- Augmentation by 400/220 kV, 4x500 MVA ICT at Bikaner-II PS
- Neemrana-II -Kotputli 400 kV D/c line (Quad Moose equivalent) (~70 km)
- Augmentation by 400/220 kV, 1x500 MVA (3rd) ICT at Kotputli (PG)

2. Jaisalmer Complex

Ramgarh: 3 GW (1 GW Solar & 2 GW Wind)

- Augmentation by 2x1500MVA, 765/400 kV ICTs at Ramgarh PS
- Augmentation by 400/220 kV, 3x500 MVA ICTs at Ramgarh PS*
- Ramgarh PS- Bhadla-III PS 765 kV D/c line (2nd) along with 240 MVAr switchable line reactor for each circuit at each end (~200 km)
- Bikaner-III PS – Bhadla-III PS 400 kV D/c line (Quad Moose equivalent) (~200 km)

*(Already planned capacity at Ramgarh PS: 3x1500 MVA, 765/400 kV, 2x500 MVA, 400/220 kV with 1 GW injection at 220 kV level and about 1.9 GW injection at 400 kV level) along with 2x240 MVAr (765 kV) Bus Reactor & 2x125 MVAr (400 kV) Bus Reactor

Fatehgarh-IV: 3 GW (1 GW Solar & 2 GW Wind)

- Establishment of 3x1500 MVA, 765/400 kV & 3x500 MVA, 400/220 kV Fatehgarh-IV (Section-2) Pooling Station along with 2x330 MVAr (765 kV) Bus Reactor & 2x125 MVAr (400 kV) Bus Reactor
- Fatehgarh-IV (Section-2) PS – Bhinmal (PG) 400 kV D/c line (Quad Moose equivalent) (~200 km)
- LILO of both ckts of 2nd D/c 765 kV Fatehgarh-III- Beawar 2xD/c line at Fatehgarh-IV (Section-2) PS
- Beawar- Neemuch-II* 765 kV D/c line along with 240 MVAr switchable line reactor for each circuit at each end (~200 km)
- Augmentation by 1x1500 MVA, 765/400 kV ICT at Fatehgarh-II PS (7th)
- Augmentation by 1x1500 MVA, 765/400 kV ICT at Fatehgarh-III PS (7th)

*765/400 kV Neemuch S/s is planned with RE projects in MP (WR) as part of 181.5GW scheme

3. Barmer Complex

Barmer-I : 4 GW (2 GW Solar & 2GW Wind)

- Establishment of 3x1500 MVA, 765/400 kV & 4x500 MVA, 400/220 kV Barmer-I Pooling Station along with 2x330 MVAr (765 kV) Bus Reactor & 2x125 MVAr (400 kV) Bus Reactor.
- Establishment of 2x1500 MVA, 765/400 kV along with 2x330 MVAr (765 kV) Bus Reactor & 2x125 MVAr (400 kV) Bus Reactor near Jalore
- Barmer-I– Jalore 765 kV D/c line along with 240 MVAr switchable line reactor for each circuit at Jalore end (~160 km)
- Jalore-Chittorgarh 400 kV D/c line along with 80 MVAr switchable line reactor for each circuit at each end (Quad Moose equivalent) (~200 km)
- Establishment 765 kV switching station with 2x330 MVAr (765 kV) Bus Reactor near Pindwara
- Jalore - Pindwara 765 kV D/c line along with 240 MVAr switchable line reactor for each circuit at Pindwara end (~100 km)
- Pindwara – Ahmedabad 765 kV D/c line with 240 MVAr switchable line reactor for each circuit at each end (~250 km)

Phase-II: 25 GW (20 GW Solar, 5 GW Wind, BESS: 10.04 GW)

Pooling Station	Potential				Phase II (by December 2027)			
	Wind (GW)	Solar (GW)	Total (GW)	BESS (GW)	Wind (GW)	Solar (GW)	Total (GW)	BESS (GW)
Bikaner-II	0	7	7	3	0	2	2	1.71
Bikaner-III	0	7	7	3	0	2	2	1.5
Fatehgarh-IV	6	6	12	4	2	2	4	1.83
Ramgarh	4	6	10	3	1	2	3	1.35
Jalore	0	3	3	1	0	1	1	0.33
Sanchore	0	3	3	1	0	1	1	0.33
Sirohi	0	3	3	1	0	1	1	0.33
Pali	0	3	3	1	0	0	0	0
Ajmer	0	2	2	0	0	1	1	0
Nagaur	0	2	2	0	0	1	1	0
Bhadla-IV	2	3	5	2	1	1	2	0.8
Barmer-I	3	4	7	1.5	1	1	2	0.86
Barmer-II	0	6	6	2	0	3	3	1
Jaisalmer/ Jodhpur (Intra-State)	0	5	5	0	0	2	2	0
Total	**15**	**60**	**75**	**22.5**	**5**	**20**	**25**	**10.04**

1. **Bikaner Complex (Solar: 4 GW, BESS: 3.21 GW)**

   Bikaner-II (2 GW Solar, BESS: 1.71 GW), Bikaner-III (2 GW Solar, BESS: 1.5 GW)

   - Augmentation by 400/220 kV, 1x500 MVA ICT at Bikaner-II PS

2. **Ramgarh (2 GW Solar & 1 GW Wind, BESS: 1.35GW) & Bhadla-IV (1 GW Wind & 1 GW Solar, BESS: 0.8 GW) Distt. Jodhpur**

   - Augmentation by 1x1500 MVA, 765/400 kV ICTs at Ramgarh PS
   - Augmentation by 400/220 kV, 2x500 MVA ICTs at Ramgarh PS
   - Establishment of 2x500 MVA, 400/220 kV Bhadla- IV Pooling Station along with 2x125 MVAr (400 kV) Bus Reactor
   - Establishment of 2x1500 MVA, 765/400 kV S/s along with 2x330 MVAr (765 kV) Bus Reactor & 2x125 MVAr (400 kV) Bus Reactor near Hanumangarh in Rajasthan
   - Establishment of 2x1500 MVA, 765/400 kV S/s along with 2x330 MVAr (765 kV) Bus Reactor & 2x125 MVAr (400 kV) Bus Reactor near Sangrur in Punjab
   - Bhadla-III PS – Hamumangarh 765 kV D/c line along with 330 MVAr switchable line reactor for each circuit at each end (~300 km)
   - Hamumangarh - Sangrur 765 kV D/c line along with 240 MVAr switchable line reactor for each circuit at each end (~200 km)
   - Hanumangarh – Fatehabad 400 kV D/c line along with 80 MVAr switchable line reactor for each circuit at Hanumangarh end (Quad Moose equivalent) (~130 km)
   - LILO of Kurukshetra – Jallandhar/Dhanansu 400 kV line at Sangrur S/s (~40 km)
   - Bhadla-IV – Bhadla-III 400 kV D/c line (Quad Moose Equivalent) (~30 km)
   - Augmentation by 1x1500 MVA, 765/400 kV ICT (3rd) at Bhadla-III PS

3. Fatehgarh-IV (2 GW Solar & 2 GW Wind, BESS: 1.83 GW), Barmer-I (1 GW Solar & 1 GW Wind, BESS: 0.86 GW) & Barmer-II (3 GW Solar, BESS: 1 GW)

- Augmentation by 2x1500 MVA, 765/400 kV ICT & 2x500 MVA, 400/220 kV ICT at Fatehgarh-IV (Section-2) Pooling Station
- Augmentation by 1x500 MVA, 400/220 kV ICT at Barmer-I Pooling Station
- Establishment of 3x500 MVA, 400/220 kV Barmer-II Pooling Station along with 2x125 MVAr (400 kV) Bus Reactor
- LILO of both circuits of Banaskantha – Chittorgarh 765 kV D/c line at Pindwara
- Beawar-Chittorgarh 765 kV D/c line (2nd) along with 240 MVAr switchable line reactor for each circuit at each end (~200 km)
- Fatehgarh-IV (Section-2) PS - Jalore 765 kV D/c line along with 240 MVAr switchable line reactor for each circuit at Jalore end (~200 km)
- Jalore – Pindwara 765 kV D/c line (2nd) along with 240 MVAr switchable line reactor for each circuit at Jalore end (~100 km)
- Fatehgarh-IV (Section-2) PS- Barmer-II 400 kV D/c line (Quad Moose equivalent) (~30 km)
- Establishment of 3x1500 MVA, 765/400 kV ICT at Pindwara
- Pindwara – Prantij (GETCO) 400 kV D/c line (Quad Moose equivalent) (~170 km) with 50MVAr switchable line reactor for each circuit at each end
- LILO of Soja – Wanakbori 400 kV 2nd line at Prantij(GETCO) S/s

4. Jalore (1 GW Solar, BESS: 0.33 GW), Sirohi (1 GW Solar, BESS: 0.33 GW) & Sanchore (1 GW Solar, BESS: 0.33 GW)

- Augmentation by 1x1500 MVA, 765/400 kV ICT at Jalore
- Augmentation by 2x500 MVA, 400/220 kV ICT at Jalore
- Establishment of 2x500 MVA, 400/220 kV Pooling Station near Sirohi along with 2x125 MVAr (400 kV) Bus Reactor
- Establishment of 2x500 MVA, 400/220 kV Pooling Station along with 2x125 MVAr (400 kV) Bus Reactor near Sanchore.
- Sanchore – Pindwara 400 kV D/c Line (Quad Moose equivalent) (~150 km)
- Sirohi - Pindwara 400 kV D/c Line (Quad Moose equivalent) (~30 km)

5. Ajmer (1 GW Solar) & Nagaur (1 GW Solar)

- Establishment of 3x1500 MVA, 765/400 kV & 2x500 MVA, 400/220 kV Ajmer (New) Pooling Station along with 2x330 MVAr (765 kV) Bus Reactor & 2x125 MVAr (400 kV) Bus Reactor
- Establishment of 2x500 MVA, 400/220 kV Nagaur Pooling Station along with 2x125 MVAr (400 kV) Bus Reactor
- Ajmer (New) – Beawar 400 kV D/c line (Quad Moose equivalent) (~50 km)
- Nagaur – Ajmer (New) 400 kV D/c line (Quad Moose equivalent) (~120 km)
- Establishment of 765/400 kV, 2x1500 MVA Kota (New) Pooling Station along with 2x330 MVAr (765 kV) Bus Reactor & 2x125 MVAr (400 kV) Bus Reactor
- Establishment of 765/400 kV, 2x1500 MVA Shujalpur (New) Pooling Station along with 2x330 MVAr (765 kV) Bus Reactor & 2x125 MVAr (400 kV) Bus Reactor
- 765 kV Ajmer (New) — Kota (New) D/c line (~200 km) along with 240 MVAr switchable line reactor for each circuit at each end
- Kota (New) – Kota (PG) 400 kV D/c line (Quad Moose equivalent) (~50 km)
- Kota (New) – Shujalpur (New) 765 kV D/c line (~250 km) along with 240 MVAr switchable line reactor for each circuit at each end
- Shujalpur (New) – Shujalpur 400 kV (Quad Moose equivalent) D/c line (~50 km)
- LILO of 765 kV Bina-Indore S/c line at Shujalpur (New) S/s (~30 km)

Phase-III: 31 GW (27 GW Solar, 4 GW Wind, BESS: 12.46 GW)

Pooling Station	Potential				Phase III (by December, 2030)			
	Wind (GW)	Solar (GW)	Total (GW)	BESS (GW)	Wind (GW)	Solar (GW)	Total (GW)	BESS (GW)
Bikaner-II	0	7	7	3	0	1	1	1.29
Bikaner-III	0	7	7	3	0	2	2	1.5
Fatehgarh-IV	6	6	12	4	2	3	5	2.17
Ramgarh	4	6	10	3	1	3	4	1.65
Jalore	0	3	3	1	0	2	2	0.67
Sanchore	0	3	3	1	0	2	2	0.67
Sirohi	0	3	3	1	0	2	2	0.67
Pali	0	3	3	1	0	3	3	1
Ajmer	0	2	2	0	0	1	1	0
Nagaur	0	2	2	0	0	1	1	0
Bhadla-IV	2	3	5	2	1	2	3	1.2
Barmer-I	3	4	7	1.5	0	1	1	0.64
Barmer-II	0	6	6	2	0	3	3	1
Jaisalmer/ Jodhpur (Intra-State)	0	5	5	0	0	1	1	0
Total	**15**	**60**	**75**	**22.5**	**4**	**27**	**31**	**12.46**

1. **Bikaner Complex (3 GW Solar, BESS: 2.79 GW)**

   Bikaner-II (1 GW Solar, BESS: 1.29 GW), Bikaner-III (2 GW Solar, BESS: 1.5 GW)

   - Augmentation by 765/400 kV, 1x1500MVA ICT (4th) at Bikaner (PG)
   - Augmentation by 1x500 MVA, 400/220 kV ICT at Bikaner-III Pooling Station along

2. **Ajmer (1 GW Solar) & Nagaur (1 GW Solar)**

   - Augmentation by 1x1500 MVA, 765/400 kV ICT & 1x500 MVA, 400/220 kV ICT at Ajmer (New) Pooling Station
   - Augmentation by 1x500 MVA, 400/220 kV ICT at Nagaur Pooling Station
   - Shujalpur (New) - Bhopal(Sterlite) 765 kV D/c line (~90 km)

3. **Ramgarh (1 GW Wind & 3 GW Solar, BESS: 1.65GW), Distt. Jaisalmer & Bhadla-IV (1 GW Wind & 2 GW Solar, BESS: 1.2 GW)**

   - Augmentation by 1x1500MVA, 765/400 kV ICT at Ramgarh PS
   - Augmentation by 400/220 kV, 1x500 MVA ICT at Ramgarh PS
   - Augmentation by 1x500 MVA, 400/220 kV at Bhadla- IV Pooling Station
   - Augmentation by 1x1500 MVA, 765/400 kV ICT at Sangrur in Punjab
   - LILO of both circuits of Patiala- Patran 400 kV D/c line at Sangrur S/s(~40 km)

4. **Fatehgarh-IV (2 GW Wind & 3 GW Solar, BESS: 2.17GW), Barmer-I (1 GW Solar, BESS: 0.64GW) & Barmer-II (3 GW Solar, BESS: 1GW)**

   - Augmentation by 1x500 MVA, 400/220 kV ICT at Fatehgarh-IV Pooling Station
   - Augmentation by 2x500 MVA, 400/220 kV ICT at Barmer-II Pooling Station

- Barmer-I - Barmer-II 400 kV D/c Line (Quad Moose equivalent) (~30 km)
- Barmer-II (HVDC)-Barmer-II 400 kV 2xD/c line (Quad Moose equivalent) (~20 km)

Common HVDC system for Fatehgarh-IV, Barmer-I and Barmer-II

- 6000MW, ±800 kV HVDC terminal station at a suitable location near Barmer-II (Barmer-II (HVDC)) #
- 6000MW, ±800 kV HVDC terminal station at a suitable location near Jabalpur#
- Establishment of 5x1500MVA, 765/400 kV ICT at pooling station at suitable location near Jabalpur along with 2x330MVAr (765 kV) bus reactor#
- ±800kV HVDC line between Barmer-II (HVDC) and Jabalpur# (~1100 km)
- Jabalpur(HVDC)-Jabalpur Pool 765 kV 2xD/c line(~50 km)
- Jabalpur Pool – Jabalpur (PG) 400 kV (2nd) D/c line (~20 km) ^

 # The HVDC system to be developed initially for 6000 MW with a provision for upgradation to 8000 MW based on the future requirements. The type of HVDC (VSC or LCC), requirement of reactive power support etc. would be decided at the time of implementation based on the system requirement

^ Suitable scheme at Jabalpur Pool/ Jabalpur (PG) S/s to be planned for fault level control

5. Common system for Ajmer & Fatehgarh/Barmer Complex

- Establishment of 2x1500 MVA, 765/400 kV Santrampur S/s along with 2x330 MVAr (765 kV) Bus Reactor & 2x125 MVAr (400 kV) Bus Reactor
- Chittorgarh –Neemuch-II 765 kV D/c line (~ 120 km)
- Neemuch-II - Santrampur 765 kV D/c line along with 240 MVAr switchable line reactors for each circuit at each end (~260 km)
- Santrampur -Dhule(BDTCL) 765 kV D/c line along with 330 MVAr switchable line reactor for each circuit at each end (~300 km)
- Establishment of 3x1500 MVA, 765/400 kV & 4x500 MVA, 400/220 kV Boisar-II S/s along with 2x330 MVAr (765 kV) Bus Reactor & 2x125 MVAr (400 kV) Bus Reactor
- Dhule(BDTCL)- Boisar-II 765 kV D/c line along with 330 MVAr switchable line reactor for each circuit at each end (~300 km)
- Boisar-II – Velgaon(MSETCL) 400 kV D/c (Quad Moose equivalent) line (~50km.) (Additional 400 kV as well as 220 kV outlets shall be planned in coordination with MSETCL)
- LILO of Navsari(New) – Padghe 765 kV D/c line at Boisar-II (~20 km)
- Santrampur – Asoj 400 kV D/c line along with 80 MVAr switchable line reactor for each circuit at Santrampur end (~150 km)*

*Issue of high fault level at Asoj to be resolved in coordination with GETCO

6. Jalore (2 GW Solar, BESS: 0.67 GW), Sirohi (2 GW Solar, BESS : 0.67 GW), Sanchore (2 GW Solar, BESS : 0.67GW) and Pali (3 GW Solar, BESS : 1GW)

- Augmentation by 1x1500 MVA, 765/400 kV ICT at Jalore
- Augmentation by 1x500 MVA, 400/220 kV ICT at Jalore
- Augmentation by 1x500 MVA, 400/220 kV ICT at Sirohi
- Augmentation by 1x500 MVA, 400/220 kV ICT at Sanchore
- Establishment of 3x500 MVA, 400/220 kV Pali Pooling Station along with 2x125 MVAr (400 kV) Bus Reactor
- Pali – Jalore 400 kV D/c line (Quad Moose equivalent) (~120 km)

B. Phasing of transmission system for integration of 20.5 GW RE capacity in Western Region

Transmission Schemes for evacuation of power from 5 GW REZ in Maharashtra at Sholapur, Dhule, Kallam and 2 GW REZ in MP at Neemuch – Phase I

District	Potential				Phase I (by March, 2025)			
	Wind (GW)	Solar (GW)	Total (GW)	BESS (GW)	Wind (GW)	Solar (GW)	Total (GW)	BESS (GW)
Sholapur	0	1	1	0.5		1	1	0.5
Dhule	1	1	2	0.3	1	1	2	0.3
Osmanabad & Parli	1	1	2	0.3	1	1	2	0.3
Location to be firmed up in Maharashtra*	0	2.5	2.5	0	0	0	0	0
Neemuch	2	0	2	0	2		2	0
Sagar	0	1.5	1.5	0	0	0	0	0
Morena	0	3.9	3.9	0	0	0	0	0
Khandwa	0	0.6	0.6	0	0	0	0	0
Offshore	5	0	5	0	0	0	0	0
Total	**9**	**11.5**	**20.5**	**1.1**	**4**	**3**	**7**	**1.1**

* Transmission system would be planned once the location of RE potential zone is firmed up by SECI/MNRE

1. Solapur: (1 GW Solar, 0.5 GW BESS)

- Direct interconnection at 400 kV level of Solapur (PG) S/s.

2. Dhule: (1 GW Solar, 1 GW Wind, 0.3 GW BESS)

- Establishment of 4x500 MVA, 400/220 kV Pooling Station near Dhule along with 2x125 MVAr (400 kV) Bus Reactor
- Dhule PS – Dhule (TBCB) 400 kV D/c Line (Quad Moose) (60 km)

3. Kallam/Parli: (1 GW Solar, 1 GW Wind, 0.3 GW BESS)

0.3 GW at Parli:

- Direct interconnection at 220 kV level of 400/220 kV Parli (PG) S/s

0.7GW at Parli(New) 765/400 kV S/s:

- Direct interconnection at 400 kV level of 765/400 kV Parli (New) S/s [through 1 no. 400 kV line bay]

1 GW at Kallam:

- Augmentation of Kallam Pooling Station by 2x500 MVA, 400/220 kV ICTs
- 1x125 MVAr bus reactor (2nd) at Kallam PS

Neemuch: 2 GW Wind

- Establishment of 2x1500 MVA 765/400 kV, 4x500 MVA, 400/220 kV Neemuch-II PS along with 2x330 MVAr (765 kV) Bus Reactor and 1x125 MVAr (400 kV) Bus Reactor
- Neemuch-II PS – Indore 765 kV D/c line (250 km) with 240MVAr, 765 kV switchable line reactors on each ckt at Neemuch-II & Indore ends respectively

Transmission Schemes for evacuation of power from 3.1 GW REZ in MP at Morena & Khandwa and 2.11 GW offshore wind farm in Gujarat– Phase II

District	Potential				Phase II (by December 2027)			
	Wind (GW)	Solar (GW)	Total (GW)	BESS (GW)	Wind (GW)	Solar (GW)	Total (GW)	BESS (GW)
Sholapur	0	1	1	0.5	0	0	0	0
Dhule	1	1	2	0.3	0	0	0	0
Osmanabad & Parli	1	1	2	0.3	0	0	0	0
Location to be firmed up in Maharashtra*	0	2.5	2.5	0	0	0	0	0
Neemuch	2	0	2	0	0	0	0	0
Sagar	0	1.5	1.5	0	0	0	0	0
Morena	0	3.9	3.9	0	0	2.5	2.5	0
Khandwa	0	0.6	0.6	0	0	0.6	0.6	0
Offshore	5	0	5	0	2.11	0	2.11	0
Total	**9**	**11.5**	**20.5**	**1.1**	**2.11**	**3.1**	**5.21**	**0**

* Transmission system would be planned once the location of RE potential zone is firmed up by SECI/MNRE

1. Morena: 2.5 GW Solar

- Establishment of 6x500 MVA, 400/220 kV Pooling Station along with 1x125 MVAr (400 kV) Bus Reactor near Morena
- Morena PS – South Gwalior (near Datia)* 400 kV D/c (quad moose) line (~100 km) with 50MVAr switchable line reactors on each ckt at Morena PS end

  *A new 765/400/220 kV S/s is being planned south of Gwalior so as to cater to increase in demand in the area. The same is proposed to be utilized for evacuation of power from Morena (3.9GW) Solar Park

2. Khandwa: 0.6 GW Solar

- To be integrated at existing Khandwa(PG) 400/220 kV S/s (MP is planning to connect it with their intra-state system)

3. Transmission Schemes for evacuation of power from Off-shore Wind Farm in Gujarat (2.11 GW Offshore wind - Mahuva) For 2.11 GW (B3 Pocket: 1GW & B4 Pocket: 1.11 GW)

- Establishment of 6x500 MVA, 400/220 kV Mahuva Onshore Pooling Station (Mahuva PS) alongwith bus reactor (with space provision for upgradation to 765 kV level so as to cater to future Offshore Wind Projects adjacent to B3, B4, B5 pockets in future)
- Off Shore Sub-Station (OSS) B3 – Mahuva Onshore PS 220 kV 2xS/c Submarine cable (~45 km)
- Off Shore Sub-Station (OSS) B4 – Mahuva Onshore PS 220 kV 3xS/c cables (~44 km)
- Mahuva Onshore PS – Vataman* 400 kV D/c line (190 km) (Quad Moose) with 63MVAr & 50MVAr, 400 kV switchable line reactors on each ckt at Mahuva & Vataman ends respectively
- Installation of 3x1500MVA, 765/400 kV ICTs at Vataman along with 2x125 MVAr (400 kV) Bus Reactor *
- Suitable Static Compensation / Dynamic Compensation

Note: *Vataman S/s has been planned through LILO of Lakadia-Vadodara 765 kV D/c line at Vataman with Khavda Ph-III (7 GW) and Dholera (Ph-I: 2GW)

Note:

1. *The no. of 220 kV Submarine Cables has been considered assuming capacity of one three phase cable as 500 MW. However, the requirement of cables (single phase or three phase and its voltage class) would be further firmed up while detailing the scheme.*

2. *Exact Reactive compensation to be worked out based on data being received from submarine cable manufactures pertaining to MVAr generation from the cables.*

Transmission Schemes for evacuation of power from 2.5 GW REZ in Maharashtra, 2.9 GW in MP at Sagar, Morena and 2.83 GW offshore wind farm in Gujarat– Phase III

District	Potential				Phase III (by December, 2030)			
	Wind (GW)	Solar (GW)	Total (GW)	BESS (GW)	Wind (GW)	Solar (GW)	Total (GW)	BESS (GW)
Sholapur	0	1	1	0.5	0	0	0	0
Dhule	1	1	2	0.3	0	0	0	0
Osmanabad & Parli	1	1	2	0.3	0	0	0	0
Location to be firmed up in Maharashtra*	0	2.5	2.5	0	0	2.5	2.5	0
Neemuch	2	0	2	0	0	0	0	0
Sagar	0	1.5	1.5	0	0	1.5	1.5	0
Morena	0	3.9	3.9	0	0	1.4	1.4	0
Khandwa	0	0.6	0.6	0	0	0	0	0
Offshore	5	0	5	0	2.83	0	2.83	0
Total	**9**	**11.5**	**20.5**	**1.1**	**2.83**	**5.4**	**8.23**	**0**

* Transmission system would be planned once the location of RE potential zone is firmed up by SECI/MNRE

1. Morena: 1.4 GW Solar

- Augmentation of Morena PS by 3x500 MVA, 400/220 kV ICT along with 1x125 MVAr (400 kV) Bus Reactor
- Morena PS – Morena (TBCB) 400 kV D/c (quad) line (~50 km)

2. Sagar: 1.5 GW Solar

- Establishment of 4x500 MVA, 400/220 kV Sagar PS along with 2x125 MVAr (400 kV) Bus Reactor
- Sagar – Damoh (PG) 400 kV D/c (quad moose) line (~80km)

3. Transmission Schemes for evacuation of power from Off-shore Wind farm in Gujarat - 2.83 GW (B5 Pocket: 1.59 GW & B6 Pocket: 1.24 GW)

For 1.59 GW (B5 Pocket)

- Off Shore Sub-Station (OSS) B5 – Mahuva Onshore PS 220 kV 4xS/c cables (~45 km)
- Augmentation of 400/220 kV Mahuva Onshore Pooling Station (Mahuva PS) with 3x500 MVA ICTs
- Mahuva Onshore PS – Vataman 400 kV 2nd D/c line (one D/c strung as S/c) (190 km) (Quad Moose) with 63MVAr & 50MVAr, 400 kV switchable line reactors at Mahuva & Vataman ends respectively

- Augmentation by 1x1500MVA, 765/400 kV ICTs at Vataman
- Suitable Static Compensation / Dynamic Compensation

For 1.24 GW (B6 Pocket)

- Establishment of 4x500 MVA, 400/220 kV Ubhrat Onshore Pooling Station (Ubhrat PS) (with space provision for upgradation to 765 kV level so as to cater to future Offshore Wind Projects adjacent to B6 pocket)
- Off Shore Sub-Station (OSS) B6 – Ubhrat Onshore PS 220 kV 3xS/c cables (~55 km)
- Ubhrat Onshore PS – Vapi 400 kV D/c line (100km) (Quad Moose) with 50MVAr, 400 kV switchable line reactors on each ckt at Ubhrat Onshore PS end
- Suitable Static Compensation / Dynamic Compensation with MSR

Note:

1. *The no. of 220 kV Submarine Cables has been considered assuming capacity of one three phase cable as 500 MW. However, the requirement of cables (single phase or three phase and its voltage class) would be further firmed up while detailing the scheme.*
2. *Exact Reactive compensation to be worked out based on data being received from submarine cable manufactures pertaining to MVAr generation from the cables.*

C. Phasing of transmission system for integration of 86 GW RE capacity in Southern Region

C1. Tentative phasing of Transmission System for 51 GW REZ (18 GW Wind & 33 GW Solar) in Andhra Pradesh

Transmission system for Potential identified under Phase -I

Pooling Station	Potential (GW)				Phase I (by March, 2025)			
	Wind (GW)	Solar (GW)	Total (GW)	BESS (GW)	Wind (GW)	Solar (GW)	Total (GW)	BESS (GW)
Kurnool-IV	4	7.5	11.5	3	2	2.5	4.5	0
Kurnool-V	4	7.5	11.5	3	0	0	0	0
Anantapur	2	2	4	1	2	1.5	3.5	0
Anantapur-II	8	8	16	4	0	4	4	0
Kadapa-II	0	8	8	3	0	0	0	0
Total	**18**	**33**	**51**	**14**	**4**	**8**	**12**	**0**

1. Transmission System for integration of Kurnool REZ-I (2.5 GW Solar, 2 GW Wind)

- Establishment of 4x1500 MVA, 765/400 kV & 5x500 MVA, 400/220 kV Kurnool-IV Pooling Station near Kurnool, Andhra Pradesh along with 2x330 MVAr (765 kV) & 2x125 MVAr (400 kV) bus reactors at Kurnool-IV PS
- Kurnool-IV – Kurnool-III PS 765 kV D/c line (~100 km)

2. Transmission System for integration of Anantapur REZ (2 GW Wind, 1.5 GW solar integrated with already planned Anantapur pooling station under 66.5 GW)

- Augmentation of 3x500 MVA, 400/220 kV ICTs at Anantapur

3. Transmission System for integration of Anantapur REZ (4 GW Solar)

- Establishment of 4x1500 MVA, 765/400 kV & 5x500 MVA, 400/220 kV Anantapur-II Pooling Station near Kurnool, Andhra Pradesh along with 2x330 MVAr (765 kV) & 2x125 MVAr (400 kV) bus reactors at Anantapur-II PS
- Anantapur-II – Cuddapah 765 kV D/c line with 240 MVAr SLR at Anantapur-II PS (~250 km)

Transmission system for Potential identified under Phase II

Pooling Station	Potential (GW)				Phase II (by December, 2027)			
	Wind (GW)	Solar (GW)	Total (GW)	BESS (GW)	Wind (GW)	Solar (GW)	Total (GW)	BESS (GW)
Kurnool-IV	4	7.5	11.5	3	2	2	4	3
Kurnool-V	4	7.5	11.5	3	1	4.5	5.5	0
Anantapur	2	2	4	1	0	0	0	0
Anantapur-II	8	8	16	4	4	1	5	2
Kadapa-II	0	8	8	3	0	4	4	1.5
Total	**18**	**33**	**51**	**14**	**7**	**11.5**	**18.5**	**6.5**

1. Transmission System for integration of Kurnool REZ-I (2 GW Solar, 2 GW Wind, 3 BESS)

- Augmentation of 1x1500 MVA, 765/400 kV and 2x500 MVA, 400/220 kV ICTs at Kurnool-IV Pooling Station
- Kurnool-IV – Bidar PS 765 kV D/c line with 240 MVAr SLR at both ends (~280 km)

2. Transmission System for integration of Kurnool REZ-II (4.5 GW Solar, 1 GW Wind, 2 BESS)

- Establishment of 3x1500 MVA, 765/400 kV & 5x500 MVA, 400/220 kV Kurnool-V Pooling Station near Kurnool, Andhra Pradesh along with 2x330 MVAr (765 kV) & 2x125 MVAr (400 kV) bus reactors at Kurnool-V PS
- Kurnool-V – Kurnool-IV 765 kV D/c line (~100 km)
- Augmentation of 2x1500 MVA, 765/400 kV ICTs at Maheshwaram 765/400 kV substation

3. Transmission System for integration of Anantapur REZ (1 GW Solar, 4 GW Wind, 2 BESS)

- Augmentation of 1x1500 MVA, 765/400 kV and 2x500 MVA, 400/220 kV ICTs at Anantapur-II Pooling Station Andhra Pradesh
- Anantapur-II – Kurnool-V PS 765 kV D/c line (~100 km)

4. Transmission System for integration of Kadapa REZ (4 GW Solar, 1.5 BESS)

- Establishment of 3x1500 MVA, 765/400 kV and 4x500 MVA, 400/220 kV Pooling Station near Kadapa (Kadapa II PS), Andhra Pradesh along with 2x330 MVAr (765 kV) & 2x125 MVAr (400 kV) bus reactors at Kadapa-II PS
- LILO of both circuits of Anantapur-II – Cuddapah 765 kV D/c line at Kadapa-II PS (~10 km)

Transmission system for Potential identified under Phase III

Pooling Station	Potential (GW)				Phase III (by December, 2030)			
	Wind (GW)	Solar (GW)	Total (GW)	BESS (GW)	Wind (GW)	Solar (GW)	Total (GW)	BESS (GW)
Kurnool-IV	4	7.5	11.5	3	0	0	0	0
Kurnool-V	4	7.5	11.5	3	3	6	9	3
Anantapur	2	2	4	1	0	0	0	0
Anantapur-II	8	8	16	4	4	3.5	7.5	3
Kadapa-II	0	8	8	3	0	4	4	1.5
Total	**18**	**33**	**51**	**14**	**7**	**13.5**	**20.5**	**7.5**

1. Transmission System for integration of Kurnool REZ-II (6 GW Solar, 3 GW Wind, 3 BESS)

- Augmentation of 2x1500 MVA, 765/400 kV and 2x500 MVA, 400/220 kV ICTs at Kurnool-V Pooling Station near Kurnool, Andhra Pradesh
- Kurnool-V – Chilakaluripeta 765 kV D/c line with 330 MVAr SLR at Kurnool-V PS end (~210 km)
- Chilakaluripeta – Podili 400 kV (quad) D/c line (~100 km)
- Augmentation of 2x1500 MVA, 765/400 kV ICTs at Chilakaluripeta 765/400 kV substation

2. Transmission System for integration of Anantapur REZ (3.5 GW Solar, 4 GW Wind, 3 BESS)

- Augmentation of 1x1500 MVA, 765/400 kV, and 2x500 MVA, 400/220 kV, ICTs at Anantapur-II PS

3. Transmission System for integration of Kadapa REZ (4 GW Solar, 1.5 GW BESS)

- Augmentation of 1x1500 MVA, 765/400 kV and 2x500 MVA, 400/220 kV ICT at Kadapa-II PS, Andhra Pradesh
- Kadapa-II PS – Thiruvalam 765 kV D/c line with 240 MVAr SLR at both ends (~250 km)

C2. Transmission System for 17 GW REZ (8 GW Wind & 9 GW Solar) in Karnataka

Transmission system for Potential identified under Phase I

Pooling Station	Potential (GW)				Phase I (by March, 2025)			
	Wind (GW)	Solar (GW)	Total (GW)	BESS (GW)	Wind (GW)	Solar (GW)	Total (GW)	BESS (GW)
Koppal-II	2	2	4	1	2	2	4	1
Gadag-II	2	2	4	1	2	2	4	1
Devanagere/ Chitragurga	2	2	4	1	2	2	4	1
Bijapur	2	0	2	0	1	0	1	0
Bellary	0	1.5	1.5	0	0	0	0	0
Tumkur-II	0	1.5	1.5	0	0	0	0	0
Total	**8**	**9**	**17**	**3**	**7**	**6**	**13**	**3**

1. Transmission System for integration of Koppal REZ (2 GW Wind, 2 GW Solar, 1 GW BESS)

- Establishment of 6x1500 MVA, 765/400 kV and 3x500 MVA, 400/220 kV Pooling Station near Koppal, Karnataka (Koppal-II PS) along with 2x330 MVAr (765 kV) & 2x125 MVAr (400 kV) bus reactors at Koppal-II PS
- Koppal-II PS – Narendra (New) 765 kV D/c line with 330 MVAr SLR at Koppal-II PS end (~150 km)
- Koppal-II PS – Raichur 765 kV D/c line with 330 MVAr SLR at Koppal-II PS end (~190 km)

2. Transmission System for integration of Gadag REZ (2 GW Wind, 2 GW Solar, 1 GW BESS)

- Establishment of 3x500 MVA, 400/220 kV Pooling Station near Gadag, Karnataka (Gadag-II PS) along with 2x125 MVAr 400 kV bus reactors at Gadag-II PS
- Gadag-II PS – Koppal-II PS 400 kV (Quad Moose equivalent) D/c line (~65km)

3. Transmission System for integration of Devanagere/Chitragurga REZ (2 GW Wind, 2 GW Solar, 1 GW BESS)

- Establishment of 3x500 MVA, 400/220 kV Pooling Station near Devanagere/ Chitragurga, Karnataka along with 2x125MVAr 400 kV bus reactors at Devanagere / Chitragurga PS
- Devanagere / Chitragurga PS – Koppal-II PS 400 kV (Quad Moose equivalent) D/c line (~100 km)

4. Transmission System for integration of Bijapur REZ (1 GW Wind)

- Establishment of 2x500 MVA, 400/220 kV Pooling Station near Bijapur (Vijayapura), Karnataka along with 2x125 MVAr, 400 kV bus reactors at Bijapur PS
- Bijapur PS – Koppal-II PS 400 kV (Quad Moose equivalent) D/c line (~100 km)

Transmission system for Potential identified under Phase II

Pooling Station	Potential (GW)				Phase II (by December, 2027)			
	Wind (GW)	Solar (GW)	Total (GW)	BESS (GW)	Wind (GW)	Solar (GW)	Total (GW)	BESS (GW)
Koppal-II	2	2	4	1	0	0	0	0
Gadag-II	2	2	4	1	0	0	0	0
Devanagere/ Chitragurga	2	2	4	1	0	0	0	0
Bijapur	2	0	2	0	1	0	1	0
Bellary	0	1.5	1.5	0	0	1.5	1.5	0
Tumkur-II	0	1.5	1.5	0	0	1.5	1.5	0
Total	**8**	**9**	**17**	**3**	**1**	**3**	**4**	**0**

1. Transmission System for integration of Bijapur REZ (1 GW Wind)

- Augmentation of 1x500 MVA, 400/220 kV ICTs at Bijapur (Vijayapura) PS

2. Transmission System for integration of Bellary REZ (1.5 GW Solar)

- Establishment of 4x500 MVA, 400/220 kV Pooling Station near Bellary (Bellary-II PS), Karnataka, along with 2x125 MVAr 400 kV bus reactors at Bellary PS
- Bellary PS – Koppal-II PS 400 kV (Quad Moose equivalent) D/c line (~100 km)

3. Transmission System for integration of Tumkur REZ (1.5 GW Solar)

- Establishment of 4x500 MVA, 400/220 kV Pooling Station near Tumkur (Tumkur-II PS), Karnataka, along with 2x125 MVAr 400 kV bus reactors at Tumkur-II PS
- Tumkur-II PS – Tumkur(Pavagada) 400 kV (Quad Moose equivalent) D/c line (~100 km)

C3. Transmission System for 13 GW REZ (3 GW Wind & 10 GW Solar) in Telangana

Transmission system for Potential identified under Phase I

Pooling Station	Potential (GW)				Phase I (by March, 2025)			
	Wind (GW)	Solar (GW)	Total (GW)	BESS (GW)	Wind (GW)	Solar (GW)	Total (GW)	BESS (GW)
Nizamabad-II	1	2.5	3.5	1	1	1	2	0
Medak	1	2.5	3.5	1	1	0.5	1.5	0
Rangareddy	1	2.5	3.5	1	1	0.5	1.5	0
Karimnagar	0	2.5	2.5	0	0	0	0	0
Total	**3**	**10**	**13**	**3**	**3**	**2**	**5**	**0**

1. Transmission System for integration of Nizamabad REZ (1 GW Wind, 1 GW Solar)

- Establishment of 4x1500 MVA, 765/400 kV and 2x500 MVA, 400/220 kV Pooling Station near Nizamabad (Nizamabad-II) along with 2x330 MVAr (765 kV) & 2x125 MVAr (400 kV) bus reactors at Nizamabad-II PS
- Nizamabad-II PS – Nizamabad(PG) 765 kV 2x D/c line (~30 km)

2. Transmission System for integration of Medak REZ (1 GW Wind, 0.5 GW Solar)

- Establishment of 2x500 MVA, 400/220 kV Pooling Station near Medak (Medak PS) along with 2x125 MVAr bus reactors at Medak PS
- Medak PS – Nizamabad-II 400 kV (Quad Moose equivalent) D/c line (~60 km)

3. Transmission System for integration of Rangareddy REZ (1 GW Wind, 0.5 GW Solar)

- Establishment of 2x500 MVA, 400/220 kV Pooling Station near Rangareddy (Rangareddy PS) along with 2x125 MVAr bus reactors at Rangareddy PS
- Rangareddy PS – Nizamabad-II 400 kV (Quad Moose equivalent) D/c line with 80 MVAr SLR at Rangareddy PS (~155 km)

Transmission system for Potential identified under Phase II

Pooling Station	Potential (GW)				Phase II (by December, 2027)			
	Wind (GW)	Solar (GW)	Total (GW)	BESS (GW)	Wind (GW)	Solar (GW)	Total (GW)	BESS (GW)
Nizamabad-II	1	2.5	3.5	1	0	1.5	1.5	1
Medak	1	2.5	3.5	1	0	2	2	1
Rangareddy	1	2.5	3.5	1	0	2	2	1
Karimnagar	0	2.5	2.5	0	0	2	2	0
Total	**3**	**10**	**13**	**3**	**0**	**7.5**	**7.5**	**3**

1. Transmission System for integration of Nizamabad REZ (1.5 GW Solar, 1 GW BESS)

- Augmentation of 2x1500 MVA, 765/400 kV and 1x500 MVA, 400/220 kV ICTs at Nizamabad-II PS
- Augmentation by 1x1500 MVA, 765/400 kV ICT at Nizamabad (PG) S/s
- Nizamabad-II PS – Warangal (New) 765 kV D/c line with 330 MVAr SLR at Nizamabad-II PS (~180 km)

2. Transmission System for integration of Medak REZ (2 GW Solar, 1 GW BESS)

- Augmentation of 1x500 MVA, 400/220 kV ICT at Medak PS

3. Transmission System for integration of Rangareddy REZ (2 GW Solar, 1 GW BESS)

- Augmentation of 1x500 MVA, 400/220 kV ICTs at Rangareddy PS

4. Transmission System for integration of Karimnagar REZ (2 GW Solar)

- Establishment of 3x500 MVA, 400/220 kV Pooling Station near Karimnagar (Karimnagar PS) along with 2x125 MVAr bus reactors at Karimnagar PS
- Karimnagar PS – Nizamabad-II 400 kV (Quad) D/c line (~100 km)

Transmission system for Potential identified under Phase III

Pooling Station	Potential (GW)				Phase III (by December, 2030)			
	Wind (GW)	Solar (GW)	Total (GW)	BESS (GW)	Wind (GW)	Solar (GW)	Total (GW)	BESS (GW)
Nizamabad-II	1	2.5	3.5	1	0	0	0	0
Medak	1	2.5	3.5	1	0	0	0	0
Rangareddy	1	2.5	3.5	1	0	0	0	0
Karimnagar	0	2.5	2.5	0	0	0.5	0.5	0
Total	**3**	**10**	**13**	**3**	**0**	**0.5**	**0.5**	**0**

1. Transmission System for integration of Karimnagar REZ (0.5 GW Solar)

- Augmentation of 1x500 MVA ICTs, 400/220 kV at Karimnagar PS

C4. Transmission System for 5 GW Offshore wind farm (Sub Zone B1 to B4 & G1 to G3) in Tamil Nadu

Prioritized Offshore Wind Zone & Capacity

Sub Zone ID	OSS ID	Installable MW#	Tentative Timelines
B1	OSS B1	912	Stage-1 auction by 2022 & Stage-2 auction between 2024 – 26
B2	OSS B2	828	
B3	OSS B3	705	
B4	OSS B4	809	
G1	OSS G1	655	
G2	OSS G2	555	
G3	OSS G3	878	
Total		**5342 MW**	

Transmission system for Potential identified under Phase II (2 GW)

Onshore pooling station and Transmission System from Onshore Pooling Station

- Establishment of 5x500 MVA, 400/230 kV Onshore Pooling Station near Avaraikulam, Tirunelveli District in Tamil Nadu
- Avaraikulam Onshore PS – Pugalur (HVDC) 400 kV D/c line with 125 MVAr switchable reactors at both ends (with Quad Moose equivalent) (300 km)
- Suitable Static Compensation / Dynamic Compensation with MSR

Transmission System for integration of Offshore Wind Farms with Onshore PS

- OSS G1 – Avaraikulam Onshore PS 230kV 2xS/c Submarine cable (40 km)
- OSS G2 – Avaraikulam Onshore PS 230kV S/c Submarine cable (35 km)
- OSS G3 – Avaraikulam Onshore PS 230kV 2xS/c Submarine cable (36 km)
- 5 nos. of 230 kV line bays for interconnection of Offshore wind projects

Transmission system for Potential identified under Phase III (3 GW)

Onshore pooling station and Transmission System from Onshore Pooling Station

- Augmentation of 400/230kV, 7x500 MVA at Avaraikulam Onshore PS
- Avaraikulam On shore PS –Tuticorin PS 400 kV (quad) D/c line (100 km)
- Suitable Static Compensation / Dynamic Compensation with MSR

Transmission System for integration of Offshore Wind Farms with Onshore PS

- OSS B1 – Avaraikulam Onshore PS 230kV 2xS/c Submarine cable (30 km)
- OSS B2 – Avaraikulam Onshore PS 230kV 2xS/c Submarine cable (35 km)
- OSS B3 – Avaraikulam Onshore PS 230kV 2xS/c Submarine cable (41 km)
- OSS B4 – Avaraikulam Onshore PS 230kV 2xS/c Submarine cable (43 km)
- 8 nos. of 230kV line bays for interconnection of Offshore wind projects

Note:

1. *The number of 230 kV submarine Cables has been considered assuming capacity of one three phase cable as 500 MW. However, the requirement of cables (single phase or three phase and its voltage class) would be further firmed up while detailing the scheme.*

2. *Reactive compensation to be worked out based on data being received from submarine cable manufactures pertaining to MVAr generation from the cables.*

Annex-V

State-wise details of margin available at various ISTS Sub-stations

Region	Additional Margin in existing / UC system (MW)		
	220 kV level	400 kV level	Total
Rajasthan	850	0	850
Haryana	550	0	550
Uttar Pradesh	250	3600	3850
Gujarat	1184	0	1184
Maharashtra	600	3000	3600
Madhya Pradesh	443.76	1000	1443.76
Chhattisgarh	0	3400	3400
Andhra Pradesh	300	500	800
Karnataka	1300	1200	2500
Tamil Nadu	1029.9	1000	2029.9
Kerala	300	0	300
Odisha	2300	2000	4300
Jharkhand	800	500	1300
Bihar	4850	0	4850
West Bengal	300	2400	2700
Total	**15057.66**	**18600**	**33657.7**

(Source: CTUIL)

Annex-VI

Additional hydro projects likely by 2030

Sl. No.	Name of Hydro Project	Capacity (MW)	Broad transmission system
	Andhra Pradesh		
1.	Polavaram (APGENCO/ Irrigation Dept.)	960	Transmission System under Intra State
2.	Pinnapuram PSP (Greenko AP01 IREP Private Limited)	1200	Greenko AP01 IREP Pvt. Ltd. – Kurnool (New) 400 kV (quad) D/c line.
	Arunachal Pradesh		
3.	Subansiri Lower (NHPC)	2000	Lower Subansiri - Biswanath Chariali 400 kV 2 x D/c line
	Assam		
4.	Lower Kopli (APGCL)	120	Transmission System under Intra State
	Himachal Pradesh		
5.	Parbati St. II (NHPC)	800	Parbati-II - Parbati Pooling Station 400 kV D/c line
6.	Luhri-I (SJVN)	210	**Common System:** 1. Establishment of 7x105 MVA, 400/220 kV Nange GIS Pooling Station. 2. Nange (GIS) Pooling Station – Koldam 400 kV D/c line. 3. Bypassing one ckt of Koldam – Ropar/ Ludhiana 400 kV D/c line at Koldam and connecting it with one of the circuit of Nange-Koldam 400 kV D/c line, thus forming Nange- Ropar/ Ludhiana 400 kV S/c line. **Under the scope of generation developer:** Luhri Stage-I – Nange Pooling Station 220 kV D/c line.
7.	Luhri Stage-II (SJVN)	172	**Common System:** 1. Establishment of 7x105 MVA, 400/220 kV Nange GIS Pooling Station. 2. Nange (GIS) Pooling Station – Koldam 400 kV D/c line. 3. Bypassing one ckt of Koldam – Ropar/ Ludhiana 400 kV D/c line at Koldam and connecting it with one of the circuit of Nange-Koldam 400 kV D/c line, thus forming Nange- Ropar/ Ludhiana 400 kV S/c line. **Under the scope of generation developer:** Luhri Stage-II – Nange Pooling Station 220 kV D/c line.
8.	Sunni Dam HEP (SJVN)	382	**Common System:** 1. Establishment of 7x105 MVA, 400/220 kV Nange GIS Pooling Station. 2. Nange (GIS) Pooling Station – Koldam 400 kV D/c line. 3. Bypassing one ckt of Koldam – Ropar/ Ludhiana 400 kV D/c line at Koldam and connecting it with one of the circuit of Nange-Koldam 400 kV D/c line, thus forming Nange- Ropar/ Ludhiana 400 kV S/c line. **Under the scope of generation developer:** Sunni Dam – Nange Pooling Station 220 kV D/c line.

Sl. No.	Name of Hydro Project	Capacity (MW)	Broad transmission system
9.	Tidong-I (Statkraft IPL)	150	1. Establishment of 2x315 MVA (7x105 MVA 1-ph units) 220/400 kV GIS Pooling Station at Jhangi. 2. 400 kV Jhangi PS – Wangtoo (Quad) D/c line. 3. 1x125 MVAR, 420kV Bus reactor at Jhangi PS (1-ph units along with one spare unit) **Under the scope of generation developer:** Tidong HEP -Jhangi PS 220 kV D/c line
10.	Shongtong Karcham (HPPCL)	450	1. LILO of one circuit of Jhangi PS - Wangtoo (HPPTCL) 400 kV D/c (Quad) line at generation switchyard of Shongtong HEP. 2. Wangtoo (HPPTCL) - Panchkula (PG) 400 kV D/c (Twin HTLS) Line along with 80 MVAr switchable line reactor at Panchkula end at each circuit.
11.	Dugar HEP (NHPC)	500	*Interim Arrangement:* Kishtwar to Dugar Section of Kishtwar PS – Tindi PS 400 kV D/c to be taken up for implementation and to be terminated at Dugar HEP switchyard. *Final Arrangement:* After completion of the section from Dugar to Tindi, one circuit of Dugar-Kishtwar D/c line would be connected directly to one circuit of Dugar to Tindi 400 kV D/c line thus forming Kistwar- Dugar-Tindi 400 kV S/c line and Kishtwar- Tindi 400 kV S/c line **Common system:** 1. 400 kV Pooling/Switching Station (GIS) at Tindi and Barangal. 2. 1x125 MVAR 420 kV bus reactor each at Tindi and Barangal. 3. LILO of Chamera-I – Chamera –II 400 kV line at Barangal PS.
12.	Reoli Dugli HEP (SJVN)	458	LILO of one circuit of Kishtwar/Dugar- Tindi 400 kV D/C line at Reoli Dugli HEP **Common system:** 1. 400 kV Pooling/Switching Station (GIS) at Tindi and Barangal. 2. 1x125 MVAR 420 kV bus reactor each at Tindi and Barangal. 3. LILO of Chamera-I – Chamera –II 400 kV line at Barangal PS.
13.	Jangi Thopan Powari HEP (SJVN)	804	LILO of Kaza/ Jhangi 400 kV PS – Wangtoo (HPPTCL) 400 kV D/c line at Jangi Thopan HEP.
14.	Dhaulasidh (SJVN)	66	Transmission system under Intra State
15.	Uhl-III (BVPCL)	100	Transmission system under Intra State
16.	Kutehr (JSW Energy Ltd)	240	Transmission system under Intra State
	Jammu & Kashmir		
17.	Pakal Dul (CVPPL)	1000	**Common System:** 1. Establishment of 2x200 MVA, 400/132 kV Kishtwar Pooling Station by LILO of one circuit of Kishenpur – Dulhasti 400 kV D/c (Quad) line 2. Stringing of 2nd circuit of Kishenpur – Dulhasti 400 kV D/c (Quad) line from Kishtwar to Kishenpur. **Under the scope of generation developer:** Implementation of Kiru –Kwar –Pakal Dul - Kishtwar 400 kV D/C Triple HTLS line

Sl. No.	Name of Hydro Project	Capacity (MW)	Broad transmission system
18.	Kiru (CVPPL)	624	**Common System:** 1. Establishment of 2x200 MVA, 400/132 kV Kishtwar Pooling station by LILO of one circuit of Kishenpur – Dulhasti 400 kV D/c (Quad) line 2. Stringing of 2nd circuit of Kishenpur – Dulhasti 400 kV D/c (Quad) line from Kishtwar to Kishenpur. **Under the scope of generation developer:** Implementation of Kiru –Kwar – Pakal Dul - Kishtwar 400 kV D/C Triple HTLS line
19.	Kwar (CVPPPL)	540	**Common System:** 1. Establishment of 2x200 MVA, 400/132 kV Kishtwar Pooling station by LILO of one circuit of Kishenpur – Dulhasti 400 kV D/c (Quad) line 2. Stringing of 2nd circuit of Kishenpur – Dulhasti 400 kV D/c (Quad) line from Kishtwar to Kishenpur. **Under the scope of generation developer:** Implementation of Kiru –Kwar – Pakal Dul - Kishtwar 400 kV D/C Triple HTLS line.
20.	Ratle (RHEPPL / NHPC)	850	**Common System:** 1. Establishment of 2x200 MVA, 400/132 kV Kishtwar Pooling station by LILO of one circuit of Kishenpur – Dulhasti 400 kV D/c (Quad) line 2. Stringing of 2nd circuit of Kishenpur – Dulhasti 400 kV D/c (Quad) line from Kishtwar to Kishenpur. 3. Kishtwar – Kishenpur 400 kV (2nd) D/c line **Under the scope of generation developer:** Ratle HEP - Kishtwar PS 400 kV D/c line
21.	Parnai (JKSPDC)	37.50	Transmission System under Intra State
	Kerala		
22.	Pallivasal (KSEB)	60	Transmission System under Intra State
23.	Thottiyar (KSEB)	40	Transmission System under Intra State
	Punjab		
24.	Shahpurkandi (PSPCL/ Irrigation Deptt., Punjab)	206	Transmission System under Intra State
	Sikkim		
25.	Teesta St. VI (NHPC)	500	Teesta VI - Rangpo 220 kV (Twin Moose) D/c line
26.	Rangit-IV (NHPC)	120	Rangit IV - New Melli 220 kV D/c line
	Tamil Nadu		
27.	Kundah PSP (TANGEDCO)	500	Transmission System under Intra State

Sl. No.	Name of Hydro Project	Capacity (MW)	Broad transmission system
	Uttarakhand		
28.	Vishnugad Pipalkoti (THDC)	444	1. Establishment of 400 kV Pipalkoti switching station. 2. Pipalkoti HEP– 400 kV Pipalkoti switching station 400 kV D/c (Twin Moose) line. 3. Pipalkoti 400 kV S/s- Srinagar 400 kV D/c (Quad Moose) line 4. Srinagar- Kashipur 400 kV D/c (Quad) line
29.	Tapovan Vishnugad (NTPC)	520	1. Establishment of 400 kV Pipalkoti switching station. 2. Tapovan Vishnugad HEP – Pipalkoti 400 kV S/s 400 kV D/c line. 3. Pipalkoti 400 kV S/s - Srinagar 400 kV D/c (Quad Moose) line. 4. Srinagar- Kashipur 400 kV D/c (Quad) line
30.	Tehri PSP (THDC)	1000	Tehri PSP - Tehri Pooling Station 400 kV D/c line
31.	Naitwar Mori (SJVNL)	60	Transmission System under Intra State
	West Bengal		
32.	Rammam-III (NTPC)	120	Transmission System under Intra State
	Madhya Pradesh		
33.	Gandhi Sagar PSP (Greenko Energies Private Limited, GEPL)	1440	GEPL – Neemuch PS 400 kV D/c line.
	Total	**16673.50**	

Note: Planning of ISTS network has also been done for some other Hydro-electric Projects like Purthi HEP, Bardang HEP etc. which are likely to be commissioned beyond 2030.

Central Electricity Authority

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