भारत सरकार

Government of India

विद्युत मंत्रालय

Ministry of Power

केन्द्रीय विद्युत प्राधिकरण

Central Electricity Authority

विद्युत प्रणाली योजना एवं मूल्यांकन - I प्रभाग

Power System Planning & Appraisal - I Division

-As per list enclosed

विषय: उत्तरी क्षेत्र की ट्रांसमिशन पर स्थायी समिति की पहली बैठक - बैठक का पुनर्निर्धारण

Subject: 1st Meeting of Northern Region Standing Committee on Transmission- Rescheduling of Meeting

Sir/ Madam,

In continuation to our letter of even number dated 24.8.2018, this is to intimate that 1st Meeting of Northern Region Standing Committee on Transmission(NRSCT), which was earlier scheduled to be held on 4.9.2018 would now be held on **11.9.2018(Tuesday)** at 1030hrs at conference Room, NRPC Katwaria Sarai, New Delhi. A brief on 50GW solar potential zones and 16.5 GW wind potential zones is enclosed herwith. The detailed agenda note for the meeting will be uploaded shortly on CEA website.

Kindly make it convenient to attend the meeting.

The inconvenience caused is regretted.

Yours faithfully,

25/8/2018

(अवधेश कुमार यादव /Awdhesh Kumar Yadav)

निदेशक/ Director

1.	Member, Secretary, NRPC, 18-A Shajeed Jeet Singh Sansanwal Marg, Katwaria Sarai, New Delhi - 110016 (Fax-011-26865206)	2.	Director (W &P) UPPTCL, Shakti Bhawan Extn,3rd floor, 14, Ashok Marg, Lucknow - 226 001 (Fax:0522-2287822)	3.	Director (Projects) PTCUL, Vidhyut Bhawan, Near ISBT -Crossing, Saharanpur Road, Majra, Dehradun-248002. Uttrakhand Fax-0135-2645744
4.	Director (Technical), Punjab State Transmission Corporation Ltd. (PSTCL) Head Office The Mall Patiala -147001 Fax-0175-2304017	5.	Member (Power) BBMB, Sectot-19 B Madhya Marg, Chandigarh-1 60019 (Fax-01 72-2549857	6.	Director (Operation) Delhi Transco Ltd. Shakti Sadan, Kotla Marg, New Delhi-110002 (Fax-01123234640)
7.	Director (Technical) RRVPNL, Vidut Bhawan, Jaipur-302005. Fax-:0141-2740794	8.	Director (Technical) HVPNL Shakti Bhawan, Sector-6 Panchkula-134109 Fax-0172-256060640	9.	Director (Technical) HPSEB Ltd. Vidut Bhawan, Shimla -171004 Fax-0177-2813554
10.	Managing Director, HPPTCL, Barowalias, Khalini Shimla-171002 Fax-0177-2623415	11.	Chief Engineer (Operation) Ministry of Power, UT Secretariat, Sector-9 D Chandigarh -161009 Fax-0172-2637880	12.	Development Commissioner (Power), Power Department, Grid Substation Complex, Janipur, Jammu, Fax: 191-2534284
13.	Director (Projects) POWERGRID Saudamini Plot no. 2, Sector - 29. Gurgaon-122 001 (Fax-0124-2571809)	14.	CEO, POSOCO B-9, Qutab Institutional Area, Katwaria Sarai New Delhi – 110010 (Fax:2682747)	15	COO (CTU) POWERGRID, Saudamini, Plot no. 2, Sector -29, Gurgaon-122 001 (Fax-0124-2571809)

Brief on 50GW solar potential zones and 16.5 GW wind potential zones

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

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

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

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

Solar Energy Zone (SEZ)						**Wind Energy Zone (WEZ)**				
State/ District	**Taluk/ Tehsil**	**Ph-1**	**Ph-2**	**Total**		**State/ District**		**Ph-1**	**Ph-2**	**Total**
		2020	**2021**					**2020**	**2021**	
		GW	**GW**	**GW**				**GW**	**GW**	**GW**
Rajasthan						**Tamil Nadu**				
Jaisalmer	Ramgarh	2.5	1.5	4		Karur		1.5	1	2.5
	Fatehgarh	2.5	1.5	4		Tirunelveli		0	0.5	0.5
Jodhpur	Phalodi	2	1	3						
Bikaner	Koyalat/ Pugal	3	1	4						
Barmer	Barmer	0	5	5						
Subtotal		10	10	20		**Subtotal**		**1.5**	**1.5**	**3**
Andhra Pradesh						**Andhra Pradesh**				
Kurnool	Gooty	2.5	0	2.5		kurnool		2	1	3
Ananthpuram	Urvakonda	0	2.5	2.5						
Subtotal		2.5	2.5	5		**Subtotal**		2	1	3
Karnataka						**Karnataka**				
Gadag		0	2.5	2.5		Koppal		2.5	0	2.5
Bidar		0	2.5	2.5						
Subtotal		0	5	5		**Subtotal**		2.5	0	2.5

Solar Energy Zone (SEZ)						Wind Energy Zone (WEZ)				
Gujarat						**Gujarat**				
Kutch	Rapar	3	2	5		Kutch	Bhuj	0	2	2
Banaskantha	Vav/ Tharad	0	2.5	2.5			Laka-diya	2	0	2
Jamnagar	Lalpur	1	1.5	2.5		Dwarka		1	1	2
Subtotal		4	6	10		**Subtotal**		3	3	6
Maharashtra						**Maharashtra**				
Solapur		1	1.5	2.5		Osmanabad		0	2	2
Wardha		0	2.5	2.5						
Subtotal		1	4	5		**Subtotal**		0	2	2
Madhya Pradesh										
Raigarh		2.5	0	2.5						
Khandwa		0	2.5	2.5						
Subtotal		2.5	2.5	5						
Total		**20**	**30**	**50**		**Total**		**9**	**7.5**	**16.5**

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

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

	(SR)							
	Total	**66.5**	**19160**	**29**	**24075**	**37.5**	**43235**	**66.5**

1.2.3 Envisaged solar (50 GW) & wind (16.5 GW) generation capacity is expected to generate about 115 billion units of renewable energy per annum. Different options are considered:

- Option 1- without any grant / upfront payment from RE generation developers
- Option 2,3,4 –with upfront payment of Rs 25 lakh/MW, 35 lakh/MW, 50 lakh/MW rom RE generation developers respectively

With option 1, considering estimated cost of Rs 43,235 Cr for proposed transmission scheme, annual transmission charges are expected to be about Rs 7782 Cr.

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

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

** *D: E- 70:30*

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

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

Phase-I

S.No	**Attribute**	**Option 1**	**Option 2 (25 lakh/MW Bid**	**Option 3 (35 lakh/MW Bid**	**Option 4 (50 lakh/MW Bid incl.)**

			incl.)	incl.)	
1	Envisaged RE Capacity (in MW)	29000			
2	Units Generated (Wind CUF@25%, Solar CUF @18%)(in BU/year)	51 BU/annum			
3	Transmission Cost (Rs. Cr)	19,160	11,910	9,010	4,660
4	Annual transmission charges (@18%)	3449	2144	1622	839
5	Tentative Transmission Tariff (Rs/Unit)	0.68	0.42	0.32	0.16

*** D: E- 70:30*

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

Phase-2

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

*** D: E- 70:30*

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

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

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

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

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

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

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

1.2.8 Based on prioritised renewable potential zones approach, CTU has proposed that transmission scheme may be further phased out for about 10-12 GW capacity. Accordingly, transmission schemes have been phased out with two RE capacity scenarios

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

Estimated cost: Rs. 9150 cr.

Scenario 2 (12.5 GW): Rajasthan (7 GW), Gujarat (3 GW) and Andhra Pradesh (2.5 GW),

Estimated cost: Rs. 10350 cr.

1.2.9 Scenario 1: Rajasthan (7GW) & Gujarat (3GW), 10 GW

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

i) Establishment of 400/220kV 5x500 MVA pooling station (RE PP1) at suitable location in Jaisalmer Distt (near Ramgarh/Kuchheri)
ii) Establishment of 765/400/220kV 3x1500 MVA, 5x500 MVA pooling station (RE PP2) at suitable location in Jaisalmer Distt (near Fatehgarh)
iii) Establishment of 765/400/220kV 2x1500 MVA, 4x500 MVA pooling station (RE PP3) at suitable location in Jodhpur Distt (between Phalodi & Osian)
iv) RE PP1 (near Ramgarh) – RE PP2 (near Fatehgarh) 400 kV D/c Line (Twin HTLS on M/c tower)
v) LILO of both ckts of 765 kV Fatehgarh (TBCB) – Bhadla (PG) D/c line at RE PP2 (near Fatehgarh) (Charged at 400kV)
vi) RE PP1 (near Ramgarh) – Jaisalmer -2 (RVPN) 400 kV D/c Line (Twin HTLS)
vii) RE PP2 (near Fatehgarh) – RE PP3 (between Phalodi &Osian) 765 kV D/c Line
viii) RE PP3 (between Phalodi &Osian) – Ajmer (PG) 765 kV D/c Line
ix) RE PP3 (between Phalodi &Osian) –Jodhpur (new) [RVPN] 400 kV D/c Line (Twin HTLS)
x) Ajmer – Bhiwani 765kV D/c line
xi) 220kV line bays for interconnection of solar projects (25 nos)
xii) Augmentation of 400/220kV Transformation capacity at various substations
xiii) Associated Reactive compensation

Estimated Cost : Rs 6000 Cr.

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

Kutch (Rapar) SEZ 2000 MW

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

Estimated Cost: Rs 2800 Cr

Jamnagar SEZ 1000 MW

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

Estimated *Cost: Rs 350 Cr*

C. Summary of Abstract Cost Estimate

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

1.2.10 Scenario 2: Scenario 1 + Andhra Pradesh (2.5GW), 12.5 GW

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

Kurnool SEZ (2500 MW), AP

i) Establishment of 765/400/220kV 3x1500 MVA, 5x500 MVA Pooling station at suitable location in Kurnool Distt
ii) Kurnool PS - Kurnool(new) 765 kV D/c Line
iii) 220kV line bays for interconnection of wind projects (8 nos)
iv) 1x330 MVAr (765kV) & 1x125MVAr (400kV) bus reactor at Kurnool PS
Estimated Cost: Rs 1200 Cr

B. Summary of Abstract Cost Estimate

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

Minutes of the meeting of the Sub–committee for providing ISTS connectivity to Renewable Energy (Solar/wind) Power Plants held in POWERGRID office, Sec-29 Gurgaon on 18.07.18.

A meeting of the sub-committee formed by MNRE to identify ISTS connectivity to Renewable Energy (Wind/Solar)Power Plants was held in POWERGRID office, Sec-29 Gurgaon on 18.07.18 at 3:00 PM. The list of participants is at Annexure-A.

Earlier, in the meeting chaired by Hon'ble MOS (Power & NRE) held on 16.07.18 at MNRE, a presentation was made for integration of additional 50 GW solar capacity as well as 16.5 GW wind capacity by POWERGRID & CEA. The estimated cost for transmission system for Solar Capacity (50 GW) & wind capacity (16.5 GW) is about Rs 36,100 Cr and Rs 8,500 Cr respectively. For Solar capacity addition of 50 GW, transmission tariff for the evolved system is about 82 paise/unit. However for Wind Capacity addition plan of 16.5 GW, transmission tariff for the evolved system is about 43 paise/unit. It was also mentioned that as Solar capacity is being planned to be enhanced mainly in Rajasthan & Gujarat, where new ISTS needs to be developed, therefore cost of transmission for Solar is relatively higher in these zones.

It was also informed that transmission system development takes around 3-4 years time therefore to match with gestation period of RE, it is prudent to finalise and take up implementation of the transmission system in advance.

Further, it was decided that transmission plan for 50 GW Solar Capacity may be bifurcated in two phases based on best locations, land feasibility, economics etc. Accordingly, as per the direction of Hon'ble MOSP, this meeting of the sub-committee was convened.

SECI vide letter dated 17.07.18 (copy enclosed at Annex-I) has provided distt/taluk wise Solar capacity addition plan in ISTS in two phases i.e. Ph-I 20 GW by Dec'20 & Ph-II 30 GW by Dec'21. SECI also shared modified distt. wise Solar & Wind capacity addition plan by Ph-I (2020) i.e. 20 GW Solar & 9 GW Wind, whereas Ph-2 (2021) included 30 GW Solar & 7.5 GW Wind (Copy enclosed at Annex-II). The above RE capacity addition plan by SECI was also evolved in consultation by MNRE & developers. It was also decided that above information shall be formally submitted by SECI.

Based on the inputs, a consolidated transmission system was identified both for Solar & wind energy zones for Ph-I & 2 time frames, which may undergo changes depending upon the change in the location/quantum of RE generation addition, location of pooling stations, stakeholders discussion in SCM etc.

In the meeting held, following action points had emerged.

1. Considering Phase-I capacity addition plan for 20 GW of Solar Generation & 9 GW wind generation by 2020, total estimated Cost for consolidated transmission scheme is about Rs 19,200 Cr, there is an immediate need to undertake implementation of commensurate transmission system in next 2 years. Accordingly, the committee suggested

implementation of associated transmission system in a compressed time schedule on an urgent basis. Further, for Phase-II capacity addition plan for 30 GW of Solar Generation & 7.5 GW wind generation by 2021, total estimated Cost for consolidated transmission scheme is about Rs 24,100 Cr

2. As per the CERC regulations, in order to take up implementation of ISTS transmission system, applicant need to apply for connectivity & LTA in ISTS. Accordingly, it was suggested that to enable SECI to apply for Connectivity & LTA, CERC may provide enabling provision in the prevailing regulations.

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

4. In order to reduce burden of transmission tariff on DICs, it was suggested that suitable mode of financing may be evolved. Accordingly, funding mechanism proposed is as under: :

   a. Entire quantum say 65 lakhs/MW may be taken from the generation developer as upfront payment towards transmission investment. In that case, transmission O&M charges may be included in the POC pool for which CERC regulatory approval is required

   b. Some % of fund say Rs 50 lakhs/MW may be taken from the RE generation developer as upfront payment towards transmission investment. For balance investment say Rs 15 Lakh/MW as well as O&M charges for entire investment through POC pool, CERC regulatory approval is required to be obtained.

5. It was discussed that Transmission is a lumpy element. For example if a 765kV corridor is being developed which can facilitate transfer of 3500-4000 MW power and bidding is carried out only for 2000 MW, how to ensure amount of upfront payment is realized for total power transfer requirement for development by transmission implementation agency. Therefore bidding strategy must take care of above aspect as well.

6. It was also suggested that site specific RE generation bidding may be carried out in accordance with the transmission plan instead of anywhere in India basis. Accordingly, to facilitate development of the transmission system, decisions are solicited on following aspects from the competent authority:

a. Amount of upfront payment from the RE generation developers at the time of bidding and grant from Government
b. Finalization of transmission system implementation mode & transmission implementation agency i.e. TBCB or RTM
c. Site specific bidding for RE generation addition in accordance to the above transmission plan
d. CERC to expedite enabling provision in connectivity regulations so that SECI can apply for Connectivity & LTA

(Sh. Ravinder Gupta)

(Dr. Subir Sen)

(Sh. S.K. Mishra)

(Sh. Girish Kumar)

Annexure-A

List of Participants

S. No.	Name	Designation	Organization
1	Sh. Ravinder Gupta	Chief Engineer (PSP&A-I)	CEA
2	Dr. Subir Sen	COO (CTU-Plg & SG)	POWERGRID
3	Sh. S.K. Mishra	Director	SECI
4	Sh. Girish Kumar	Director/Coordinator	MNRE
5	Sh. Kashish Bhambhani	Chief Manager (SG)	POWERGRID

ANNEXURE - I

सोलर एनर्जी कॉर्पोरेशन ऑफ इंडिया लिमिटेड
(भारत सरकार का उपक्रम)
Solar Energy Corporation of India Ltd.
(A Government of India Enterprise)
स्वच्छ भारत – स्वच्छ ऊर्जा

SECI/PS/CTU/ 23180

Dated: 17.07.2018

To,

Dr. Subir Sen,
Chief Operating Officer, Central Transmission Utility
Powergrid Corporation of India Limited
Saudamini, Plot No.2, Sector 29, Near IFFCO Chowk,
Gurgaon (Haryana) – 122001

Sub: Regarding details of evacuation infrastructure at CTU substations for ISTS-connected Solar PV projects
Ref: SECI/PS/CTU/CEA/SPD/2305 dated 06/07/2018

Dear Sir,

With reference to the state-wise list of pockets with cumulative capacity of 50 GW envisaged for Phase-I of evacuation infrastructure plan provided vide Ref 1., please find enclosed proposed tentative phasing of the same in line with the tendering plan of SECI Schemes for Solar and Hybrid projects over the planning period till year 2021. It is estimated that the cost of erecting transmission line shall be in the range of 90 lakhs per MW in case of Rajasthan and Gujarat while it is approx. 30-40 lakhs per MW in the case of other states. In order that the project costs are averaged out in the tariffs, the proposed evacuation capacity has been distributed over the states in proportion to the planned tendering capacities. However, the CTU may alter the same with an overall objective to keeping the average evacuation costs in the range of 60-70 lakhs per MW so as to deter significant variations in tariffs over the different tendering processes. It is further reiterated that the proposed locations have been shared with the respective SNAs and changes, if any, shall be communicated.

Additional 5 GW evacuation capacity for Wind Power is proposed to come up in High priority Wind zones for ISTS as identified in the Powergrid's Green Energy Corridor Report for Transmission Scheme for Wind Energy Zones and are enclosed herewith.

Thanking you,

Yours faithfully,

(S. K. Mishra)
Director (Power System)

Copy to:
(i) Sh. Girish Kumar, Scientist E, MNRE, Block 14, CGO Complex, Lodhi Road, New Delhi- 110003

Identified Solar Energy Zones & envisaged capacity (SECI Tendering Plan) by 2021

District	Taluk	Capacity (GW)	Envisaged in Phase-I	Phase I Breakup 2020	2021
Rajasthan					
Bikaner	Bikaner	10	4	1.5	2.5
Barmer	Barmer	15	5	2	3
Jaisalmer	Jaisalmer	15	8	3	5
Jodhpur	Phalodi	5	3	1.5	1.5
Churu	Sujangarh, Ratangarh	5	0	0	0
Total		50	20	8	12
					0
Gujarat					0
Banaskantha	between Vav and Tharad	5	2.5	1	1.5
Patan	Santhalpur	5	0	0	0
Kacchh	Rapar	10	5	2	3
Jamnagar	Lalpur	5	2.5	1	1.5
Total		25	10	4	6
Karnataka					0
Gadag	Sirhatti	5	2.5	1	1.5
Bidar		5	2.5	1	1.5
Total		10	5	2	3
Telangana					
Narayankhed		5	0	0	0
Total		5	0	0	0
				0	0
Andhra Pradesh				0	0
Ananthapuram	Uravakonda	5	2.5	1	1.5
Kurnool	Gooty	5	2.5	1	1.5
Total		10	5	2	3
Tamil Nadu					
Tutthokodi	Kovilpatti	5	0	0	0
Karur	Kulittalai	5	0	0	0
Total		10	0	0	0
Maharashtra					
Solapur	Mohol	5	2.5	1	1.5
Wardha		5	2.5	1	1.5
Yavatmal		5	0	0	0
Total		15	5	2	3
Madhya Pradesh					
Bina		5	0	0	0
Rajgarh		5	2.5	1	1.5
Dhar		5	0	0	0
Khandwa		5	2.5	1	1.5
Total		20	5	2	3
Himachal Pradesh					
Kaza		1	0	0	0
Total		1	0	0	0
Total		146	50	20	30

4068/2018/PSP&A-I

Identified Wind Energy Zones & envisaged capacity by 2022 (Green Energy Corridor Report, Powergrid)			
		Phase I Break up	
District	**Envisaged in Phase-I**	**2020**	**2021**
Andhra Pradesh			
Kurnool	3	1.5	1.5
Total	**3**	1.5	1.5
Gujarat			
Devabhumi Dwarka	2	1	1
Total	**2**	1	1
Total	**5**	**2.5**	**2.5**

ANNEXURE - II.

Solar Energy Zone(SEZ)

State/District	Taluk/Tehsil	Ph-1 2020 (GW)	Ph-2 2021 (GW)	Total (GW)
Rajasthan				
Jaisalmer	Ramgarh	1.5	1.5	3
	Fatehgarh	2.5	1.5	4
Jodhpur	Phalodi	2	1	3
Bikaner	Kolayat (Pugal)	2	1	3
Barmer	Barmer	0	5	5
Subtotal		10	10	20
Andhra Pradesh				
Kurnool	Gooty	2.5	0	2.5
Ananthapuram	Uravakonda	0	2.5	2.5
Subtotal		2.5	2.5	5
Karnataka				
Gadag		0	2.5	2.5
Bidar		0	2.5	2.5
Subtotal		0	5	5
Gujarat				
Kutch	Rapar	3	2	5
Banaskantha	Vav /Tharad	0	2.5	2.5
Jamnagar	Lalpur	1	1.5	2.5
Subtotal		4	6	10
Maharashtra				
Solapur		1	1.5	2.5
Wardha		0	2.5	2.5
Subtotal		1	4	5
Madhya Pradesh				
Rajgarh		2.5	0	2.5
Shandwa		0	2.5	2.5
Subtotal		2.5	2.5	5
Total		20	30	50

Wind Energy Zone(WEZ)

State/District		Ph-1 2020 (GW)	Ph-2 2021 (GW)	Total (GW)
Tamil Nadu				
Karur		1.5	1	2.5
Tirunelveli		0	0.5	0.5
Subtotal		1.5	1.5	3
Andhra Pradesh				
Kurnool		1	1	2
Subtotal		2	1	3
Karnataka				
Koppal		2.5	0	2.5
Subtotal		2.5	0	2.5
Gujarat				
Kutch	Bhuj	0	2	2
	Lakadiya	2	0	2
Dwarka		1	1	2
Subtotal		3	3	6
Maharashtra				
Dharmabad		0	2	2
Subtotal		0	2	2
Total		9	7.5	16.5

Transmission scheme for Renewable Energy Zones (REZs)

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

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

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

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

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

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

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

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

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

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

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

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

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

C) Study Assumptions

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

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

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

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

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

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

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

Phase-I Solar & Wind Energy Zone Transmission Schemes:

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

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

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

Estimated Cost : Rs 9180 Cr.

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

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

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

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

Estimated Cost: Rs 2730 Cr

3. Wind Energy Zone in Karnataka (2500 MW)

Koppal WEZ (2500MW), Karnataka

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

Estimated Cost: Rs 730 Cr

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

Karur WEZ (1500MW), Tamil Nadu

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

Estimated Cost: Rs 450 Cr

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

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

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

Estimated Cost: 4465 Cr

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

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

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

Estimated Cost: 480 Cr

6. Solar Energy Zone in Maharashtra (1000 MW)

Solapur 1000 MW

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

Estimated Cost: 335 Cr

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

Rajgarh 2500 MW

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

Estimated Cost: 790 Cr

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

Phase-II Solar & Wind Energy Zone Transmission Schemes:

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

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

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

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

Estimated Cost : Rs 8265 Cr.

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

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

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

Estimated Cost: Rs 60 Cr

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

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

Estimated Cost: Rs 90 Cr

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

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

Estimated Cost: Rs 1540 Cr

4. Solar Energy Zone in Karnataka (5000 MW)

(a) Gadag SEZ (2500 MW)

- Establishment of 400/220kV 5x500 MVA Gadag Pooling Station(with provisions to upgrade to 765 kV)
- Gadag PS-Koppal PS 400kV D/c Line(HTLS)-50 km
- LILO of Tumkur (Vasantnarsapura)-Narendra (New) 765 kV D/c Line(Ch. At 400 kV) at Gadag PS-50 km
- 220kV line bays for interconnection of solar projects (8 nos)
- 1x125MVAr (400kV) bus reactor at Gadag PS

Estimated Cost: Rs 780 Cr.

(b) Bidar SEZ (2500 MW)

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

Estimated Cost: Rs 850 Cr.

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

(a) Bhuj WEZ 2000 MW

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

Estimated Cost: Rs. 1845 Cr

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

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

- Vadodra - Dhule 765 kV D/c line -330 km
- 220 kV line bays for interconnection of solar projects(15 nos)
- Associated Reactive Compensation (Line + Bus)

Estimated Cost: Rs 6865 Cr

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

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

Estimated Cost: Rs 1875 Cr

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

(a) Solapur SEZ 1500 MW

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

Estimated Cost: Rs 240 Cr

(b) Wardha SEZ 2500 MW

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

Estimated Cost: Rs 620 Cr

(c) Osmanabad and Beed WEZ 2000 MW

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

Estimated Cost: Rs 425 Cr

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

Khandwa SEZ: 2500 MW

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

Estimated Cost: Rs 620 Cr

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

E) Summary of Abstract Cost Estimate

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

F) Funding Requirements & Bidding Strategy

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

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

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

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

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

G) Annual Transmission Charges

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

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

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

*** D: E- 70:30*

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

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

Phase-I

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

*** D: E- 70:30*

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

Phase-2

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

*** D: E- 70:30*

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

H) Other Requirements

- **Solar Generation shifting**

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

- **Requirement of other Infrastructure**

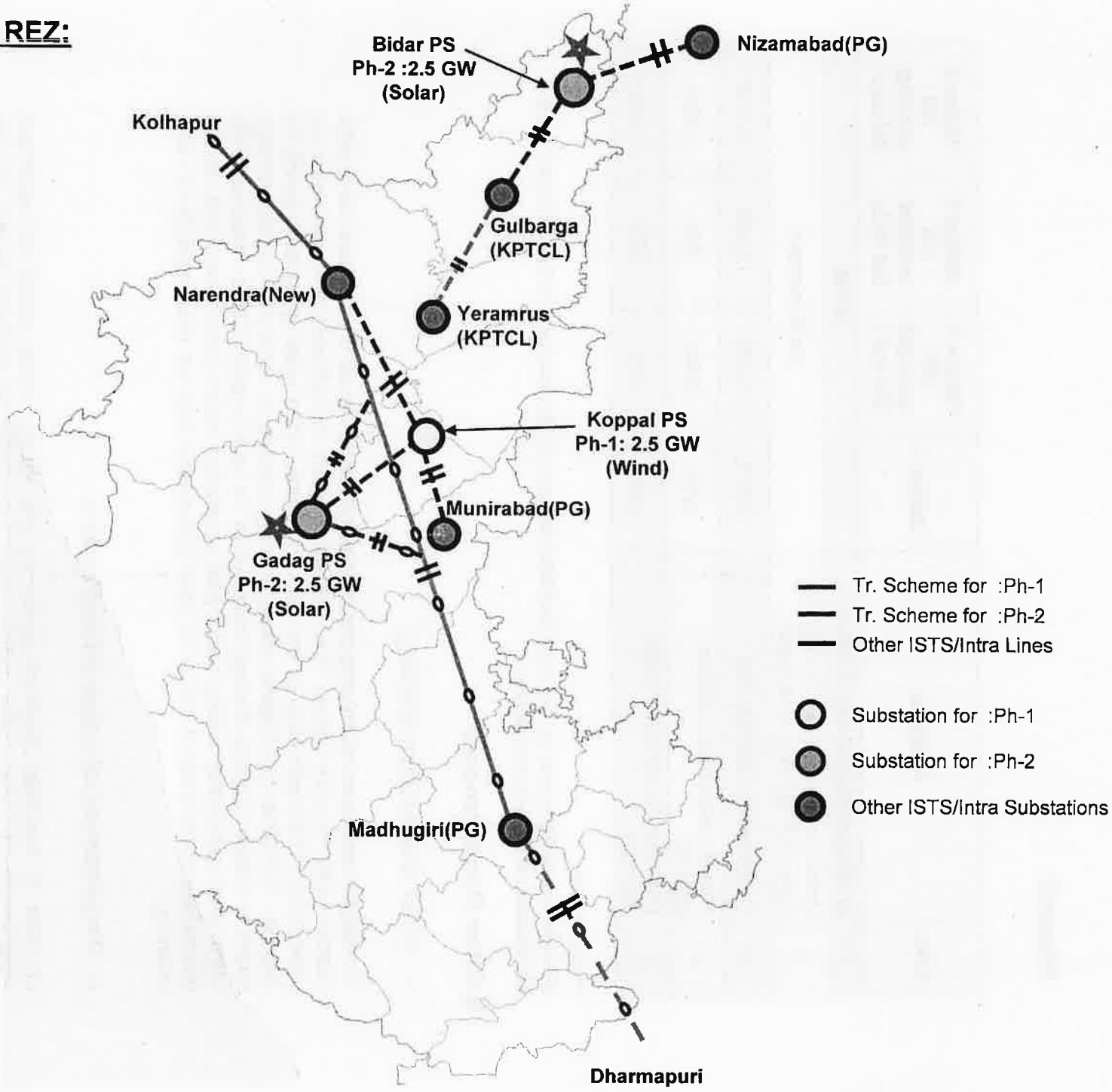
In order to facilitate drawl of power by the states, there would be additional requirement of Intra state system also. This shall be evolved based on the identification of the beneficiaries at the subsequent stage. Further, control infrastructure in form of dynamic compensation, storage etc shall also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

- **Inverter Control Feature**

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

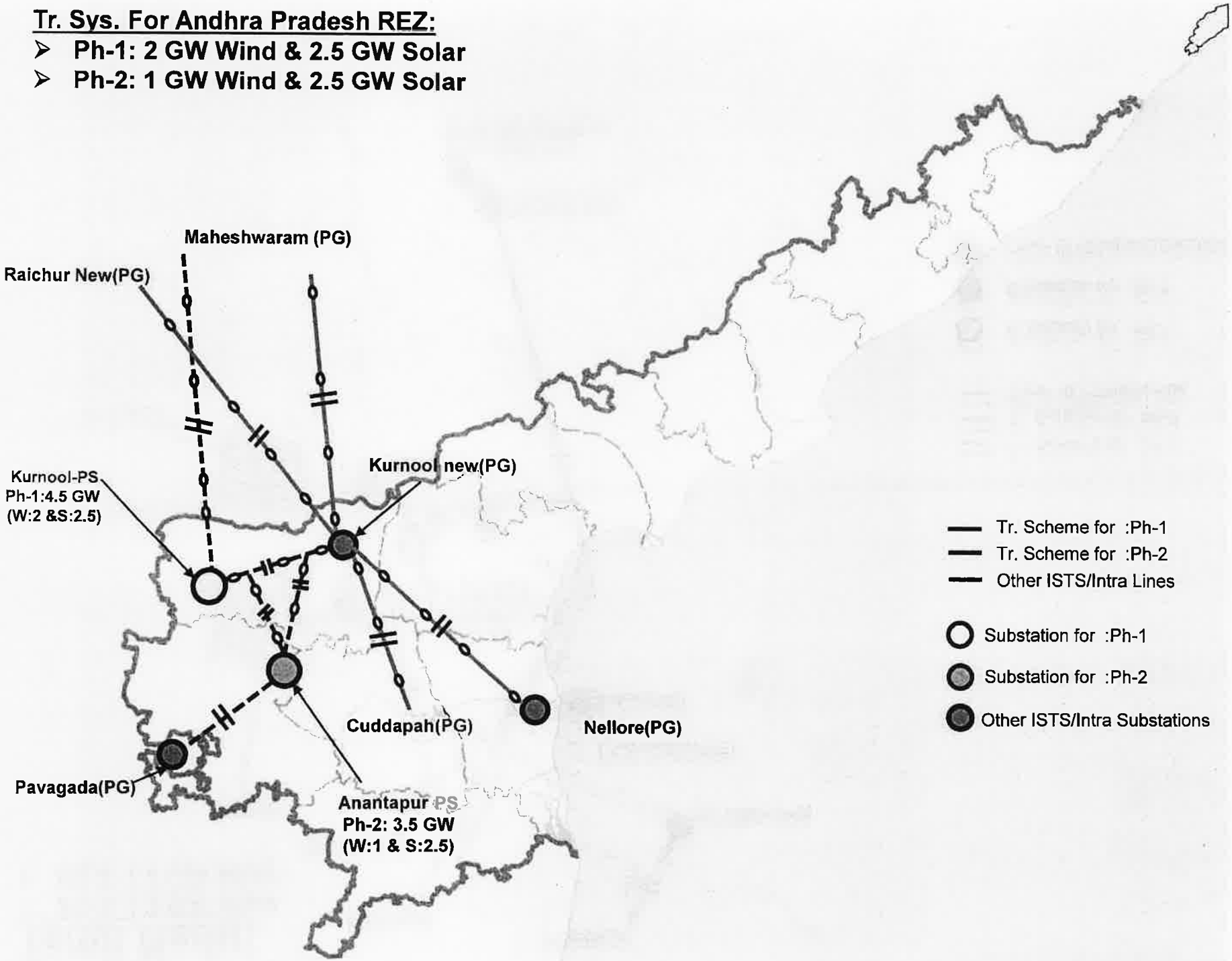
Tr. Sys. For Karnataka REZ:

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



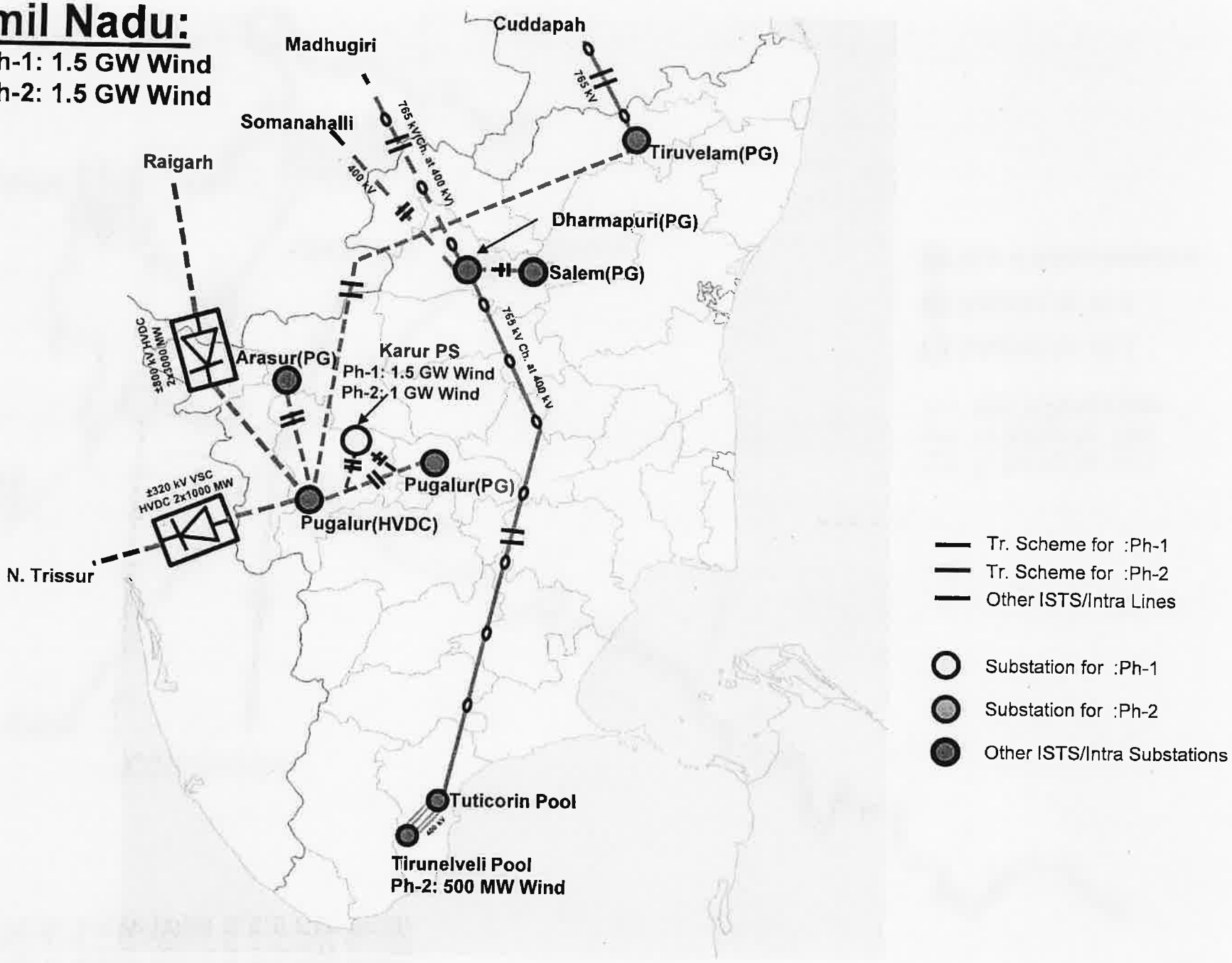
Tr. Sys. For Andhra Pradesh REZ:

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



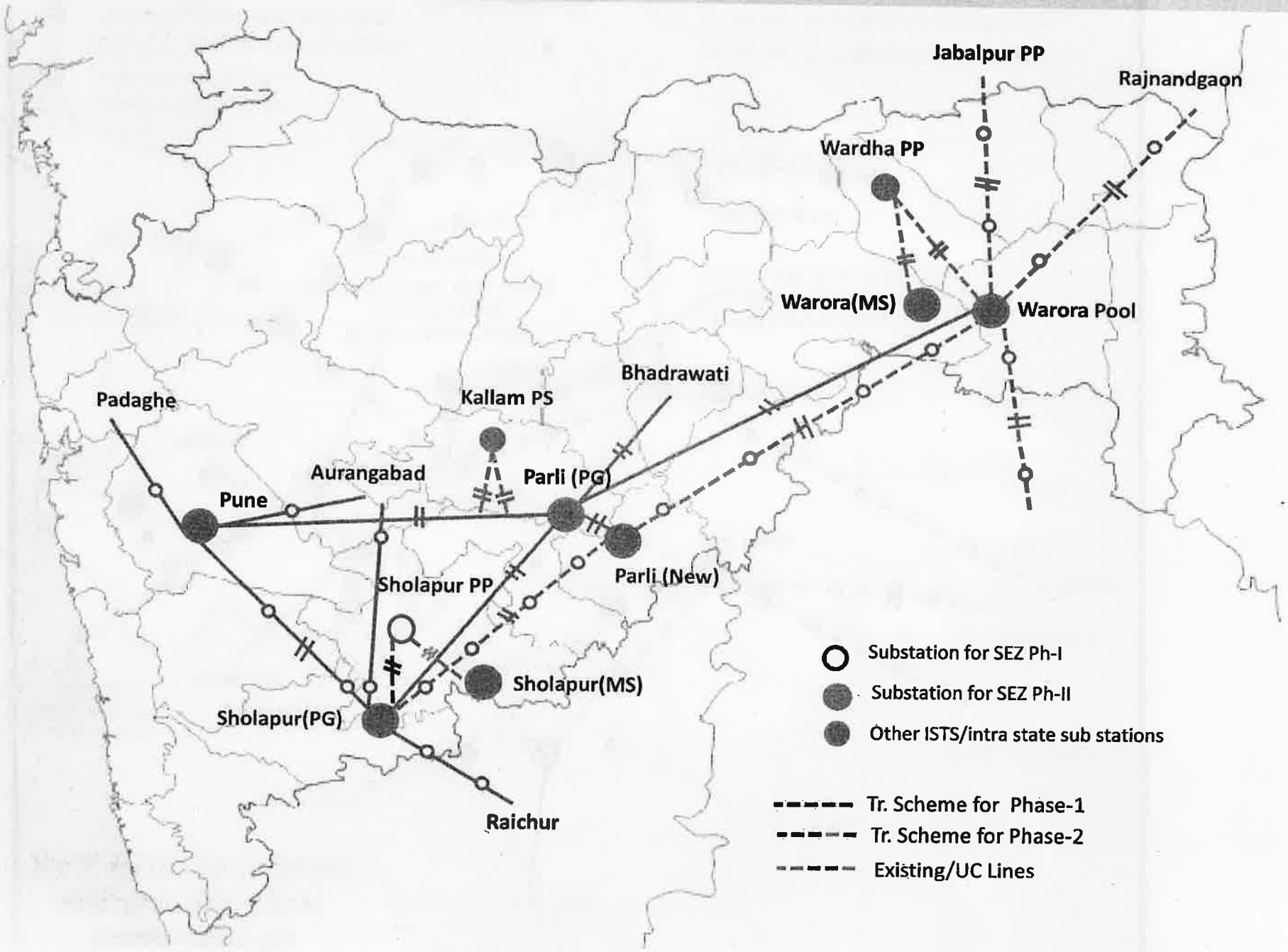
Tamil Nadu:

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

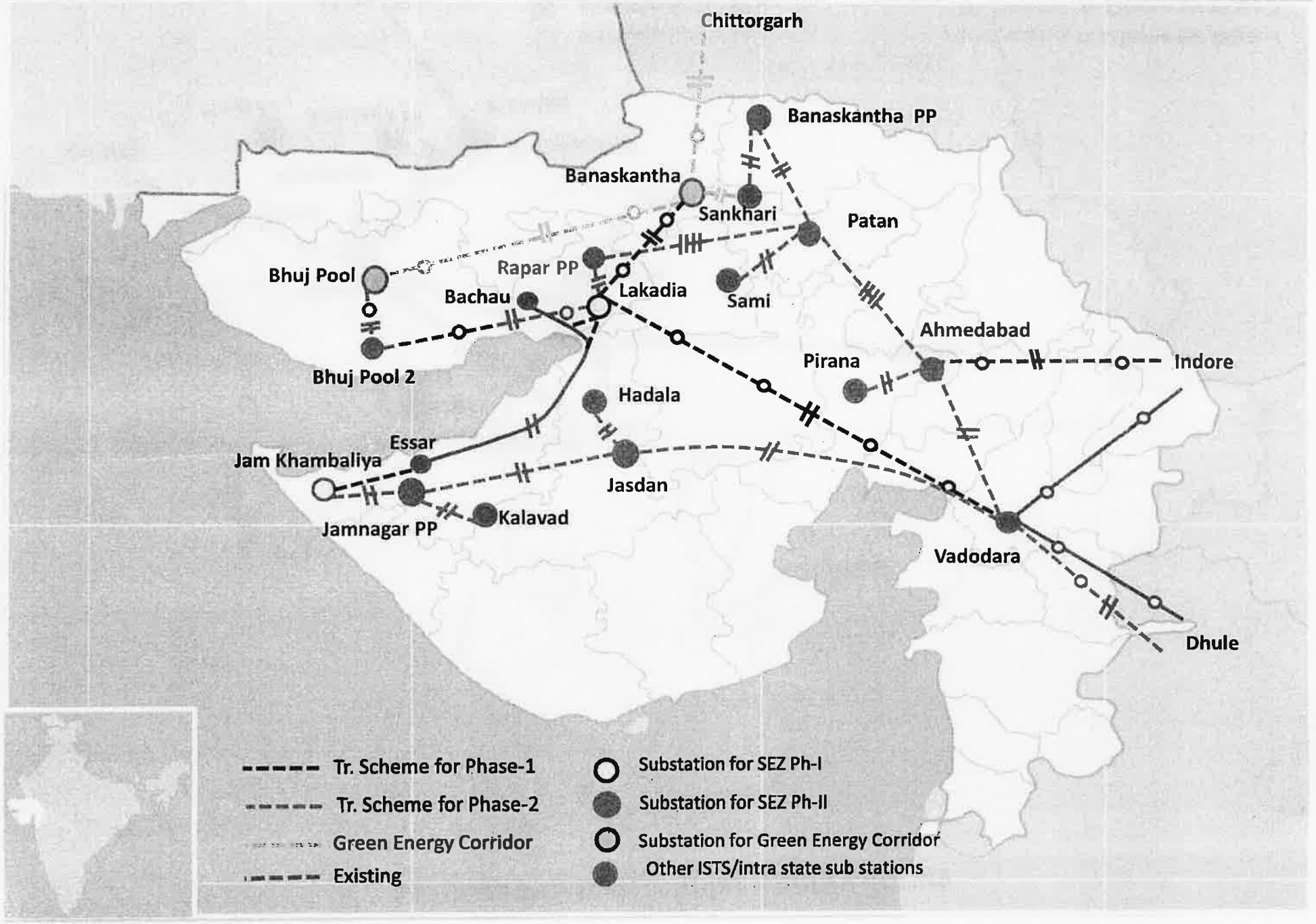


Transmission for
Rajasthan SEZ: 20GW
(Ph-I: 10GW, Ph-II:10GW)
RE PP4 Bikaner(4 GW)
between Pugal & Kolyat
(S: Ph-I: 3 GW, Ph-II: 1GW)
Moga
To Jhatikara
To Meerut
To Bhiwani
Bikaner (RVPN)
Bhadla (RVPN)
Bhadla (PG)
Bikaner
SIKAR (PG)
Sikar (New)
RE PP3 Jodhpur
Jodhpur (New)
(RVPN)
Ajmer
Ajmer (RVPN)
RE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

Maharashtra – Solar Energy Zones



Gujarat - Solar Energy Zones



Madhya Pradesh – Solar Energy Zones