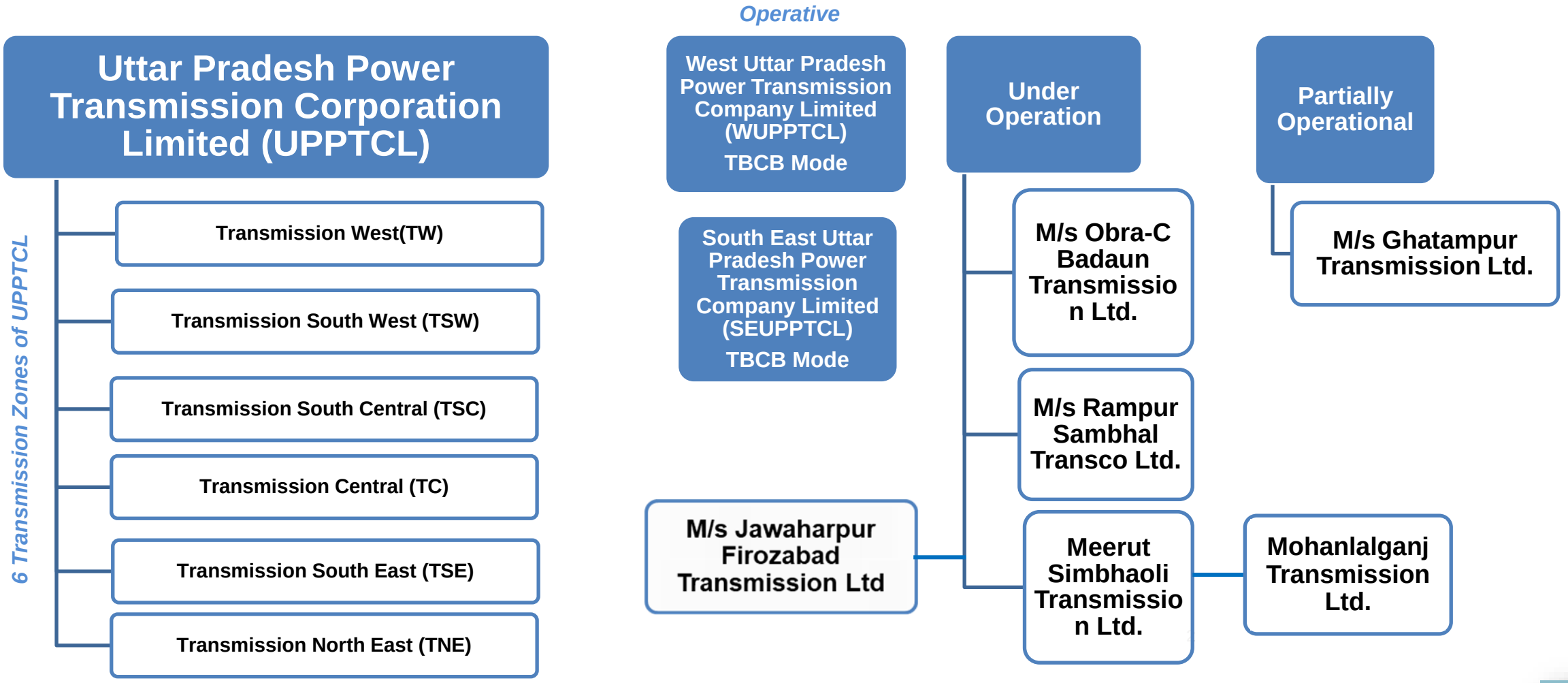
Transmission Planning for RE Projects in Uttar Pradesh

Ranvir Prasad
Managing Director,
Uttar Pradesh Power Transmission Corporation Ltd

Existing Transmission Network of UPPTCL

Existing Transmission Licensees:



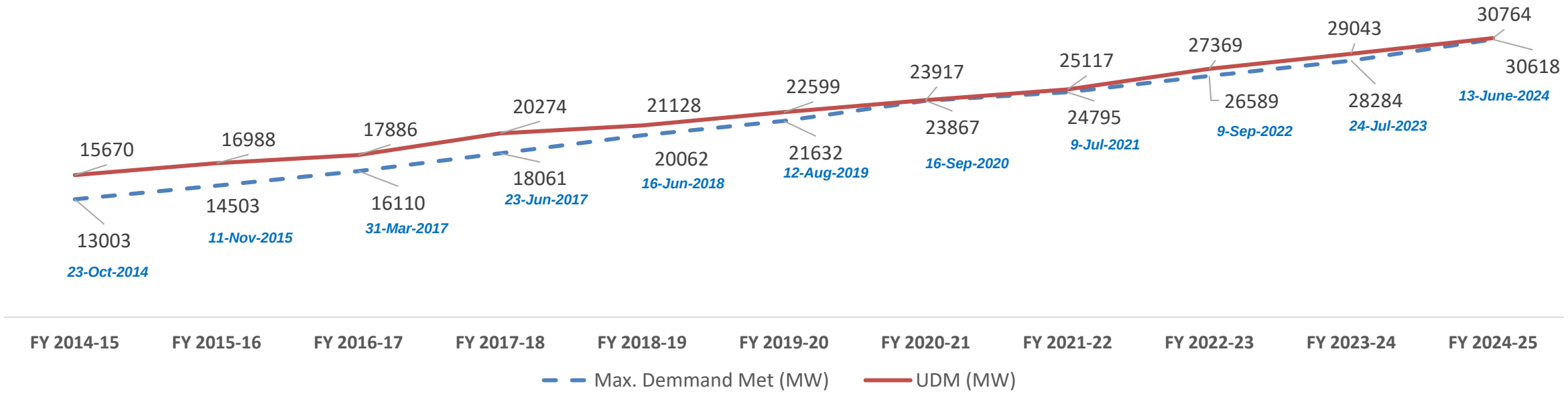
UPPTCL is also designated as State transmission Utility (STU)

Existing Transmission Network of UPPTCL

Summary of Transmission Network of STU till NOV-2024:

Voltage Level (kV)		132 KV	220 KV	400 KV	765 KV	Total
No. of Substations (Nos.)	UPPTCL	476	169	29	2	676
	PPP	0	1	11	5	17
	Total	**476**	**170**	**40**	**7**	**693**
Transformation Capacity (MVA)	UPPTCL	67400	63720	27925	6,000	1,65,045
	PPP	0	2520	13120	14000	29640
	Total	**67,400**	**66,240**	**41,045**	**20,000**	**1,94,685**
Transmission Lines (Ckt. Km)	UPPTCL	29181	16597	7509	1511	54,798
	PPP	176	78	1926	1075	3255
	Total	**29,357**	**16,675**	**9,432**	**2586**	**58,053**

Peak Demand Handled in Past Years



- ✓ *The Un-restricted Demand (UDM) was 27,369 MW in the FY 2022-23, the same has grown with an annual growth rate of around 6% in the last 5 years.*
- ✓ *The Demand met by UPPTCL in the FY 2022-23 was 26589 MW, which has grown by 7.30% annually in the last 5 years*
- ✓ *UPPTCL though its robust & efficient transmission system was able meet 30618 MW of peak demand in the current year (FY 2024-25), which is the highest among all the states.*

Data Source: UPSLDC

Peak Demand Met

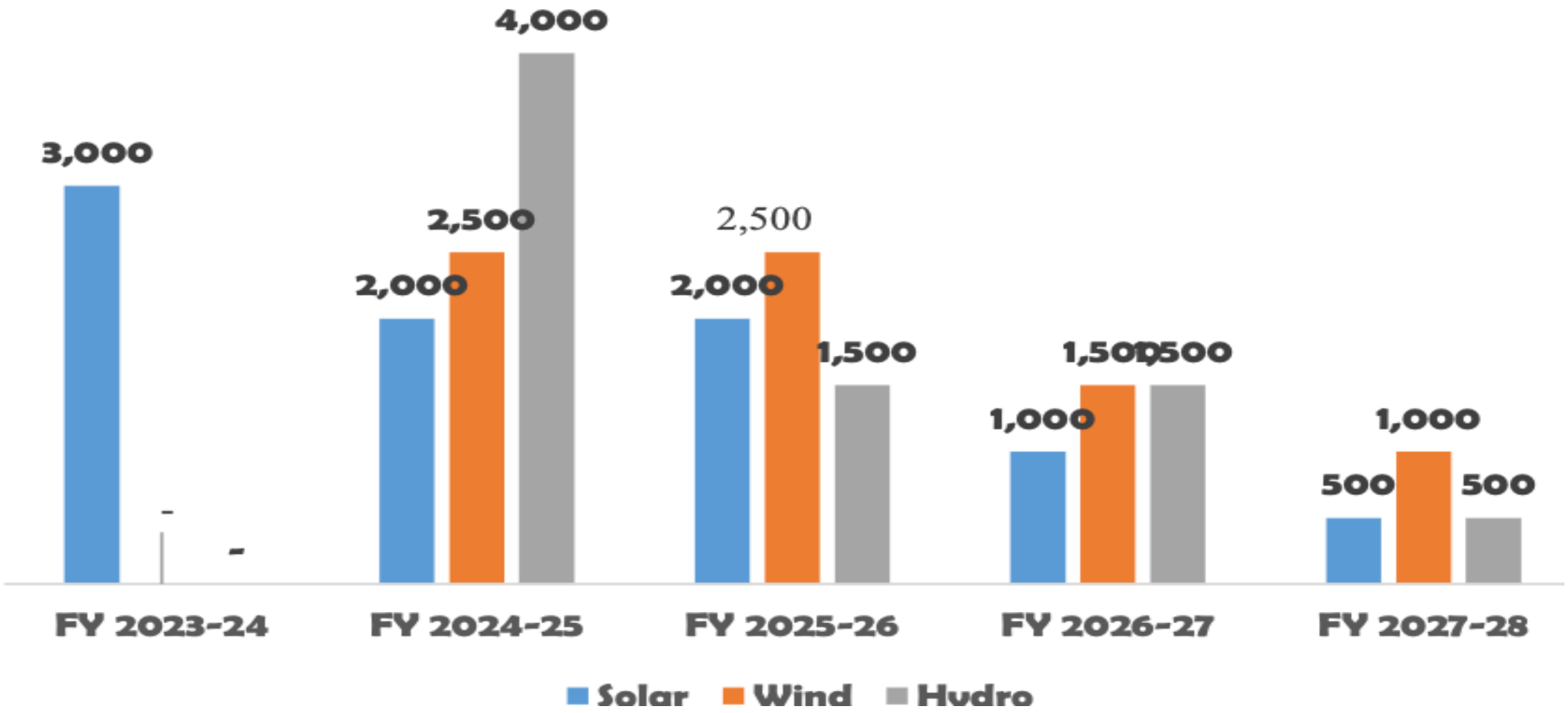
The State ranks first in the country in meeting the maximum demand.

Sr. No.	State	2024-25	
		MW	Month
1	Uttar Pradesh	30618	June
2	Maharashtra	28969	February
3	Gujarat	25588	June
4	Tamil Nadu	20784	May
5	Rajasthan	18128	January
6	Madhya Pradesh	17817	January

Transition to RE

- Presently Solar Plants of capacity of around 2500 MW installed in Uttar Pradesh.
  - Primarily connected to 132 or 33 KV Substations
- Target of installation of 14 GW solar capacity inside Uttar Pradesh
- RPO of UPPCL
- TTC for use of RE power generated outside the State (Solar, Wind, Hydro etc.)
- Pump Storage Plant of around 14 GW planned in and around Sonbhadra
- Battery Storage

RENEWABLE PURCHASE OBLIGATION (RPO) Road map of UPPCL



Solar Plant Installation in Uttar Pradesh

Uttar Pradesh has designated land bank for approximately 58000 acre comprising both govt. and private land which can be utilized for the installation of the Solar project with a capacity exceeding 14 GW. The Planning of Green Corridor-III should incorporate this capacity.

District	Govt. Land(Acre)	Private Land(acre)	Total Land(acre)	Proposed capacity(MW)
Jalaun	7,895	9,377	17,273	4,318
Jhansi	1,221	25,623	26,843	6,711
Chitrkoot	1,668	-	1668	417
Lalitpur	12,465	-	12,465	3,116
Total	**23,249**	**35,000**	**58,249**	**14,562**

Green Energy Corridor (GEC-II)

- The Central Government of India and the State Government of U.P. have approved a **4000 MW Solar Power Generation Project's Power Evacuation System**.
- Funding includes **33% grant** from the Government of India, **47% soft loan** from financial institution KFW, and **20% equity**.
- The project involves **constructing 21 transmission substations and associated lines**.
- It will **add over 10,440 MVA transformation capacity** and **2432 Ckt. km transmission lines** to the grid.
- Project cost is approximately **Rs. 5,375 Crore**
- Implementation occurs in **two stages**, with the **first phase scheduled for completion by March 2025** and the **second by March 2026**.
- **LOIs issued for all 23 packages and work in progress at site**.

RE Transition – Green Corridor Projects

- To facilitate the evacuation of 4000 MW of Green Energy, an Evacuation system plan for solar projects in Bundelkhand region.
- Tusco Solar Park in Jhansi 600 MW, Lalitpur 600 MW, Chitrakoot 800 MW.
- BSUL solar Park in Jalaun 600 MW
- Rest Distributed Solar Plants.

Particulars	No. of S/s	Total transformation capacity(MVA)	Year	Project Cost(Rs. In Cr.)
Phase-I	10	7920	2022-23 to 2024-25	4019.54
Phase-II	11*	2520	2023-24 to 2025-26	736.41
Total	21	10440		4755.95+619.90*

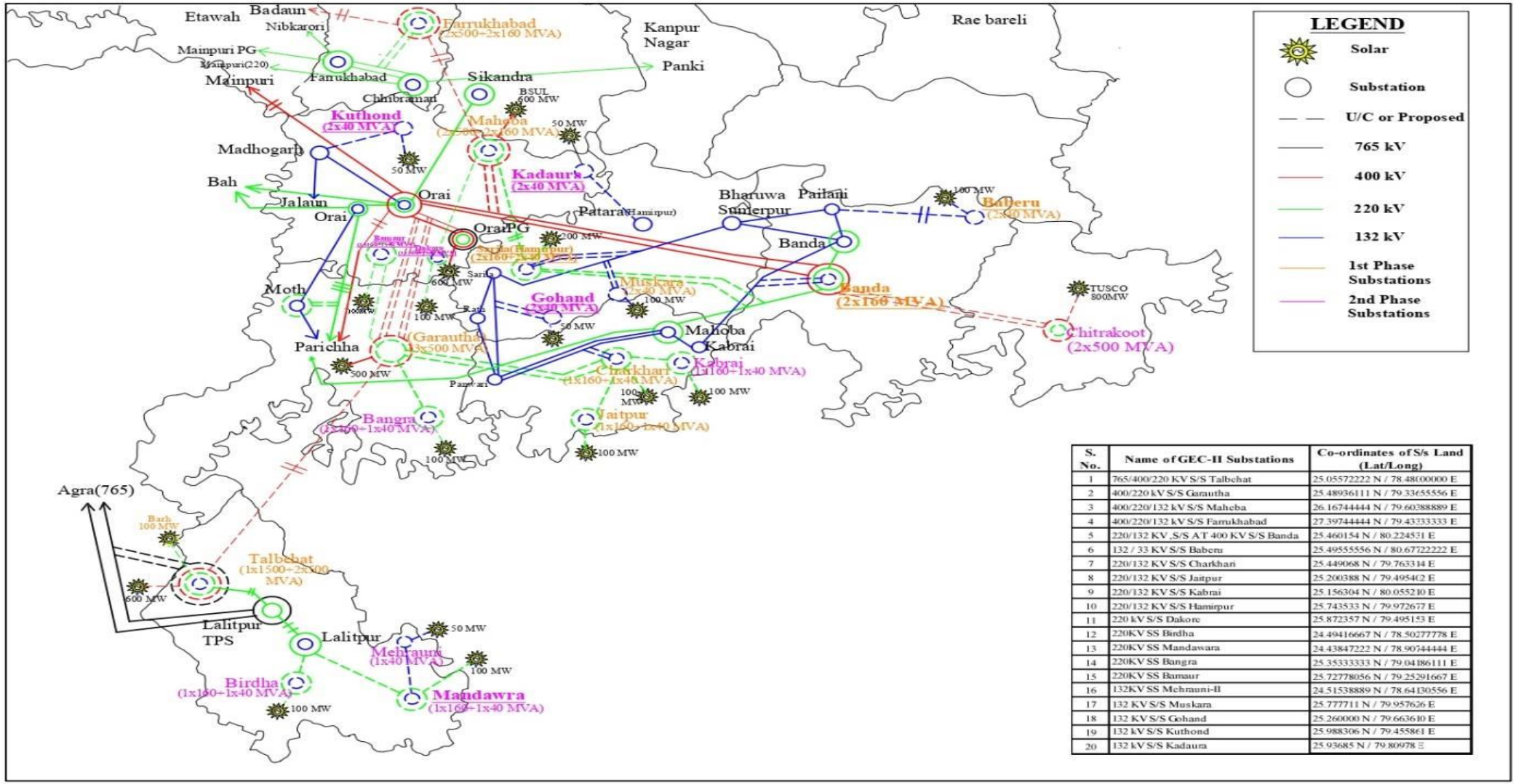
400/220 kV Chitrakoot S/s is under approval

DETAIL OF 765/400/220/132 KV SUBSTATION AND LINES

Detail of Substations			
S.No.	**Description**	**Quantity (in Nos.)**	**Capacity (in MVA)**
1	765/400 kV S/s	1	2500
2	400/220 kV S/s	4	5140
3	220/132 kV S/s	10	2320
4	132/33 kV S/s	6	480
	Total	**21**	**10440**

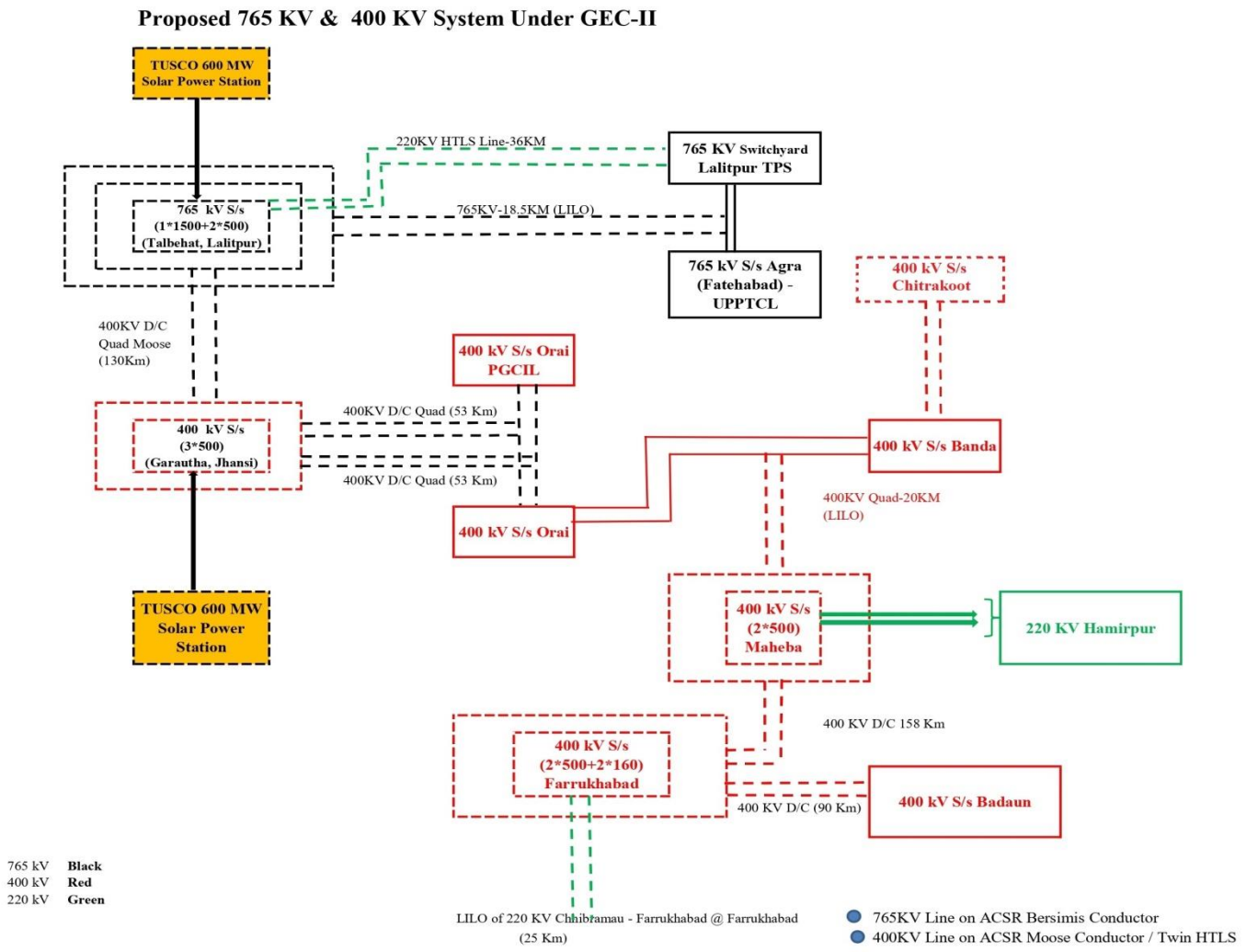
Detail of Lines			
S.No.	**Description**	**Quantity (in Nos.)**	**Circuit Km (in Km)**
1	765kV line	1	37
2	400kV line	7	1268
3	220kV line	12	832
4	132kV line	9	295
	Total	**29**	**2432**

Geographical map of Solar Power 4000 MW Evacuation Plan Under GEC-II Project

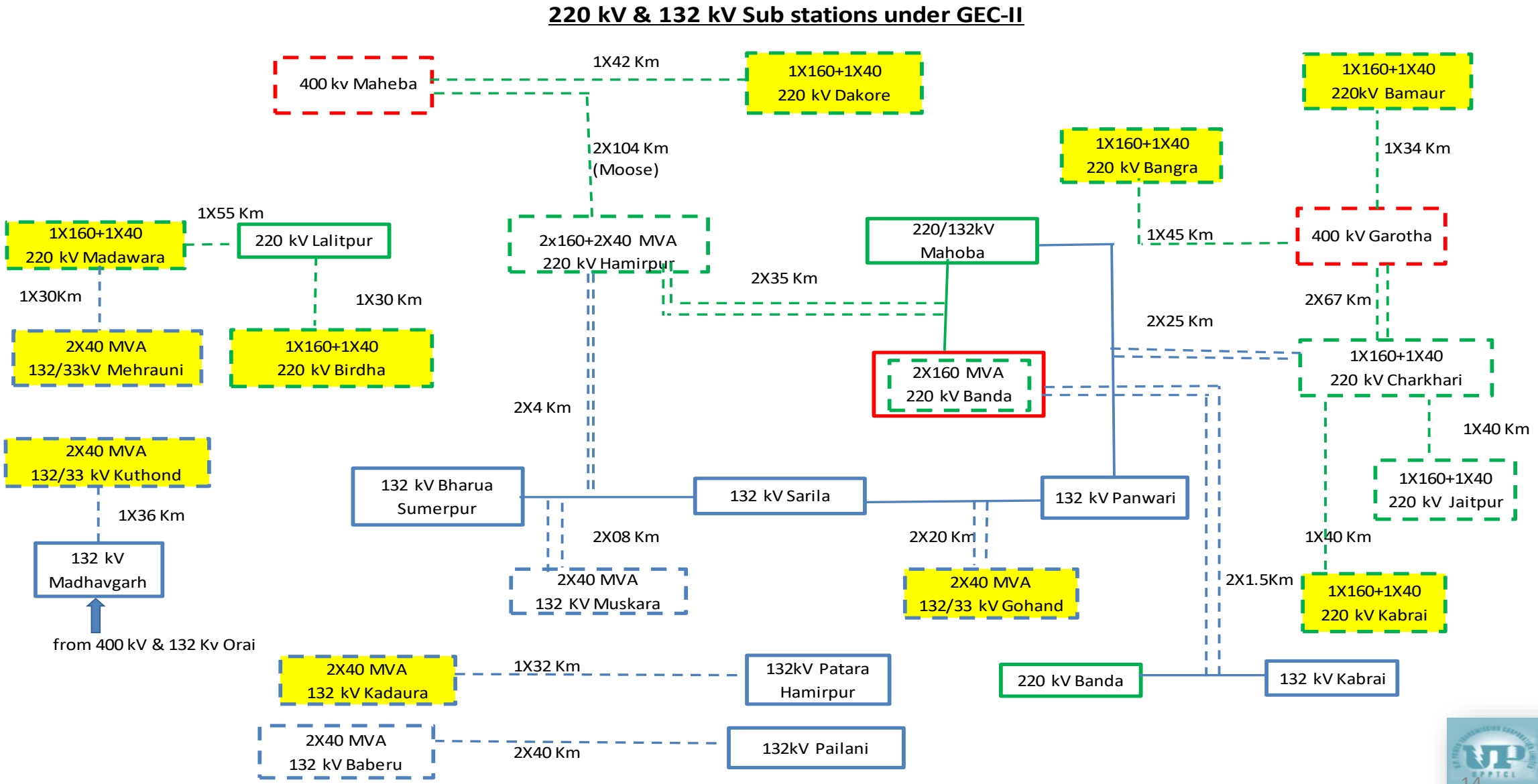


S. No.	Name of GEC-II Substations	Co-ordinates of S/s Land (Lat/Long)
1	765/400/220 KV S/S Talbehat	25.05572222 N / 78.48000000 E
2	400/220 kV S/S Garautha	25.48936111 N / 79.33655556 E
3	400/220/132 kV S/S Maheba	26.16744444 N / 79.60388889 E
4	400/220/132 kV S/S Farrukhabad	27.39744444 N / 79.43333333 E
5	220/132 KV ,S/S AT 400 KV S/S Banda	25.460154 N / 80.224531 E
6	132 / 33 KV S/S Baberu	25.49555556 N / 80.67722222 E
7	220/132 KV S/S Charkhari	25.449068 N / 79.763314 E
8	220/132 KV S/S Jaitpur	25.200388 N / 79.495402 E
9	220/132 KV S/S Kabrai	25.156304 N / 80.055210 E
10	220/132 KV S/S Hamirpur	25.743533 N / 79.972677 E
11	220 kV S/S Dakore	25.872357 N / 79.495153 E
12	220KV SS Birdha	24.49416667 N / 78.50277778 E
13	220KV SS Mandawara	24.43847222 N / 78.90744444 E
14	220KV SS Bangra	25.35333333 N / 79.04186111 E
15	220KV SS Bamaur	25.72778056 N / 79.25291667 E
16	132KV SS Mehrauni-II	24.51538889 N / 78.64130556 E
17	132 KV S/S Muskara	25.777711 N / 79.957626 E
18	132 KV S/S Gohand	25.260000 N / 79.663610 E
19	132 kV S/S Kuthond	25.988306 N / 79.455861 E
20	132 kV S/S Kadaura	25.93685 N / 79.80978 E

Proposed 765 kV & 400 kV System under GEC-II



Proposed 220 kV & 132 kV System under GEC-II



List of GEC-II Substation with coordinates

Sl. No.	Name of Substation	Capacity (MVA)	GPS-Coordinates (Lat / Long) in "D"M"S"
1.	765/400/220kV Talbehat (Village – Khandi, Lalitpur)	1x1500+2x500	25°03'20.6"N,78°78'48.0"E
2.	400/220 kV Garautha (Village- Jalalpura, Jhansi)	3x500	25°29'21.7"N,79°60'11.6"E
3.	400/220/132 kV Maheba (Village- Gorakalan, Jalaun)	2x500+ 2x160	26°10'2.8"N,79°8'14.0"E
4.	400/220/132 kV Farrukhabad (Village- Ukhra/Karanpur)	2x500+ 2x160	27°23‘50.8"N,79°25‘59.0"E
5	400/220/132 kV Chitrakoot (Village- Usari)	2x500	25°8'49.65"N,81°24'56.05"E
6.	220/132/33 kV Hamirpur (Village- Kargaon)	2x160 + 2x40	25°44'36.7"N,79°28'21.6"E
7.	220/132 kV Banda on Existing 400/220kV Banda (Village- Khairada)	2x160	25°27'36.4"N,80°13'27.96"E
8.	220/132/33kV Dakaur (Village-Bandhauli, Jalaun)	1x160+1x40	25°52'20.5"N,79°29'42.6"E
9.	220/132 /33 kV Charkhari (Village-Kakra, Mahoba)	1x160+1x40	25°26'56.6"N,79°35'47.9"E
10.	220/132/33kV Teekra Grant (Madawara)	1x160+1x40	24°26'18.5"N,79°54'26.8"E
11.	220/132/33kV Bamaur (Village-Kuretha,Jhansi)	1x160+1x40	25°43'40.01"N,79°15'10.5"E

List of GEC-II Substation with coordinates

Sl. No.	Name of Substation	Capacity (MVA)	GPS-Coordinates (Lat / Long) in "D"M"S"
12.	220/132/33 kV Chichara (Kabrai)	1x160+1x40	25°9'22.7"N,79°3'18.8"E
13.	220/132/33kV Bangra (Village-Gairaha, Jhansi)	1x160+1x40	25°21'12.0"N,79°02'30.7"E
14.	220/132/33 kV Jaitpur (Village-Khoi, Mahoba)	1x160+1x40	25°11'59.3"N,79°29'48.4"E
15.	220/132/33kV Birdha (Village-Bangariya, Lalitpur)	1x160+1x40	24°29'39.0"N,79°30'10.0"E
16.	132/33kV Baberu (Village-Korram, Banda)	2x40	25°29'43.2"N,80°40'36.4"E
17.	132/33kV Muskara (Village-Niwada, Hamirpur)	2x40	25°46'39.8"N,79°59'49"E
18.	132/33kV Gohand (Village-Rawatpura, Hamirpur)	2x40	25°15'36"N,79°57'27.5"E
19.	132/33kV Kuthond (Village-Bijwaha, Jalaun)	2x40	26°21'17.9"N,79°26'59.6"E
20.	132/33kV Mehrauni (Village-Baijnath, Lalitpur)	2x40	24°30'55.4"N,79°38'28.7"E
21.	132/33kV Kadaura (Village-Chatela, Jalaun)	2x40	25°56'10.2"N,79°48'35.7"E

List of Planned Transmission Network under GEC-II Scheme

Sr.No.	Voltage	Name of Scheme	Cost approved by UPERC (In Cr.)
1	765	765/400/220kV, 1x1500+2x500 MVA Talbehat (Lalitpur) & associated lines	1496.09
2	400	400/220kV,3x500 Garotha (Jhansi)& associated lines	694.26
3	400	400/220kV 2x500+2x160 MVA Farrukhabad& associated lines	926.77
4	400	400/220/132kV, 2x500+2x160MVA Maheba (Jalaun)& associated lines	459.81
5	400	400/220kV 2x500MVA Chitrakoot & associated lines	619.90
6	220	220/132kV, 2x160MVA S/s at Existing 400kV Banda S/s (Double Main Transfer)& associated lines	52.14
7	220	220/132/33 kV 2x160+2x40 MVA Hamirpur S/s& associated lines	110.04
8	220	220/132/33kV, 1x160+1x40MVA Charkhari S/s& associated lines	141.92
9	220	220/132/33 kV, 1x160+1x40 MVA Jaitpur (Mahoba)& associated lines	94.86
10	220	220/132/33 kV, 1x160+1x40 MVA Mandwara (Lalitpur)& associated lines	90.43
11	220	220/132/33 kV, 1x160+1x40 MVA Dakaur (Jalaun)& associated lines	90.59
12	220	220/132/33 kV, 1x160+1x40 MVA Kabrai (Mahoba)& associated lines	91.93
13	220	132/33 kV, 2x40 MVA Kadaura (Jalaun)& associated lines	45.20
14	220	132/33 kV, 2x40 MVA Kuthond, Jalaun (Double Main Transfer)& associated lines	46.71
15	220	132/33 kV, 2x40 MVA Gohand, Hamirpur (Double Main Transfer)& associated lines	39.13
16	132	132/33 kV 2x40 MVA Muskara (Hamirpur) S/s& associated lines	32.60
17	132	132/33 kV 2x40 MVA Baberu (Banda) S/s& associated lines	58.23
18	132	220/132/33 kV, 1xl60+1x40 MVA Birdha (Lalitpur)& associated lines	74.12
19	132	220/132/33 kV, 1x160+1x40 MVA Bamaur (Jhansi)& associated lines	76.83
20	132	220/132/33 kV, 1x160+1x40 MVA Bangra (Jhansi)& associated lines	91.35
21	132	132/33 kV, 2x40 MVA Mehrauni(Lalitpur)& associated lines	42.94
		Grand Total	**5375.85**

Solar Projects Under GEC-II

S.NO.	Organization Name	Name of Substation	Capacity (MW)
1	Lucknow Solar Power Development Corporation Ltd	400 kV S/s Maheba	300
2	M/s Ken Renewables India Pvt. Ltd.	400/220 kV S/s Garautha	70
3	M/s Rimjhim Ispat Limited	400KV S/s Maheba, Jalaun	70
4	M/s Torrent Urja 9 Pvt. Ltd.	765 kV S/s Talbhet	150
5	M/s Enfinity Global Energy Innovations Pvt. Ltd.	220/132kV S/s Jaitpur	50
6	M/s Enfinity Global Energy Partners Pvt. Ltd.	132 kV S/s Baberu	50
7	M/s VEH Infinite Green Source Pvt. Ltd.	220 kV S/s Hamirpur	10
8	M/s VEH Sustainable Energy Solutions Pvt. Ltd.	220 kV S/s Hamirpur	10
9	M/s kaniv Solar Pvt Ltd	220/132kV S/s Charkhari	10
10	Lucknow Solar Power Development Corporation Ltd	400 kV S/s Maheba	300

Cont..

S.NO.	Organization Name	Name of Substation	Capacity (MW)
11	M/s NUPPL Ghatampur	400 kV S/s Maheba	200
12	M/s SURYAURJA FOUR Pvt Ltd	220KV S/s Kabrai	10
13	M/s Sone Solar Three Pvt Ltd	220/132/33KV Dakor	50
14	M/s Sunsure Solarpark Seven Pvt. Ltd.	220/132kV S/s Charkhari	70
15	M/s Sone Solar Energy Four Pvt. Ltd.	220KV S/s Kabrai	10
16	M/s Sone Solar Energy two Pvt. Ltd.	132/33 KV S/s gohand	10
17	M/s Truere sunrise Pvt. Ltd.	400/220KV S/s Garautha	100
18	M/s Truere Raj spv Pvt. Ltd.	765/400/220KV S/s Talbahet	100
19	M/s Michaelites Den Recreational Services Pvt. Ltd.	220/132/33 KV S/s Kabrai	20
		Total	1290

Utilization of alternate source of energy (SOLAR)

Sr. No.	Scheme Name	Project Name	Capacity to be installed (MW)	Installed uptill now (MW)	Work in Progress (MW)
1	Solar Policy-2013	Solar Policy Phase-I	110	110	0
		Solar Policy Phase-II	125	125	0
		Solar Policy Phase-III	205	205	0
2	UPNEDA	UPNEDA	25	25	0
3	SECI	JNNSM Phase-II Batch-II	100	100	0
		JNNSM Phase-II Batch-III	160	160	0
4	LSPDCL (A joint venture of SECI and UPNEDA)	Solar Park	365	365	0
5	Solar Policy-2017	Bid-I	390	390	0
		Bid-II	310	310	0
		Bid-III	72	52	20
6	Open Access	OA 2019	325	325	0
		OA 2020	268	157	111
		OA 2021	171	80	91
		OA 2022	212	92	120
		OA 2023	713	75	638
		OA 2024	400	0	400
		Total	**3951**	**2571**	**1380**

Land Status of ongoing Solar Projects

- Number of ongoing projects- 36
- Projects having 100% land- 13
- Projects having land above 50%- 10
- Projects Having No Land at all - 13

Status of Solar Open *Access Project through Online Connectivity* Portal (2024)

No. of Received applications in Dir. (O) office	-	76
Applications forwarded to Dir.(C&P) office	-	76
Response received from Dir (C&P) office	-	72 (03 no. under analysis)
Applications forwarded to Zones	-	76
Applications accepted by zones	-	72 (04 no. under analysis)
Con-3 issued to applicants by Dir. (O) office	-	69
Con-4 submitted by applicants	-	59 (10 nos. pending at applicant side)
Con-5 issued to applicants by Dir. (O) office	-	59
Connection Agreement signed	-	55 (04 Connection agreement to be signed by the applicant)

Battery Energy Storage System(BESS) & Pump Storage Plant (PSP)

Battery Energy Storage System(BESS)

- Out of total demand - 4%
- EOI for 3200 MWhr (800MWx4hr) Battery storage system implementation has been floated by UPPCL.
- Potential Substation location identified in Bundelkhand Area by UPPTCL & Planning is in Progress.

Pump Storage Plant(PSPs)

- Total PSPs potential in state of UP has been identified as 14 GW in Sonebhadra and Mirzapur district.
  - Transmission connectivity primarily planned through ISTS
- 600 MW Pump Storage Plant is in Under Planning Stage in Sonebhadra district (Intra State)
- Green Energy Corridor-III may include evacuation system if required

Prospective Developers for PSPs in UP

Sr. No.	Name of Company	District	Water Source	Capacity (MW)
1	Greenko Energy Pvt. Ltd.	Sonebhadra	Sone River	3,660
2	Torrent Power Lt.	Sonebhadra	Sone River	4,150
3	JSW Neo Energy Ltd.	Sonebhadra	Sone River	1,200
4	Avaada Water Battery	Sonebhadra	Sone River	1,120
5	Amunra Infrotech & Agreetech	Sonebhadra	Sone River	1,620
6	ACME Cleantech Soplution	Chandauli	Moosakhand Dam & Awada Dam	600

Uncertainty in RE Generation

- Uncertainty in solar generation affects the real time load generation balance.
- For monitoring of RE generation, Renewable Energy Management Centre (REMC) for Uttar Pradesh is to be established by M/s PGCIL.
- DPR submitted by M/s PGCIL to MoP, GoI in Oct-2023. Funding from central PSDF.
- Upgradation of SCADA/EMS under ULDC – phase III is underway and expected to be operational by January 2026.

Way forward to mitigate Grid Stability

- Load Scheduling – Shifting of Load during Day time – Solar Power Generation Period.
- Interlinking of Solar Power Generating Station associated Transmission lines with PSPs Stations onwards with load center.
- Interlinking of Solar Power station transmission lines with Hydro & Gas Power Stations onwards with load center.
- Generation of Thermal Power Plant kept in the governing mode with minimum critical design generating capacity in order to ramp up generation at a time of withdrawal of solar power generation.
- Use of STATCOM at Solar power pooling station for fast regulation of reactive power and grid voltage for system stability.
- Installation of Mega Battery Energy Storage System(BESS) at major Grid Substations.

THANK YOU