Annexure - 8

26. BSPTCL shall plot their existing as well as planned transmission system of PM GatiShakti Portal.

Meeting ended with thanks to all the participants.

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Annexure - 8

Annexure-I

List of Participants

Sl. No	Name & Designation	Email-id
Central Electricity Authority		
1.	Sh. B.S. Bairwa, Chief Engineer (PSPA-II) (I/c)	bs.bairwa@nic.in
2.	Sh. Rahul Raj, Director (PSPA-II)	rahulraj@nic.in
3.	Sh. Manish Maurya, Deputy Director (PSPA-II)	manishmaurya.89@nic.in
4.	Sh. Ajay Malav, Assistant Director (PSPA-II)	ajaymalav.cea@gov.in
CTUIL		
5.	Sh. Anupam Kumar, Sr. Manager	i.anupamk@powergrid.in
6.	Sh. Divesh Kamdar, Engineer	diveshkamdar@powergrid.in
7.	Sh. Amit Kumar, Engineer	emailamit0014@powergrid.in
BSPTCL		
8.	Sh. Sunil Agrawal, Director (Project)	
9.	Sh. Kumar Prasant, CE (P&E)	ceplaningengg@gmail.com
10.	Sh. Rakesh Kumar , ESE (P&E)	rk.bsptcl@gmail.com
11.	Sh. Abhishek Kumar, EEE(P&E)	abhishek.bsptcl@hotmail.com

Minutes of 11th Meeting of State Level Standing Committee held on dated 12-07-2024

Attendance: Annexure 1

Meeting started with the welcome notes of Chief Engineer-P&E, BSPTCL explaining the requirement of various elements necessary for Strengthening of BSPTCL Transmission System.

All the points related to load growth and subsequent planning for quality & uninterrupted power supply to the State were discussed in detail.

Discussion & Deliberations:

Item 1: Renovation and Modernization (R&M) of 6 nos. of GSSs:

- R&M of some old GSS was approved by State Govt. considering the requirements to change the equipments such as Isolator, CT, PT, Battery & Battery Charger, LT Switchgear etc. as these equipments are much old and protection system is getting compromised. R&M work of few old GSS have already been completed in the past.
- R&M of two nos. 220/132/33KV GSS **Khagaul & Bodhgaya** and Four nos. of 132/33 kV GSSs – **Jehanabad, Banjari, Sheikhpura, Hajipur** have been considered.
- The said work includes replacement of older 132KV & 33KV isolators, CTs, PTs and replacement of 132 KV C&R Panels, Battery & Battery charger, LT switchgear etc along with necessary associated works.
- This will ensure better utilization of transformation capacity and GSS.

DELIBERATION: Members agreed on the above proposal and suggested to include old GSSs one by one on basis of requirement in future time frame in Rolling Plan [2027-2028]. Members also suggested to take care the work of implementation of SAS during R&M to avoid duplicacy of work.

Item 2: Evacuation of 50 MW Solar Power from Avaada to Banka (New)

- M/s AVAADA Clean Sustainable Energy Private Limited submitted the application for planning and grant of connectivity for power evacuation of 50 MW Solar Power at 132 KV level at Banka (New) GSS
- Single circuit single strung (SCSS) connectivity with one 132 KV bay adjacent to existing switchyard had been allocated to M/s ACSEPL (AVAADA) as it seems technically feasible for evacuating 50 MW power of M/s ACSEPL solar power at 132 KV level at Banka (New) GSS
- In view of above, following scheme has been finalized for M/s Avaada and agenda had already been placed in ERPC:

  1. Connectivity of 50 MW Solar power plant at Banka (New) GSS through ACSEPL-Banka (New), SCSS, Panther.

  2. Allocation of one 132 KV bay adjacent to existing switchyard of Banka (New) GSS to M/s ACSEPL

DELIBERATION: Members agreed on the above proposal with allocation of 132 kV Bay adjacent to existing system at Banka (New).

Item 3: Reconductoring of 220 kV and 132 kV Transmission Lines

- BSPTCL has planned for Reconductoring of 220kV and 132kV Transmission Lines with HTLS equivalent to Zebra and Panther conductor, respectively based on reasons mentioned below-

Increase in Load of Grid Sub-station
System improvement
Enhancement of power availability by complying N-1 contingency (of transmission lines)
High-Capacity conductor at Source points
Evacuation of power from Generating Plants (BTPS and TTPS)

- **Ampacity of HTLS conductor at 180 deg C as per CEA Planning Manual**
  1. Eq. to Panther (Casablanca): 1049 A
  2. Eq. to Zebra (Drake): 1539 A
- The proposal/ Scheme is already approved by CEA in its meeting on Transmission Planning of Bihar.
- Following transmission Lines have been considered for Reconductoring as mentioned below: -
- **LIST 1 – 12 nos. of Lines – 10th SLSC**

Sl. No.	Name of the lines
1	220 KV Darbhanga (DMTCL)-Darbhanga (220 KV) DCDS
2	220 KV BTPS – Begusarai DCDS
3	400 KV TTPS – Biharsharif S/C charged on 220kV
4	220 kV Pusauli – Nadhokhar DCDS
5	132 KV Sitamarhi – Runisaidpur (Single Circuit)
6	132 KV Begusarai – Dalsinghsarai (Single Circuit)
7	132 KV Musahari - Sitamarhi DCDS
8	132 KV Motihari (DMTCL) – Bettiah DCDS
9	132 kV Motipur – Motihari (Single Circuit)
10	132 kV Supaul – Phulparas(Single Circuit)
11	132 kV Supaul – Nirmali (Single Circuit)
12	132 kV Phulparas - Nirmali (Single Circuit)

- **LIST 2 – 5 nos. of Lines – New Agenda**

Sl. No.	Name of the lines
1	132 kV Pusauli – Kochas – Dehri S/C
2	132 kV Purnea – Dhamdaha S/C
3	132 kV Darbhanga – Madhubani DCDS
4	132 kV Chapra – Ekma – Raghunathpur S/C
5	132 kV Bettiah – Narkatiyaganj S/C

DELIBERATION: Members agreed on the above proposal and suggested to prepare a fresh list of Transmission Lines on the basis of "0 loading considering the ongoing as well as approved schemes in Rolling Plan [2027-2028].

Item 4: SAS implementation in GSS

- A substation automation system, known as SAS, is a collection of hardware and software components that are used to monitor and control an electrical system, both locally and remotely.
- BSPTCL has proposed to implement the SAS in all the existing/old 12 nos. 220/132/33 kV GSSs where SAS was not available. Accordingly, the proposal was sent to NLDC for funding under PSDF:
- Under this scheme following existing 220/132/33 kV GSSs have been considered:

1. 220/132/33 KV Bihta (New)	*7. 220/132/33 KV Begusarai*
2. 220/132/33 KV Khagaul	*8. 220/132 KV Darbhanga*
3. 220/132/33 KV Gaurichak	*9. 220/132/33 KV Pusauli*
4. 220/132/33 KV Fatuha	*10. 220/132/33 KV Dehri-On-Sone*
5. 220/132/33 KV Bodhgaya	*11. 220/132 Hajipur*
6. 220/132/33 KV Madhepura	*12. 220/132/33 KV Gopalganj*

- NLDC vide Letter No. MoP,GoI, 10/1/2014-OM [234849] dated: 16.01.2023 has given approval for funding for implementation

DELIBERATION: Members agreed on the above proposal.

- BSPTCL mentioned that they have already implemented Substation Automation System (SAS) in all new GSS under 13th plan and under implementation in various existing GSSs.
- Now, it is proposed to implement SAS at various (10 nos.) 132/33kV GSSs in Patna area viz. Bihta (Old), Digha (Old), Gaighat, Jakkanpur, Karbighaiya, Katra, Paliganj, Hatidah, Masaurhi and Barh.

DELIBERATION: Members agreed on the above proposal.

Item 5: Construction of 132/33 kV GSS at Bhorey (Gopalganj) and 132 kV Hatuha - Bhore DCDS Transmission line

- As we can notice in the District Map of Bihar, Block: Bhorey, Dist. Gopalganj is situated in the remote and densely populated region of Gopalganj.
- The 33 kV power of these areas are being fed from 132/33 kV Hathua GSS with average feeder length greater than 40 kM.
- Construction of 132/33 kV GSS with Transformation capacity (2x50 MVA) at Block: Bhorey, Dist.: Gopalganj along with associated 132 kV Hathua - Bhorey DCDS, Panther conductor has been planned to cater to load demand by minimising the feeder length resulting in better voltage profile and lowering the maintenance issue at remote place.

DELIBERATION: Members agreed on the above proposal.

Item 6: Construction of 132/33 kV GSS at Chandi (Nalanda) and 132 kV Harnaut - Chandi DCDS Transmission line

- Construction of 132/33 kV GSS with Transformation capacity (2x50 MVA) at Block: Chandi, Dist.: Nalanda along with associated **132 kV Asthawan – Chandi DCDS**, Panther conductor as primary source, has been planned to cater to load demand of 33 kV PSSs – Chandi, Nagarnausha, Bhobhi, Sirnawan, Noorsarai, Hilsa &Tharthari.
- By construction of the proposed GSS, 33KV feeder length of existing PSS will decrease & resulting in increase in voltage profile.
- 2nd source connectivity of 132 kV Harnaut - Chandi DCDS, Panther is also being considered.

DELIBERATION: Members agreed on the above proposal.

Item 7: Construction of 132/33 kV GIS at PMCH and 132 kV Digha (New) - PMCH DCDS:

- Patna Medical College and Hospital (abbreviated as PMCH) was **established in 1925** and originally known as Prince of Wales Medical College, is a medical college located in Patna, the state capital of Bihar, India
- PMCH is getting power from 132/33 kV Gaighat which was constructed in 1994 . Presently redevelopment work of PMCH is going on for making it a 5462 bed hospital aims to make PMCH a world class hospital.
- Accordingly, Health Dept., GoB has requested Energy Dept./BSPTCL for construction of new 132/33 Green GIS GSS considering expected increase in load in near future.
- After system study, BSPTCL is proposing to construct a new GIS with Green Building in the PMCH premise to provide better uninterrupted power supply to PMCH connected directly on higher voltage level source (i.e., 220/132/33 kV Digha (New)) which will provide better voltage regulation.

  Scope of work: *Construction of 132/33 kV Green GIS with Transformation capacity (2x80 MVA) along with 132 kV Digha (New) - PMCH DCDS transmission line with Single Moose Conductor.*

DELIBERATION: Members agreed on the above proposal.

Item 8: Construction of 132/33 kV GSS at Sarairanjan and 132 kV Tajpur - Sarairanjan DCDS Transmission Line:

- NBPDCL has recommended for construction of 132/33 kV GSS at Sarairanjan, Dist.-Samastipur.
- BSPTCL has performed the system study considering load details obtained from NBPDCL.
- In the load flow, load demand of 38MW has been considered in the time frame of the financial year 2026-27 and connectivity from Tajpur have been analyzed.

  Connectivity: 132 kV Tajpur-Sarairanjan DCDS, Panther.

- To cater the load demand of aforesaid feeders [Khajuri, Sarairanjan, Panchbhinda and 33KV Shree Ramjanaki Medical College (u/c)and avoid maintenance issue due to larger feeder length, proposal for construction of 132/33 kV Sarairanjan, Samastipur is essentially required.

DELIBERATION: Members agreed on the above proposal.

Item 9: Construction of 132/33 kV GIS at Maithi and LILO of 132 kV SKMCH - Mushari DCDS Transmission Line

- **Consideration:**

  Capacity: 3x80 MVA

  Connectivity: LILO of 132 kV Mushari – SKMCH DCDS, Panther
- BSPTCL is planning for construction of new GSS between Muzaffarpur and Darbhanga to cater the growing demand in the area.
- Presently, only one 132/33KV GSS SKMCH is situated between new Flyover SKMCH to Benibadh (Darbhanga NH-57) and distance between them is 50km. Moreover, proposal of capacity augmentation from 3x50MVA (=150MVA) to 3x80MVA (=240MVA) for GSS SKMCH has also been received from O&M wing.
- As such to off-load and to avoid further augmentation at SKMCH GSS, Muzaffarpur, Maithi GSS at 132/33 kV voltage level is essentially required.

DELIBERATION: Members agreed on the above proposal.

Item 10: Construction of 132/33 kV GSS at Warisnagar and 132 kV Tajpur - Warisnagar DCDS Transmission Line

- The construction of a 132/33 kV GSS at Block-Warisnagar, Dist-Samastipur, with a transformation capacity of 2x50 MVA, along with the associated transmission line 132KV Warisnagar-Tajpur as primarly source, has been planned to cater to the load demand of approximately 49MW in the present scenario and 67MW by FY 2027-28.
- This project will support the 33KV PSSs in Khanpur, Kalyanpur, Madhupur, Warisnagar, Hayaghat, Hathauri, and the upcoming PSSs in Sari and Chakmahashi as planned by DISCOMs.
- By constructing the proposed GSS, the voltage profile of the 33KV PSSs will be maintained, and the load from the 132KV Samastipur GSS will be shifted to the proposed GSS. This shift will enhance the reliability and efficiency of the power supply in the region, ensuring a stable and consistent voltage profile for the connected PSSs.
- This proposal will be highly beneficial for the districts of Samastipur and Darbhanga, as well as the area between the Gandak and Bagmati rivers.
- 2nd source connectivity of LILO of 132KV S/C Samastipur-Darbhanga Transmission line, Panther is also being considered.

DELIBERATION: Members agreed on the above proposal.

Item 11: Construction of 132/33 kV GSS at Rupauli and LILO of 132 kV Purnea – Dhamdaha S/C Transmission Line

- The construction of a 132/33 kV GSS at Block-Rupauli, Dist-Purnea (Transformation capacity: 2x50 MVA) along with the associated Transmission line LILO of 132KV Dhamdaha-Banmankhi, Panther conductor, has been planned to cater to the load demand of, approx. 40MW in present scenario and 52MW in time frame of FY 2027-28.
- It will support 33KV PSSs Dargaha, Sondip, Bhitta, Shrimatta, W. Tola, as well as upcoming PSSs planned by DISCOMs.
- By constructing the proposed GSS, the voltage profile of 33KV PSSs will be maintained, and the load of the 132KV Dhamdaha GSS will be shifted to proposed GSS, achieving the N-1 contingency criteria for GSS Purnea and GSS Dhamdaha, which is fed by GSS Purnea.
- This proposal aims to improve the reliability and efficiency of the power supply in the Purnea district, ensuring stable and sufficient electricity for the connected areas.

DELIBERATION: Members discussed the proposal. It was deliberated to proceed ahead with feasibility for 132/33 kV GSS at Bhawanipur, Purnea in place of Rupauli. Revised proposal to be sent by NBPDCL. It was conveyed that the proposed GSS will be fed power from Purnea or/and Dhamdaha.

Item 12: Construction of 132/33 kV GSS at Halsi and LILO of 132 kV Jamui - Lakhisarai S/C Transmission line

- Construction of 132/33kV GSS at Halsi, Lakhisarai with transformation capacity 2x80 MVA has been planned to cater the load demand of upcoming and existing nearby 33kV PSSs.
- By construction of the proposed GSS, 33kV feeder length of existing PSS will decrease, resulting in better voltage profile.

BPTCL has performed the system study considering load details obtained from SBPDCL. In the load flow, load demand of 90 MW has been considered and connectivity from LILO of 132kV Jamui – Lakhisarai Transmission line has been analyzed.

DELIBERATION: Members agreed on the above proposal.

Item 13: Construction of 132/33 kV GIS at Akhgaon (Sandesh) and 132 kV Naubatpur (BGCL) – Akhgaon DCDS Transmission Line

- SBPDCL has recommended for construction of 132/33kV GSS at Akhgaon (Sandesh), Ara with transformation capacity 2x80 MVA to cater the load demand of 33kV PSSs Akhgaon, Sandesh, Azimabad, Bahiyara, Agion, Sahar, Koilwar & Narayanpur(upcoming).
- By construction of the proposed GSS, 33kV feeder length of existing PSS will decrease, resulting in better voltage profile.
- BSPTCL has performed the system study considering load details obtained from SBPDCL. In the load flow, load demand of 48 MW has been considered and connectivity from GSS Naubatpur(BGCL).

DELIBERATION: Members agreed on the above proposal.

Item 14: Construction of 220/33kV GIS at Bairiya, Patna along with associated Transmission Line

- SBPDCL requested for construction of new GSS at Bairiya, Patna(with transformation capacity of 2x50 MVA) for providing power to proposed PSS at Nandlal Chhapra, Bhogipur/Sahpur, Simra and existing PSSs.
- There is very rapid growth in the nearby area due to construction of **new ISBT and Patna metro**. Therefore, construction of new GSS at Bairiya will cater the load demand of the area and for insuring the uninterrupted power supply.

  Voltage level of 220/33kV, 3x100 MVA will be more feasible as 220kV Gaurichak – Jakkanpur (BGCL) & Gaurichak – Fatuha transmission line crosses through the proposed land. Also transmission of power at 220 kV voltage level will reduce the losses, as compared to that of at 132 kV voltage level.

DELIBERATION: Members discussed on the above proposal and it was also emphasized upon inclusion of 132KV voltage level based on feasibility and interconnection.

Item 15: Requirement of 132kV and 33kV Bays

- O&M, BSPTCL wing along with respective DISCOMs have proposed the requirement of 33 kV Bays in various Grid Sub-stations necessary for Transformer Augmentation to meet upcoming load demand.

GSSs for 33 kV Bays:

A. **LIST of SBPDCL**

Sl. No	GSS	No of 33KV Bays
1	Biharsharif	02
2	Sonenagar(old)	01
3	Belaganj	01
4	Goradih	02
5	Kahalgaon	02
6	Gaighat	04
7	Karbighaiya	03
8	Katra	05
	Total	**20**

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B. LIST of NBPDCL

Sl. No	GSS	No of 33KV Bays		Net 33KV bay requirement(a+b)
		Required for Existing PSS(a)	For PSS proposed in State Plan(b)	
1	SKMCH	8	0	8
2	Vaishali	6	0	6
3	Rosera	2	0	2
4	Hathua	4	0	4
5	Muzaffarpur (Bhikanpura)	2	0	2
6	Darbhanga	2	0	2
7	Ekma	1	1	2
8	Manjhaul	1	0	1
9	Balia	1	0	1
10	Chakiya	1	0	1
11	Areraj	1	0	1
12	Sheohar	1	0	1
13	Motihari	1	1	2
14	Shahpur Patori	1	0	1
15	Udakishanganj	2	0	2
16	Runnisaidpur	2	0	2
17	Benipatti	1	1	2
18	Pupri	1	0	1
19	Simribakhtiyarpur	2	0	2
20	Banmankhi	1	0	1
21	Dalsinghsarai	1	0	1
22	Mushahri	1	0	1
23	Khagaria (old)	0	1	1
24	Sheetalpur	0	1	1
25	Masrakh	0	2	2
26	Laukahi	0	1	1
27	Barsoi	0	2	2
28	Madhepura	0	1	1
	Total	**43**	**11**	**54**

DELIBERATION: Members agreed on the above proposal and opined that the requirement of 33 kV Bays may also be reviewed and prepared by O&M, BSPTCL in coordination with DISCOMs.

Item 16: Augmentation/Addition of 132/33 kV Power Transformers

A. 23 nos. of 50 MVA - cont., Ref NIT 40/PR/BSPTCL/2021 (Under Implementation)

- Considering the growth in power demand/load growth and to ensure uninterrupted power supply, capacity augmentation by addition/replacement of few 132/33 KV GSS has been planned.
- Accordingly, augmentation/ replacement of 23 nos. of 50 MVA Power Transformers are in progress against NIT 40/PR/BSPTCL/2021.

B. 10 nos. of 50 MVA & 5 nos. of 80 MVA (New Proposal)

Sl. No.	Name	Capacity in MVA	Peak Load (MW)	Remarks
1	Hajipur (old)	3x50	120	Replacement of existing 50MVA with 80MVA
2	Purnea	3x50	116	Replacement of existing 50MVA with 80MVA
3	Dumraon	2x50	77	Replacement of existing 50MVA with 80MVA
4	Siwan	3x50	115	Replacement of existing 50MVA with 80MVA
5	Muzaffarpur	3x50	104	Replacement of existing 50MVA with 80MVA
6	Bodhgaya	3x50	113	Addition
7	Goh	3x20	45	Replacement of existing 20MVA with 50MVA
8	Simri Bakhtiyarpur	2x20	29	Replacement of existing 20MVA with 50MVA
9	Tarapur	2x20	29	Replacement of existing 20MVA with 50MVA
10	Tehta	2x20	29	Replacement of existing 20MVA with 50MVA
11	Shahpurpatori	2x20	28	Replacement of existing 20MVA with 50MVA
12	Manjhaul	1x20 + 1x50	42	Replacement of existing 20MVA with 50MVA
13	Ramnagar	1x20 + 2x50	83	Replacement of existing 20MVA with 50MVA
14	Banka (old)	2x20 + 1x50	62	Replacement of existing 20MVA with 50MVA
15	Chakiya	1x20 + 1x50	48	Replacement of existing 20MVA with 80MVA

DELIBERATION: Members agreed on the proposal. Moreover, it was suggested by the committee to DISCOMs and O&M, BSPTCL to analyse the load growth and suggest the requirement of Augmentation of 50/80/160/200 MVA.

Item 17: Evacuation of 185 MW Solar Power from Kajra Solar Plant Pool:

- It has been informed by Chief Engineer, Generation the M/S Gujrat Energy Research & Management Institute (GERMI) has submitted the DRAFT DPR for 185 MW AC Solar Power at Kajra, Lakhisarai due to unavailability of necessary/ required land for 250 MW Solar Power.
- The work along with Battery Energy Storage System (BESS) has been awarded to M/S L&T.
- Earlier proposal for Evacuation of Power
  220 kV Kajra (Solar Plant) – Haveli Kharagpur DCDS, Zebra
- Revised proposal for Evacuation of Power
  LILO of 132KV D/C Haveli Kharagpur – Lakhisarai at 132 kV Kajra (Solar Plant)

DELIBERATION: Members agreed on the above proposal.

Item 18: Lakhisarai (PG) downlinking line and bays:

- BSPTCL is facing the practical problems of high voltage at 220 KV level in nearby sub-stations as well as violating N-1 criteria in some GSSs. Accordingly, system studies were performed and observed that there is need of creation of 220 kV voltage at existing 400/132 kV Banka (PG) and Lakhisarai (PG) which may be connected to the remote end grids to provide an alternate source 220 kV at Haveli Kharagpur and Goradih and to maintain better voltage regulation.
- **Creation of 220 KV System at Banka (PG) along with construction of 220 KV Banka (PG) – Goradih DCDS was agreed in the 2nd and 3rd Meeting of ERPC-TP.**
- It has been gathered from the Study that reversal of power during Peak to Off-peak period and vice versa, voltage regulation is within the permissible limit (5%) with the inclusion of 220 kV Bus system at Lakhisarai (PG) and connecting it 220/132/33 kV Haveli Kharagpur GIS, in the ring system of vicinity of 220/132 kV GSSs.
- **Scheme:**
  1) Construction of 220 kV Bus at Lakhisarai (PG) and 2 nos. 220 kV Bays at Haveli Kharagpur
  2) Construction of 220 kV Lakhisarai (PG) - Haveli Kharagpur DCDS Transmission Line
  3) Installment of 400/220 kV Auto Transformers at Lakhisarai (PG) and corresponding bays – by PGCIL
- The work has been awarded.

DELIBERATION: Members agreed on the above proposal.

Item 19: 132KV Khagaul - Digha Transmission line Construction with Monopole:

- Recently, a number of trippings and failures were observed in the cable portion due to internal growth of moisture tree which resulted in complete outage of Digha (old) GSS.
- Due to elevated Digha - AIIMS flyover and construction of roads there is severe corridor issue. Moreover, this portion is severely water logged.
- Maximum Peak Demand of Digha (old) is 145MW. Considering load growth of Digha (old) and N-1 (contingency for failure of Digha (New) or tripping of 220kV Amnour-Digha (New) T/L, it is advisable to go ahead with HTLS.
- This proposal has been received from field/O&M.
- The work has been awarded.

DELIBERATION: Members agreed on the above proposal.

ADDITIONAL AGENDA

Item 20: Evacuation Plan for Upcoming Expansion of Nabinagar Thermal Power Plant (NPGCL), Dt-Aurangabad:

- NPGCL Existing Capacity : 2x660 MW
- Being evacuated through Inter State Transmission System (ISTS) at 400/220/132 kV Chandauti (New, PMTL)
- As learnt, expansion (upcoming unit) of NPGCL is being proposed.
- BSPGCL and PMC wings may confirm for the exact quantum of power, ownership of the bus, time frame and % share for Bihar.

NOTE: *Exact expansion plan yet to be confirmed by CEA.*

DELIBERATION: Members suggested to coordinate with PMC and BSPGCL for the exact quantum of power, ownership of the bus, time frame and % share for Bihar. P&E has envisaged with PMC/BSPGCL to gather required data for performing System Study.

Item 20: Upcoming Grid Sub-stations:

Sl. No.	Proposed GSS	Reasonings
1	**400/220 kV at Buxar/ Nearby Areas with inclusion of 132 kV**	1. In case of tripping of 400/220 kV ICTs at Buxar Thermal Power Plant (BTPP), N-1 condition will be violated for Evacuation of Power from existing System. 2. To feed power to proposed Market Cluster/ SEZ which is being planned at Nawanagar. 3. To further avoid dependency from 400/220/132 kV Pusauli (PG) 4. To Evacuate additional power from proposed 3rd unit of SJVN/ Buxar Thermal Power Plant.
2	**132/33 kV GSS at Bhelahi to be upgraded at 220 kV**	NBPDCL is exploring the feasibility of 132/33 kV GSS at Bhelahi, Saharsa. However, direct connectivity of Bhelahi at 220 kV from Saharsa (New) and extending 220 kV or/and 132 kV to the GSSs situated in the vicinity will reduce burden of Drabhanga (New), Madhepura and Laukahi.
3	**132/33 kV GSS at Narkatiyaganj, West Champaran**	NBPDCL is exploring the feasibility of 132/33 kV GSS at Narkatiyaganj, West Champaran.

DELIBERATION: Members perused on the above and deliberated to come up with complete proposal.

MD, BSPTCL and MD, SBPDCL have instructed P&E, BSPTCL to work on the overall plan of SEZ so that reliable, quality and uninterrupted power supply may be ensured to Market Cluster. It was further informed to explore feasibility of such cluster at Buxar, Gaya and Bettiah (Kumarbag, Paschim Champaran & Nawanagar).

REFERENCES

1. 20th EPS
2. Bihar Power Atlas
3. Planning Procedure
4. CEA Planning Manual

Meeting ended with the votes of thanks.

Attendees

Sl. No.	Name of Officer	Designation
	BSPTCL	
	Sri Sunil Agrawal	Director (Projects)
	Sri A K Singh	Director (Operations)
	Sri Kumar Prasant	Chief Engineer (P&E)
	Sri A K Chaudhary	Chief Engineer (SO)
	Sri Perwez Alam	Chief Engineer (STU)
	Special Invitee	
	Sri Ratan Kumar	Chief Engineer (Project-I)
	BSPGCL	
	Sri A K Singh	Director (Operations)
	NBPDCL	
	Sri I.C. Yadav	Director (Projects)
	Sri Nasim Eqbal	Director (Operations)
	SBPDCL	
	Sri Deepak Kumar Singh	Director (Projects)
	Sri Vijay Kumar	Director (Operations)
	BGCL	
	Mahesh Tewari	Managing Director

(5) Business Plan for the Control Period of FY 2025-26 to FY 2027-28

5.1. Background

Regulation 5 of the BERC MYT Tariff Regulations, 2024 provides that the licensee needs to file an application for approval of Business Plan prior commencement of the Control Period. The relevant extract of the Regulation is as follows:

> *"**5. Business Plan***
>
> *5.1 The Transmission Licensee or SLDC, as the case may be, shall file a Business Plan, for the Control Period by a Petition in accordance with BERC (Conduct of Business) Regulations, 2005 as amended from time to time, by 15th September of the year prior to the commencement of the Control Period and accompanied by such fee payable, as specified in the BERC (Fees, Fines and Charges) Regulations, 2019 as amended from time to time."*

Based on the above regulation BSPTCL has prepared its Business Plan for the Control Period from FY 2025-26 to FY 2027-28.

In accordance with the provision of the MYT Tariff Framework and regulation 5.2 of the BERC MYT Tariff Regulations, 2024, Transmission Licensee is required to incorporate the components of the Business Plan in the MYT Petition for the each year of the Control Period. The relevant extracts are as follows:

> *"5.2 Such Business Plan shall comprise but not be limited to infrastructure requirement commensurate with load growth forecast and demand projections, capital investment plan, financing plan and physical targets.*
>
> *Provided that the Business Plan shall take into account schemes costing below the threshold limit to be notified separately that are to be developed by the State Transmission Utility on cost plus basis in accordance with the Tariff Policy notified by Govt. of India."*

Accordingly, BSPTCL has incorporated the broad framework of the Business Plan in this MYT Petition, as detailed in the following paragraphs:

5.2. Business Scope

Considering the duties and functions of Transmission Licensees illustrated in the Electricity Act, 2003, the business scope for BSPTCL essentially covers the following:

- Planning and development of a properly co-ordinated intra-State transmission system in its Capital Investment Plan;

- Provide access to Transmission facilities to the State distribution utilities and any other user of the Transmission system, on payment of transmission charges;
- Provide long-term and short-term open access to consumers on payment of requisite transmission and other charges approved by the State Commission;
- Explore and develop the new dimensions of business from growth perspective and enhance value.

5.3. Approach to Development of Business Plan

The Business Plan comprises the infrastructure requirement commensurate with load growth forecast and demand projections, capital investment plan, financing plan and physical targets. The capital investment is determined based on the analysis of projected demand growth in electricity distribution sector commensurate with the economic growth in the State, and generation capacity additions/ increased evacuation requirement vis-à-vis the available transmission capacity. Also, transmission infrastructure has been planned considering the DISCOM's infrastructure requirement. Transmission infrastructure requirement planning is done in conjunction with DISCOMs and considering the following:

- Increasing integration of renewable energy in the system,
- In order to avoid source outage, BSPTCL has to keep ready infrastructure to accommodate power from multiple sources,
- To meet increasing demand due to various initiatives of Central as well as State Government, i.e., 24&7 power for all, Smart Grid, SAUBHAGYA, etc.

Further, based on these growth projections, requirement of additional transmission lines and substations or augmentation of existing transmission capacity are planned. A rational approach has been followed for ascertaining various data points using practical assumptions wherever required.

The components of Business Plan depend upon various factors such as historical data, current and future financial estimates, growth estimates, economic, financial and business-related assumptions, current operational requirements, other foreseeable changes/requirements in future, etc. Any deviations due to a number of

uncontrollable externalities shall be brought to the notice of the Hon'ble Commission in accordance with the provisions of MYT Regulations. The Business Plan may need to be updated periodically in accordance with various schemes/ policy initiatives of the Government and in order to comply the directions of the Government/ Hon'ble Commission, as the case may be. Thus, BSPTCL would like to submit that the Business Plan is a dynamic document, which may need to be updated at various intervals in order to align it with the goals and objectives of the company and various schemes/ directions of the Central and State Government. Further, due to changing electricity market trends and various internal and external factors, the Business Plan may need to be updated.

5.4. Key Objectives of the Business Plan

The primary objectives for developing the Business Plan are as follows:

- Providing a tool for Strategic Planning: The Business Plan is intended to chart the Company's way forward. The key objective for developing the Business Plan is to analyse and anticipate the major requirements of transmission infrastructure commensurate with the expected demand growth of electricity. The Business Plan may prove to be a tool to strategically plan for capital investments and it's financing. Further, it may help in timely execution and monitoring of the work.
- For the regulatory compliance of incorporation of requirements of Business Plan in the MYT Petition as mandated by MYT Regulations, 2024.
- The Business Plan may aid in decision making while planning and execution of the project. Further, proactive actions may be taken during the execution of the project in order to achieve the Company's goal of supplying quality power to all. This may help in improving the operational efficiency by running the transmission network in accordance with the set performance target.

5.5. Business Plan

The Business Plan of BSPTCL covers the following for the Control Period.

- Performance targets
- Norms for O&M Expenses
- Capital expenditure and Capitalisation

- Source of Funding of capital investment

The details of the same are discussed in the following sections:

5.6. Performance Targets

BSPTCL has projected each component of its performance Targets for the Control Period of FY 2025-26 to FY 2027-28 in line with the BERC MYT Tariff regulations, 2024. The details of the same discussed in the following paragraphs:

5.6.1 Transmission Availability

It is submitted that the BSPTCL is consistently trying to ensure a transmission system availability of above 98% as specified in the MYT Regulations, 2024. During the Control Period from FY 2022-23 to FY 2024-25, BSPTCL had also achieved Transmission System Availability above 98.50% and ensure its Incentives for better performance.

BSPTCL submits that it shall continue to ensure a transmission system availability of at-least 98% despite the increasing network loading. The projected Transmission system availability for the Control Period of FY 2025-26 to FY 2027-28 proposed by BSPTCL is as follows:

Table 5-1: Transmission System Availability proposed for the Control Period

Particulars	Projected in MYT ARR FY 2025-26	Projected in MYT ARR FY 2026-27	Projected in MYT ARR FY 2027-28
Transmission System Availability (%) For full recovery of the ARR	98%	98%	98%
Transmission System Availability (%) For entitlement of Incentives	98.50%	98.50%	98.50%

BSPTCL respectfully prays to the Hon'ble Commission to kindly consider the same in line with the BERC MYT Tariff regulations, 2024 for full recovery of the ARR for ensuing years and for entitlement of Incentive during its Truing up Exercise.

5.6.2 Transmission Loss

The Hon'ble Commission had approved transmission losses at 3% for the last Control Period of FY 2022-23 to FY 2024-25. Over the period, BSPTCL has taken various initiatives like installation of ABT meter, routine maintenance, etc to reduce transmission losses . BSPTCL has been able to reduce the transmission losses in

comparison of loss level approved by the Hon'ble Commission in the last Control Period. BSPTCL has achieved the actual transmission losses of 2.57% and 2.58% for FY 2022-23 and FY 2023-24, respectively.

However, BSPTCL expects the transmission losses of 3% for the period from FY 2025-26 to FY 2027-28 due to ongoing network expansion as well as system loading. The transmission loss trajectory proposed for the ensuing Control Period is shown in the table below:

Table 5-2: Transmission Loss for the FY 2025-26 to FY 2027-28

Particulars	Projected in MYT ARR FY 2025-26	Projected in MYT ARR FY 2026-27	Projected in MYT ARR FY 2027-28
Transmission Loss (%)	3.00%	3.00%	3.00%

BSPTCL respectfully prays to the Hon'ble Commission to kindly consider the Transmission Loss for the Control Period of FY 2025-26 to FY 2027-28 as projected by the BSPTCL.

5.7. Norms for O&M Expenses

Regulations 21 of BERC MYT Regulations 2024 specify that the Hon'ble Commission shall stipulate a separate trajectory of norms for each of the components of O&M expenses. The relevant extract of the Regulations is reproduced as below:

> ***"21. Operation and Maintenance Expenses***
>
> *(a) The Commission shall stipulate a separate trajectory of norms for each of the components of O&M expenses viz., Employee cost, Repair and Maintenance (R&M) expense and Administrative and General (A&G) expense.*
>
> *Provided that such norms may be specified for a specific Transmission Licensee or a class of Transmission Licensees.*
>
> *(b) Norms shall be defined in terms of number of personnel per ckt/km (for different categories of transmission lines for e.g. 400 KV, 220 KV, 132 KV etc. Lines) and number of personal per bay (for different categories of bay for e.g. 400 KV, 220 KV, 132 KV etc. Bays) along with annual expenses per personnel for Employee expenses; combination of A&G expense per personnel and A&G expense per substation for A&G expenses and R&M expense as percentage of gross fixed assets for estimation of R&M expenses.*
>
> *(c) One-time expenses such as expense due to change in accounting policy and arrears paid due to pay commission recommendation shall be excluded from the norms in the trajectory."*

In view of the above Regulations, BSPTCL has proposed the norms applicable for the Control Period from FY 2025-26 to FY 2027-28 for each of the components of O&M expenses as discussed below:

5.7.1. Norms for Employee Expenses

The Hon'ble Commission in Tariff Order dated 25th March 2022 had stipulated a separate trajectory of norms for Employee Expenses applicable for the Control Period from FY 2022-23 to FY 2024-25.

Further, the Hon'ble Commission has revised its base norm for Employee Expenses vide Tariff Order dated 21st March 2023.

It is submitted that the BSPTCL has worked out norms based on the approach adopted by the Hon'ble Commission for computation of norms of Employee Expenses for the entire Control Period.

BSPTCL has considered the number of employees, transmission line in Ckt km, no. of substations and actual employee cost for the past years, i.e., for FY 2021-22 to FY 2023-24. BSPTCL has adopted a ratio of 45% of the total no. of employees as a part of norms for substation and 55% personnel as a part of norms for Ckt km for the purpose of calculation of norms in line with the methodology adopted by the Hon'ble Commission. Since, the Employee expenses of BSPTCL includes the SLDC cost also, SLDC cost has been deducted from the total Employee expenses of BSPTCL for computation of base norm for the control period of FY 2025-26 to FY 2027-28. The details of Base Norms for computation of Employee Expenses for the control Period of FY 2025-26 to FY 2027-28 is as tabulated below:

Table 5-3: Base Norm for Employee Expenses for the Control Period of FY 2025-26 to FY 2027-28

Sl. No.	Particulars	FY 2021-22	FY 2022-23	FY 2023-24	Average
1	No. of Employee	2,243.00	2,230.00	2,211.00	
2	No. of Ckt Km	15,778.00	16,653.00	17,552.22	
3	No. of Sub Stations	148.00	149.00	155.00	
4	**Number of personnel per Ckt Km (55%)**	**0.0782**	**0.0737**	**0.0693**	**0.0737**
5	**Number of personnel per Sub Station (45%)**	**6.8199**	**6.7349**	**6.4190**	**6.6580**

Sl. No.	Particulars	FY 2021-22	FY 2022-23	FY 2023-24	Average
6	Employee Cost Including SLDC	280.11	249.04	319.37	
7	Less: SLDC Cost	6.17	6.24	6.36	
8	Employee Cost for Transmission Utility	273.94	242.8	313.007	
9	**Annual Expenses per Personnel (Rs. Cr.)**	**0.1221**	**0.1089**	**0.1416**	**0.1242**

BSPTCL respectfully prays to the Hon'ble Commission to kindly consider the same as base Norms for Employee Expenses for the Control Period of FY 2025-26 to FY 2027-28 as computed in the table above.

5.7.2. Norms for R&M Expenses

The Regulation 21.2 of the MYT Regulations, 2024 specify R&M expenses as percentage of opening gross fixed assets (excluding land cost) for estimation of R&M expenses. Regulation 21 (i) specifies that the norms shall be determined based on audited accounts of operations of last three years. BSPTCL has accordingly computed the 'K' factor (i.e., R&M norm) based on the audited annual accounts for FY 2021-22 to FY 2023-24 as given below:

Table 5-4: Base Norm for R&M Expenses for the Control Period of FY 2025-26 to FY 2027-28

Sl. No.	Particulars	FY 2021-22	FY 2022-23	FY 2023-24
1	Opening GFA	10,156.28	10,785.97	12,101.28
2	Less: Opening Value of Land	1,503.07	1,523.09	1,533.57
3	Net Opening GFA (1-2)	8,653.21	9,262.88	10,567.71
4	R&M Expenses	35.67	52.22	54.10
5	% of R&M Expenses to GFA ((4/3)*100)	0.41%	0.56%	0.51%
6	**Average % of R&M expenses to GFA- "K" Factor**			**0.50%**

BSPTCL respectfully prays to the Hon'ble Commission to kindly consider the same as base Norms for R&M Expenses for the Control Period of FY 2025-26 to FY 2027-28 as computed in the table above.

5.7.3. Norms for A&G Expenses

The Hon'ble Commission in Tariff Order dated 25th March 2022 had stipulated a separate trajectory of norms for A&G Expenses applicable for the Control Period from FY 2022-23 to FY 2024-25.

It is submitted that the BSPTCL has worked out norms based on the approach adopted by the Hon'ble Commission for computation of norms of A&G Expenses for the entire Control Period.

BSPTCL has considered the number of employees, no. of substations and actual A&G cost for the past years, i.e., for FY 2021-22 to FY 2023-24. BSPTCL has adopted a ratio of 45% of the expenses as a part of norms for substation and 55% of the expenses as a part of norms for per-Personnel for the purpose of calculation of norms in line with the methodology adopted by the Hon'ble Commission. Since, the A&G expenses of BSPTCL includes the SLDC cost also, SLDC cost has been deducted from the total A&G expenses of BSPTCL for computation of base norm for the control period of FY 2025-26 to FY 2027-28. The details of Base Norms for computation of A&G Expenses for the control Period of FY 2025-26 to FY 2027-28 is as tabulated below:

Table 5-5: Base Norm for A&G Expenses for the Control Period of FY 2025-26 to FY 2027-28

Sl. No.	Particulars	FY 2021-22	FY 2022-23	FY 2023-24	Average
1	No. of Employee	2,243.00	2,230.00	2,211.00	
2	No. of Sub Stations	148.00	149.00	155.00	
3	A&G Expenses (Including SLDC)	42.87	54.63	71.04	
4	Less: SLDC	0.63	0.58	1.04	
5	A&G Expenses for Transmission Utility	42.24	54.05	70.00	
6	**A&G Expenses per Personnel (55%)**	**0.0104**	**0.0133**	**0.0174**	**1.3700**
7	**A&G Expenses per Sub-Station (45%)**	**0.1284**	**0.1632**	**0.2032**	**16.4966**

BSPTCL respectfully prays to the Hon'ble Commission to kindly consider the same as base Norms for A&G Expenses for the Control Period of FY 2025-26 to FY 2027-28 as computed in the table above.

5.8. Capital Investment Plan

BSPTCL submits that due to changing business environment and the Regulations governing the Transmission Business, the Capital Investment Plan may need to be updated at various intervals in accordance with the policy initiatives of the

Government and to align the growth path of the Company with the external business environment and internal factors affecting the business / operations of the Company.

BSPTCL has submitted Capital Investment Plan in accordance with the provisions specified in the MYT Regulations, 2024 and BERC (Procedure for filing Capital investment and Capitalisation plan) Regulations, 2018. While preparing the Capital Investment Plan, BSPTCL follows policy initiatives of the Government of Bihar (GoB). The Capital Investment Plan mainly comprises two categories of projects, viz., ongoing projects, which are spilled over from previous Control Period, and new projects.

BSPTCL proposes to undertake new projects during the Control Period of FY 2025-26 to FY 2027-28.

Further, it has also undertaken new projects based on its requirements during FY 2024-25. Therefore, BSPTCL now seeks Regulatory approval of the same vide this instant petition.

The details of the projects i.e. Name of projects, tentative project cost and tentative completion date and mode of finance proposed by BSPTCL are as given below:

Table 5-6: Details of the new projects for the Control Period of FY 2025-26 to FY 2027-28

Sl. No.	Name of the Project	Details of approval of GoB	Total Project Cost (Rs. Crore)	Year of Capitalisation	Status	Funding of Works
1	Construction of (i)2x500 MVA + 2x200 MVA, 400/220/132 KV AIS Sub-Station at Chhapra (New), (ii) 132 kV Chhapra(New) - Raghunathpur DCDS with Single Moose conductor. (line length- 80 km) & (iii) 132 kV Chhapra(New) - Maharajganj DCDS (45 km) with Single	GoB Letter No. BSPTCL-01/2020-24, dated 15.03.2023	482.89	FY 2026-27	Awarded through 06/PR/BSPTCL/2024	State Plan

Sl. No.	Name of the Project	Details of approval of GoB	Total Project Cost (Rs. Crore)	Year of Capitalisation	Status	Funding of Works
	Moose conductor. (line length- 45 km)					
2	Construction of 03 nos. MD+6 tower with pile foundation for shifting the existing 33KV Baruar line, 33KV Nepal (Sirha) line & 11KV Hanuman Nagar line on turnkey basis under deposit head of NBPDCL.	Lettter received from NBPDCL	7.04	FY 2025-26	Awarded through 16/PR/BSPTCL/2024	Deposit head of NBPDCL
3	Construction of newly proposed 2x50MVA, 132/33 KV GSS Sarairanjan (Sarairanjan Block in Samastipur District) with Construction of associated 02 nos. 132KV Line bays at 220/132/33 KV GSS Tajpur & Construction of 132KV D/C Tajpur - Sarairanjan Tr. Line with ACSR Panther Conductor (Line length- 25 RKM) on Turnkey basis under State Plan	GoB Letter No. BSPTCL-13/2023-4546, dated 29.11.2023	74.43	FY 2026-27	Awarded through 34/PR/BSPTCL/2023	State Plan
4	Construction of 400 KV, 220 KV transmission line associated to 400/220/132 KV Chhapra (New) & Construction of 220 KV GIS Bays & 132	GoB Letter No. BSPTCL-01/2020-24, dated 15.03.2023	452.49	FY 2026-27	Awarded through 23PR/BSPTCL/2023	State plan

Sl. No.	Name of the Project	Details of approval of GoB	Total Project Cost (Rs. Crore)	Year of Capitalisation	Status	Funding of Works
	KV AIS Bays for power evacuation from 400/220/132 KV Chhapra (New)					
5	Construction of 02 nos. of 400KV GIS bays at GSS Naubatpur (BGCL)	GoB Letter No. BSPTCL - 02/2021-1021, dated 31.03.2021	34.74	FY 2025-26	Awarded through 40/PR/BSPTCL/2023	State plan
6	2nd circuit stringing of 12 nos. of 132 KV transmission line of BSPTCL along with construction of 12 nos. of 132 KV line bays in connecting GSSs	GoB Letter No. BSPTCL-02/2023-2993, dated 16.08.2024	146.03	FY 2025-26	Awarded through 24/PR/BSPTCL/2024	Special assistance to States for Capital Investment for FY-2024-25.
7	(i) Construction of (2x160MVA+3x50 MVA), 220/132/33KV GSS, Tajpur (Dist.-Samastipur) with SAS including Residential Quarters under turnkey basis. (ii)Construction of (2x160MVA+3x50 MVA), 220/132/33KV GSS, Thakurganj (Dist.-Kishanganj) with SAS including Residential Quarters	GoB Letter No. BSPTCL-03/2018.2028, dated 24.07.2018	241.85	FY 2025-26	Awarded through 49/PR/BSPTCL/2022	State plan
8	132/33kV GSS Bagha, West Champaran	NITI Aayog Memo No. M-	67.90	FY 2026-27	Approved in SLSC and by CEA	BRGF Special Plan

Sl. No.	Name of the Project	Details of approval of GoB	Total Project Cost (Rs. Crore)	Year of Capitalisation	Status	Funding of Works
		13099/3/1/2016-MLP dtd 20.01.2022				
9	132/33kV GSS Maithi, Muzaffarpur	Submitted to Energy Dept. vide letter no. 705 dated 14.08.2024	134.42	FY 2026-27	Approved in SLSC and by CEA	State Plan
10	132/33kV GSS Roh, Nawada	Yet to be approved	138.00	FY 2026-27	Approved by CEA	Yet to be decided
11	132/33kV GSS Mahua, Vaishali	Yet to be approved	164.00	FY 2026-27	Approved by CEA	Yet to be decided
12	132/33kV GSS Halsi, Lakhisarai	Yet to be approved	172.00	FY 2026-27	Approved in SLSC and by CEA	Yet to be decided
13	132/33kV GSS Barari, Bhagalpur	2319 dated 07.07.2022	156.32	FY 2027-28	Approved in SLSC and by CEA	State Plan
14	220/132/33kV GSS Korha, Katihar	Rajyadesh No. 2561 dated 29.08.2015 & 3489 dated 20.11.2027	118.10	FY 2027-28	Approved in SLSC and by CEA	State Plan
15	2nd Sorce Connectivity of existing GSS of BSPTCL	Submitted to Energy Dept. vide letter no. 777 dated 12.09.2025	442.82	FY 2027-28	Approved in SLSC and by CEA	State Plan
16	33kV bay extension in existing GSS of BSPTCL	Submitted to Energy Dept. vide letter no.	88.99	FY 2027-28	Approved in SLSC	State Plan

Sl. No.	Name of the Project	Details of approval of GoB	Total Project Cost (Rs. Crore)	Year of Capitalisation	Status	Funding of Works
		801 dated 19.09.2024				
17	220/132/33kV GSS Shobhan, Darbhanga	Yet to be approved	305.00	FY 2027-28	Approved in SLSC and by CEA	Yet to be decided
18	132/33kV GSS Bhawanipur, Purnea	Yet to be approved	142.00	FY 2027-28	Approved in SLSC	Yet to be decided
19	132/33kV GSS Akhgaon, Bhojpur	Yet to be approved	150.00	FY 2027-28	Approved in SLSC	Yet to be decided
20	132/33kV GSS Warisnagar, Samastipur	Yet to be approved	132.00	FY 2027-28	Approved in SLSC	Yet to be decided
21	220/33kV GSS Bairiya, Patna	Yet to be approved	175.00	FY 2027-28	Approved in SLSC	Yet to be decided
22	220/132/33kV GSS Amarpur, Banka	Yet to be approved	340.00	FY 2027-28	New Proposal	Yet to be decided
23	220/132/33kV GSS Begusarai	Yet to be approved	325.00	FY 2027-28	New Proposal	Yet to be decided
24	Augmentation of 50MVA & 80MVA Power Transformer	Yet to be approved	130.00	FY 2027-28	Approved in SLSC	Yet to be decided
25	**Total**		**4,621.02**			

It is respectfully submitted that the BSPTCL has received the approval of the concerned authority for few of the projects while for the remaining projects, BSPTCL is in the process to get approval of the concern authority.

Based on the above and by considering all ongoing projects, the Summary of capex and Capitalisation during FY 2025-26 to FY 2027-28 are tabulated below:

Table 5-7: Summary of the Capex and Capitalisation of new projects during FY 2025-26 to FY 2027-28 (Rs. Cr.)

Sl. No.	Particulars	Claimed for FY 2025-26	Claimed for FY 2026-27	Claimed for FY 2027-28
1	Capex during the year	**1,682.18**	**1,691.75**	**1,213.75**

Sl. No.	Particulars	Claimed for FY 2025-26	Claimed for FY 2026-27	Claimed for FY 2027-28
2	Capitalisation	**1,880.67**	**1,686.13**	**2,505.23**

Further, it is submitted that the BSPTCL has estimated the project cost by considering the historical cost and the same may vary at the time of awarding the contracts.

Therefore, BSPTCL at this stage, seeks the regulatory approval for the above projects before the Hon'ble Commission. Further, any variations will be submitted to the Hon'ble Commission at the time of truing up of the respective projects.

5.9. Mode of Finance for the New Projects

BSPTCL has received approval for mode of finance for few of the proposed projects and accordingly considered the same to compute the normative debt and equity addition during the control period of FY 2025-26 to FY 2027-28 in line with the BERC MYT Tariff Regulations, 2024.

Further, it is respectfully submitted that the BSPTCL is in the process to receive approval for mode of finance for the remaining projects. Therefore, at this stage BSPTCL considered the normative debt: Equity ratio of 80:20 for the upcoming projects of Control Period of FY 2025-26 to FY 2027-28. However, any variations regarding mode of finance as approved by the GoB will be submitted to the Hon'ble Commission during truing of exercise of the respective year.

The details of Mode of Finance for the new Projects is as tabulated below:

Table 5-8: Details of mode of Finance for the Control Period of FY 2025-26 to FY 2027-28 (Rs. Cr.)

Sl. No.	Particulars	FY 2025-26 Projections	FY 2026-27 Projections	FY 2027-28 Projections
1	Gross Capitalization	1,880.67	1,686.13	2,505.23
2	Less: Deposit Work and Grants	106.65	0.00	0.00
3	Net Capitalization	1,774.02	1,686.13	2,505.23
4	**Total Equity addition Considered**	**378.67**	**344.02**	**501.05**
5	**Total Debt addition Considered**	**1,395.35**	**1,342.11**	**2,004.18**

Therefore, BSPTCL respectfully prays to the Hon'ble Commission to kindly consider the same and approve the mode of finance for the new projects proposed during Control Period of FY 2025-26 to FY 2027-28.

घनश्याम प्रसाद
अध्यक्ष तथा पदेन सचिव भारत सरकार
GHANSHYAM PRASAD
Chairperson & Ex-officio Secretary
To the Government Of India

सत्यमेव जयते
आज़ादी का अमृत महोत्सव

केन्द्रीय विद्युत प्राधिकरण
भारत सरकार
विद्युत मंत्रालय
सेवा भवन, आर,के, पुरम
नई दिल्ली–110066
Central Electricity Authority
Ministry of Power
Sewa Bhawan, R. K. Puram
New Delhi-110066

D.O.No. CEA-PL-11-37/14/2024-IRP

6 May 2024

Dear Shri Sanjeev

Ministry of Power had notified Electricity (Amendment) Rules in December, 2022. As per Rule 16 of the Electricity (Amendment) Rules, Ministry of Power has already issued guidelines in June 2023 for assessment of resource adequacy during the generation planning stage and operational planning stage.

As per the Recourse Adequacy (RA) Guidelines, Central Electricity Authority is entrusted to prepare Long Term-National Resource Adequacy Plan (LT-NRAP). Further Distribution Utilities need to carry out LTDRAP (Long Term Discoms Resource Adequacy Plan) to meet the utility peak and energy requirement reliably.

CEA is guiding & hand holding the states in data collection, power system modelling and analysis of result for carrying out state specific resource adequacy studies in order to prepare the respective LT-DRAP within stipulated time frame.

In view of the above, LT-DRAP studies have been carried out for Bihar till 2033-34, based on the inputs shared by BSPHCL in alignment with the RPO trajectory notified by Ministry of Power and National Resource Adequacy framework. The results of the preliminary RA study for Bihar are being enclosed herewith for your kind reference. The data assumptions for the state pertaining to future demand projections, upcoming capacity of different technologies and/ or tie ups based on the inputs received from the state are also included. Additionally, the RPO targets and corresponding RE plan prepared by CEA for Bihar which have been considered for carrying out the studies are also included.

A report has been prepared based on the LT-DRAP RA studies for bringing out the requirement of capacity addition for meeting the electricity demand from various sources optimally and is attached for your kind perusal.

As per the Resource Adequacy Guidelines, Central Electricity Authority is entrusted to prepare LT-NRAP RA study for the period of 10 years (up to 2034-35) and to revise annually on a rolling basis. Therefore, it is requested that the year wise demand estimation and planned capacity addition be provided till 2034-35, in the prescribed format shared with this letter.

With regards

Yours sincerely

(Ghanshyam Prasad)

Shri Sanjeev Hans,
Principal Secretary (Energy),
Government of Bihar,
Urja Vibhag,
8, Daroga Rai Path,
Patna – 800001.

Resource Adequacy Plan
For Bihar

Government of India
Ministry of Power
Central Electricity Authority

Table of Contents

Executive Summary

India's power sector has seen a huge transition during the last few years, driven primarily by climate change and energy security concerns. India's Intended Nationally Determined Contributions (INDCs) envisaged 40% non-fossil fuel capacity and 30-35% reduction in emissions intensity as compared to the pre-industrial level. Since then, there has been substantial addition of renewable energy (RE) and transmission capacities.

As per Rule 16 of the Electricity (Amendment) Rules 2022, Ministry of Power has notified Resource Adequacy guidelines. As per the Resource Adequacy (RA) Guidelines, Central Electricity Authority is entrusted to prepare Long Term-National Resource Adequacy Plan (LT-NRAP). Further Distribution Utility need to carry out LTDRAP (Long term Discoms Resource Adequacy Plan) to meet the utility peak and energy requirement reliably.

The government of India has notified RPO till 2029-30 which ensure certain amount of energy consumption to be met from renewable energy sources. To find out the least cost option for generation capacity expansion for the period 2024-25 to 2033-34, long-term study for BSPHCL has been carried out with an objective to minimize the total system cost of generation including the cost of anticipated future investments while fulfilling all the technical/financial constraints associated with various power generation technologies.

The electricity demand for Bihar (BSPHCL) is increasing with a CAGR of 7.51 % from 2024-25 to 2033-34 as forecasted by 20th EPS. The projections of BSPHCL has indicated that electricity demand may increase with a CAGR of 7.32 % during the period 2024-25 to 2029-30. For satisfying resource adequacy i.e., meeting the electricity demand reliably and at affordable cost, the State need to methodically plan its capacity expansion either by investing or by procuring power. In view of the reduction in cost of solar panels and newer technology options like battery energy storage systems, planning for long term optimal generation capacity mix gains tremendous importance so as the future generation capacity mix is cost effective as well as environmentally friendly.

Generation capacity expansion pathways have been considered for the long-term study based on the yearly capacity addition plans of the state along with RPO constraints for solar and wind technologies. The Renewable capacities have been assessed in view of adherence to RPO notified by Ministry of power considering the fungibility among different sources. Various scenarios such as high demand growth scenario, agricultural load shifting, delayed RE capacity addition scenario etc has been considered in the model to determine optimal capacity mix in each of the scenario.

The resource adequacy studies to assess the hourly generation dispatch with the existing and planned capacity have been carried out to assess the hourly demand supply gap till 2033-34 based on inputs received from BSPHCL.

Reliability study has been carried out to determine the probability of Unmet demand and hours by implementing the variation in demand, RE (Solar, Wind) and forced outage of thermal generators (Coal, gas) etc

1. Introduction

The electricity demand for Bihar (BSPHCL) is increasing with a CAGR of 7.51 % from 2024-25 to 2033-34 as forecasted by 20th EPS. The projections of BSPHCL has indicated that electricity demand may increase with a CAGR of 7.32 % during the period 2024-25 to 2029-30. For satisfying resource adequacy i.e., meeting the electricity demand reliably and at affordable cost, the State need to methodically plan its capacity expansion either by investing or by procuring power. In view of the reduction in cost of solar panels and newer technology options like battery energy storage systems, planning for long term optimal generation capacity mix gains tremendous importance so as the future generation capacity mix is cost effective as well as environmentally friendly.

Ministry of Power has notified Electricity (Amendment) Rules, 2022. Rule 16 (I) of the said rules stipulates that "A guideline for assessment of resource adequacy during the generation planning stage (one year or beyond) as well as during the operational planning stage (up to one year) shall be issued by the Central Government in consultation with the Authority". Accordingly, the Resource Adequacy Guidelines has been notified in June, 2023.

Resource Adequacy is generally defined as a mechanism to ensure that there is an adequate supply of generation resources to serve expected demand reliably at least cost. A key aspect of resource adequacy planning is to ensure that adequate generation capacities are available, round-the-clock, to reliably serve demand, under various scenarios. This naturally translates into the need for ensuring adequate reserve margin, which could cater to varying levels of demand and supply conditions in the grid. In the wake of high RE generation, it is important to understand demand-supply situation in the grid precisely. Resource Adequacy exercise may also help in assessment of capacity requirement to be tied up or contracted on long term, medium term, and short-term basis.

Further, Ministry of Power vide notification dated 20th October 2023 had notified the RPO trajectory for the states. Based on the trajectory specified the hydro, wind and other (solar, biomass etc.) RPO quantum in million units (MUs) has been calculated to find additional quantum of renewable capacity that the states have to contract in addition to its existing/planned capacity to meet their RPO targets.

Resource Adequacy studies has been carried out for Bihar (BSPHCL) based on the inputs received from Bihar (BSPHCL) while fulfilling RPO trajectory. The study suggests the optimal resource mix till 2033-34 taking into account all technical and financial parameters associated with capacities. The study optimizes power purchase on a long-term basis while evaluating resource adequacy for meeting the demand 24 X 7 considering variation in demand, RE generation and forced outages of thermal capacities. The study has also assessed the requirement of Planning Reserve margin for Bihar (BSPHCL) for catering to the above highlighted uncertainties so that demand can be met reliably throughout the year.

2. Bihar (BSPHCL) RA Study

2.1 Present Power Scenario in Bihar (BSPHCL)

The present contracted capacity of Bihar as on 31.03.2023 stands at 9002 MW. The Source Wise distribution is shown below. The share of Coal is around 72% of total capacity while the share of Solar and Wind is around 10% & 8% respectively.

The fuel-wise contracted capacity as on March 2023 is given in Table and Figure below:

Table 1 Fuel-wise Contracted Capacity as on March 2023

Source	Contracted Capacity (MW)	Percentage
Coal	6515	72%
Hydro	825	9%
Solar	890	10%
Wind	699	8%
Biomass	72	1%
Total	**9002**	100%

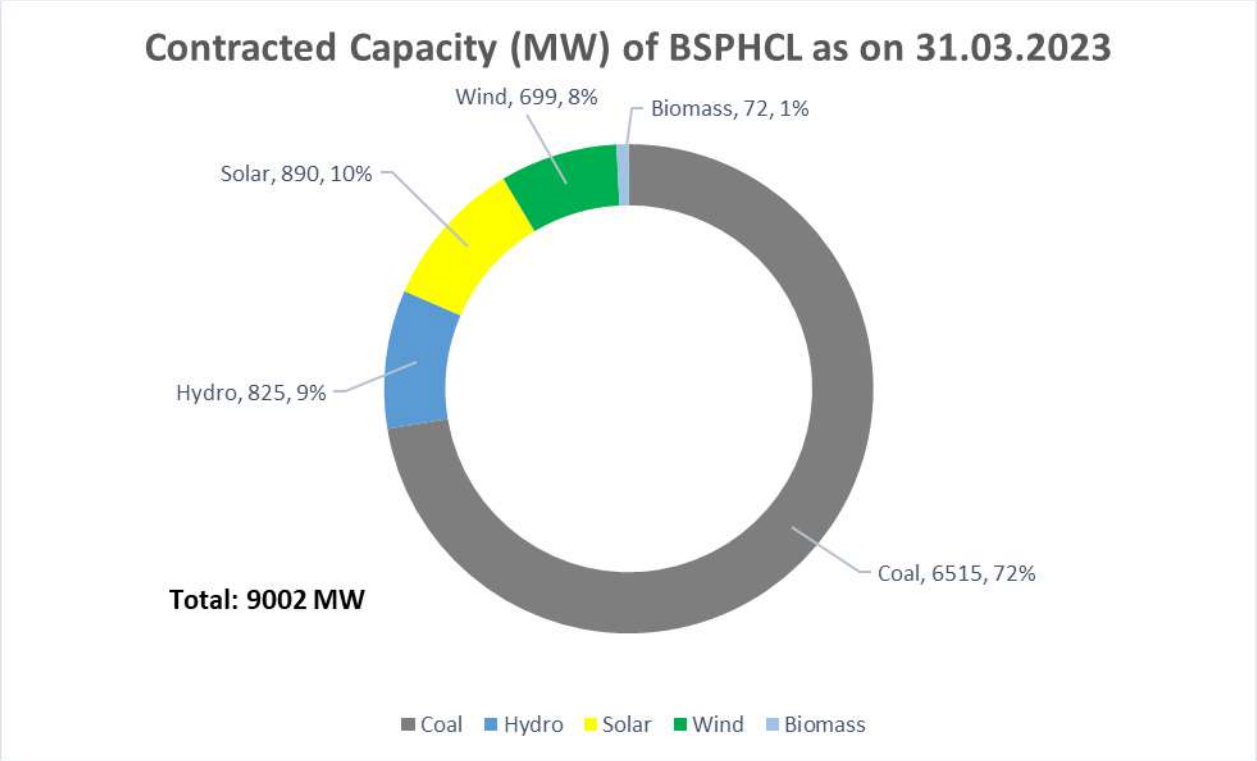


Figure 1 Fuel-wise Contracted Capacity (in MW) as on Mar 2023

2.2 Present Demand Analysis (2022-23):

Hourly demand pattern of 2022-23 was analyzed (as shown in Fig 2) and it was observed that the peak Demand season for Bihar (BSPHCL) is during the months of April to September. Bihar (BSPHCL) witnesses Peak demand during night hours.

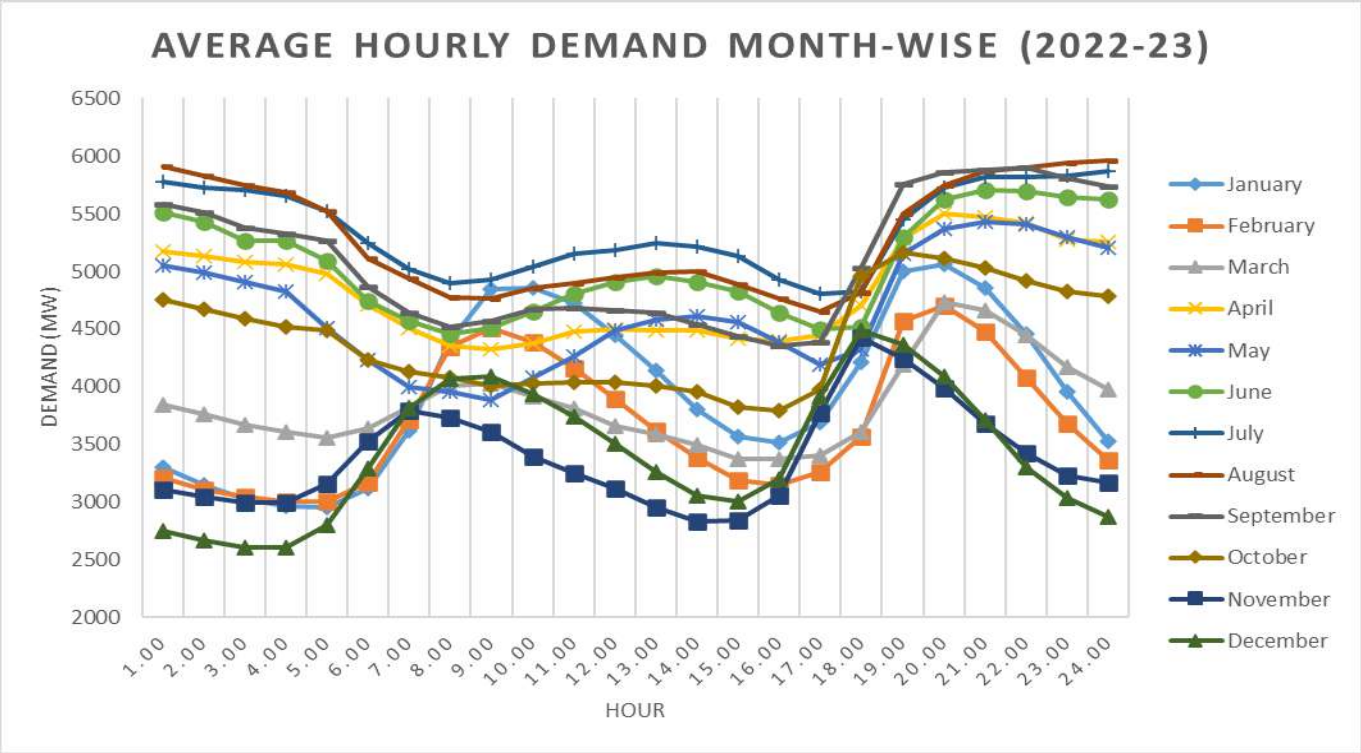


Figure 2 Average Hourly Demand Variation (Month-wise) of Bihar (BSPHCL) for 2022-23

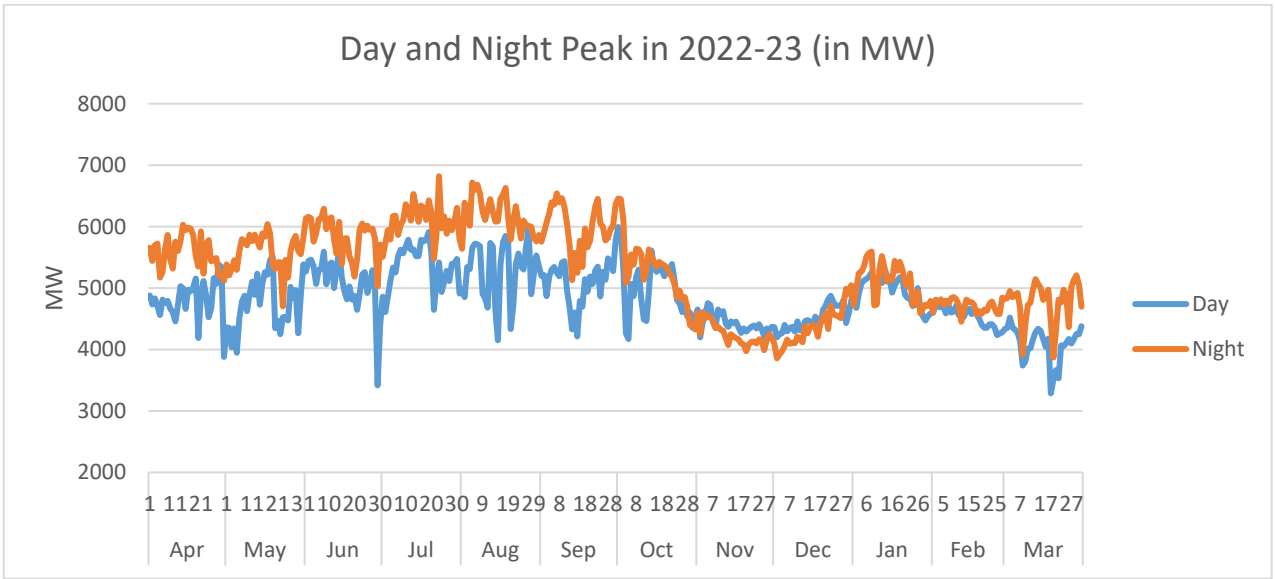


Figure 3 Day and Night Peak in MW of Bihar (BSPHCL) (2022-23)

The above graph reflects the comparison of the daily peak demand for day time and night time. It can be observed that night peak is higher than day peak for all most all months in a year.

The hourly demand pattern of 2022-23 was analysed (Figure 4) for finding out the number of occurrences of the peak and near peak demand. Such instances are critical for study purpose as it is necessary to ensure resource adequacy during such instances with an optimal mix of long-term, medium-term and short-term contracts.

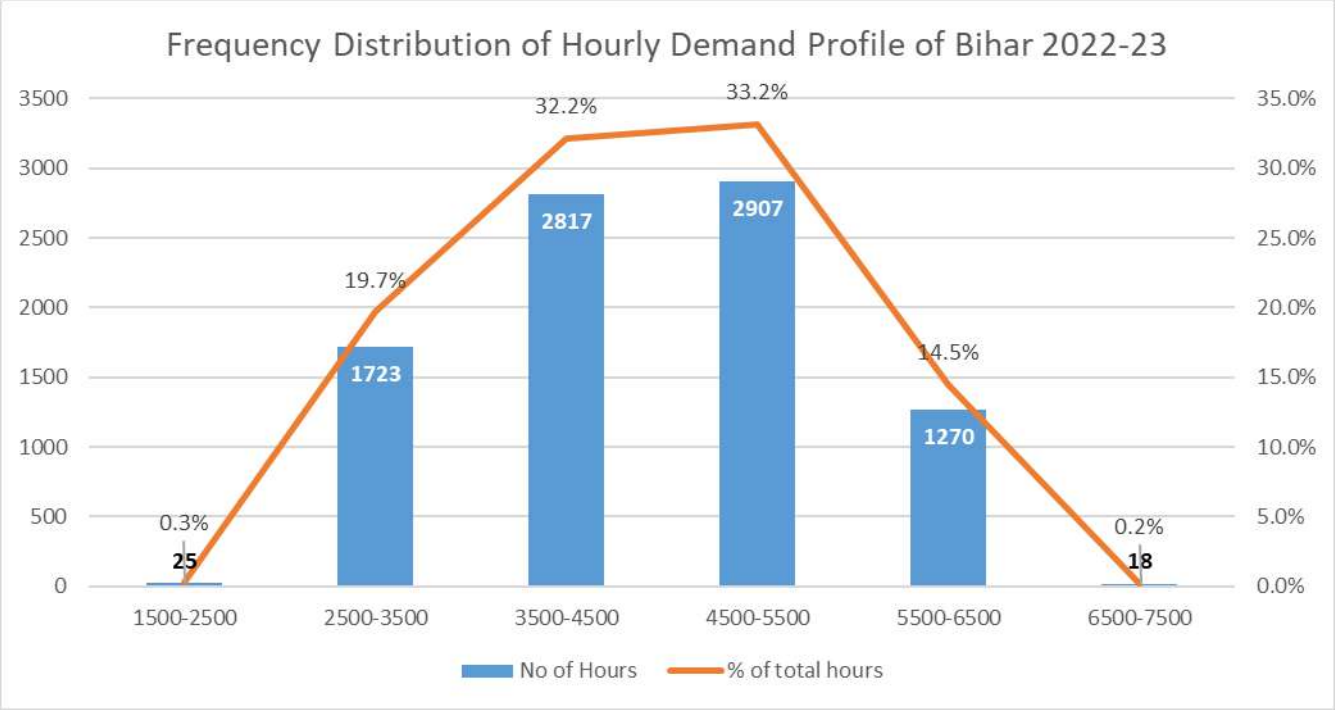


Figure 4 Frequency Distribution of Hourly Demand Profile of Bihar (BSPHCL) 2022-23

3. Inputs/Assumptions for the Study

i) Peak and Energy Demand for the State of Bihar (BSPHCL) as furnished by the utility, were compared with the 20th EPS (Electric Power Survey) projections. The Demand estimation by Bihar (BSPHCL) was found to be lower than projected by 20th EPS as shown in Figure 5. Therefore, the Studies have been carried out using 20th EPS projections.

Table 2 Future Demand Projection by 20th EPS

	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34
Energy Projections (MU)	49438	53920	58256	62871	67715	73241	78155	82876	87882	93190
Year on Year Growth		9.07%	8.04%	7.92%	7.70%	8.16%	6.71%	6.04%	6.04%	6.04%
Peak Demand Projections (MW)	8908	9743	10553	11416	12326	13360	14276	15159	16099	17097
Year on Year Growth		9.37%	8.31%	8.18%	7.97%	8.39%	6.86%	6.19%	6.20%	6.20%

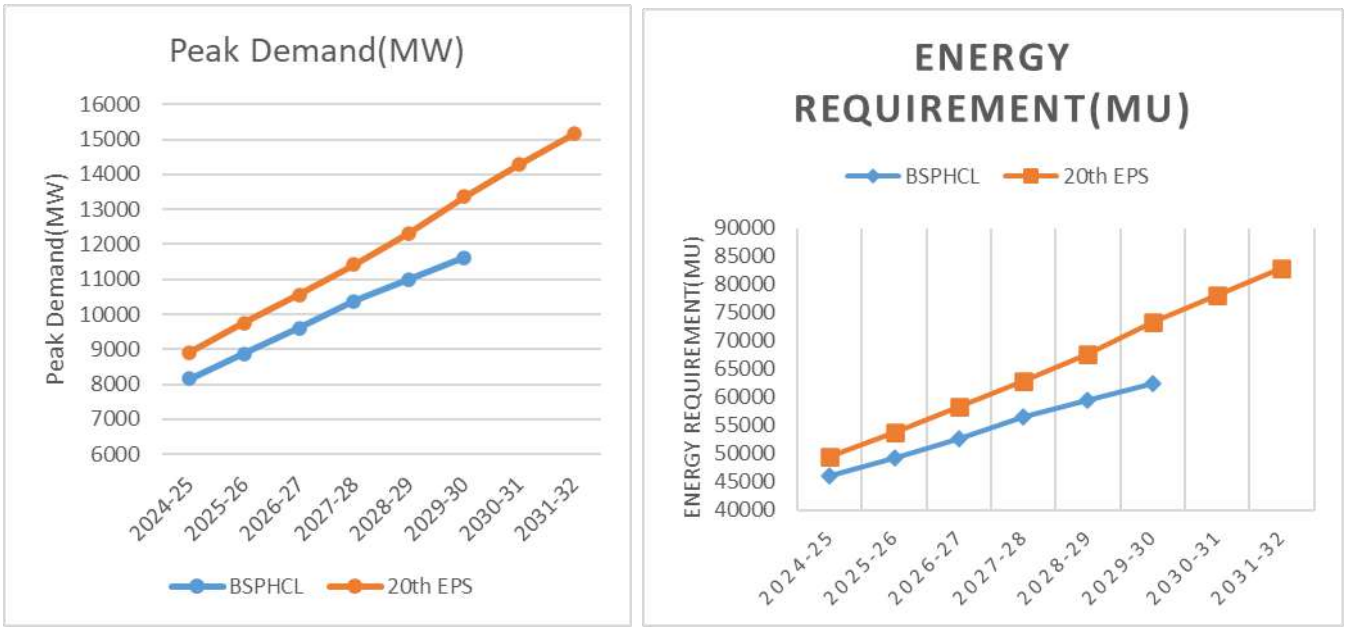


Figure 5 Comparison of Energy Requirement and peak Demand Projections of 20th EPS vs Bihar (BSPHCL)

i) Future demand profile for the year 2033-34 has been projected using the demand profile for the year 2022-23 as the base profile.

ii) The actual solar and wind generation profiles and CUFs have been referred from National Electricity Plan.

iii) Capital cost of candidate plants for Coal, Wind, Solar, Battery and PSP have been referred from National Electricity Plan.

iv) Existing & Planned Capacity: As per the information received from Bihar (BSPHCL). (List of Planned Thermal is attached in **Annexure-I**)

Table 3 Year on Year source wise Planned capacity addition

FY	COAL	HYDRO	SOLAR	PSP	BESS	TOTAL
2024/25	1712	100	1470	70	0	3352
2025/26	381	0	140	0	45	566
2026/27	0	400	22	0	0	422
2027/28	0	0	0	0	0	0
2028/29	150	0	0	0	0	150
2029/30	0	0	0	0	0	0
2030/31	0	0	0	0	0	0
2031/32	0	0	0	0	0	**0**
2032/33	0	2000	0	0	0	2000
2033/34	0	0	0	0	0	0
TOTAL	**2243**	**2500**	**1632**	**70**	**45**	**6490**

v) **Renewable Purchase Obligation (RPO) trajectory**: Ministry of Power gazette notification dated 20th October, 2023 had notified the source wise minimum share of consumption of non-fossil sources (renewable energy) by designated consumers, till the year 2029-30. In view of the country's energy transition goals as well as the long term net zero target of 2070, it is estimated that the share of RE generation in the generation mix will continue to increase beyond 2029-30. Therefore, the RPO trajectory is assumed to rise steadily beyond 2029-30 and hence, RPO targets till 2033-34 are given below:

*Table 4 Renewable Purchase Obligation (RPO) trajectory as per MoP order**

Sl. No.	**Year**	**Wind renewable energy**	**Hydro renewable energy**	**Other renewable energy**	**Distributed renewable energy**	**Total renewable energy**
(1)	(2)	(3)	(4)	(6)	(5)	(7)
1.	2024-25	0.67%	0.38%	27.35%	1.5%	29.91%
2.	2025-26	1.45%	1.22%	28.24%	2.1%	33.01%
3.	2026-27	1.97%	1.34%	29.94%	2.7%	35.95%
4.	2027-28	2.45%	1.42%	31.64%	3.3%	38.81%
5.	2028-29	2.95%	1.42%	33.10%	3.9%	41.36%
6.	2029-30	3.48%	1.33%	34.02%	4.5%	43.33%
7.	2030-31	40.50%			5.0%	45.50%
8.	2031-32	41.50%			5.5%	47.00%
9.	2032-33	42.30%			6.0%	48.30%
10.	2033-34	43.00%			6.5%	49.50%

*Trajectory for RPO till 2029-30 as per MoP RPO order notified in October,2023. After 2029-30, RPO targets assumed based on anticipated RE capacity requirement on national level given in National Electricity Plan (Vol-I Generation)

Based on the trajectory specified, RPO quantum in million units (MUs) from hydro, wind, other (solar,

biomass etc.) and distributed renewable energy (DRE) is calculated and tabulated below:

*Table 5 Total Energy required to meet RPO (MU)**

Annexure - I

Sl. No.	Year	Wind renewable energy (MU)	Hydro renewable energy	Other renewable energy	Distributed renewable energy	Total renewable energy
(1)	(2)	(3)	(4)	(6)	(5)	(7)
1	**2024-25**	331	188	13521	742	14787
2	**2025-26**	782	658	15227	1132	17799
3	**2026-27**	1148	781	17442	1573	20943
4	**2027-28**	1540	893	19892	2075	24400
5	**2028-29**	1998	962	22414	2641	28015
6	**2029-30**	2549	974	24917	3296	31735
7	**2030-31**	31653			3908	35561
8	**2031-32**	34394			4558	38952
9	**2032-33**	37174			5273	42447
10	**2033-34**	40072			6057	46129

*Considering the fungibility aspect of RPO targets among Wind, Hydro and other RE generation

Accordingly, the additional source wise MW requirement considering the fungibility aspects in the RPO has been estimated by the model as tabulated below:

Table 6 As per RPO trajectory, Bihar needs to add/contract following additional capacity (MW).

FY	HYDRO	WIND	SOLAR	DRE	TOTAL
2024/25	0	0	0	605	605
2025/26	0	1000	2649	318	3967
2026/27	0	1000	0	360	1360
2027/28	0	1000	0	409	1409
2028/29	0	1000	418	461	1879
2029/30	0	1000	392	534	1926
2030/31	0	1000	557	499	2056
2031/32	0	1000	381	531	1912
2032/33	0	0	0	582	582
2033/34	0	0	0	640	640
TOTAL	**0**	**7000**	**4398**	**4939**	**16337**

4. Reliability Analysis

One of the main criteria of resource adequacy studies is to determine the reliability of the system to meet the demand adequately at very instance of time. This reliability is measured via two indices (i.e.) LOLP (Loss of Load Probability) and EENS (Expected Energy Not Served). These indices have been defined in resource adequacy guidelines as below:

- **Loss of Load Probability (LOLP)**: Measure of the probability that a system's load may exceed the generation and firm power contracts available to meet that load in a year. E.g., 0.0274 % probability of load being lost.
- **Expected Energy Not Served (EENS):** Expected amount of energy (MWh) that may not be served for each year within the planning period under study. It is a summation of the expected number of megawatt hours of demand that may not be served for the year. This is an energy-centric metric that considers the magnitude and duration of energy being not served, calculated in Mega Watt hours (MWh). The metric can be normalized (i.e., divided by total system load) to create a Normalized Energy Not Served (NENS) metric.

Monte Carlo /Stochastic simulation has been used to factor-in the uncertainty associated with various generation resources and demand. It is an approach which is used to predict the probability of a variety of outcomes when the potential for random variables is present as compared to deterministic modelling of economic dispatch model. Monte Carlo simulation helps in analysing the randomness associated with RE energy resource, demand pattern changes and forced outages of plant. A large no of random samples of these variables are simultaneously simulated to ascertain system reliability indices (i.e. Loss of load probability LOLP & Energy Not Served (ENS)) & the system robustness in case of above variation of system parameters.

Planning Reserve Margin (PRM): To meet the prescribed standard of LOLP / NENS conditions, sufficient reserve margins need to be maintained in the system for adequately addressing the demand and supply variations. Planning Reserve Margin (PRM) is the predominant metric used to ensure adequacy of generation resources in the system. PRM in a power system is expressed as a certain % of peak load forecast of the system.

4.1 Demand variation:

The variation in demand pattern of Bihar (BSPHCL) for last 5 years has been analyzed. The hourly demand variation for consecutive years (i.e., 2021-22 and 2022-23) has been analyzed. The Demand pattern variation of 2021-22 and 2022-23 is shown below.

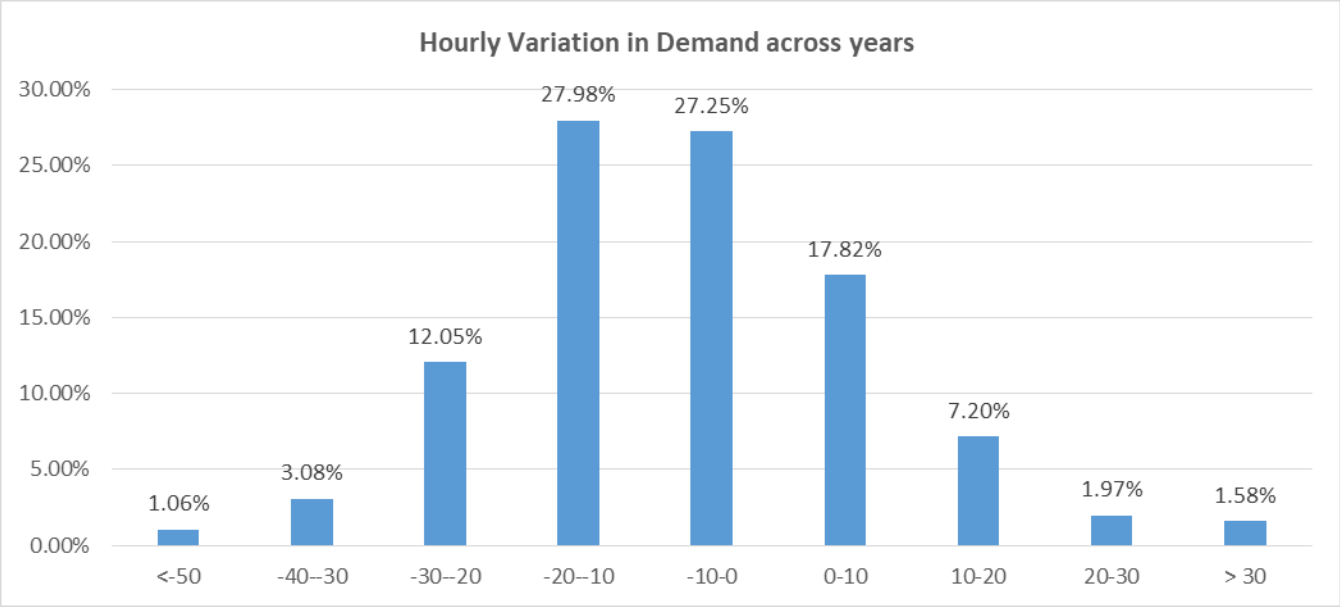


Figure 6 Hourly Variation in Demand across years

It can be observed that the hourly demand typically varies ±15% for 73% of instances. This variation is primarily due to temperature, weather parameter or any random outages of transmission line and generation units etc. This variation has been captured in the reliability study by varying the projected hourly demand for the future years by varying ±15% by introducing a random variable (with normal distribution) for demand as per observed behaviour over the years.

4.2 RE variation

In the Long-term capacity expansion planning studies, a particular profile for Solar and Wind Plants are considered based on the observed solar and wind generation data to determine the optimal capacity mix. However, due to intermittent nature of these sources the generation from these non-dispatchable sources may vary across years. As per the analyses carried out based on historical generation data, solar generation and wind generation has been varied by 10 % and 50% respectively to incorporate the variation in these generation sources and plan for requisite measures to mitigate such behaviour.

4.3 Forced Outage of Thermal Generators

The average forced outage rate of thermal generators is typically at 10% with ±5% variation. The same has been incorporated in the model.

Based on these variations, reliability studies are carried out to ascertain robustness of the system. The LOLP & EENS of the system is within specified range.

5. Results of the study

5.1 Unserved Demand Projections

The study was carried out considering existing capacity and planned capacity only. It was observed that the unserved energy in the year 2033-34 is around 16 BU.

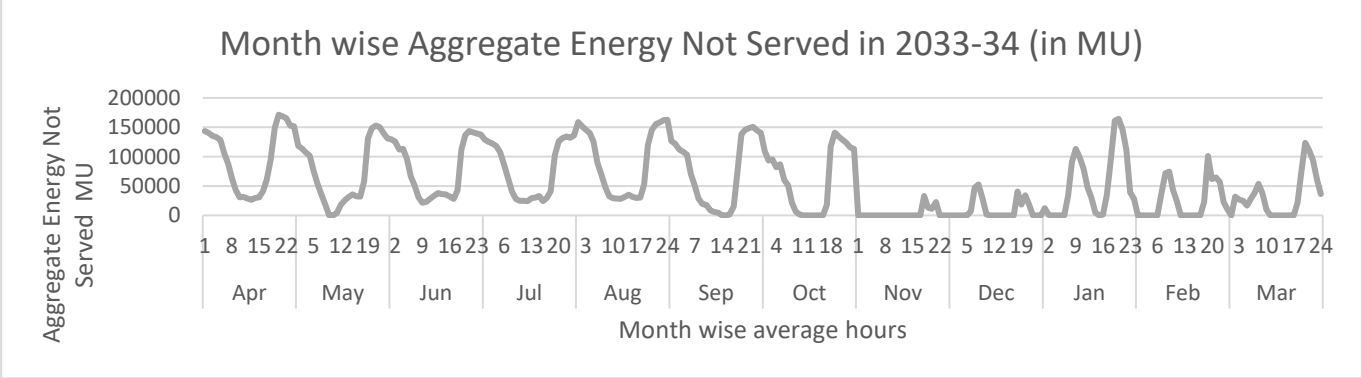


Figure 9 Projected unmet energy (MU) for Bihar for 2033-34

5.2 Capacity Mix Projection

The study was carried out considering existing capacity, planned capacity and additional capacity required to fulfil the RPO obligations.

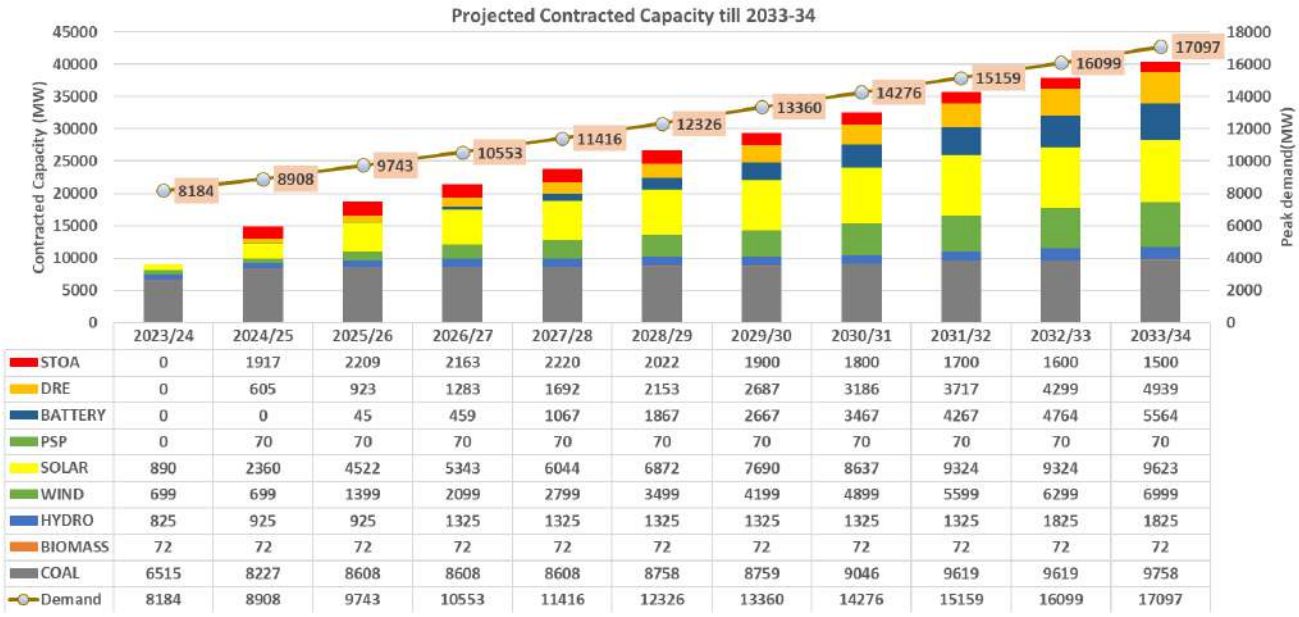
The year wise capacity projections for Bihar (BSPHCL) are given below:

Table 7 Year-wise contracted capacity projections (in MW)

YEAR	COAL	BIOMASS	HYDRO	WIND	SOLAR	PSP	BATTERY	DRE	STOA
2024/25	8227	72	925	699	2360	70	0	605	1917
2025/26	8608	72	925	1399	4522	70	45	923	2209
2026/27	8608	72	1325	2099	5343	70	459	1283	2163
2027/28	8608	72	1325	2799	6044	70	1067	1692	2220
2028/29	8758	72	1325	3499	6872	70	1867	2153	2022
2029/30	8759	72	1325	4199	7690	70	2667	2687	1900
2030/31	9046	72	1325	4899	8637	70	3467	3186	1800
2031/32	9619	72	1325	5599	9324	70	4267	3717	1700
2032/33	9619	72	1825	6299	9324	70	4764	4299	1600

2033/34	9758	72	1825	6999	9623	70	5564	4939	1500

The projected contracted capacity mix, year-wise is given in the figure below:



	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34
STOA	0	1917	2209	2163	2220	2022	1900	1800	1700	1600	1500
DRE	0	605	923	1283	1692	2153	2687	3186	3717	4299	4939
BATTERY	0	0	45	459	1067	1867	2667	3467	4267	4764	5564
PSP	0	70	70	70	70	70	70	70	70	70	70
SOLAR	890	2360	4522	5343	6044	6872	7690	8637	9324	9324	9623
WIND	699	699	1399	2099	2799	3499	4199	4899	5599	6299	6999
HYDRO	825	925	925	1325	1325	1325	1325	1325	1325	1825	1825
BIOMASS	72	72	72	72	72	72	72	72	72	72	72
COAL	6515	8227	8608	8608	8608	8758	8759	9046	9619	9619	9758
Demand	8184	8908	9743	10553	11416	12326	13360	14276	15159	16099	17097

Figure 10 Projected Contracted Capacity Mix Year-wise (MW) for Bihar (BSPHCL)

As per the Resource Adequacy studies, the total projected contracted Capacity for the year 2033-34 is 38,850 MW which consists of 9758 MW from Coal, 1825 MW from Hydro, 9623 MW from Solar, 6999 MW from Wind, 5634 MW of Storage, 4939 MW from DRE AND 72 MW of Biomass. Besides this there is a need for 1500 MW of STOA. This IC shall be able to meet the projected demand with prescribed reliability criteria.

The Reliability studies have been carried out to adhere to the reliability criteria of LoLP and NENS as provided in NEP (0.2% and 0.05% respectively). The PRM for the state of Bihar (BSPHCL) has been assessed as 5.5%. In addition, the projected/contracted capacity fulfils the stipulated Renewable Purchase Obligation and aforementioned reliability criteria.

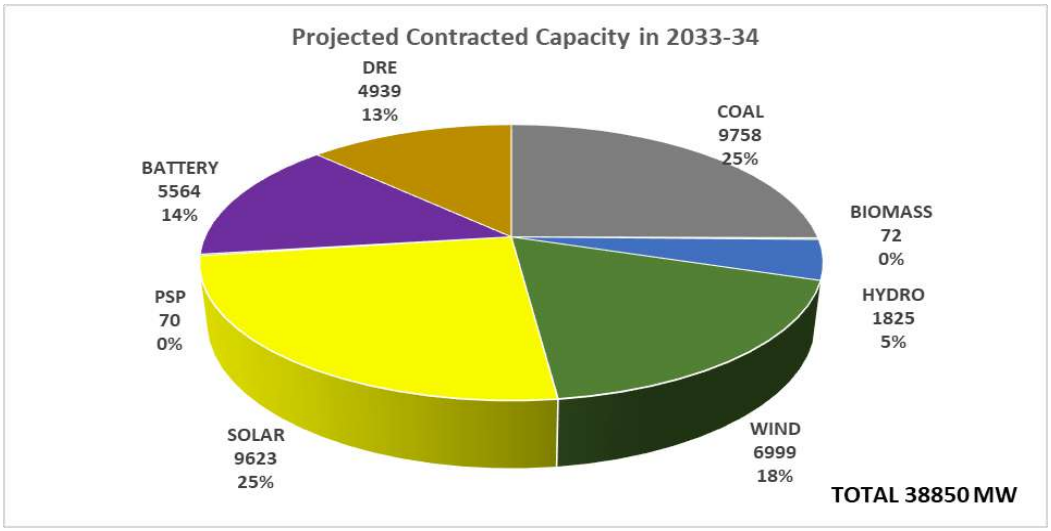


Figure 11 Projected Capacity Mix in 2033-34 with 5.5% PRM

The share of non-fossil fuel-based capacity in the generation mix is projected to increase to around 69 % by 2033-34 from 28% in 2022-23 with higher contribution from non-fossil fuel-based capacities in alignment with RPO trajectory.

The projected generation mix for the state is shown in Fig 12 & 13 below: -

It is seen that the share of non-fossil generation will increase to around 54% by FY 34.

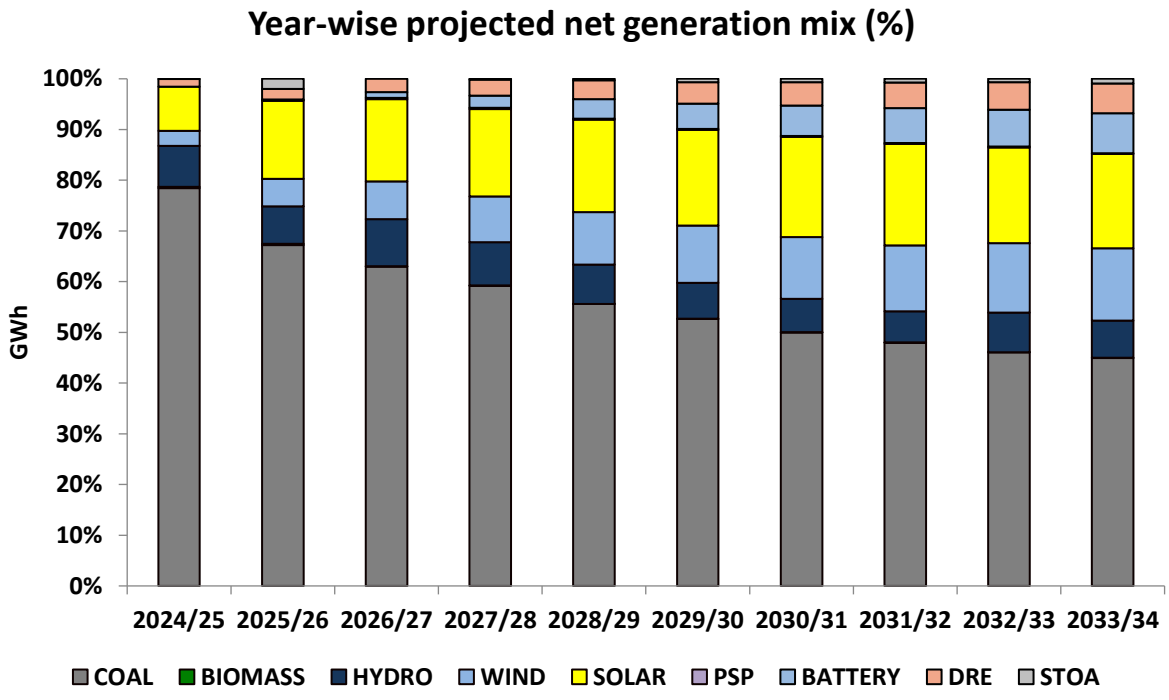
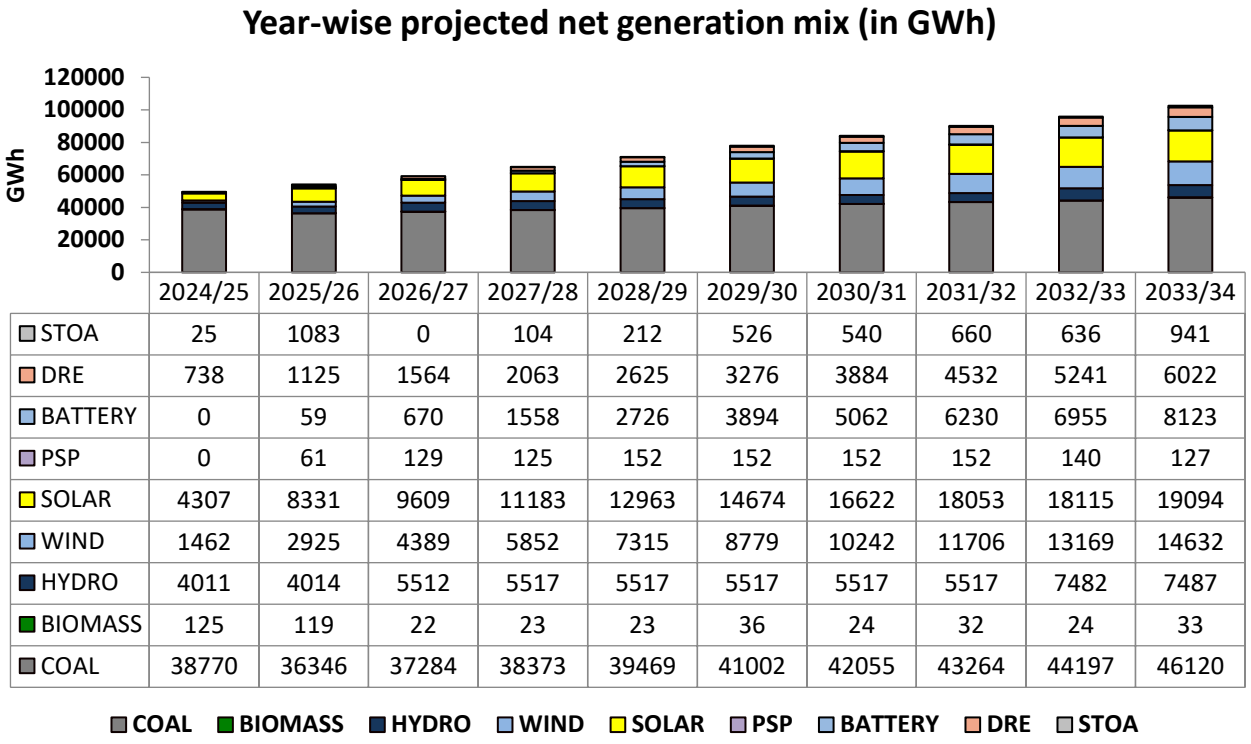


Figure 12 Projected Generation Mix (%)



	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34
STOA	25	1083	0	104	212	526	540	660	636	941
DRE	738	1125	1564	2063	2625	3276	3884	4532	5241	6022
BATTERY	0	59	670	1558	2726	3894	5062	6230	6955	8123
PSP	0	61	129	125	152	152	152	152	140	127
SOLAR	4307	8331	9609	11183	12963	14674	16622	18053	18115	19094
WIND	1462	2925	4389	5852	7315	8779	10242	11706	13169	14632
HYDRO	4011	4014	5512	5517	5517	5517	5517	5517	7482	7487
BIOMASS	125	119	22	23	23	36	24	32	24	33
COAL	38770	36346	37284	38373	39469	41002	42055	43264	44197	46120

Figure 13 Year-wise projected net generation mix (in GWh)

5.3 Capacity contract requirement for future

It has been found out in the studies that Bihar (BSPHCL) needs to contract following capacities (planned and additional) per year till 2033-34 to meet its demand reliably while ensuring fulfilment of its RPO obligations.

Table 8 Year wise Capacity Addition for Bihar (BSPHCL) (in MW)

	COAL		**HYDRO**	**WIND**	**SOLAR**	
Year	Planned Contracts	Additional Requirement	Planned Contracts	Additional Requirement	Planned Contracts	Additional Requirement
2024/25	1712	0	100	0	1481	0
2025/26	381	0	0	700	151	2000
2026/27	0	0	400	700	0	820
2027/28	0	0	0	700	0	701
2028/29	150	0	0	700	0	828
2029/30	0	0	0	700	0	818
2030/31	0	287	0	700	0	947
2031/32	0	572	0	700	0	687
2032/33	0	0	500	700	0	0
2033/34	0	139	0	700	0	298
	Distributed RE	**PSP**	**BATTERY**		**MTOA/STOA**	**TOTAL**

Year	Additional Requirement	Planned Contracts	Planned Contracts	Additional Contract	Additional Contract	Planned Contracts	Additional Contract
2024/25	605	70	0	0	1917	3363	2522
2025/26	318	0	45	0	2209	577	5227
2026/27	360	0	0	414	2163	400	4457
2027/28	409	0	0	608	2220	0	4638
2028/29	461	0	0	800	2022	150	4811
2029/30	534	0	0	800	1900	0	4752
2030/31	499	0	0	800	1800	0	5033
2031/32	531	0	0	800	1700	0	4990
2032/33	582	0	0	496	1600	500	3378
2033/34	640	0	0	800	1500	0	4077

5.4 Projected Coal Capacity utilization

The coal capacity PLF is expected to remain in the range of 58%- 71% for the years till 2034 ensuring higher absorption of higher renewable energy.

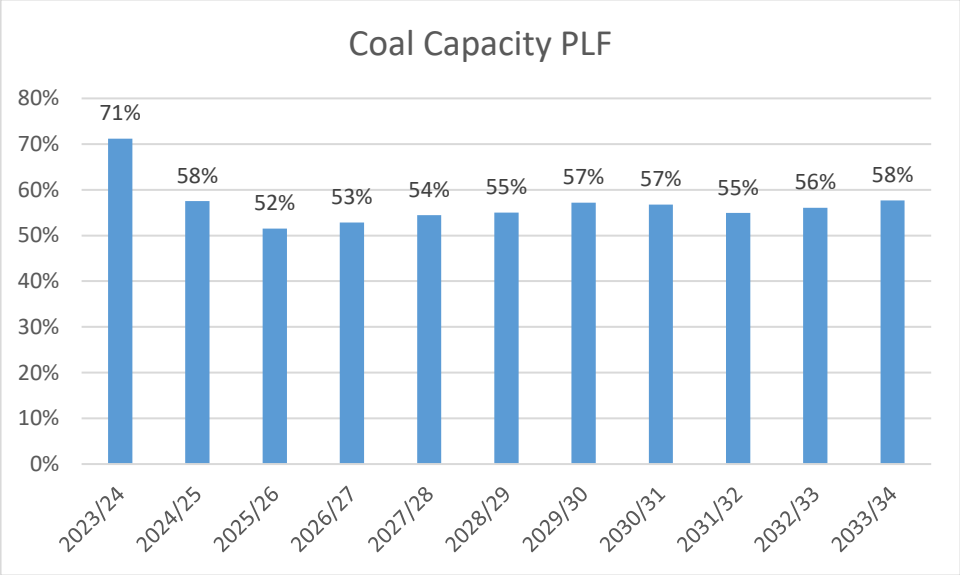


Figure 14 Year-wise coal capacity PLF for Bihar (BSPHCL) (in %)

Based on the information received from the utilities of the planned future tie ups of coal based capacity. It is seen from the studies that the state is likely to have surplus coal based generation available after meeting the projected hourly demand (as shown in Figure 14). This indicates that the state may look for banking / medium term bilateral agreements with other states to optimize utilization of these likely surpluses.

5.5 Projected Aggregate Surplus generation for Bihar (BSPHCL) (MW)

Surplus generation is likely to be available with the state due to RE availability, Demand variation etc. The pattern of surplus capacities for Bihar (BSPHCL) has been observed as shown below. This capacity can be shared with other states and reduce the fixed cost burden on the utilities resulting in reduction in the cost for consumer. Bihar (BSPHCL) has likely surplus capacity available during the day time for 2024-25,2025-26 and 2026-27 is shown below which can be shared with other states / utilities.

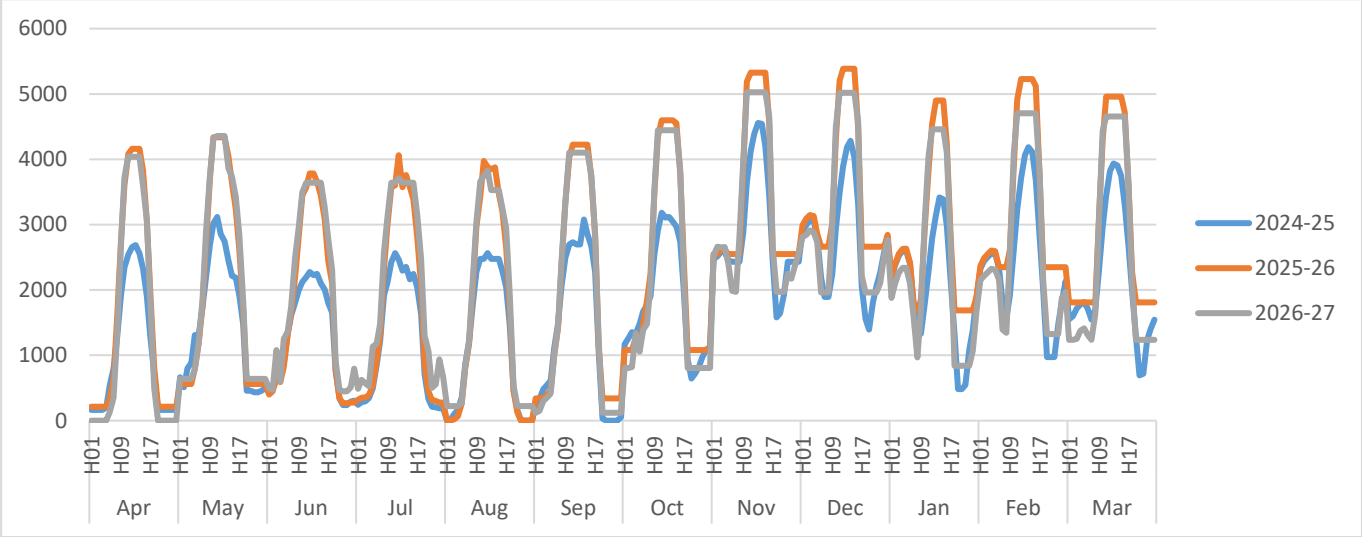


Figure 15 Average Surplus Hourly Coal generation (MW)

6.0 Delayed Capacity Addition Scenario

In view of the recent issues being faced by developers leading to capacity addition being delayed compared to the envisaged timelines, it was realized that an alternate scenario may be assessed to comprehend such situations arising in the future and prepare the utilities for navigating such challenging situations optimally so as to fulfil their consumer end demand reliably.

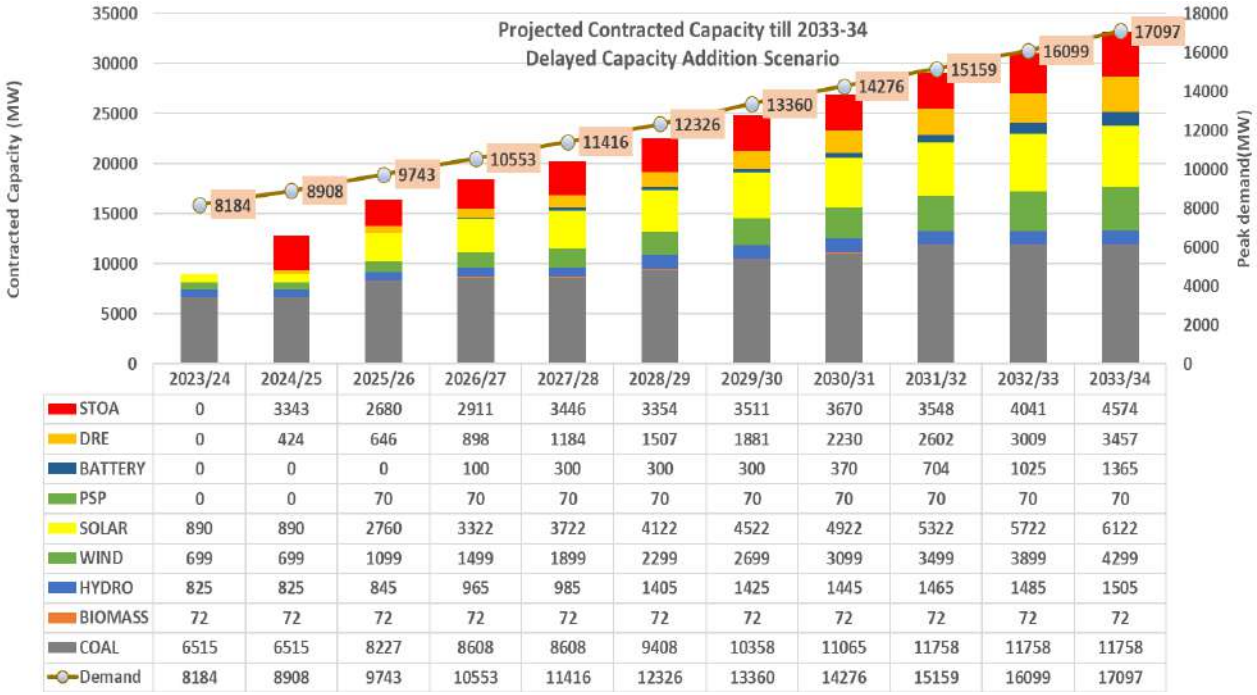
In this scenario, the planned capacity addition from all sources has been assumed to be delayed by 1 or 2 years. Following assumptions have been made for carrying out the studies under this scenario:-

Time Delay in commissioning of contracted capacity

Contracted Capacity Type	Years Delayed
Hydro	2
Renewable Energy Capacity	1
Coal	1

Additionally, it is assumed that owing to delay in realization of RE based capacity addition, the state is able to meet the RPO requirement of around 70% each year till 2033-34.

6.1 Capacity Mix Projections



	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34
STOA	0	3343	2680	2911	3446	3354	3511	3670	3548	4041	4574
DRE	0	424	646	898	1184	1507	1881	2230	2602	3009	3457
BATTERY	0	0	0	100	300	300	300	370	704	1025	1365
PSP	0	0	70	70	70	70	70	70	70	70	70
SOLAR	890	890	2760	3322	3722	4122	4522	4922	5322	5722	6122
WIND	699	699	1099	1499	1899	2299	2699	3099	3499	3899	4299
HYDRO	825	825	845	965	985	1405	1425	1445	1465	1485	1505
BIOMASS	72	72	72	72	72	72	72	72	72	72	72
COAL	6515	6515	8227	8608	8608	9408	10358	11065	11758	11758	11758
Demand	8184	8908	9743	10553	11416	12326	13360	14276	15159	16099	17097

In this scenario, increased coal based tie-ups are required for the state (from the year 2028-29 onwards) owing to delay in RE based capacity addition. Additionally, year-on-year STOA/MTOA requirement is seen to have increased to meet the demand during peak months.

7.0 Conclusions

Based on the Resource Adequacy studies for the state of Bihar up to the year 2033-34, the following conclusions may be drawn:

1. The state is dependent on primarily the coal based tie ups from Central Generating stations for meeting their demand.
2. The study is based on the hourly load pattern of the year 2022-23. The Peak demand for the state occurs during summer months viz. July-Aug. On daily basis, the peak demand is observed during night hours (non solar hours). The diurnal variation of peak and off peak demand is significantly high throughout the year
3. The study was carried for assessing the resource adequacy of Bihar (BSPHCL) based on the demand projections by 20th Electric Power Survey report (The demand projections by Bihar (BSPHCL) are lower compared to the demand projections report by 20th Electric Power Survey (20th EPS)).
4. The current capacity mix in Bihar (BSPHCL) has 73% of IC from fossil fuel sources. This share is likely to decrease to as low as 25% by 2033-34.
5. The state has sufficiently surplus coal based capacity planned such that in order to meet the projected demand. Bihar (BSPHCL) is likely to not witness energy deficit throughout the period of

study i.e. from 2023-24 to 2033-34 with the existing and planned capacity addition. However, Bihar (BSPHCL) is deficit in fulfilment of its Renewable Purchase Obligations (RPO) as per the MOP notification dated 20th October 2023 and needs to contract additional renewable capacities. The projected capacity and generation mix fulfils the RPO obligation.

6. Around 1000 MW of additional Coal based capacity required in 2033-34 (beyond under construction/ planned).
7. Given the projected capacity mix, the PRM for the state in 2033-34 is likely to be around 5.5% in order to meet the reliability criteria (EENS 0.05% and LOLP 0.2%).
8. The state is likely to require storage of about 5.56 GW/22.26 GWh by 2033-34 in order to meet the demand during the non-solar hours in peak summer months. In this regard, it is suggested that state may prioritize DSM (Demand Side Management) policy measures to be able to shift peak demand from non-solar to solar hours.
9. In view of likely RE based capacity addition the coal capacity PLF is expected to reduce from 71% to as low as 52% during some years till 2033-34 ensuring higher absorption of higher renewable energy.
10. In case the likely RE based capacity is delayed and the coal based planned capacity addition considered by state is delayed in upcoming years, increased coal based tie-ups are required for the state (from the year 2028-29 onwards). Additionally, year-on-year STOA/MTOA requirement is seen to have increased to meet the demand during peak months.

Annexure-I

Future Contracted/Approved Capacity (MW) of Central and State Sector (Thermal)

SR. NO	POWER PLANT	BIHAR'S SHARE (MW)	TYPE OF GENERATION	EXPECTED COD/ REMARK
1	North Karanpura Unit #2	295	THERMAL	01-04-2024
2	North Karanpura Unit #3	295	THERMAL	01-10-2024
3	Buxar TPP Unit #1	561	THERMAL	2024-25
4	Buxar TPP Unit #2	561	THERMAL	2024-25
5	Barh I Unit #3	381	THERMAL	01-03-2025
6	Darlipalli Stg II	150	THERMAL	2028-29
	TOTAL	**2243 MW**		

Assumption for Resource Adequacy Studies for the state of Bihar (BSPHCL)

1. Electricity Demand & peak requirement: As per 20th Electric Power Survey
2. Demand Profile: Based on hourly demand profile of 2022-23
3. Existing & Planned Capacity: As per the information received from Bihar (BSPHCL)
4. Future Capacity addition: based on RPO trajectory
5. Cost parameters: based on information in National Electricity Plan

RE CUF considered

Solar CUF Existing & Planned	Wind CUF Existing & Planned
18% & 21%	24%

Technical Parameters

Technology	Type	Availability (%)	Ramping (%/min)	Min. Technical. (%)	Start -up time (hr)		
					Hot	Warm	Cold
Coal/ Lignite	Existing/Planned	85	1	55	2	5	10
	Candidate	88	1	55	2	5	10
Gas	Existing	90	5	40	1.5	2	3
Nuclear	Existing/Planned	68	Const. Load	-	-	-	-
Biomass	Existing/Planned	60	2	50	2	4	8
Hydro	Existing/Planned/ Candidate	As per available hourly generation profile	100	-	-	-	-
Solar	Existing/Planned		-	-	-	-	-
	Candidate		-	-	-	-	-
Wind	Existing/Planned		-	-	-	-	-
	Candidate		-	-	-	-	-
Pumped storage	Existing/Planned	95	50	-	-	-	-
	Candidate		50	-	-	-	-
Battery Energy Storage	Candidate	98	NA	-	-	-	-

Technology	Type	Heat Rate (MCal/MWh)		Aux. Consum. (%)	Min. online time (hr)	Min. offline time (hr)	Start-up fuel consumption (MCal/MW)		
		At max loading	At min loading				Hot	Warm	Cold
Coal	Existing/ Planned	2300 to 2879	2438 to 3052	7.0	6	4	600	1000	1800
	Candidate (SC & USC)	2060 to 2125	2183 to 2253	6.5	6	4	600	1000	1800
Gas	Existing	2000 to 2900	2260 to 3277	2.5	4	3	30	50	90
Nuclear	Existing/ Planned	2777	2777	10	6	4	-	-	-
	Candidate	2777	2777	10	-	-	-	-	-
Biomass	Existing/ Planned	4200	4450	8	6	4	600	1000	1800
	Candidate	4200	4450	8	6	4	600	1000	1800
Hydro	Existing/ Planned	-	-	0.7	-	-	-	-	-
	Candidate	-	-	0.7	-	-	-	-	-
Pumped Storage	Existing/ Planned	-	-	pump efficiency 80 %	-	-	-	-	-
	Candidate	-	-		-	-	-	-	-
Battery Energy Storage	Candidate	-	-	Round trip losses 12%	-	-	-	-	-

Transmission Parameters

A single node has been considered for the purpose of study with all generating units and demand connected to the node. No transmission bottleneck has been considered for the study. Interstate ATC limit has not been considered in the study.

Financial Parameters

Following cost parameters have been assumed in the year 2021-2022:

Resource	Capex* (in ₹/MW)	O&M Fixed Cost (in ₹/MW)	Construction Time (in years)	Amortization /Life time (in years)
Coal	8.34 Cr	19.54 Lakh	4	25
Hydro~	6 Cr to 20 Cr	2.5% of Capex	5 to 8	40
Solar**	4.5 Cr to 4.1 Cr	1 % of Capex	0.5	25
Wind(Onshore)	6 Cr	1% of Capex	1.5	25
Wind(Offshore)	13.7 Cr	1% of Capex	1.5	25
Biomass	9 Cr	2% of Capex	3	20
Pumped Storage	3 Cr to 8 Cr	5 % of Capex	7	40
Battery Energy Storage (2-Hour)	5.13 Cr to 3.13 Cr	1 % of Capex	0.5	14
Battery Energy Storage (4-Hour)	8.22 Cr to 4.72 Cr	1 % of Capex	0.5	14
Battery Energy Storage (5-Hour)	9.77Cr to 5.51 Cr	1 % of Capex	0.5	14
Battery Energy Storage (6-Hour)	11.31 Cr to 6.30 Cr	1 % of Capex	0.5	14

* All the Capex figures are on actual basis at the cost level of 2021-22 i.e., inflation is not considered while calculating capex.

~ The Capex values of Hydro and PSS candidates are considered as per the project cost details furnished by the respective developers for state and private sector plants and as per RCEs done periodically by CEA for central sector plants.

**Solar Cost is assumed to reduce from Rs 4.5 Cr/MW in 2021-22 to Rs 4.1 Cr/M