Resource Adequacy Laws/Guidelines

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Policy Framework

✓ MoP has notified Electricity (Amendment) Rules, 2022 on 29.12.2022

Rule 16:

➢ ***Resource Adequacy Guidelines*** *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, within six months from the date of commencement of these rules.* **- Final Guidelines issued on 28th June 2023.**

➢ *State Commission shall* ***frame regulations*** *on resource adequacy, in accordance with the* ***guidelines*** *issued by the Central Government, the* ***distribution licensees*** *shall formulate the* ***resource adequacy plan*** *in accordance with these Regulations and* ***seek approval of the Commission***

➢ *The* ***National Load Dispatch Centre and the Regional Load Dispatch Centers*** *shall carry out assessments of resource adequacy, for* ***operational planning, at the national and regional levels****, respectively, on an annual basis*

Policy Framework

- *The **State Commission** may determine **non-compliance charges** for failure to comply with the resource adequacy target approved by the Commission.*

- *The **State Load Dispatch Centre** shall carry out assessments of resource adequacy, for **operational planning, at the state level,** in consultation with all the concerned stakeholders on an annual basis ,in accordance with the guidelines issued by the Central Government and the directions of the State Commission.*

- *The State Load Dispatch Centre **shall review** the **operational resource adequacy** on a daily, monthly and quarterly basis*

Roles and Responsibilities in Resource Adequacy Framework

Role of CEA

- Publish Long Term National Resource Adequacy Plan (LT-NRAP) for 10 years containing the following:
  - National Level PRM and reliability indices
  - Share of State in National Peak Demand
  - Capacity credit of all generation technologies
  - Optimal Generation Mix at national level
- LT-NRAP shall be revised annually
- Vetting of state specific LT-DRAP for all states

Role of NLDC

- To Publish Short Term National Resource Adequacy Plan (ST-NRAP) for one year considering the following :-
  - Reserves (Primary, Secondary and Tertiary) in the Grid for grid security
  - Planned maintenance schedules of existing stations
  - Station-wise historic forced outage rates
  - Resource Availability based on new projects
  - Decommissioning plans, if any.

Role of Distribution Utility

- Long-term Discom Resource Adequacy Plan (LT-DRAP) (on annual rolling basis) for 10 year for:
  - Meet the ***peak demand and energy requirement*** of the Discoms along with the RPO Obligations
  - Meeting ***contribution towards national peak*** with PRM
  - Adhering Reliability norms
- LT-DRAP shall be vetted by CEA and submitted to State Commission for approval
- Demonstrate 100% tie-up for the first year and min 90% tie-up for the second year to meet their contribution towards national peak.
- To submit the details of contracted capacities to the respective STU/SLDC after the approval of State Commission.

Role of STU/SLDC

- To provide the following inputs for formulation of LT-NRAP:-
  - Hourly demand (15 minute time block wise)
  - Hourly demand forecasts for the next 10 years
  - Availability from the existing/contracted generation resources
  - Any other inputs required for national RA plan
- Aggregate the total contracted capacities at the state level and submit the information to the respective RLDC.
- RLDCs shall aggregate the capacities at Regional Level and submit to NLDC
- SLDC shall carry out assessments of resource adequacy, for operational planning, at the state level
- Review the ST-DRAP on a daily, monthly and quarterly basis based on actual availability of generation resources.

Judicious mix of Long, Medium and Short-Term Contracts

Type of Contract	Meeting Distribution Licensee Contribution in national Peak	Distribution licensee own peak and electricity requirement
Long-Term	75-80%	>75%
Medium-Term	10-20%	10-20%
Short-Term	0-15*%	0-15%

* Power procurement through the power exchanges, such as the Day-Ahead Market segment, shall not be considered

Timely Procurement of Resources

- The distribution licensee must ensure that procurement process for the projected demand is undertaken and completed sufficiently in advance to ensure its availability for meeting the demand.

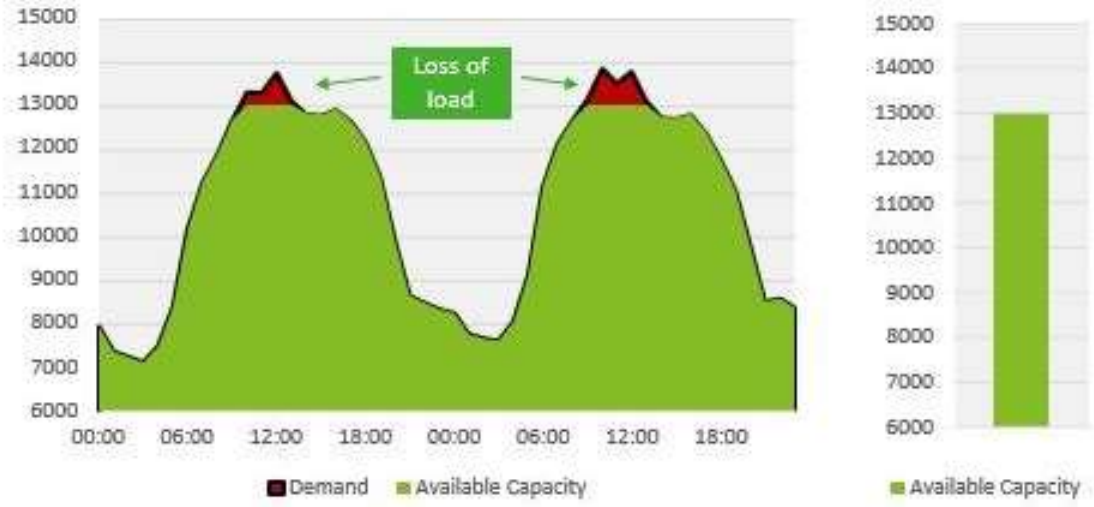
Resource	Long Term	Medium Term
Coal/Lignite Based Capacity	7	2
Hydro	9	2
Solar	2	1
Wind	3	1
PSP	5	3
Other Storage	2	1
Nuclear	9	3

Key Design Parameters

- Reliability Indices
  - Loss of Load Probability (LOLP)
  - Expected Energy Not Served (EENS) and Normalised ENS (NENS)
- Planning Reserve Margin- Sufficient Reserve margins are required for adequately addressing the demand and supply variations to meet reliability criteria.
  - PRM is expressed as a certain % of peak load of the system.

Loss of Load Probability

- Measure of the probability that a system's load may exceed the available generation to meet the load in a year.

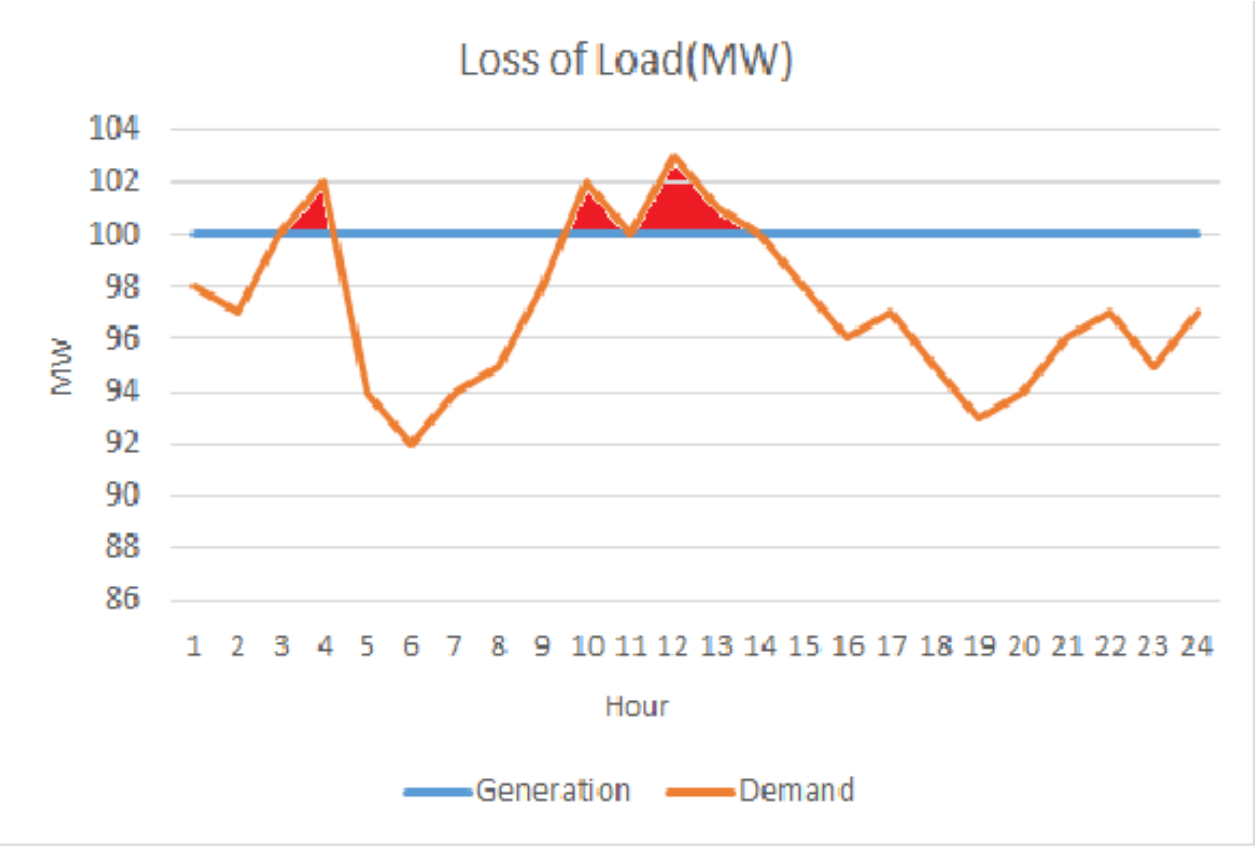


- The LOLP value adopted by CEA for the purposes of the National Electricity Plan (NEP) is 0.2%

Expected Energy Not Served (EENS) and Normalised ENS (NENS)

- Expected amount of total energy (MWh) that may not be served in a year
- Normalized ENS (NENS)- total expected load shed due to supply shortages (MWh) as a percent (%) of the total system energy.
- NENS value adopted by CEA for National Electricity Plan is 0.05%

CALCULATION of LOLP and NENS



Hours of Lost Load (A)	4	LoLP = A /B	LoLP =16.67 %
Hours in a Day (B)	24		
Quantum of Lost Load (MWh) (C)	8	NENS = C/D	NENS= 0.34%
Total Demand (MWh) (D)	2334		

The sample calculation shown is for LoLP and NENS on a daily basis.

Calculation of Resource Adequacy Requirement

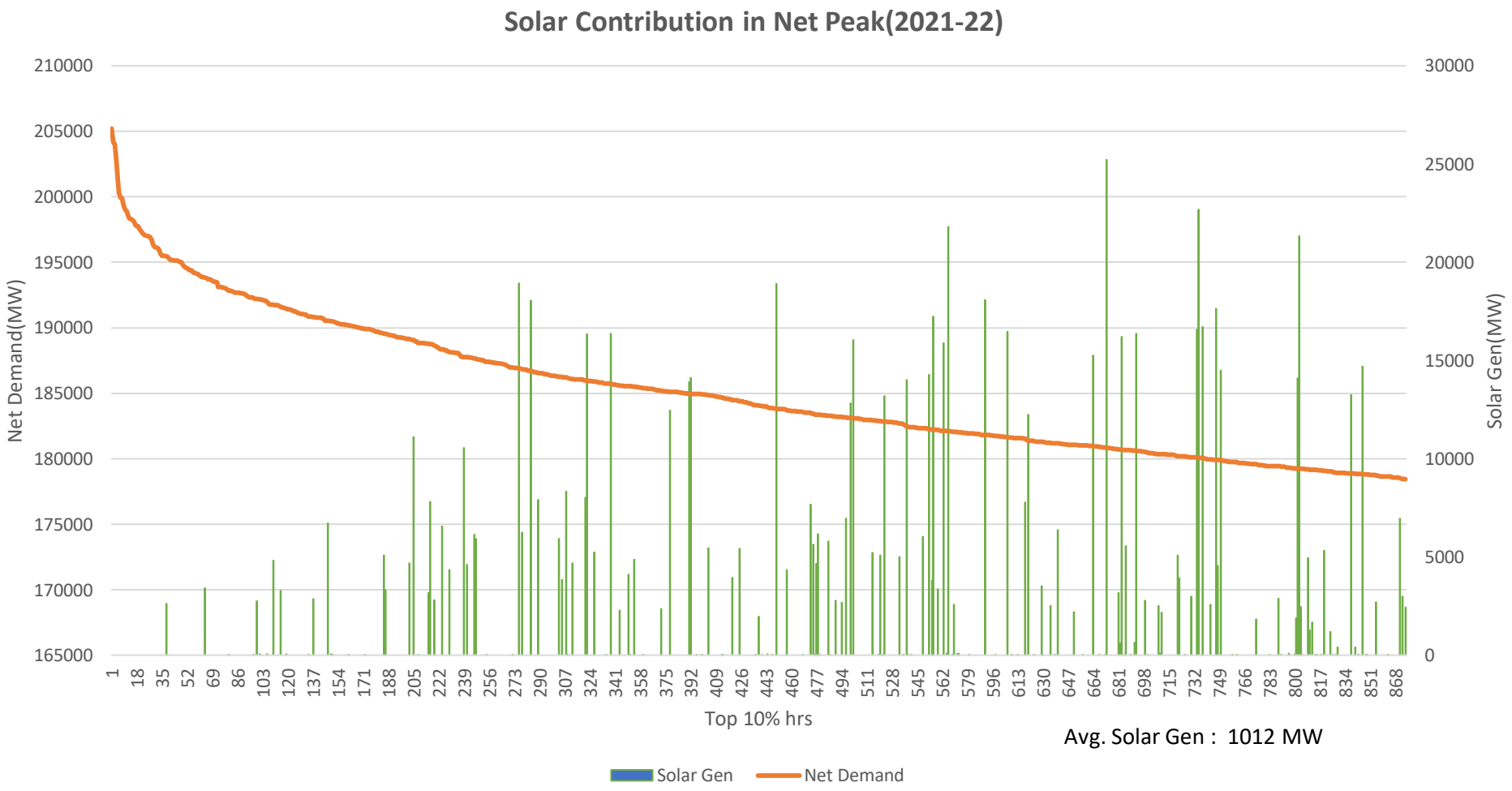
- RAR (supply side)= ∑ (Installed Capacity * Capacity Credit)

*Capacity credit- Percentage of installed capacity that a generator can reliably provide to meet peak demand

- RAR (demand side)

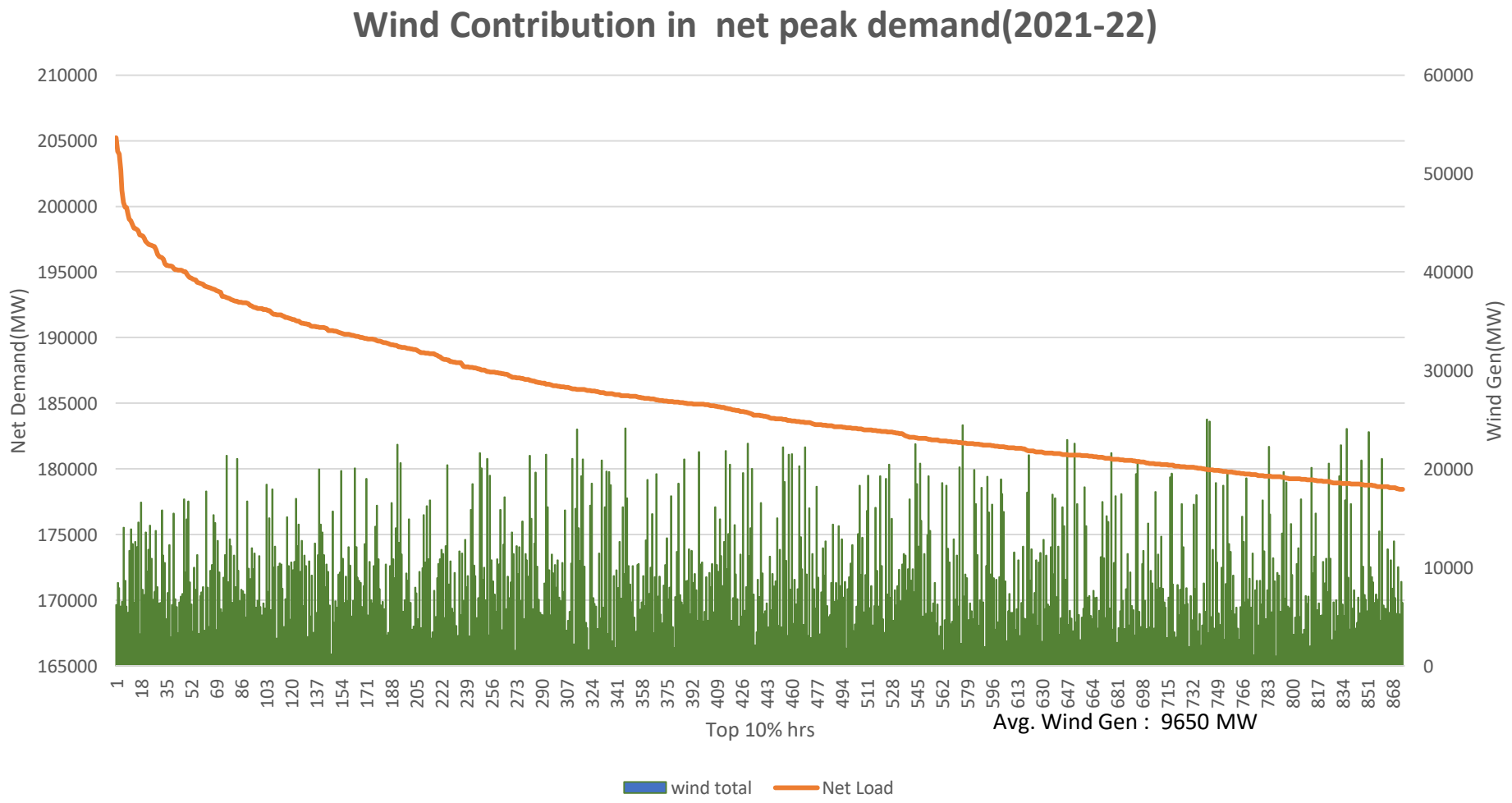
  = Contribution to forecasted National peak demand * (1 +PRM)

Capacity Credit for Solar



Avg. Solar Gen : 1012 MW

Capacity Credit for Wind



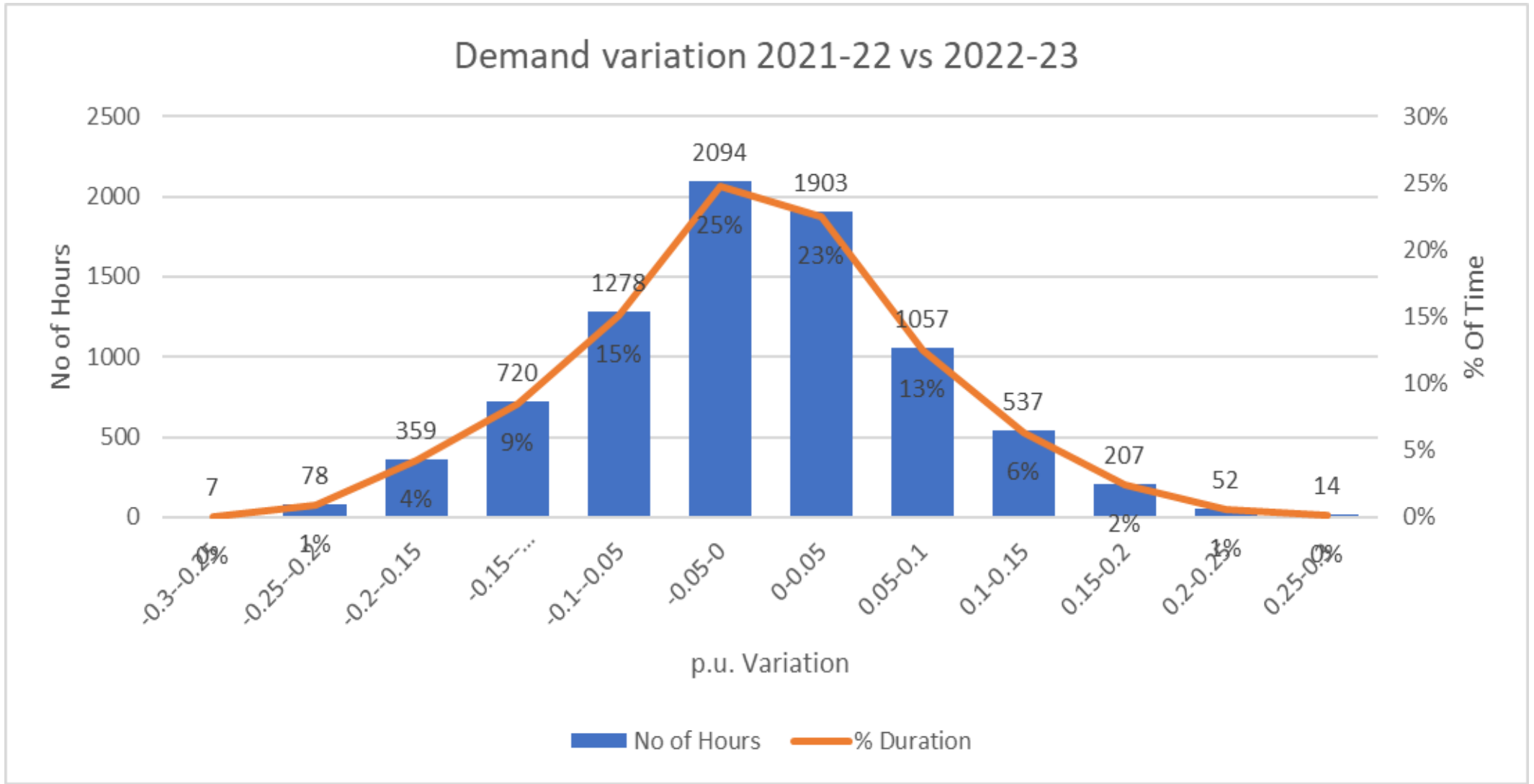
Integrated Resource Planning (IRP) for RA

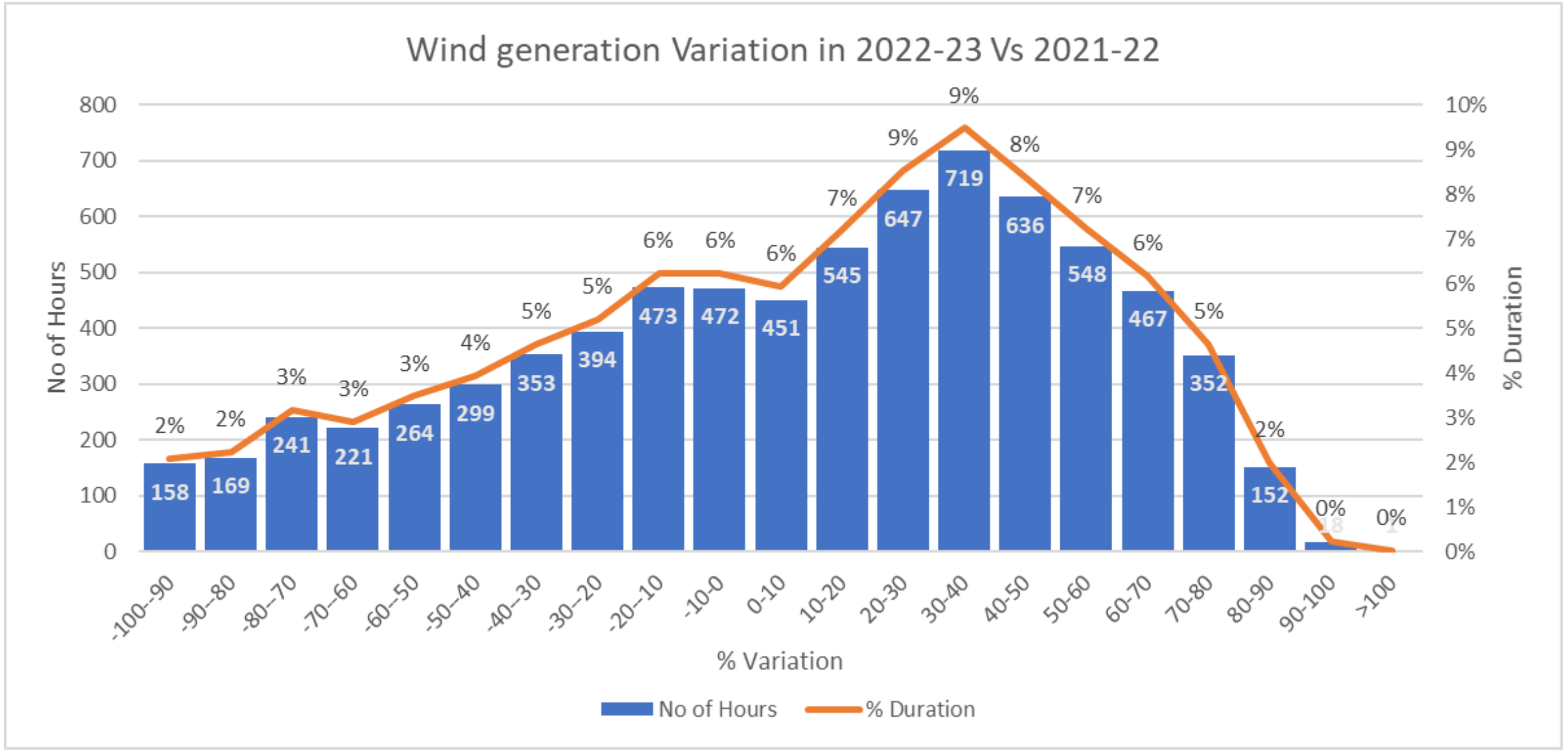
- IRP- To determine the target generation capacities for meeting the forecast peak and energy demand over a specified future period.
- Inputs for IRP-
  - Reliability indices
  - Demand pattern (Hourly/sub-hourly demand pattern)
  - Estimated Load Growth
  - VRE generation profiles
  - Technical & Financial parameters of Existing, Planned and Candidate Generating Plants
  - RPO & ESO targets
  - Spinning reserve requirements

Reliability Analysis

Monte Carlo /Stochastic simulation - To factor-in the uncertainty associated with various generation resources and demand

SI No.	System Parameter
1.	Forced outage of conventional generators
2.	Solar Generation
3.	Wind generation
4	Hydro generation
5.	Demand


Demand variation 2021-22 vs 2022-23
No of Hours
% Of Time
p.u. Variation
No of Hours
% Duration
2500
2000
1500
1000
500
0
30%
25%
20%
15%
10%
5%
0%
7
78
359
720
1278
2094
1903
1057
537
207
52
14
4%
9%
15%
25%
23%
13%
6%
2%
1%
0%
-0.25--0.2
-0.2--0.15
-0.15--...
-0.1--0.05
-0.05-0
0-0.05
0.05-0.1
0.1-0.15
0.15-0.2
0.2-0.25


Wind generation Variation in 2022-23 Vs 2021-22
No of Hours
% Duration
% Variation
No of Hours
% Duration
800
700
600
500
400
300
200
100
0
10%
9%
8%
7%
6%
5%
4%
3%
2%
1%
0%
158
169
241
221
264
299
353
394
473
472
451
545
647
719
636
548
467
352
152
18
1
2%
2%
3%
3%
3%
4%
5%
5%
6%
6%
6%
7%
9%
9%
8%
7%
6%
5%
2%
0%
0%
-100--90
-90--80
-80--70
-70--60
-60--50
-50--40
-40--30
-30--20
-20--10
-10-0
0-10
10-20
20-30
30-40
40-50
50-60
60-70
70-80
80-90
90-100
>100

DEMAND FORECASTING

Forecast of What?

- Restricted or Unrestricted ?
- Utility only or Overall Power Demand ?
- At User End or at Generator End ?

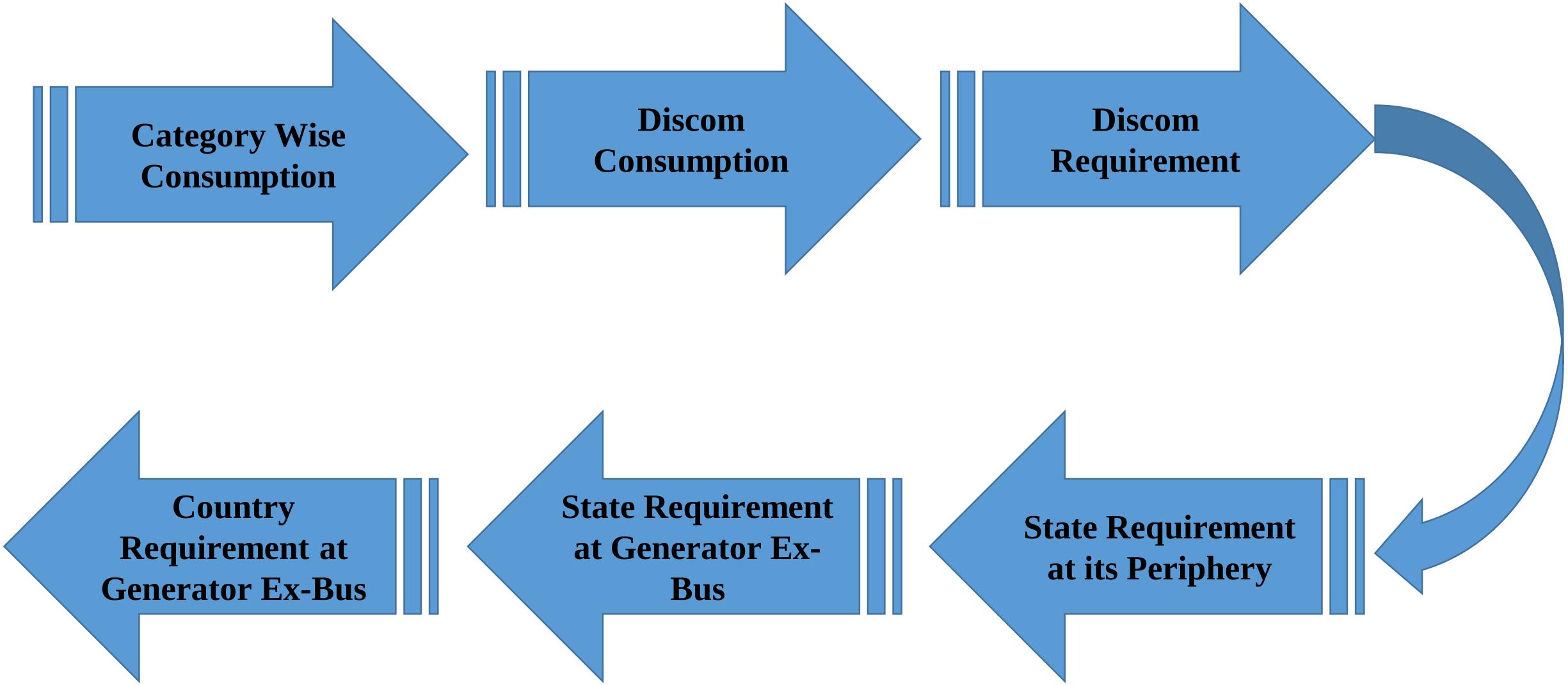
Include or Exclude ?

- Energy Efficiency.
- Weather Conditions.
- Open Access Consumption.
- Latent Demand.

General - Terms, Range & Periodicity

- Term - Medium Term (> 1 & < 5 years) & Long Term (> 5 years)
- Input data – At least for last 10 years
- Periodicity – Annual
- Time Granularity – Yearly/Monthly
- Spatial Granularity – At least at the DISCOM/State (If granular data is available then Zonal level, Circle level, District level, Sub-Station Level, Feeder/Transformer level)
- Scenario – Business As Usual, Optimistic & Pessimistic

Forecasting Approach – Bottom Up



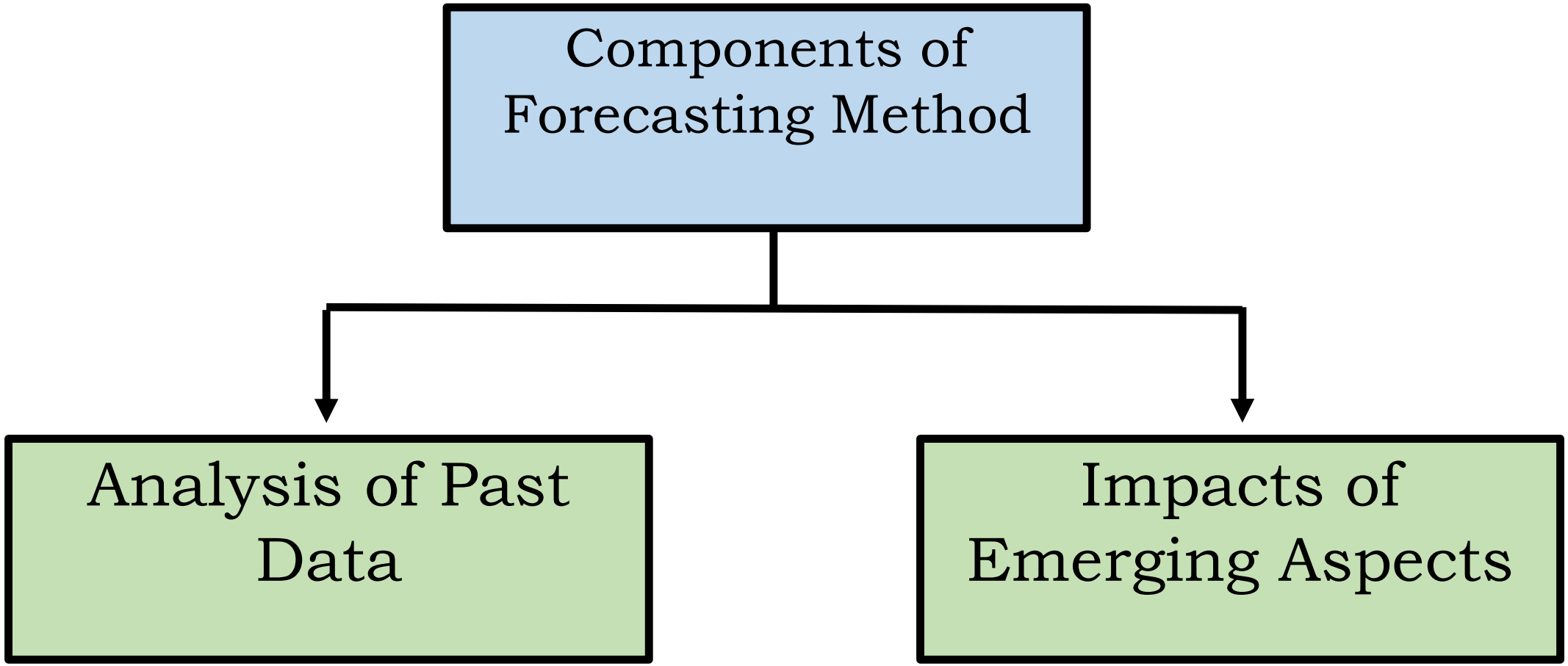
Base Year

- Base Year : (T-3).
- Rationale : Out of Sample Validation.
- If the data for T-3 year is showing some abnormal trends, then the last normal year till which some definite trends were observable may be considered as the base year.

Consumption Categories

- Domestic
- Commercial
- Public Lighting
- Public Water Works
- Irrigation
- LT Industries
- HT Industries
- Railways
- Bulk Supply
- Open Access
- Others

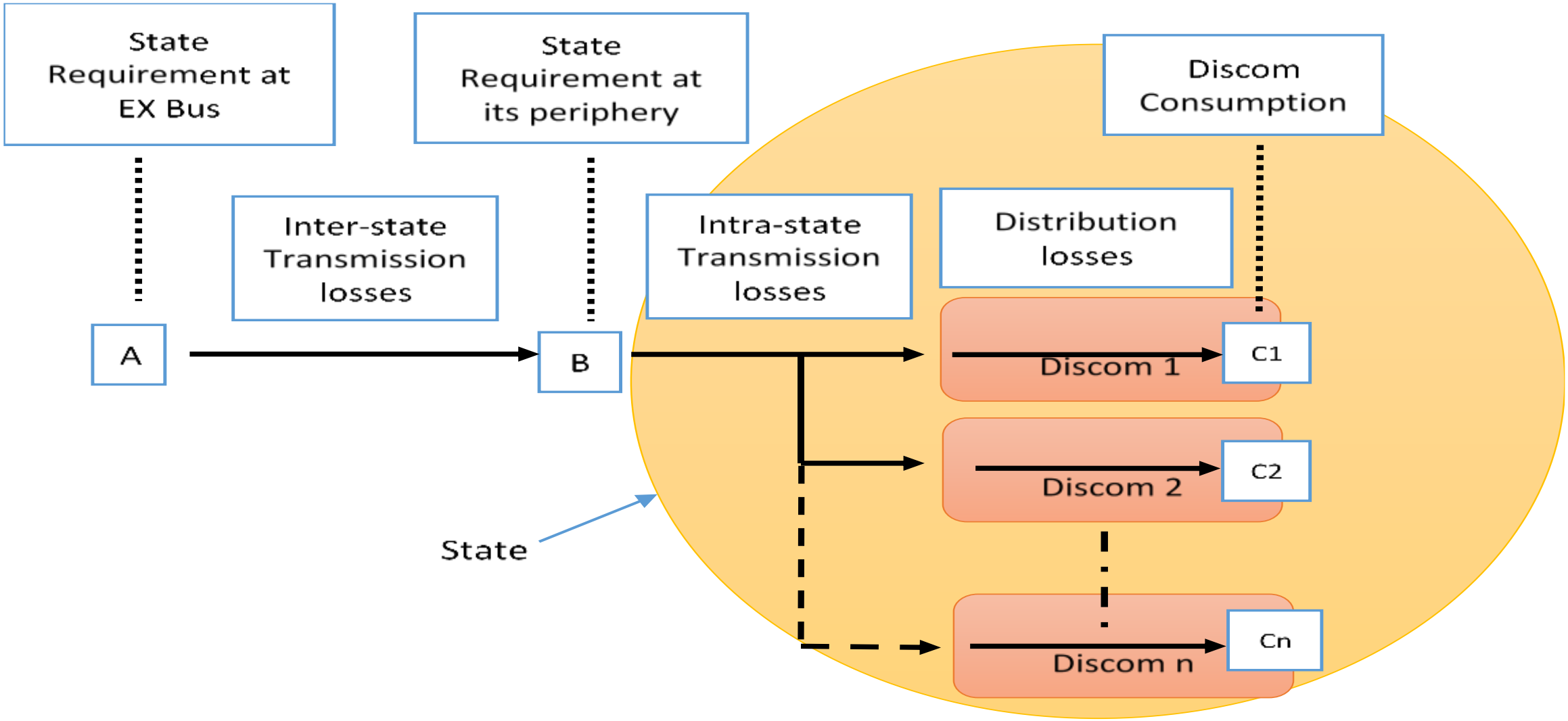
Components of Forecasting Methodology



Analysis of Past Data

- Analysis of past growth rate for each energy consumption category.
- Two of the simplest and appropriate statistical methods - “Least Square Method” and “Weighted Average Method”.
- Other advanced statistical tools may also be used to analyse growth rates.

Factoring in T&D losses in Energy Requirement



Analysis of Past Data – T&D Losses

- Analysis of past growth trends of T&D losses.
- The three components of T&D losses should be analysed separately -
  - ✓ Distribution losses
  - ✓ Intra-state transmission losses
  - ✓ Inter-State transmission losses
- Reduction in losses should not been considered in complete isolation.

Impact of Emerging Aspects

- Should be factored in additionally if upcoming.
- Should not be factored in additionally if they are already in vogue for quite some time in the past and expected to follow similar trajectories in future.

Impact of Emerging Aspects

- Impact should be quantified in sync with the targets set by the government.
- In case of non-availability of any target, suitable assumptions should be taken.
- If the targets are not segregated at annual level or no definite trends are anticipated - Exponential trend with more impact in the later years should be considered.
- As far as possible, the impact of the emerging effects should be apportioned to the corresponding pre-defined consumption categories only.
- In absence of suitable category, a new category could be created if the impact is substantial. Otherwise, it could be clubbed in “Others” category.

Approach for Medium Term & Long Term Forecasting

- Medium Term Forecast - in addition to past growth trends, it should be based on the assessment of impact of specific government policies, developmental plans and other emerging aspects in the definite quantum of electrical energy.
- Long Term Forecast - Based on further extrapolation of the growth trends estimated under medium-term horizon.

Peak Demand

- Should be derived from the energy requirement by applying appropriate load factor.
- Load factors for future should be estimated on its past trend.
- If the pattern of specific consumer mix is expected to differ from the past, the expected load factor should be derived by examining load factors of other Discoms with similar consumer mix.
- Peak electricity demand of the state should be estimated by applying suitable diversity factor, as per the past trends, to the sum of peak electricity demand of its all Discoms.

General Checks & Balance

- Load Factor < 1.
- Diversity factor > 1. (Normal Range - 1 to 1.1)
- Every consumption should be accounted for.
- No double accounting of any energy.
- Energy requirement met at state periphery = Total net generation + net import.

Different Scenario Building

- The forecast under BAU scenario should be derived first.
- Based on BAU Scenario, forecasting under Optimistic and Pessimistic scenarios should be arrived at.

RESOURCE ADEQUACY PLAN
Assam
2024-25 to 2034-35

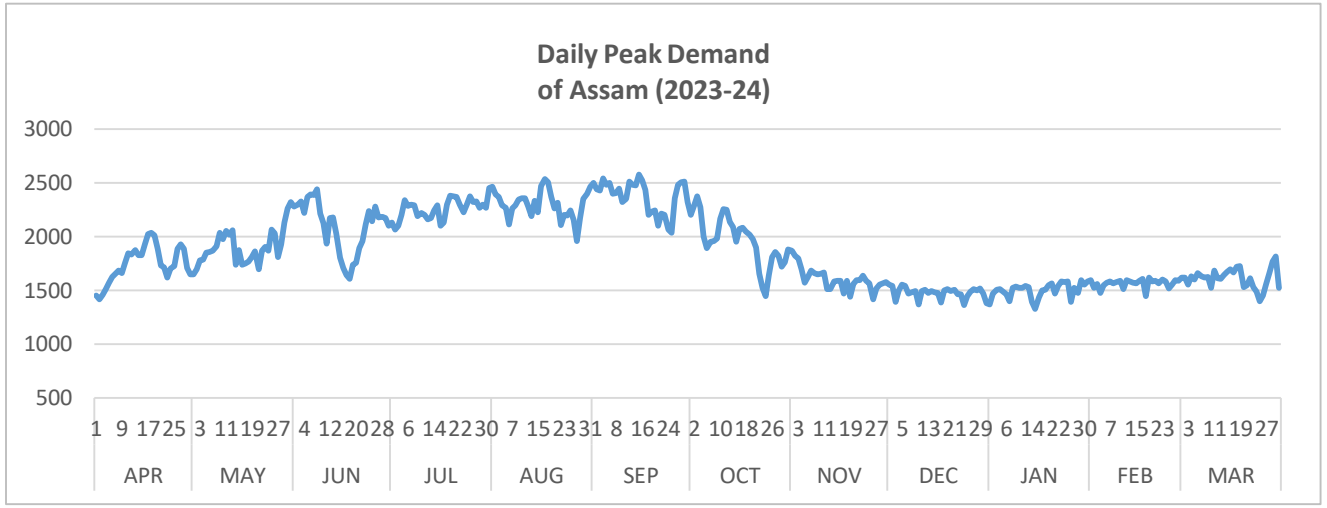
Preliminary Results

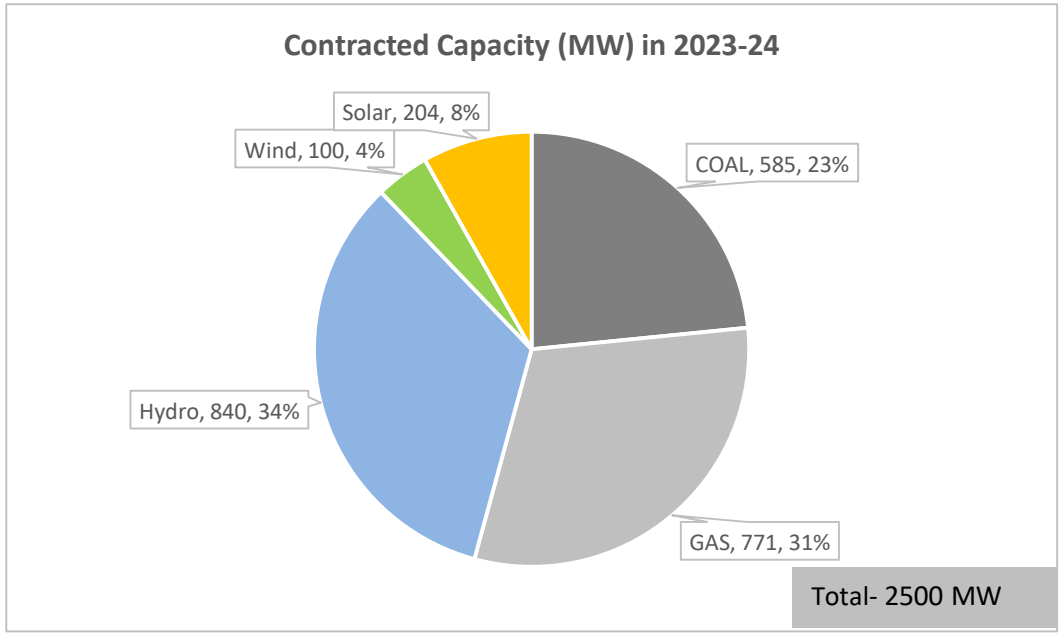
Assam

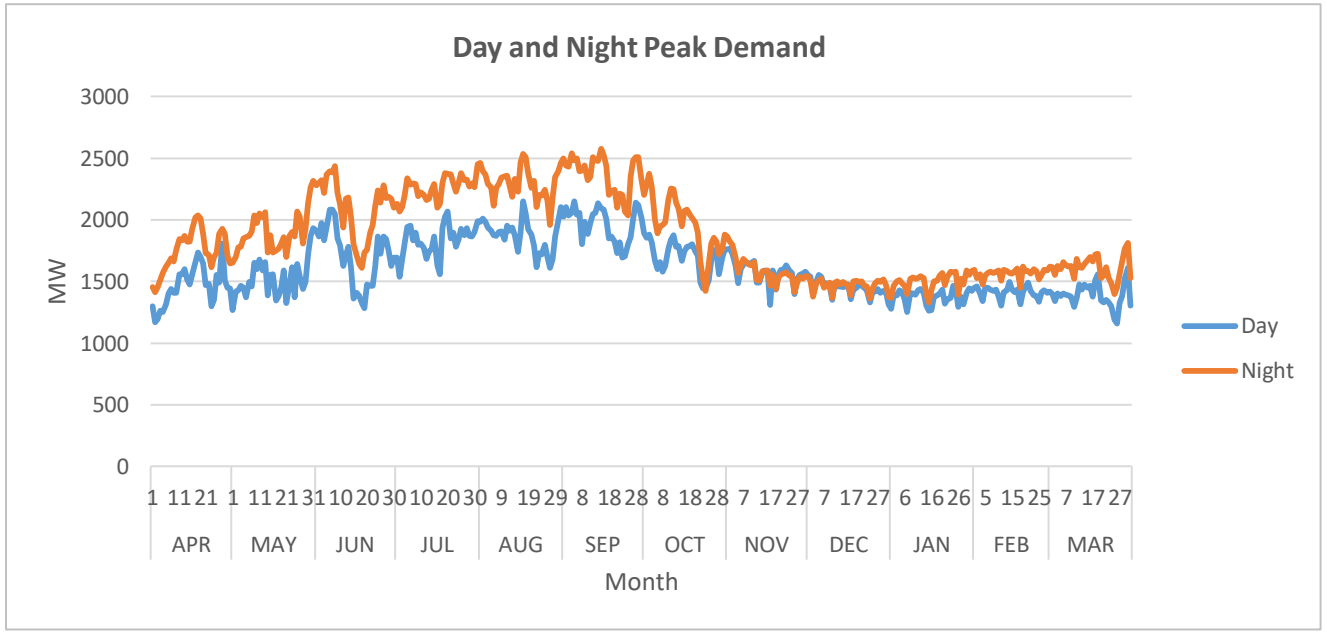
Installed Capacity, Peak demand

As of 31st March,24 the total contracted capacity of Assam is 2500 MW

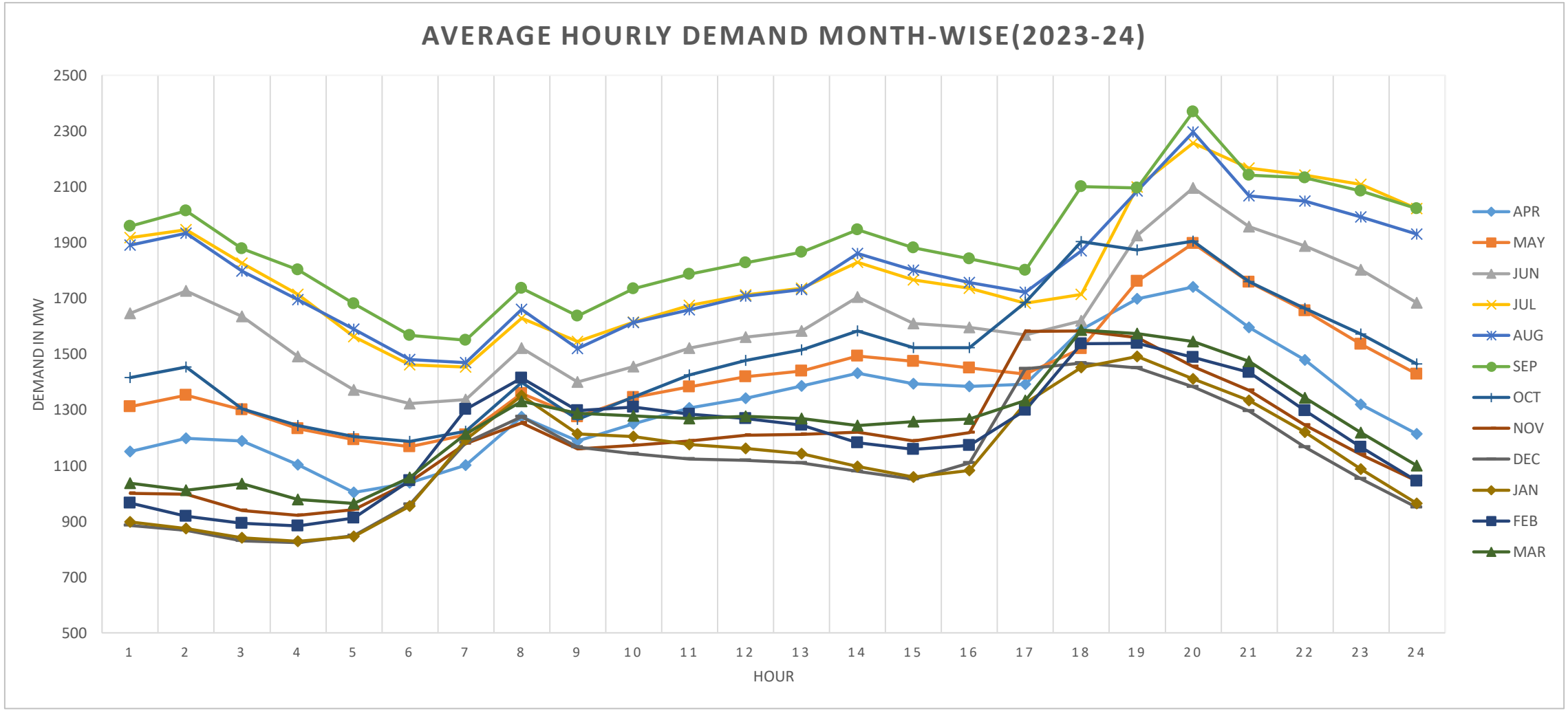
- Share of Thermal: 54.24 %
- Share of Hydro, Wind and Solar: 45.76%







Demand Analysis of Assam



RPO trajectory

(as per Ministry of Power gazette notification dated 20th October, 2023)

Sl. No.	Year	Wind renewable energy	Hydro renewable energy	Other renewable energy	Distributed renewable energy*	Total renewable energy
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%
11.	2034-35	44.00%			7.0%	51.00%

Note:- RPO trajectory for the years till 2029-30 is considered based on MoP RPO Notification dated 20th October,2023.

Resource Adequacy Study Results

Projected Contracted Capacity (in MW) of Assam

In view of lack of firm capacity in the next five years, considerable requirement of market based contracts (STOA/MTOA) is seen.

	COAL	HYDRO	WIND	Solar	Battery (4 Hrs)	DRE*	STOA#
2024-25	585	840	100	204	0	165	1029
2025-26	950	1168	100	304	0	247	689
2026-27	1115	1168	150	514	0	339	746
2027-28	1434	1168	200	824	0	443	697
2028-29	1434	1168	250	1134	0	560	911
2029-30	1734	1168	300	1564	0	690	907
2030-31	1830	1168	350	1974	6	819	1072
2031-32	1957	1168	400	2384	164	963	1082
2032-33	2127	1168	450	2789	473	1122	929
2033-34	2271	1168	500	3199	790	1299	811
2034-35	2436	1168	550	3559	1027	1495	774

*Includes Hydro based DRE capacity (<10 MW) and additional Solar RT required for RPO compliance.

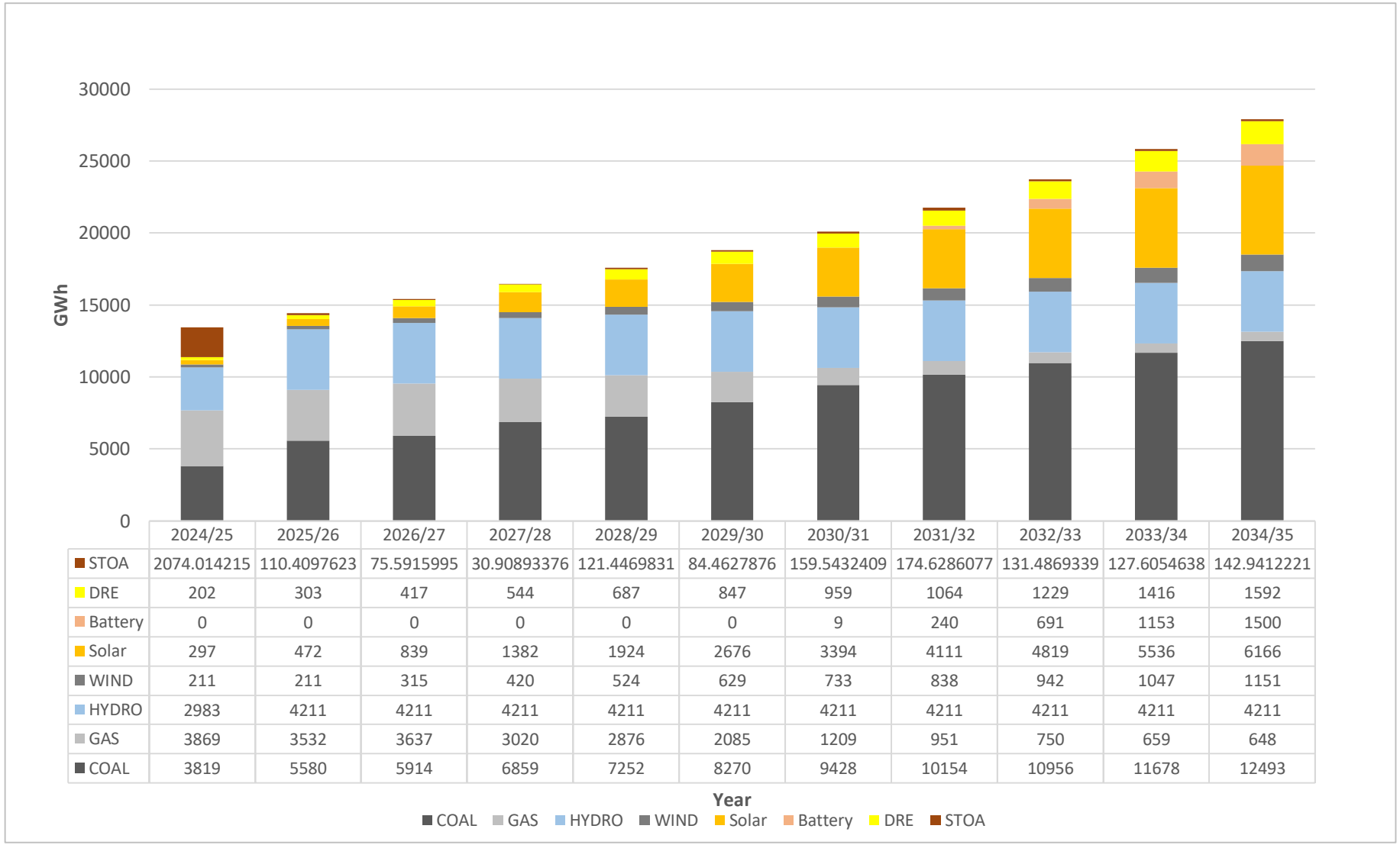
#STOA/MTOA requirement can be fulfilled through power procurement from markets or bilateral agreements.

Recommended year on year Capacity Addition (in MW)

	COAL		WIND	Solar		Battery (4 Hrs)	DRE	STOA (yearly) Additional
	Planned	Additional	Additional	Planned	Additional	Additional	Additional	
2024-25	0	0	0	0	0	0	165	1029#
2025-26	365	0	0	100	0	0	82	689
2026-27	165	0	50	0	210	0	92	746
2027-28	319	0	50	100	210	0	104	697
2028-29	0	0	50	100	210	0	116	911
2029-30	300	0	50	100	330	0	130	907
2030-31	0	96	50	100	310	0	129	1072
2031-32	0	127	50	100	310	164	144	1082
2032-33	0	171	50	100	305	309	160	929
2033-34	0	143	50	100	310	316	177	811
2034-35	0	165	50	50	310	237	196	774
Total	**1149**	**702**	**450**	**850**	**2505**	**1027**	**1495**	**-**

Note :**1**. The STOA/MTOA value reflects the contribution of short term/medium term/market-based contracts in meeting the peak demand in terms of MW.
2. The planned solar capacity of 750 MW from the year 2027-28 has been staggered at the rate of 100 MW/ year starting 2027-28.
Due to lack of sufficient tied-up capacity in 2024-25, the %age share of STOA/MTOA is more than 25% of the total contracted capacity.

Projected Net generation(GWh) of Assam



	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35
STOA	2074.014215	110.4097623	75.5915995	30.90893376	121.4469831	84.4627876	159.5432409	174.6286077	131.4869339	127.6054638	142.9412221
DRE	202	303	417	544	687	847	959	1064	1229	1416	1592
Battery	0	0	0	0	0	0	9	240	691	1153	1500
Solar	297	472	839	1382	1924	2676	3394	4111	4819	5536	6166
WIND	211	211	315	420	524	629	733	838	942	1047	1151
HYDRO	2983	4211	4211	4211	4211	4211	4211	4211	4211	4211	4211
GAS	3869	3532	3637	3020	2876	2085	1209	951	750	659	648
COAL	3819	5580	5914	6859	7252	8270	9428	10154	10956	11678	12493

Thank You

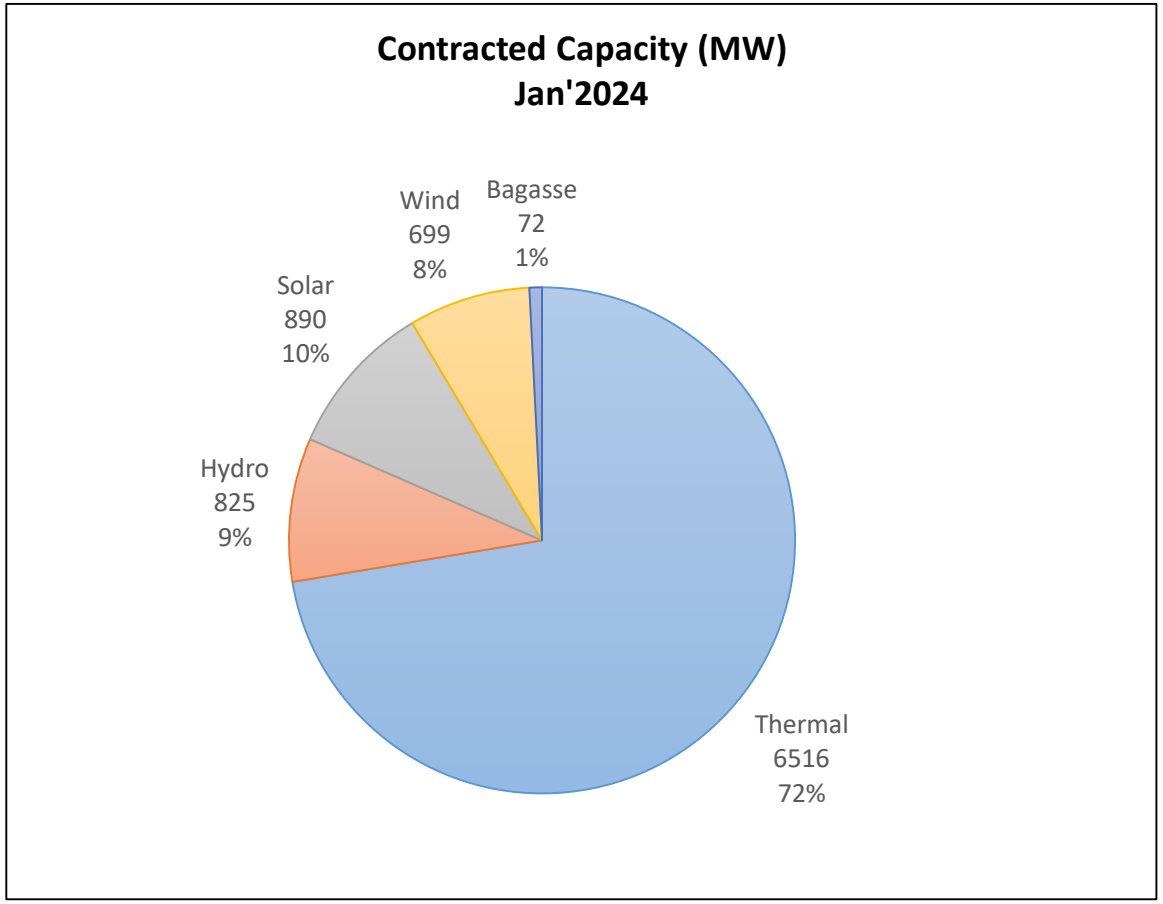
Resource Adequacy Studies of Bihar

Contracted Capacity of Bihar

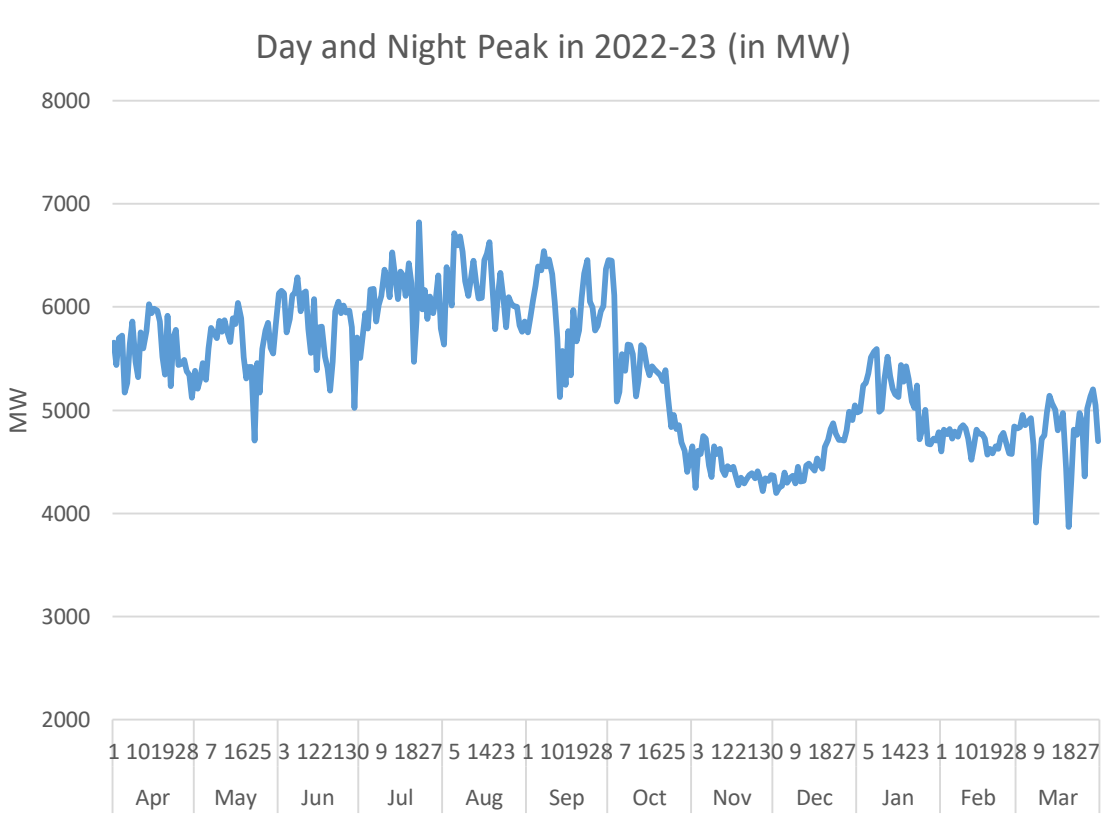
As of Jan’2024 the total contracted capacity of Bihar is 9002 MW

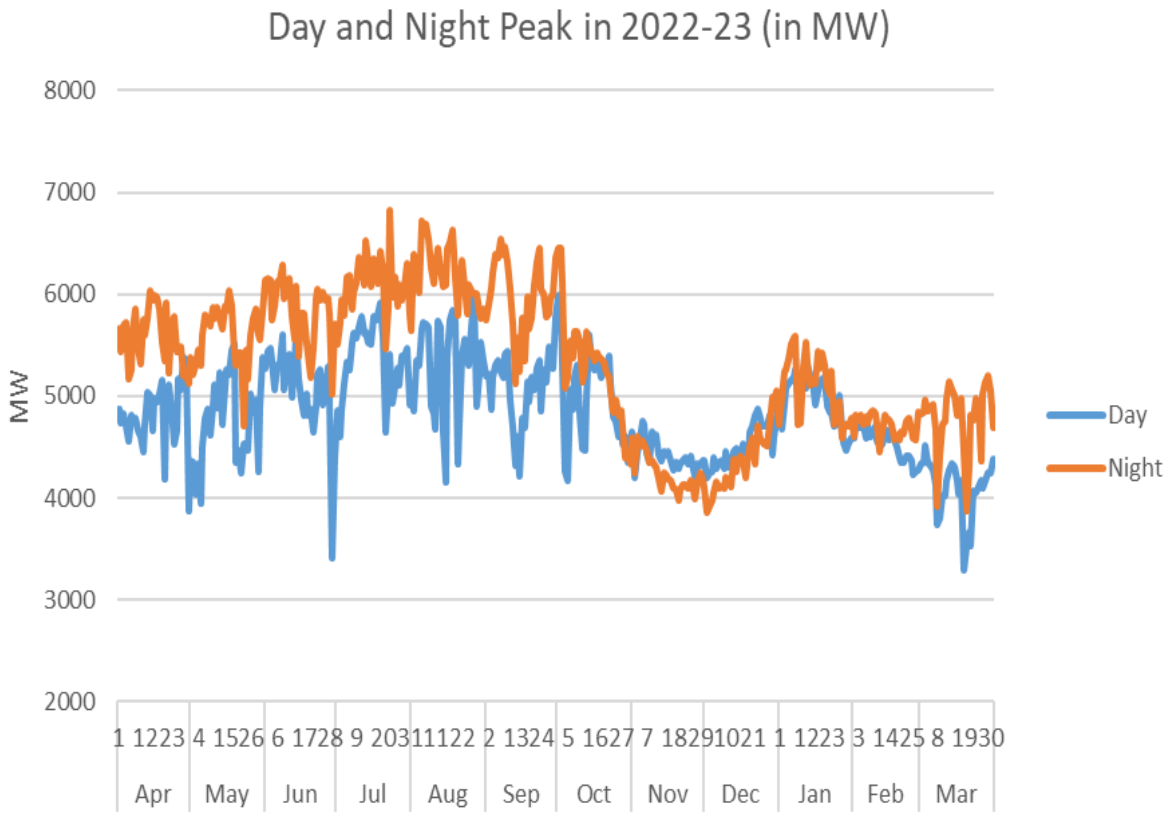
— Share of Thermal: 72.4%

— Share of RE: 27.6%



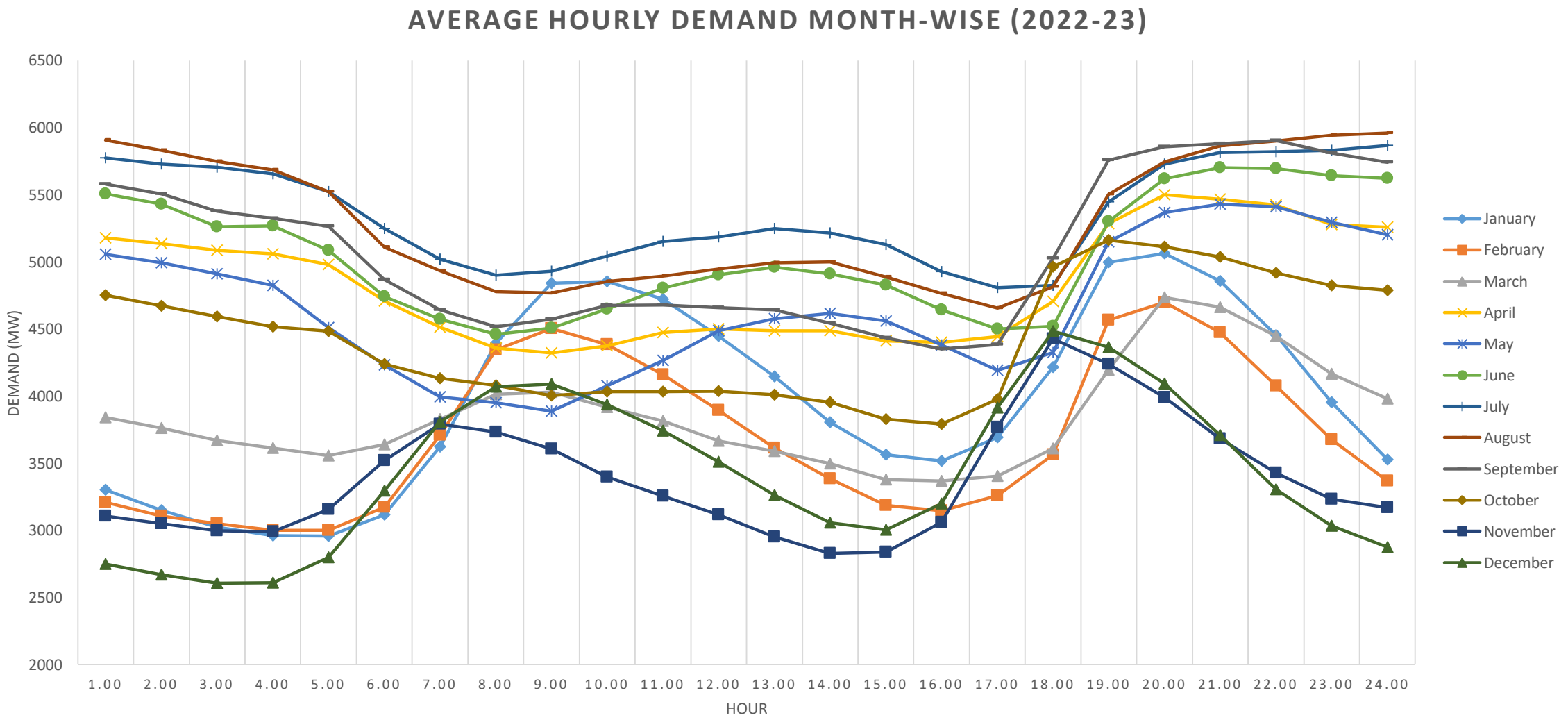
Demand Analysis of Bihar





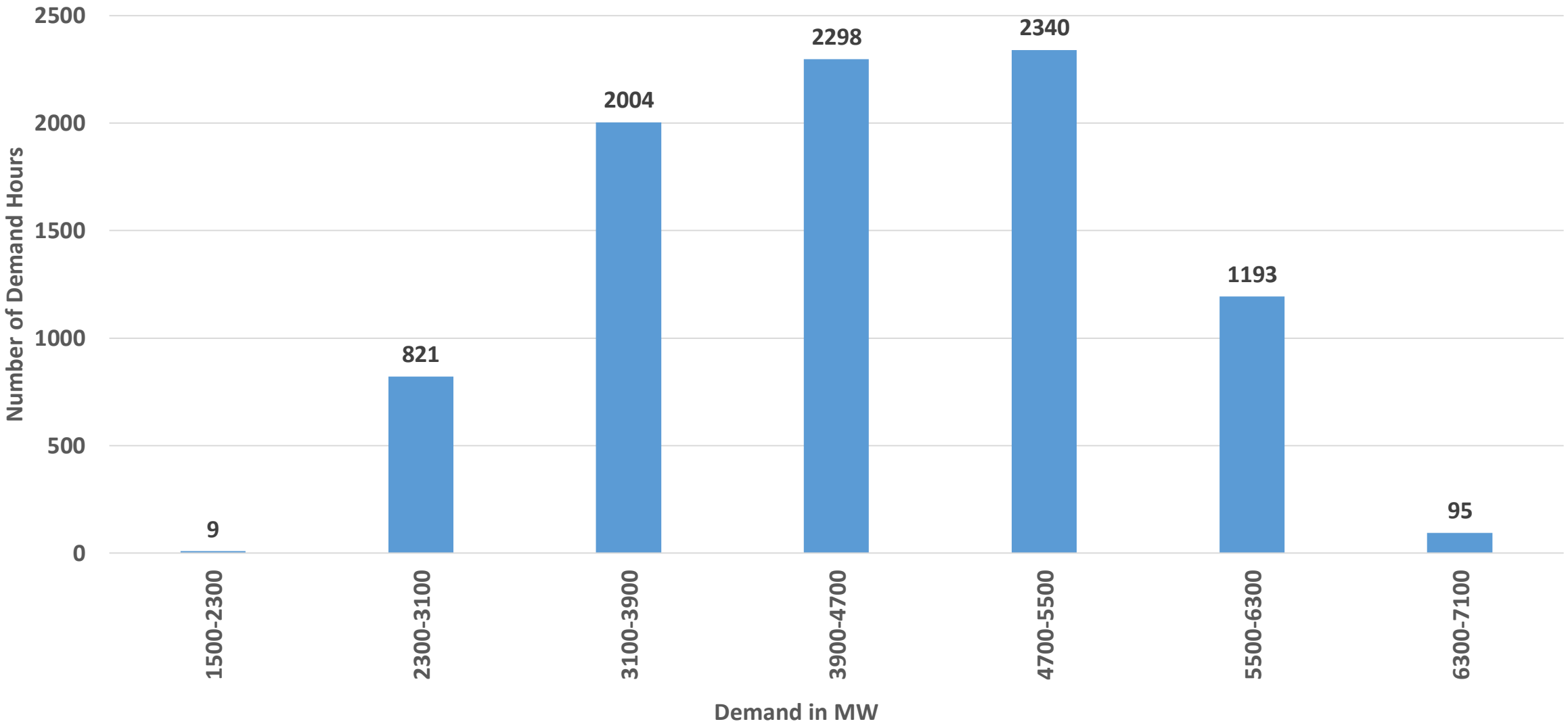
Peak Demand of Bihar occurs during July-Aug during night hours.

Demand Analysis of Bihar

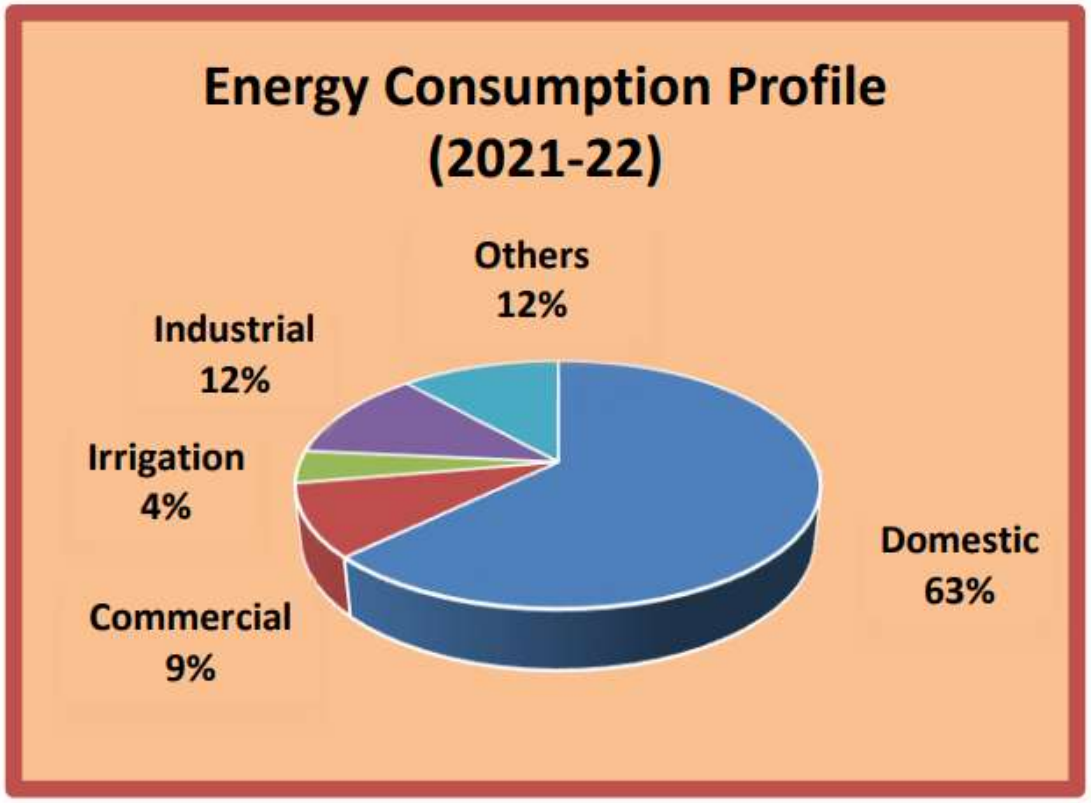


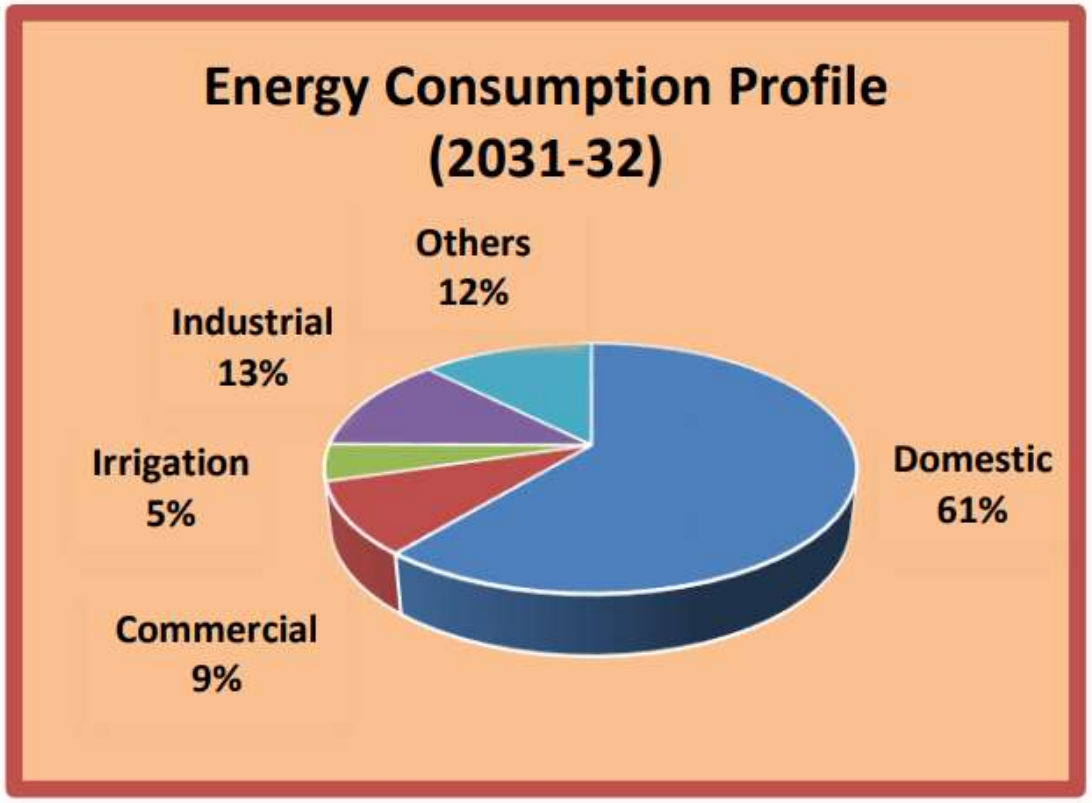
- **Demand during Summer months i.e. June, July remains substantially high compared to other months.**
- **The diurnal variation of peak and off peak demand is significantly high through out the year.**

Frequency Distribution of Hourly Demand Profile of 2022-23



Energy consumption profile for the year 2021-22 and 2031-32





Demand Projections

Demand Projections as 20th EPS

Source: 20th EPS

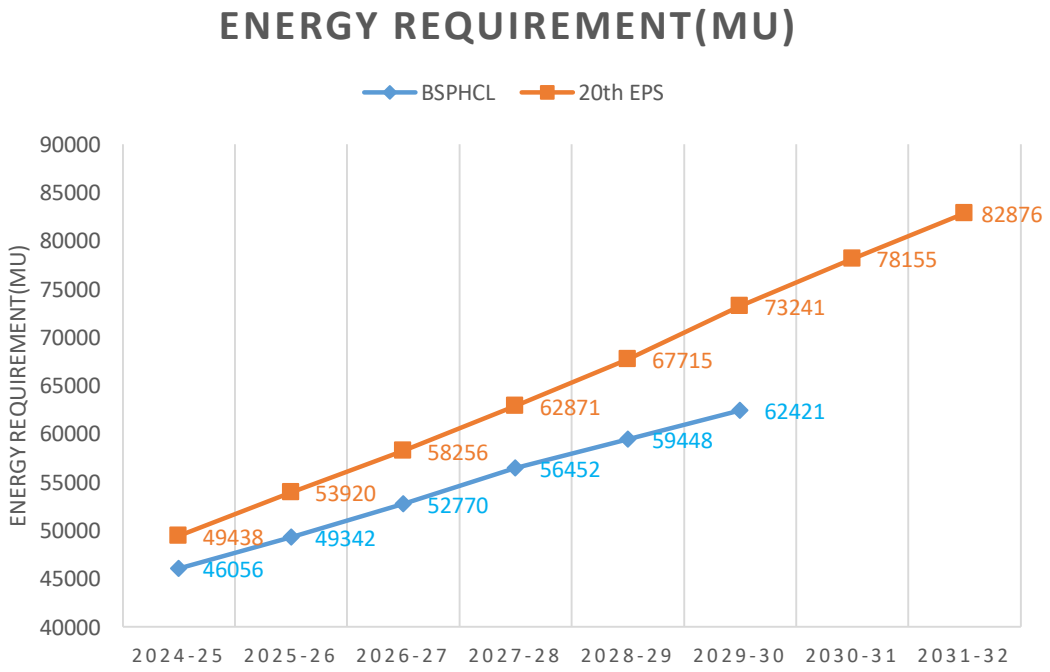
Energy Requirement (MU) and Peak Demand (MW) Projections								
	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32
Energy Projections (MU)	49438	53920	58256	62871	67715	73241	78155	82876
Year on Year Growth (Energy)		9.1%	8.0%	7.9%	7.7%	8.2%	6.7%	6.0%
Peak Demand Projections (MW)	8908	9743	10553	11416	12326	13360	14276	15159
Year on Year Growth (Peak)		9.4%	8.3%	8.2%	8.0%	8.4%	6.9%	6.2%

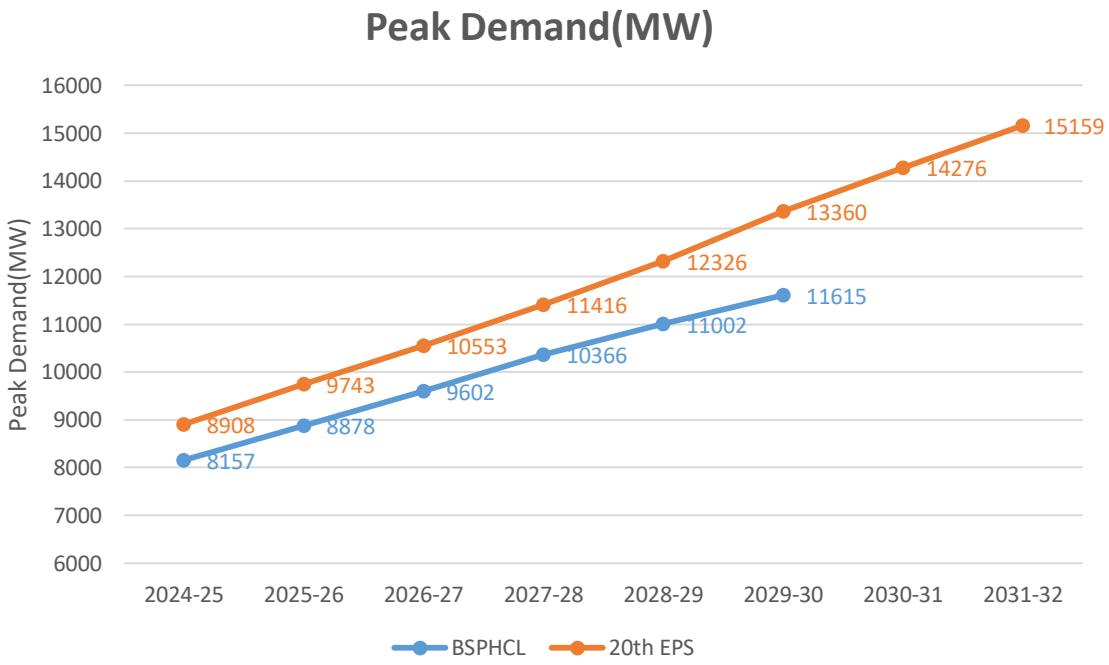
Demand Projections as per state

Source: State Planning Cell

Energy Requirement (MU) and Peak Demand (MW) Projections						
	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30
Energy Projections (MU)	46056	49342	52770	56452	59448	62421
Year on Year Growth		7.1%	6.9%	7.0%	5.3%	5.0%
Peak Demand Projections (MW)	8157	8878	9602	10366	11002	11615
Year on Year Growth		8.8%	8.2%	8.0%	6.1%	5.6%

20th EPS vs State demand projections





- State Energy Requirement and Peak Projections is less than the 20th EPS projections.
- The 20th EPS projections has been extrapolated for the year beyond 2031-32 with a similar growth rate as seen in the years till 2031-32.

Key Takeaways

Year	Actual	As projected in 20th EPS	Projection as per state
Energy Requirement(MU)			
2021-22	36216	36239	
2022-23	39545	41814	-
2023-24	38624	45560	-
Peak Demand(MW)			
2021-22	7154	6923	
2022-23	7852	7495	-
2023-24	8049	8184	-

RA studies for the State of Bihar has been carried out considering 20th EPS Projections.

Year Wise Contracted Capacity Addition Plan of Bihar

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**

Source: BSPHCL

RPO trajectory (as per Ministry of Power gazette notification dated 20th October, 2023)

Sl. No.	Year	Wind renewable energy	Hydro renewable energy	Other renewable energy	Distributed renewable energy	Total renewable energy
1	2024-25	0.67%	0.38%	27.35%	1.50%	29.91%
2	2025-26	1.45%	1.22%	28.24%	2.10%	33.01%
3	2026-27	1.97%	1.34%	29.94%	2.70%	35.95%
4	2027-28	2.45%	1.42%	31.64%	3.30%	38.81%
5	2028-29	2.95%	1.42%	33.10%	3.90%	41.36%
6	2029-30	3.48%	1.33%	34.02%	4.50%	43.33%
7	2030-31	40.50%			5.00%	45.50%
8	2031-32	41.50%			5.50%	47.00%
9	2032-33	42.30%			6.00%	48.30%
10	2033-34	43.00%			6.50%	49.50%

Note:- RPO trajectory for the years till 2029-30 is considered based on MoP RPO Notification dated 20th October,2023. RPO targets beyond 2029-30 is considered based on RE generation in National Electricity Plan (Vol-I Generation) (2022-32).

TOTAL ENERGY REQUIRED TO MEET RPO (MU)

Sl. No.	Year	Wind renewable energy (MU)	Hydro renewable energy (MU)	Other renewable energy (MU)	Distributed renewable energy (MU)	Total renewable energy (MU)
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	28007
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

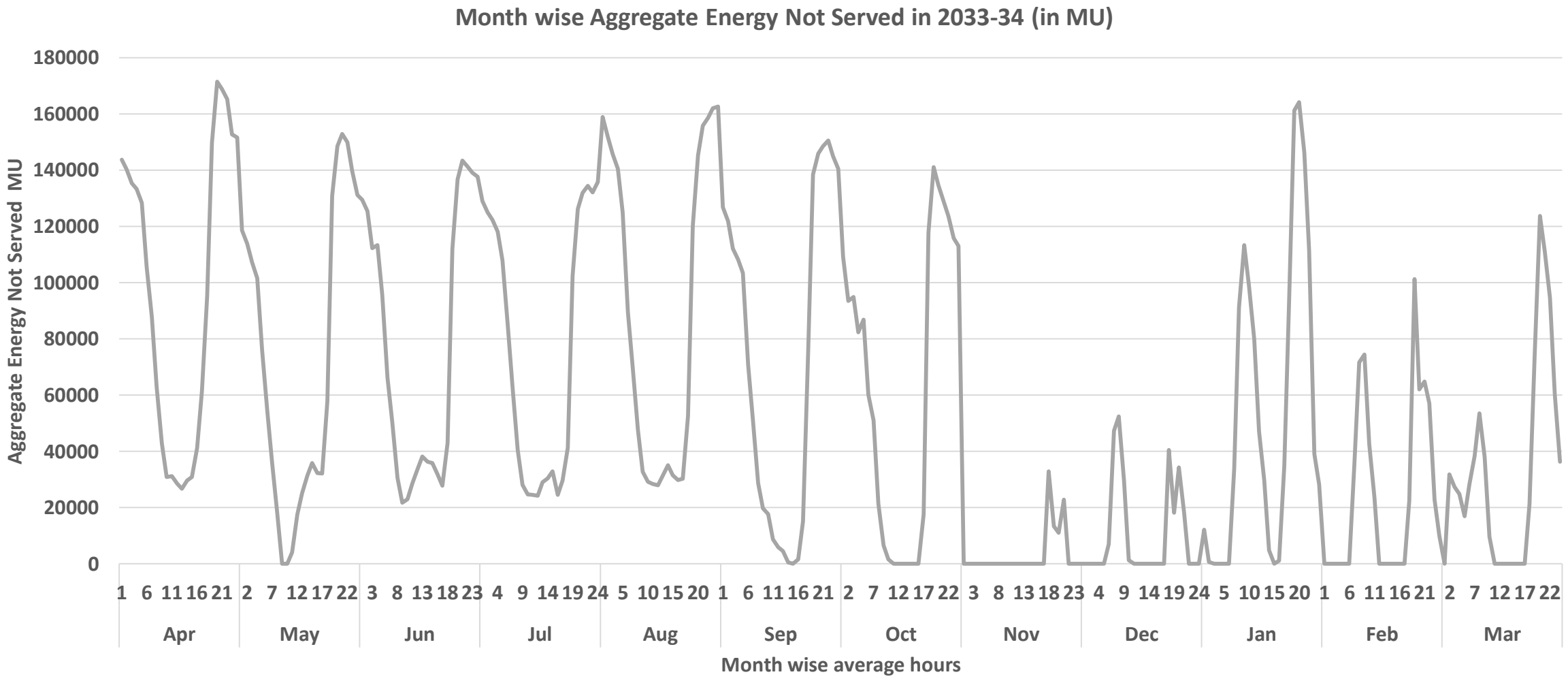
Source wise year on year RE capacity required to fulfil RPO

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**

Bihar
Result Analysis

Month-wise Energy Not Served in 2033-34

(Considering only the Existing and Planned Capacity Addition as furnished by state)



Assumptions for the Resource Adequacy Studies(1/2)

- Investment options given to the model to meet the unserved energy (ENS)
  - Coal, STOA/MTOA.
  - Storage options (PSP, Battery).
- CAPEX considered:

Technology	CAPEX (Rs/MW)	Fixed O&M (Rs/MW/year)
Coal	8.34 Cr	19.5 Lakhs
PSP	7 Cr	35 Lakhs
Battery (2 Hr)	3.65 Cr in 2026-27 to 3.13 Cr in 2031-32	1.5 Lakhs
Battery (4 Hr)	5.63 Cr in 2026-27 to 4.71 Cr in 2031-32	4 Lakhs

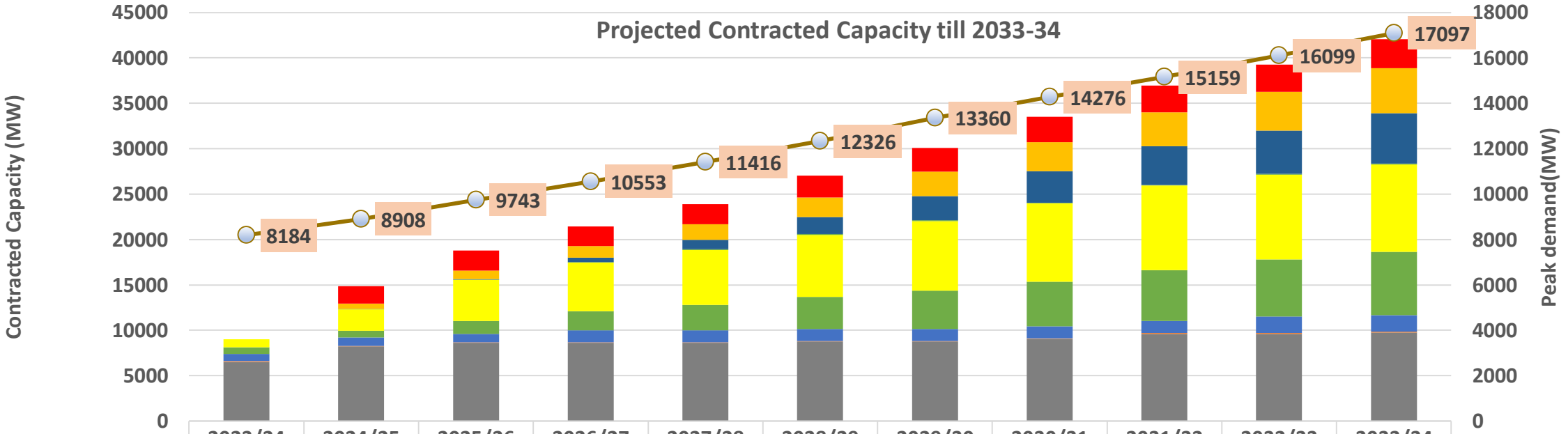
Assumptions for the Resource Adequacy Studies (2/2)

- For doing reliability analysis the range of variation considered for generating the samples of different system parameters is as below:

SI No.	System Parameter	Range of Variation (in %)
1.	Forced outage of conventional generators	10±5
2.	Solar Generation	±5
3.	Wind generation	±50
4	Hydro generation	±5
5.	Demand*	±15

*Based on the hourly variation of demand for the year 2021-22 and 2022-23.

Projected Contracted Capacity of Bihar 2025-34 to meet the demand



	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	2410	2600	2790	2980	3000	3190
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

Recommended Year-Wise Capacity Addition (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

Conclusion

- 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).
- Share of Thermal is 73% of present contracted capacities (6516 MW) decreases to 25% by 2033-34.
- Around 1000 MW of additional Coal based capacity required in 2033-34 (beyond under construction/ planned).
- Year on year STOA/MTOA/Banking arrangement/Bilateral arrangement to meet the power deficit in peak hours during peak is:

Year	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34
STOA/MTOA/ Bilateral contracts	1917	2209	2163	2220	2022	1900	1800	1700	1600	1500

- 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%).

Thank You