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India SMART UTILITY Week 2025

Session : Demand Forecasting using AI/ML model

PRESENTATION TOPIC

Presented By

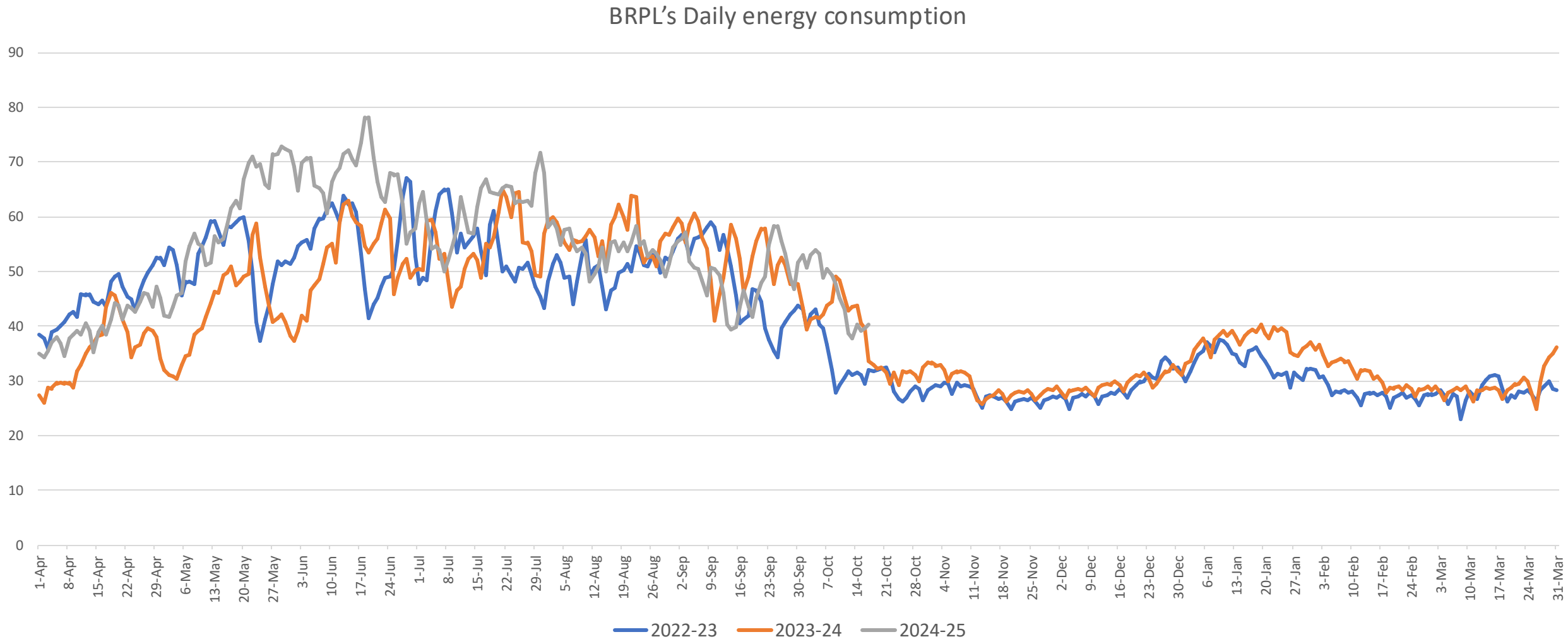
T Murthi, Addl. Vice President, BSES Rajdhani Power Ltd

Importance of Demand Forecast

- Power purchase cost constitute 70% - 80% of total cost of supply for discom
- Diversity in different state power demand is an opportunity for discom to management its cost
- Power exchange / Deep portal provides additional lever to manage demand
- Understanding of different consumer needs / mix for shifting of demand to maximize use of green power

Data based decision making and optimization of power purchase cost

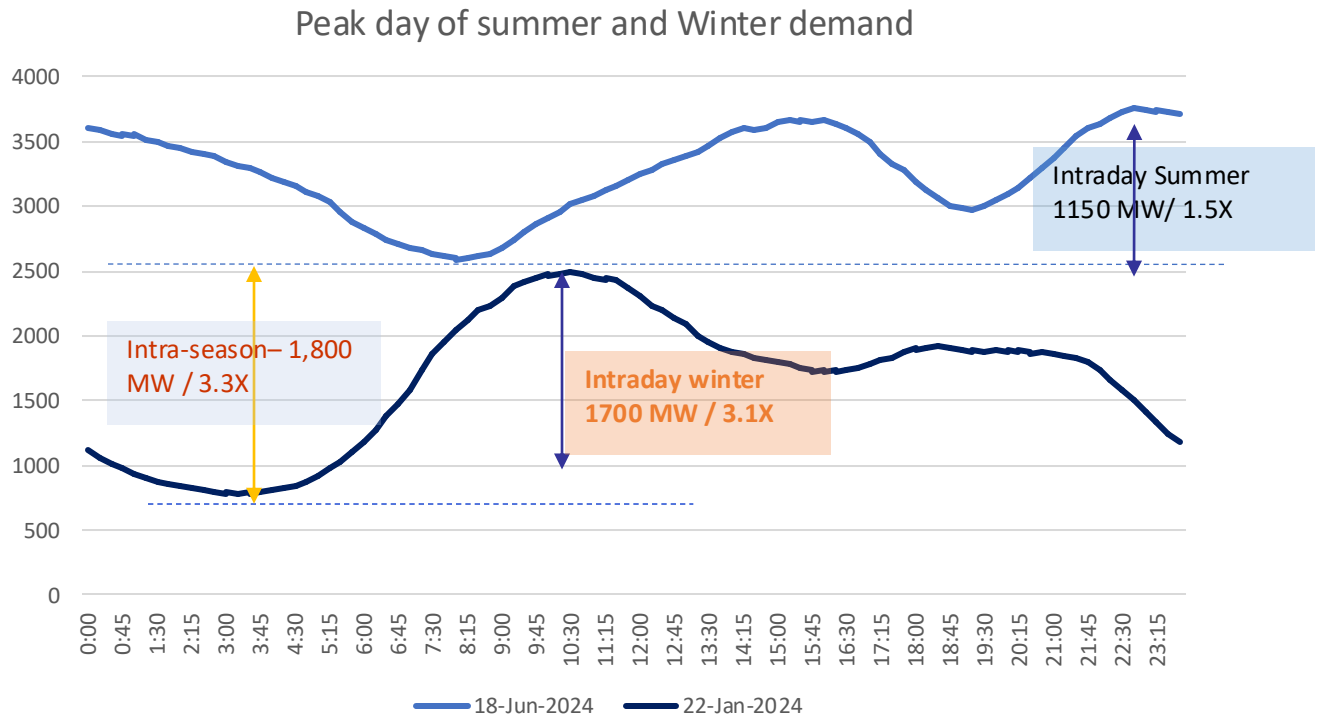
BRPL Demand Pattern



Weather extremes are normal due to climate change

Demand side challenges

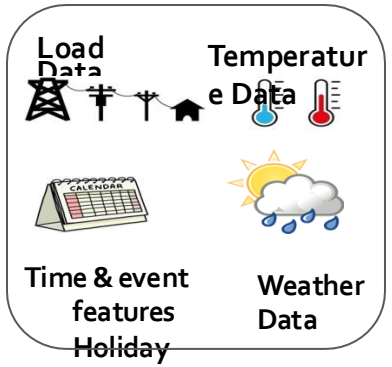
- Day – Night load variation of 1.5X during summers and 3.1X during winters, leading to potential surplus of RTC power
- Significant seasonal load variations to the tune of 3.3 X (winter to summer)
- Quick ramping requirement during evening and morning time when significant demand availability changes
- Due to unpredictable weather changes like rain, thunder storm demand drops up to 1500 MW within 6/8 slots



BRPL MW Demand	No. of Hrs (Summer' 19)	No. of Hrs (Summer' 21)	No. of Hrs (Summer '22)	No. of Hrs (Summer '23)	No. of Hrs (Summer'24)
3000 MW +	12.5	7	78	48	475
2,500 MW +	500	247	720	750	1505
2,300 MW +	1018	505	1307	1378	2158
2,000 MW +	2168	1296	2586	2452	3075

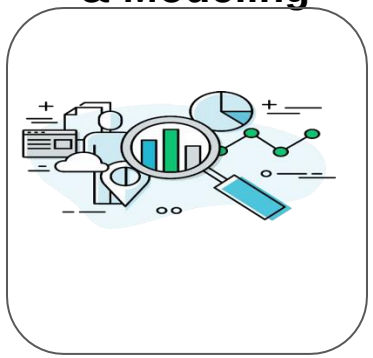
Demand Forecast using AI/ML Model

Data Collection



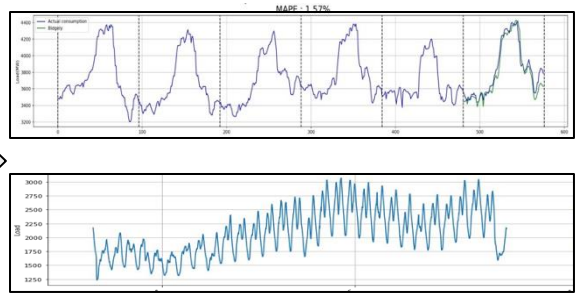
- Historical Demand Data
- **Weather Data from multiple sources-**
- Region Specific parameter identification
- Calendar Events
- Outages

Data Exploration & Modeling



- **Handling Data Issues- sanitisation**
- Dynamic Load Pattern for model correction
- **Combination of Weather Sources**
- **Special & Regional Events**

Day Ahead Forecast



Month Ahead Forecast

- **Intraday Forecast** every 15 minutes for next blocks
- **Day Ahead** - everyday at 8 am for the next day
- **Month Ahead** - 25th of previous month
- Seasonal forecast

Year	MAPE
FY 2020-21	4.31%
FY 2021-22	4.60%
FY 2022-23	3.89%
FY 2023-24	3.80%

Day ahead forecasting error reduced to ~3.8%

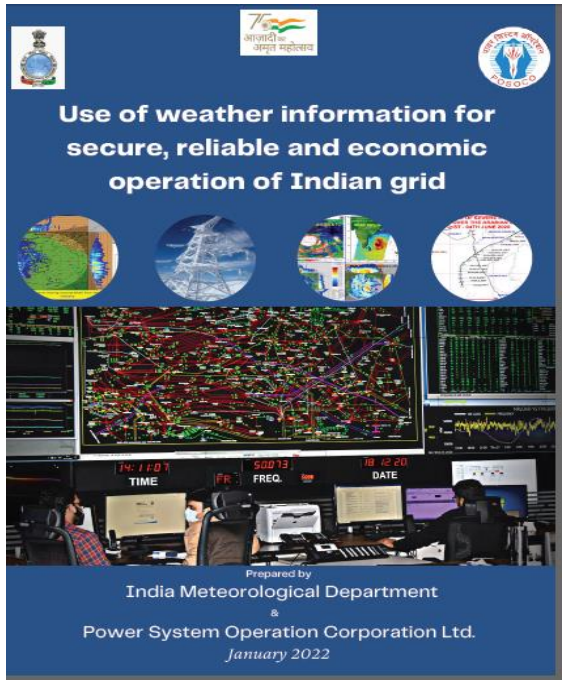
Intra-Day forecasting error reduced to ~2.0%.

Schedule Optimisation Using LP model

1. BSES has allocation from 50+ plants (Coal, gas, Nuclear, Hydro, Solar and Wind)
    a) Manual tracking of plant wise revision of DC / schedules, which is time consuming process.
    b) To optimize the Schedule based on ECR of plants, deployed Schedule optimiser application (Third party application) which will fetch declared capacities of all the plants and prepares schedule based on Merit Order dispatch.
2. The Schedule optimiser generates merit order drawl schedule based on
    a) ECR of coal and gas plants,
    b) ramp up / down rate,
    c) must run criteria of the plant
    d) technical minimum capacity and
    e) Forecasted demand

Schedule from long term tie up cost is optimised – Intra day & day ahead basis

POSOCO Report



5.2.9. Utilization of weather information by BRPL:

The Delhi's Discom BRPL was able to take proactive action to minimize its drawl from the grid and purchases from power exchange/bilateral contracts, based on the weather information obtained from IMD website. At BRPL, Day Ahead and Intraday demand forecast is done by AI and ML techniques (Artificial Intelligence and Machine Learning) which are data-driven techniques used to model complex relationships between inputs and outputs. The basis of machine learning is mostly statistical. Combinations of ensemble models are used for generating the best output. The input which goes into these forecasting tools are the historical data and historical and current weather parameters.

Meteograms published by IMD helps in Day Ahead demand forecasting which in turn leads to optimal use of available resources (generation) by way of practising Reserve Shut down options (RSD), balanced sale/purchase option in Day ahead Market (DAM)/ Real Time Market (RTM) etc. Further, the 3 hrs ahead weather advisory and live feeds of radar imagery finds its usefulness on volatile days in predicting changes in demand, based upon the intensity and approximate time of weather disturbances such as rainfall and thunderstorm as per radar imagery. The discom made significant savings by utilising weather portal. BRPL used meteogram to predict the increasing temperature and therefore anticipate the increase in demand, based on which requests were made to SLDC Delhi to bring additional generating units on bar. This also helped the Discom in following merit order despatch, by avoiding costly power purchase from power exchange during peak summer. During monsoon season, based upon prediction for thunderstorm/rainfall as per meteogram, decisions were made to reduce purchases from exchange/bilateral contracts while incorporating the above input in the Day Ahead demand forecasting. In addition to meteogram, live radar imagery helped BRPL in predicting reduction in intraday demand based on which timely revisions of its schedule were sent to SLDC for backing down of generating stations in anticipation of thunderstorms/ rain. By this action BRPL avoided under drawl of power, optimised distress sale on RTM and also ensured grid security. Further, it has helped System Operators in BRPL to minimize longer duration outages by way of putting off the feeders with less clearance, which are suspected to get damaged severely due to gusty winds and thunder storm. A few occasions where savings were made by the discom are as follows:

- **Both BRPL and BYPL are using AI/ML tools for Demand forecast and Schedule optimization**
- **POSOCO has highlighted the best practices adopted by us by the use of meteogram and radar imagery.**
- **This has resulted in limiting the under drawal quantum in case of sudden rainfall, putting plants in RSD to avoid loss on sale in case of day ahead prediction of rainfall**
- Earlier also POSOCO has show cased same in 134th OCC of NRPC

Challenges ahead to improve performance

- Availability of numerical weather forecast data
- Unpredictable EV load
- Unavailability of Real time rooftop generation data
- Demand Response
- Access to schedule data real time basis

KEY TAKEAWAYS

- Accurate demand Forecast critical for optimization of cost of power purchase
- Grid Security and power planning
- Maximize RE integration
- Ensuring uninterrupted supply to consumer

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THANK YOU

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