Load Forecast Development and Use at MISO

IRP Conference IURC
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Summary

Purpose

- Report on various MISO load forecast efforts across different time periods (3)

Key Takeaways

- Load forecasts used by MISO in the capacity auction (prompt planning year) originate from LSEs
- MISO operations use neural net models to help forecast for one week out to next five minutes
- Planning & Futures forecasts use a combination of LSEs' forecasts, the OMS survey along with energy policy goals and expected load additions from regional economic development

Planning Year Forecasts
(Resource Adequacy)

Tariff Requirements for Forecasts Used to Ensure Resource Adequacy

Module E-1, section 69A.1.1

a) Provide seasonal coincident peak demand, monthly non-coincident peak demand and net energy, LRZ peak demand.

b) Forecasts include peak demand behind any demand resources registered or not with MISO, and demand behind any EERs in operation within the last 4 years.

c) MISO reviews a sampling of submitted Demand forecast methodologies and inputs to ensure accuracy and consistency. If methodologies are inaccurate or inconsistent, MISO will work with the applicable LSEs to reconcile such issues.

d) All Demand forecasts shall reflect a 50% probability that the Demand will not exceed the forecasted Demand for the relevant period.

Forecast Review

- Random sampling of ‘large’, ‘small’ and ‘very small’ LSEs/EDCs
- Focus on coincident peak demand methodology, inputs & forecasted values
- Review of non-coincident peak & energy methodologies
- Reviewed LSEs whose forecasted coincident peak demands represent 52.4% of MISO’s expected summer peak demand

Reminders

NCP ‘good forecasting method’, by season?

- Data provided?
- Historic period meaningful?
- Statistical results meaningful?
- Supporting studies included?

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Forecast makes sense? By season?

- DSM & EE?
- Weather normalized?
- Accounting for distribution/transmission losses

APPENDIX: FORECAST DOCUMENTATION EXAMPLE LIST

- Narrative summary of non-coincident peak forecast methodology
- Narrative summary of net energy for load forecast methodology
- Narrative explanation of coincident peak forecast methodology
- Description of equations including:
  - Variables (data series) used
  - Full names
  - Abbreviations used
  - Description of variable
  - Data source
  - Links to data used in development
- Statistical output for estimations (as typically provided by software)
  - adjusted R^2
  - coefficient values
  - standard errors of coefficients
  - t-statistics of coefficients
  - standard error of regression
  - Durbin-Watson statistic
  - mean of dependent variable values used
  - standard deviation of dependent variable values used
  - time span of data employed in estimation
- Graphical depiction of residuals
- Tabular presentation of residuals
- Graphical depiction of fitted and actual dependent variable values
- Description of any adjustments made to data employed in equation

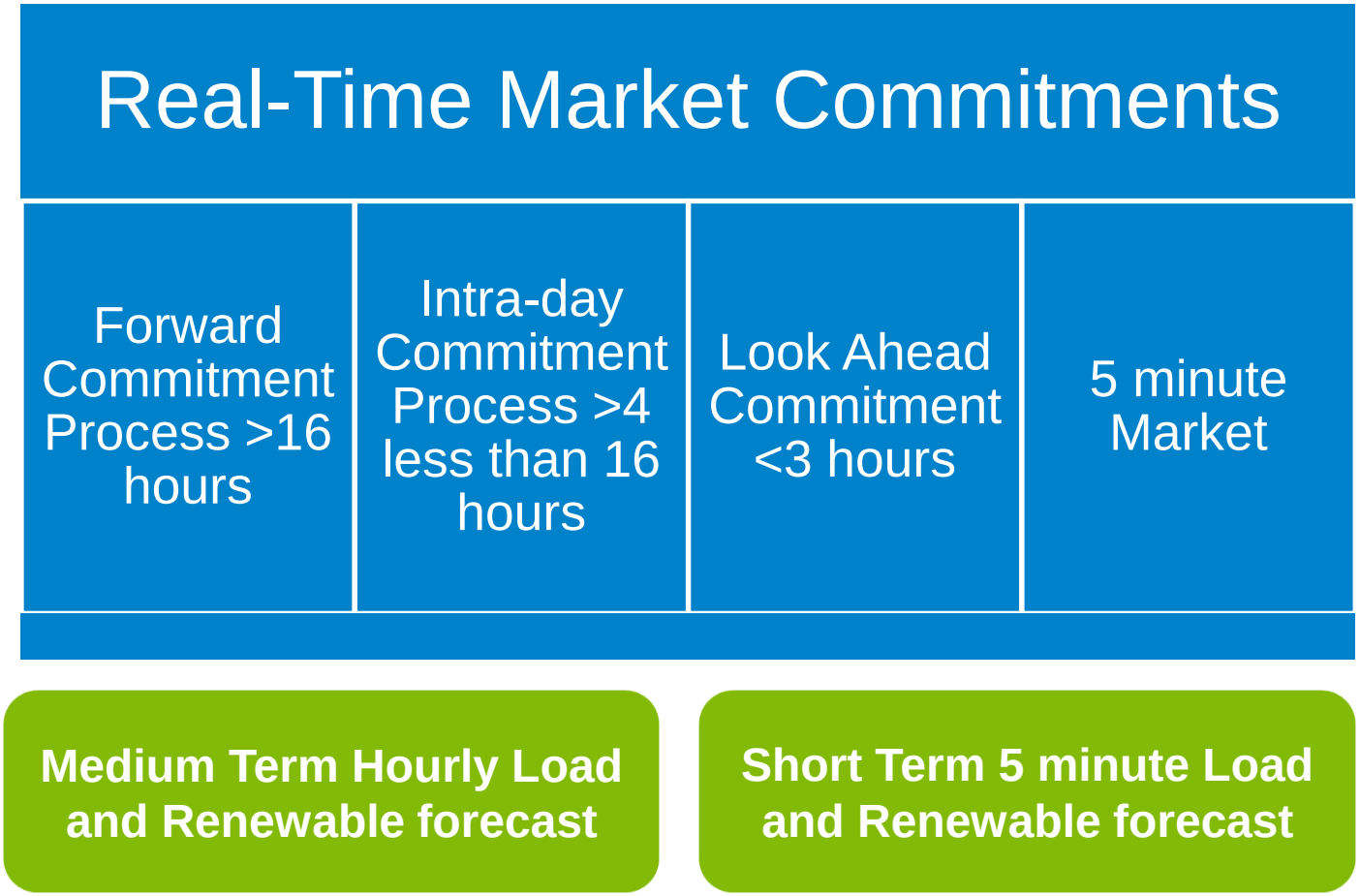
FORECAST DOCUMENTATION EXAMPLE LIST (cont'd)

- Non-statistical assessment of the reasonableness of the estimated coefficients
- Description of process used to determine forecast values used for independent ("explanatory") variables
- Narrative description of any load-shape studies employed
  - Description of sample customers
    - Geographical location
    - Customer class / type
    - Sample selection criteria
  - Duration and time-period of sample data employed
  - Links to complete study reports
- Provision of supporting studies used to justify end-use parameters
- Provision of supporting materials used to benchmark end-use results
- Name, phone number, and e-mail address of contact individual knowledgeable of forecast preparation details
- One-page summary of coincidence factor employed or resulting from coincident peak forecast methodology, including high-level schematic of general approach used

Operational Forecasts

(transmission security & power balance)

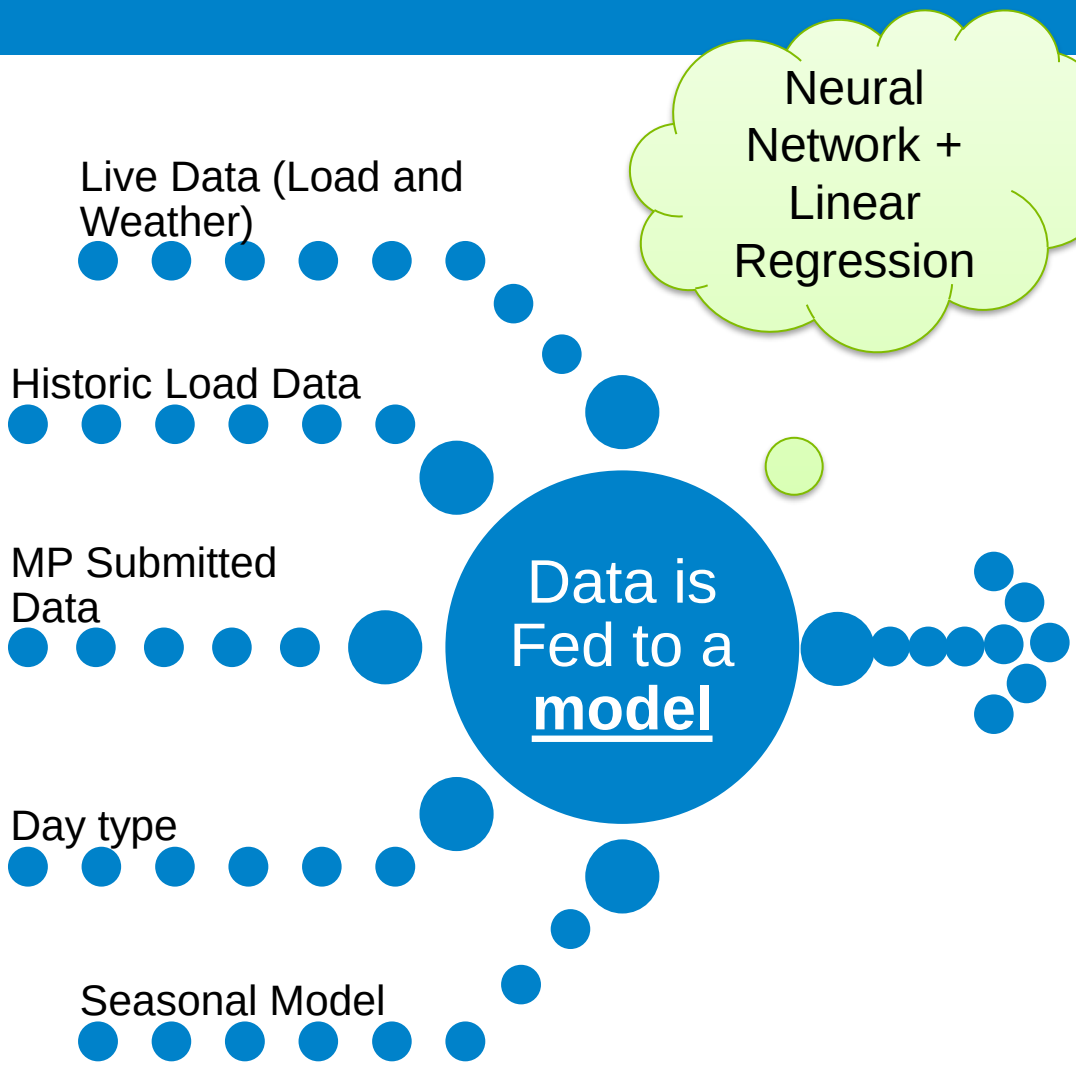
Forward and Real-Time commitment is highly dependent on forecasts



Responsibilities of MISO's forecasting function:

- Supply forecasts consisting of near real-time and hourly granularity for the next 7 days
- Maintain forecasting processes and applications, including the monitoring, alerting and resolution of issues
- Maintain compliant business processes
- Evaluate and report on forecast accuracies to peers and management

How do we build load forecasts?



Forecast is Produced

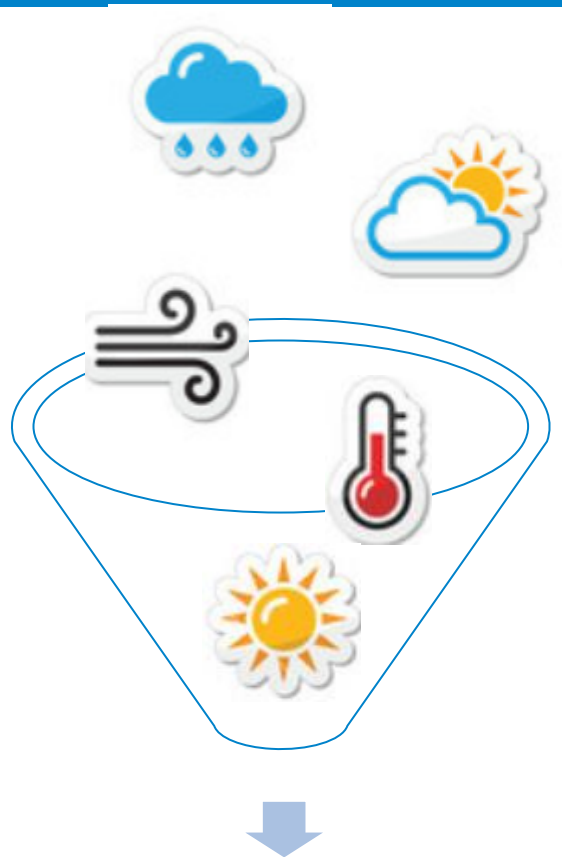
Staff can manually adjust it

Sent to customers

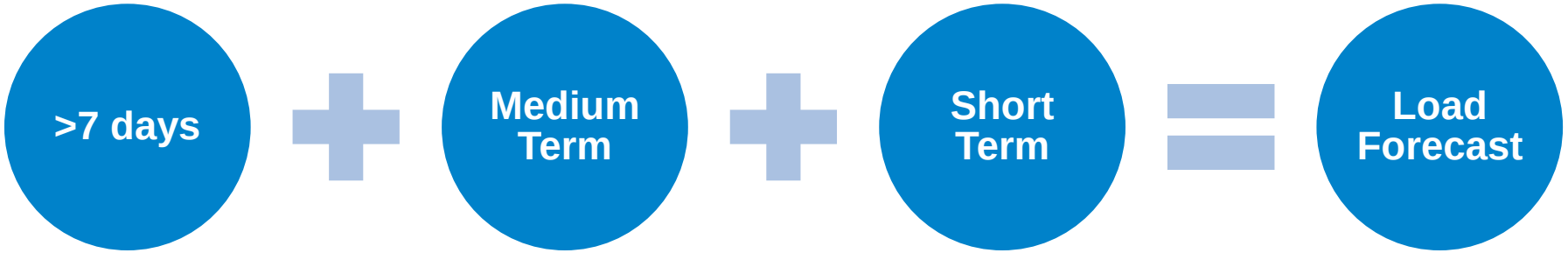
Customers do provide feedback

Weather Forecast Parameters

- Dry Bulb (Temperature)
- Dew Point (Humidity)
- Wind Speed
- Cloud Cover
- Sunshine Minutes
- Precipitation (Rain)



Load Forecasting is used by MISOs commitment & planning processes



Daily peaks for 31 days out forecasts are shared with other RTOs, and used by outage coordination

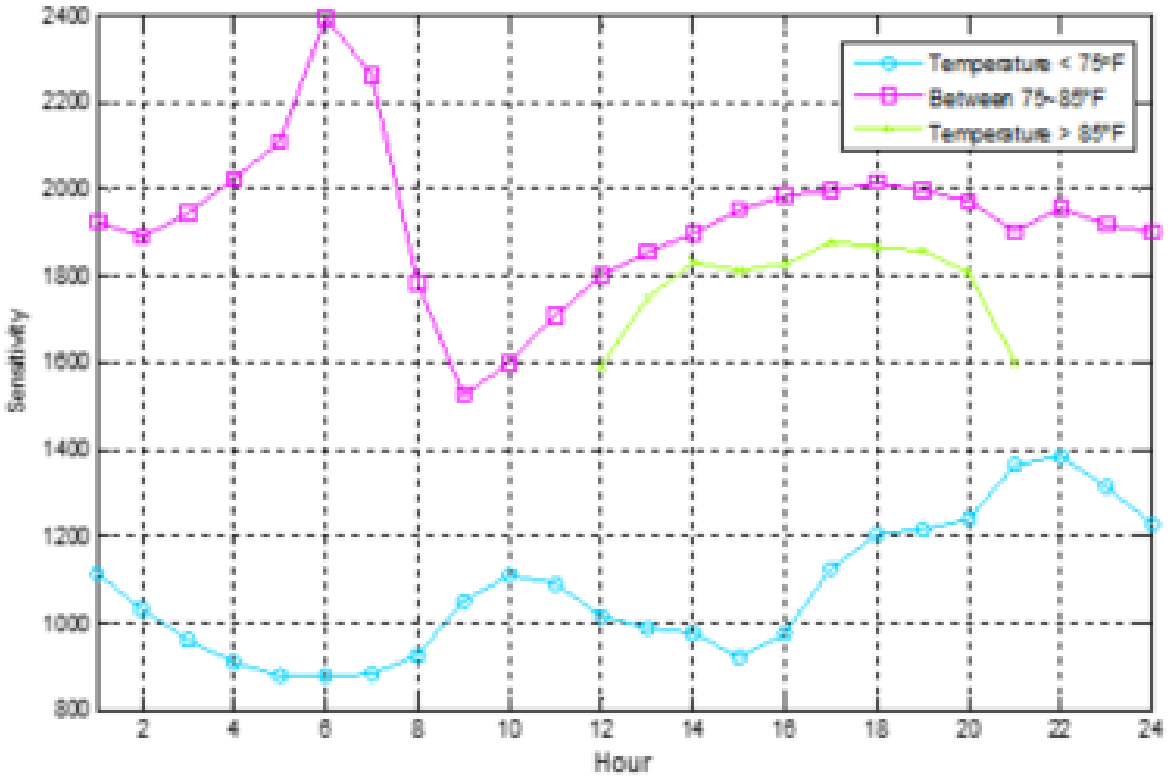
Medium Term Load Forecast (MTLF)

- Hourly Load Forecasts updated every 15 minutes extending 7 days out
- Used for control room planning

Short Term Load Forecast (STLF)

- 5-min forecasts updated every 5 minutes extending 6 hours out
- Actual Real Time Input load submitted at a 2 second frequency

Load is very sensitive to temperature forecast, especially in the summer



One degree of temperature forecast error results in up to 2000 MW of load forecast error

Planning and Futures Forecasts
(MTEP & LRTP)

Elements of MISO's longer term forecasting function:

- To perform reliability and economic planning studies needed to fulfill various NERC and Tariff compliance obligations
- Inputs: LSEs provide monthly energy & peak forecasts for the next 2 years, and on a seasonal basis for years 3 through 10, to conform with FERC form 714 and NERC MOD standards
- Inputs: SUFG provides energy & peak forecasts using publicly available data at the state level and at the local resource zone, as a check but mainly for sensitivity analysis
- Inputs: annual forecasts for DERs and electrification, with additional assumptions on hourly load shapes

Planning & Futures Forecast Review

- Deploy an hourly modeling approach that ensures standardization, consistency, and comparability across different forecasting scenarios and timeframes.
- Examine various drivers in load forecast assumptions, by market segment, using end-use forecasting techniques
  - Residential: EVs, electrification, distributed solar and building efficiencies
  - Commercial: electrification, DERs and building efficiencies
  - Industrial: data centers, electrolysis and increased efficiencies
- Strong engagement across MISO groups to better support consistency
- Strong engagement with stakeholders to ensure broad support

Appendix

Questions?

https://cdn.misoenergy.org/Peak%20Forecasting%20Methodology%20Review%20Whitepaper173766.pdf

https://cdn.misoenergy.org/MISO_Forecast_Template282957.docx

Contact

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