Load Forecast Model Development

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Resource Adequacy Planning
Planning Committee
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Consultant Engagement

- After an RFP process, PJM engaged with Itron starting in late April to perform a model review and to make recommendations for potential model enhancements as we transition to an hourly model for the 2023 Load Forecast.
  - Early discussion and feedback session at Load Analysis Subcommittee (LAS) on June 10, 2022
  - Itron presented their review and recommendations, and solicited feedback at LAS on July 28, 2022
  - Itron delivered their final report to PJM consistent with their presentation from July 28, 2022

Itron's Recommendations

1) Replace Annual/Quarterly End-Use Indices with Monthly/Daily Indices

2) Continue with Weather Simulation Approach

3) Replace Daily Models (Energy, Zone peak, and Coincident peak) with Hourly Load Models

4) Adjust Loads for Solar and New Technologies Through the Simulation Process

5) Capture Increasing Temperature Trends

Recommendation #1

1. Replace Annual/Quarterly End-Use Indices with Monthly/Daily Indices

Heating, cooling, and base-use load indices can be derived from monthly class SAE models. The SAE models are well documented, used by many utilities for long-term sales and energy forecasting, and are relatively robust in the sense that adding new data and dropping old data does not generally result in significant changes in the model parameters. Indices based on monthly (vs annual models) provide significantly more observations and as a result require fewer years of historical data; resulting in estimated model parameters that will be more representative of the current and forecast periods. Monthly models will also result in stronger heating and cooling coefficients because there is generally more weather variation in monthly data series than in an annual data series.

- Shift away from using annual data to benchmark heating, cooling, and non-weather sensitive trends and instead use monthly data
- Stronger models that better represent end-use trends and allow to use fewer historical years.

Recommendation #2

2. Continue with Weather Simulation Approach

Given the diversity of weather across PJM zones, it is nearly impossible to define a normal daily or hourly weather pattern for the entire system. The current method of developing load distributions from zonal weather simulations represents the best approach for estimating expected long-term demand. Twenty-years of historical weather data with 7 rotations within in each year provides a strong basis for simulating the distribution of load outcomes.

- Weather simulation offers ability to capture realistic diversity patterns across large geographic footprint
- Indicate that using 20 years and 7 rotations (2022 Forecast had 27 years and 13 rotations) should give a "strong basis" for the load distribution.

Recommendation #3

3. Replace Daily Models (Energy, Zone peak, and Coincident peak) with Hourly Load Models

The need to capture the impact of solar, EV, and other technologies that are reshaping demand requires an hourly modeling framework. Replacing the set of zonal daily models with the hourly model described in the report will meet this need. PJM should utilize the hourly rolling weather approach with two-part heating degree and cooling degree variables. PJM should interact these weather variables and other hourly model variables with heating, cooling, and base-use indices developed from the SAE models.

- Hourly models will provide more flexibility for incorporating future trends.

Recommendation #4

4. Adjust Loads for Solar and New Technologies Through the Simulation Process

To correctly account for solar, EVs and other load adjustments, the hourly projections for these technologies should be constructed to be consistent with the weather simulation process. Each load simulation can then be adjusted appropriately to reflect the impact of solar and other weather-sensitive technology adjustments for each simulation. The load impact of EVs and other non-weather sensitive technologies will also need to be adjusted within the simulation process, as the impact of EVs and other technologies on load depends on the net of solar simulation outcome. The adjusted hourly load simulations can then be post-process to derive zonal adjusted peak and energy and coincident peaks from the aggregation of the net zonal hourly load forecasts.

- Incorporate technologies into the simulation process at an hourly granularity.
- Better anticipation of technology impact on demand shapes and the resulting peaks.

Recommendation #5

5. Capture Increasing Temperature Trends

Long-term temperature trends should be evaluated for each of the planning zones with results used to adjust cooling and heating indices that are inputs in the hourly load models. We expect to see increasing temperatures across the PJM service area that will contribute to an increase in cooling requirements and a decrease in space heating loads. Zone-level temperature trends can be used to construct trended HDD and CDD that are in turn incorporated into the heating and cooling model indices.

- Ongoing climate trends could have an impact on future space heating and cooling needs.
- Long-term forecasts should take these trends into consideration.

Load Forecast Plan

- PJM is in the process of evaluating Recommendations 1-4 for the 2023 Load Forecast, and will report on its progress through LAS (met 9/12/2022 and will meet 10/27/2022).
  - Part of Recommendation #2 calls for shortening the weather history used in the simulation to 20 years. We plan on running a sensitivity to gauge the impact of this change prior to deciding on whether to incorporate.

- Incorporation of Recommendation #5 (climate trends) will require additional thought and education with stakeholders. Tentative plan to incorporate with 2024 Load Forecast following stakeholder engagement and review.

Contact

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