

Introduction

At the April 3rd MIC meeting PJM asked stakeholders to submit questions to PJM regarding Energy Efficiency in PJM's load forecast. Below is a list of questions received along with PJM answers. On page 8, a table with additional educational presentations related to Energy Efficiency throughout this MIC process is listed.

Questions Received/PJM Answers

- 1 |** If someone invented a new EE technology that was wildly successful and installed in tens of millions of homes next year. How would that make it into the load forecast? If there was corresponding load growth, say from EV adoption and electrification, would PJM be able to distinguish between the sources of increase and decrease? Does such distinction matter to PJM?

A: PJM's forecast is a top down model therefore, we do not distinguish between every individual impact. Some of the changes will be implicitly captured in historical loads and others are more explicitly captured such as EVs.

PJM has continually incorporated new technologies in the load forecast with solar in 2016, battery 2022, and EV in 2020. Another possibility would be to use Manual 19 Attachment B process for this new technology as a large load adjustment, but this would be information we would receive from EDC/LSEs.

- 2 |** EIA tells us that the AEO is a projection (not a prediction) based on current policies, programs, etc. When a significant new state (or federal) program launches, how does that make its way into the PJM Load Forecast? For instance, the IRA has lots of EE incentives. How and when do those programs show up in the PJM Load forecast?

A: Once the program is modeled in the EIA AEO data, it will flow into the PJM Load Forecast. However, PJM's forecast is a top down model therefore, we do not distinguish between every individual policy.

- 3 |** PJM acknowledges that the RECs (residential) data is based on a 2015 study (CBECs is from 2012) but says it has also been updated since then so the data is still valid. Do the updates include field studies, extrapolations, or something else? If the latter, should EE providers apply similar extrapolations to TRM data to keep them current?

A: The RECS/CBEC data is used in the EIA AEO.

https://www.eia.gov/outlooks/aeo/assumptions/pdf/RDM_Assumptions.pdf
https://www.eia.gov/outlooks/aeo/assumptions/pdf/CDM_Assumptions.pdf

- 4 |** Does PJM know which specific utility programs are used for each census sector study? How is that different from and/or reconciled with this (from the LF Supplement):

- American Electric Power – all appliance categories through 2021
- Allegheny Power – all appliance categories through 2016
- American Transmission Systems, Inc. – all appliance categories through 2016
- Commonwealth Edison – all appliance categories for 2019
- Duke Energy Ohio and Kentucky – all appliance categories through 2014

- East Kentucky Power Cooperative – Heat Pumps for Heating and Cooling, Electric Furnaces, Secondary Heating (Room Heating), Central A/C, Room Air Conditioners, and Water Heaters through 2013
- Jersey Central Power & Light – all appliance categories through 2016
- Metropolitan Edison – all appliance categories through 2016
- Pennsylvania Electric – all appliance categories through 2016
- Dominion Virginia Power – Heat Pumps for Cooling, Central A/C and Room Air Conditioners through 2014

A: PJM annually solicits EDCS to provide any load research data that they may have. This is provided in the form of saturation rates for different appliances. This data does not pertain to utility programs.

All saturation data provided is in the estimation period, not in the forecast period. Forecasted saturation values are derived by splicing the historical zonal-provided values with the data provided by Itron. All appliance category efficiency values are from Itron.

5 | From NREL ResStock FAQ's: Question: "What year does the baseline building stock represent?"

Answer: The building stock represents, as closely as possible, the U.S. building stock as it was in 2018." Is PJM changing building stock projections or treating such values as static values? If it is projected, how is that done?

A: PJM uses the NREL ResStock data to calibrate zones for 2018 to help provide granularity across PJM. Once calibrated to 2018, the projections are driven by the EIA AEO data.

6 | What are the input variables in the Itron model that PJM adjusts or relies on for EE projections? For instance, does PJM make any changes to the EIA assumptions regarding rebates for heat and cooling equipment?

A: PJM does not make changes to EIA data for rebates.

7 | The 2023 AEO relies on CBECs data from 2012. In the MIC and other PJM forums we have learned a lot about the growth of data centers in PJM. That has prompted special attention for certain forecasting (e.g. large load additions). Has it impacted the CBECs assumptions related to commercial end use intensities and drivers? If so, how so? Has kwh/GDP modeling changed? Has cooling kwh/sqft changed?

A: PJM removes historical data center load from our Commercial sector data used to help inform our understanding on usage trends.

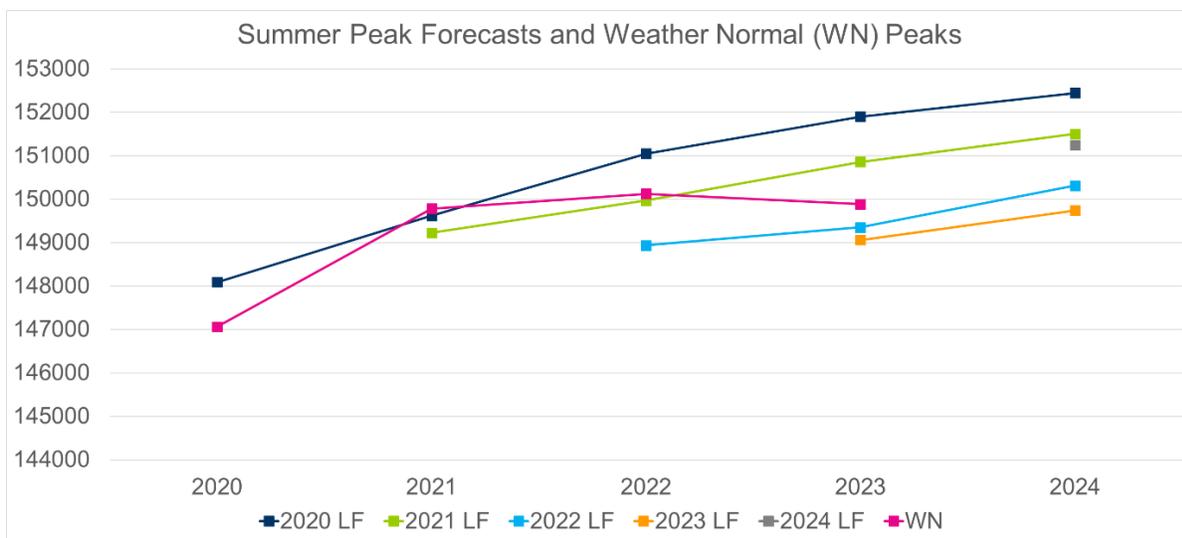
8 | CBECs was updated in 2018 and will be included in the 2025 AEO. RECs was updated in 2020 and will be included in the 2025 AEO. So EIA takes 5+ years to parse field study results. What's the rationale for PJM to accept this delay for Load Forecasting but require TRM's to be completed and analyzed within 3 years to qualify for market participation? Does the AEO cadence have implications for how best to apply it as a long term forecasting tool (i.e. maybe it is appropriate for 5+ years out but not for the immediate future)?

A: PJM's forecast models are using this data to calibrate historical data. This step allows the forecasted trends to be aligned with the calibrated history.

9 | What's the deviation between the load forecast 4 yrs in advance vs. the measured load? How would this be impacted by zeroing out the load forecast EE growth assumptions (e.g. locking energy intensity saturation values), and using the actual cleared EE for the 4 yr growth expectation?

A: Below is a snapshot of the last five official PJM Load Forecasts relative to Weather Normal. Keep in mind that the methodology has changed over those years. Only the 2023 Load Forecast and 2024 Load Forecast were conducted using the current hourly forecast methodology.

The 2023 Load Forecast was used as the basis for the 2024 BRA Planning Parameters. If we zeroed out the efficiency improvements in the 2023 Load Forecast, we would have forecast 151,921 MW rather than 149,737 MW. If we then take that modified forecast and use the actual cleared EE (7,669 MW), we would have 144,252 MW compared with a currently anticipated summer peak forecast of 151,247 MW.



10 | Would it be possible to remove the capacity payment impact on EE by removing capacity revenue amounts from the EIA's modeled assumptions? E.g. let's say 10% of the cleared EE capacity for 24/25 is for HVAC incentives. Let's say that's \$1mm of incentives in a given LDA. Could you model the loss of \$1mm of HVAC incentives/rebates/etc in that LDA using the Itron SAE tools?

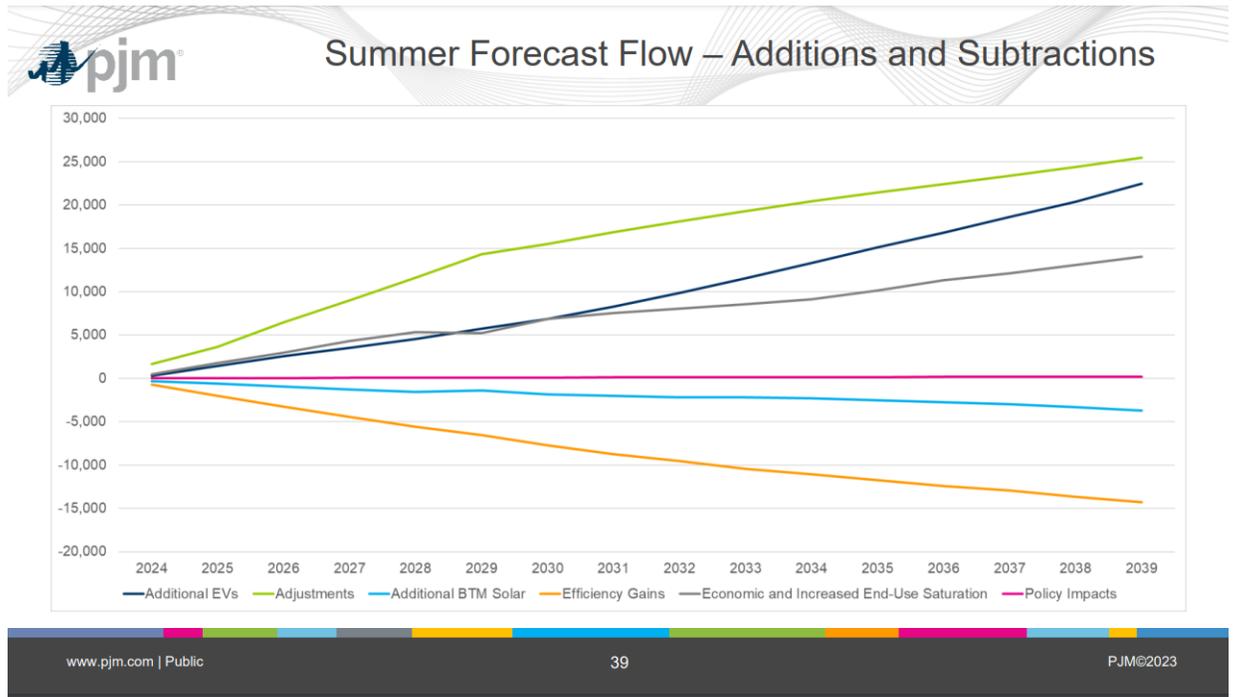
A: We do not have that capability.

11 | In the AEO, EIA says they do not model Low Income EE programs. Does that mean that programs targeting low income households are not in the load forecast? Or is there some additional change that PJM has implemented to bring in these programs?

A: PJM's forecast is a top down model therefore we do not distinguish between every individual program.

12 | From earlier presentations, it looks like PJM is modeling roughly 900 MW/yr of EE. How did you produce the numbers for that graph?

A: The reference is to slide 39 here: <https://www.pjm.com/-/media/committees-groups/subcommittees/las/2023/20231127/20231127-item-03---2024-preliminary-pjm-load-forecast.ashx>



This sensitivity was performed by holding the respective forecast drivers such as end-use efficiency constant at current 2023 levels and seeing how much the forecast would have been higher or lower. This sensitivity is incremental from the starting point whereas capacity market participation usually covers multiple installation periods. Moreover, PJM’s model is a statistical model and not modeling individual sites like EE resources.

13 | Does the load forecast model leakage? If so, how?

A: No.

14 | 4 years of EE eligibility seems to be based on 2 things: 1) the initial model of EE participation prior to the load forecast’s inclusion of EE and 2) FERC guidance related to fairly compensating these resources. In light of the fact that the load forecast necessarily sees a widening confidence interval the farther out we go from the most recent actual load reconciliation (i.e. annual load forecast update), what is the time period of uncertainty for which financially assured EE would be most valuable for PJM to mitigate risk and protect reliability?

A: PJM believes the forecast properly accounts for future load patterns including the change in the electricity consumption for “EE”.

15 | How does PJM adjust the EIA census region level data to cover the PJM specific territory?

A: Individual zones are modified by economics, sectoral differences, and appliance mixes. Refer to Supplement sections Sector Models and Zonal End-Use Variable Calibration: <https://www.pjm.com/-/media/planning/res-adeq/load-forecast/load-forecast-supplement.ashx>

16 | (Related to question 6 and 15) If PJM makes adjustments to the EIA data what resources or other data are used to support those adjustments?

A: We use economic data and NREL data to benchmark.

17 | According to the PJM Load Forecast Supplement “In 1998, Miscellaneous represented about a fifth of non-weather sensitive uses and now represents about half...” How does PJM characterize the performance of “Miscellaneous” loads throughout the day and across seasons? As an example, dehumidifiers would appear to fall into this category. Does PJM assume that dehumidifiers run equivalently in the summer and winter?

A: PJM's forecast is a top down statistical model therefore we do not distinguish between every individual end use. We use data available to capture weather vs. non-weather sensitive uses. We cannot get down to granularity of dehumidifiers at present.

18 | Per the Load Forecast Supplement, PJM includes increased saturation of electric heating and water heating in the state of New Jersey based on NJ’s Executive Order No 316. What makes this Executive Order worthy of explicit consideration? Has PJM asked NJ whether EE capacity revenues are contemplated as a contributor to achieving their goals?

A: The State Of New Jersey's Executive Order No. 316 is an executive order signed into law by Governor Phil Murphy on February 15th, 2023. Since it is signed into law PJM included it in the 2024 Load Forecast. PJM did not ask NJ about energy efficiency capacity revenues.

19 | The 2022 PJM Model Review states that 10-years of monthly models could be used to inform the current period end-use mix. How many years of historical data are used in today’s model, which is informed by quarterly end-use indices? Does end-use mix from 2014 receive equivalent weight to 2023 data? Relatedly, does it mean that end use mixes take ten years (or more) to be fully accommodated / internalized by the model? In transitioning from annual to monthly modeling, Itron recommends ten years as an acceptable period. What’s the optimal, statistically informed look-back period?

A: The Residential, Commercial, and Industrial models use monthly data from 2013-2022. Final model is estimated January 1, 2014 – August 31, 2023.

Historical end-use data is not weighted in any way.

From Itron’s report pg. 12: <https://www.pjm.com/-/media/planning/res-adeq/load-forecast/pjm-model-review-final-report-from-itron.ashx>

“Moving to monthly models addresses this issue; ten years of historical data gives 120 observations vs. 10 observations in an annual model. The shorter historical period will result in indices that are more reflective of current period end-use mix and economic activity impacts.”

20 | The 2022 PJM Model Review states: “The model variables are constructed by combining long-term annual saturation and efficiency trends (the end-use stock variables) with monthly weather, household income, and household size (the monthly utilization variables). The coefficients – bc , bh , and bo are estimated using linear regression that relates average residential use to the constructed end-use model variable.” Can Itron or PJM explain the use of a linear model when energy use and income are substantially decoupled in the United States

and in fact Energy Usage Intensity (EUI) shows that low income houses have a higher EUI than higher income households?

A: PJM's model is a statistical model that is not forecasting individual households. Inherent in PJM's modeling, is a distribution of households with a distribution of behaviors.

21 | Itron suggests the incorporation of AMI data to improve hourly estimates. Does PJM intend to pursue this improvement? If so, when and in which zones?

A: PJM does not have AMI data and would need to receive any such data from our EDC/LSEs.

22 | Would the references and methods employed by the load forecast meet all of the requirements PJM currently has or intends to impose on EE resources in the market? For example, could an EE provider rely on the same temperature and weather sources cited by PJM in their M&V Plans and Reports? If so, could PJM standardize, publish and require such values to impose more uniform treatment across all EE?

A: PJM needs more information on this question. Is this a question about a proposal?

23 | In the 2022 PJM Model Review Itron presents several accuracy statistics regarding the existing model and proposed changes (e.g. pg 38 Peak Day Predicted...). For these predictions which load forecast is being used? I.e. when predicting the Jan 29, 2021 peak, is Itron showing their day-ahead, year-ahead, 3-yr, etc. forecast accuracy?

A: These were in-sample tests.

24 | "Updated estimates for the SAE inputs are produced annually, but the underlying research that leads to major updates take several years to develop and process, and as a result, we place these in the Other category." Can PJM be more specific than "several years?"

A: This is from the Itron report pg. 46. It refers to the SAE saturation and efficiency data but PJM cannot be more specific regarding "several years".

25 | Itron articulates: "...growing interest on the part of system operators and planners in quantifying hourly load uncertainty." What data would be most helpful with respect to end use to better inform, understand and quantify hourly load uncertainty?

A: Data related to future policy impacts on hourly load including steering towards particular technologies would be most helpful.

26 | From the 2022 PJM Model Review: "the underlying information on new technologies including number of units sold and associated efficiency information are updated on an on-going basis; this information is derived from annual appliance shipments data." What are the sources, statistical significance and time-delay on the "annual appliance shipments?"

A: PJM is a consumer of the data and use it in our top down statistical modeling. Specific questions on composition of the data would be best directed towards the EIA.

27 | For Large Load Adjustments, “PJM relies on Dominion for the first five years of the load projection; this makes sense since Dominion works directly with their data center customers as Dominion plans and builds capacity for future needs.” Might a similar rationale be appropriate for separating EE, i.e. rely on EE providers who work directly with the efficient product installers, sellers and users for the first five years of load projection?

A: PJM made revisions to our Manual 19 Attachment B process in 2023. We now ask for 15 years of forecast. From Manual 19 Attachment B pg 27:

- *Acquire an extended forecast of the adjustment from the EDC and/or LSE for the length of the long-term load forecast.*

Manual 19 Attachment B also lists historical data needed in order to avoid double counting in the forecast.

Table with educational presentations:

Date	Topic	Reference
4/11	RPM clearing process: EE Addback	https://www.pjm.com/-/media/committees-groups/committees/mic/2024/20240403/20240403-item-09b---ee-addback-education---imm.ashx
4/11	RPM clearing process: EE Addback history (just materials)	https://www.pjm.com/-/media/committees-groups/committees/mic/2024/20240403/20240403-item-09b---reference---irm-study-draft-manual-19-revisions---exeutvie-summary--nov-2015.ashx https://www.pjm.com/-/media/committees-groups/committees/mic/2024/20240403/20240403-item-09b---reference---irm-study-draft-manual-19-revisions---presentation---nov-2015.ashx
3/6	RPM clearing process: treatment of load modifiers	https://www.pjm.com/-/media/committees-groups/committees/mic/2024/20240306/20240306-item-08a---load-modifiers-education.ashx
3/6	Load forecast process: EE Addbacks	https://www.pjm.com/-/media/committees-groups/committees/mic/2024/20240306/20240306-item-08b---addbacks-and-energy-efficiency-in-the-load-forecast.ashx
2/7	EE education: Affirmed	https://www.pjm.com/-/media/committees-groups/committees/mic/2024/20240207/20240207-item-10a---energy-effieincy-education---affirmed-energy.ashx
2/7	Current state of EE in the capacity market	https://www.pjm.com/-/media/committees-groups/committees/mic/2024/20240207/20240207-item-10b---energy-efficiency-education-follow-up---pjm.ashx
2/7	Market concentration analysis	https://www.pjm.com/-/media/committees-groups/committees/mic/2024/20240207/20240207-item-10c---hhi-education---imm.ashx
1/16	EE education: IMM	https://www.pjm.com/-/media/committees-groups/committees/mic/2024/20240116-special/item-01---energy-efficiency-education---imm.ashx
1/16	EE education: PJM	https://www.pjm.com/-/media/committees-groups/committees/mic/2024/20240110/20240110-item-06b---energy-efficiency-education---pjm.ashx