COMMONWEALTH OF KENTUCKY
BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

ELECTRONIC APPLICATION OF EAST KENTUCKY POWER COOPERATIVE, INC. FOR 1) CERTIFICATES OF PUBLIC CONVENIENCE AND NECESSITY TO CONSTRUCT A NEW GENERATION RESOURCES; 2) FOR A SITE COMPATIBILITY CERTIFICATE RELATING TO THE SAME; 3) APPROVAL OF DEMAND SIDE MANAGEMENT TARIFFS; AND 4) OTHER GENERAL RELIEF	)	CASE NO. 2024-00370

TESTIMONY OF
ELIZABETH A. STANTON, PHD

ON BEHALF OF JOINT INTERVENORS
APPALACHIAN CITIZENS' LAW CENTER,
KENTUCKIANS FOR THE COMMONWEALTH,
AND MOUNTAIN ASSOCIATION

Public Version

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Dated: February 14, 2025

DIRECT TESTIMONY OF LIZ STANTON
ON BEHALF OF JOINT INTERVENORS
BEFORE THE PUBLIC SERVICE COMMISSION OF KENTUCKY

Case No. 2024-00370

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I. INTRODUCTION

Q. Please state your name and business address.

A. My name is Elizabeth A. Stanton, and my business address is 6 Liberty Sq., PMB 98162, Boston, MA 02109.

Q. By whom are you employed, and in what capacity, for the purposes of this proceeding?

A. I am the Executive Director and Principal Economist of the Applied Economics Clinic, a mission-based non-profit consulting group specializing in the areas of energy, climate, environment, and social equity.

I am providing comments and testimony on behalf of the Joint Intervenors, comprised of Appalachian Citizens' Law Center, Kentuckians for the Commonwealth, and Mountain Association.

II. BACKGROUND AND QUALIFICATIONS

Q. Please summarize your educational background and professional qualifications.

A. I earned my Ph.D. in economics at the University of Massachusetts-Amherst, and have taught economics at Tufts University, the University of Massachusetts-Amherst, and the College of New Rochelle, among others. I am the founder and Executive Director of the Applied Economics Clinic. I have an extensive publication record, including more than 180 reports, journal articles, books and book chapters as well as more than 60 expert comments and oral and written testimony in public proceedings on topics related to energy, the economy, the environment, and equity. I have submitted expert testimony and comments in Alabama, Connecticut, Indiana, Illinois, Louisiana, Massachusetts, Minnesota, New Hampshire, North

Carolina, Ohio, Pennsylvania, Puerto Rico, Rhode Island, South Carolina, Vermont, and several federal dockets. My work includes testimony and comments on Integrated Resource Plans, Certificates of Public Convenience and Necessity, climate plans, energy efficiency plans, alternatives to fossil fuel infrastructure, proposed pipelines, and energy storage.

Between 2014 and 2024, I have worked on numerous reports and testimonies focused on key energy topics in Southeastern and Southern states, including testimony regarding utility planning and rate cases such as natural gas price hedging in Florida (2017), rate cases in South Carolina (2020), and several utility plans in Washington, D.C. and Louisiana. Several of my reports addressed electrification and renewable energy, including assessments of electrification incentives in D.C. (2021) and renewable energy transition plans for utilities in Louisiana (2020) and Florida (2022). Energy infrastructure and carbon emissions were also key topics, including the impact of refinery activities in Texas (2023) and carbon capture strategies in Louisiana's power sector (2023). In additional, my energy policy analysis covered issues like net metering in Mississippi (2014), Tennessee Valley Authority's planning practices in Tennessee (2023), the Mountain Valley Pipeline in West Virginia (2019), and analyses of the Clean Power Plan and Clean Air Act § 111(d) targets, with reports in Alabama, Georgia, North Carolina, and Virginia assessing compliance.

In my previous position as a Principal Economist at Synapse Energy Economics, I led studies examining environmental regulation, cost-benefit analyses, and the economics of energy efficiency and renewable energy. Prior to joining Synapse, I was a Senior Economist with the Stockholm Environment Institute's Climate Economics Group, where I was responsible for leading the organization's work on the Consumption-Based Emissions Inventory ("CBEI") model and on water issues and climate change in the western United States.

My articles have been published in Ecological Economics, Renewable Climate Change, Environmental and Resource Economics, Environmental Science & Technology, and other journals. I have published books, including Climate Change and Global Equity (Anthem Press, 2014) and Climate Economics: The State of the Art (Routledge, 2013), which I co-wrote with my colleague at Synapse, Dr. Frank Ackerman. I also co-authored Environment for the People (Political Economy Research Institute, 2005, with James K. Boyce) and was a co-editor of Reclaiming Nature: Worldwide Strategies for Building Natural Assets (Anthem Press, 2007, with Boyce and Sunita Narain). My curriculum vitae is attached as Exhibit EAS-1.

Q. Have you previously testified before this or any commission?

A. I have not previously testified before the Kentucky Public Service Commission ("PSC" or the "Commission"). I have testified before utility commissions in Alabama, Connecticut, Illinois, Louisiana, Massachusetts, Minnesota, New Hampshire, North Carolina, Ohio, Pennsylvania, Puerto Rico, Rhode Island, South Carolina, and Vermont.

III. <u>PURPOSE OF TESTIMONY</u>

Q. What is the purpose of your testimony?

A. My testimony reviews and assesses the 2024 request for approval of Certificates of Public Convenience and Need ("CPCN") filed by East Kentucky Power Cooperative, Inc. ("EKPC" or the "Company") in Kentucky PSC Case No. 2024-00370. In this case, EKPC requests CPCN approval for three new or modified resources:

- 745 megawatt (MW) Integrated Combined Cycle Gas Turbine ("CCGT") facility at Cooper Station;

- Coal to natural gas co-firing conversion at Cooper Station Unit 2; and
- Coal to natural gas co-firing conversion at Spurlock Station Units 1-4.

In addition, EKPC seeks an "acknowledgment" that the proposed CCGT "will be the eventual replacement capacity for Cooper Station Unit 1 (nameplate capacity 116 MW) under KRS 278.264,"[1] but has not proposed or requested retirement of any existing generating units.

As I discuss below, EKPC explains that approval of its CPCN requests should be judged on the basis of inadequacy of existing service, absence of wasteful duplication, and performance of a thorough review of alternatives.

In my testimony I assess EKPC's: annual and peak customer demand forecasts, with a focus on its Winter Peak; assessment of alternatives supply resource options; modeling and resource selection methods; and rate impacts.

Q. Are you sponsoring any exhibits to your testimony?

A. Yes. I have prepared the following exhibits:

- Exhibit EAS-1 – a copy of my CV
- Exhibit EAS-2 – 2025 PJM Long-Term Load Forecast Report
- Exhibit EAS-3 – USDA Press Release: Historic Investment in Rural Communities
- Exhibit EAS-4 – Role of Battery Energy Storage Systems (BESS) in the ERCOT market. Aurora Energy Research

[1] Application, Case No. 2024-00370, at 19 (Nov. 20, 2024) ("Application"); Application Ex. 2, Direct Testimony of Don Mosier on Behalf of East Kentucky Power Cooperative, Inc., Case No. 2024-00370, at 17-18 (Nov. 20, 2024) ("Mosier Direct").

IV. BACKGROUND

A. Kentucky PSC CPCN Requirements

Q. What criteria does the PSC use to evaluate Certificate of Public Convenience and Need applications?

A. By statute, regulated utilities cannot construct or acquire any facility to be used in providing utility service to the public until it has obtained a CPCN from this Commission.[2] In order to obtain a CPCN, a utility must demonstrate to the Commission that there is a need for the proposed project and an absence of wasteful duplication.[3]

Demonstrating "need" requires:

> [A] showing of a substantial inadequacy of existing service, involving a consumer market sufficiently large to make it economically feasible for the new system or facility to be constructed or operated.
>
> [T]he inadequacy must be due either to a substantial deficiency of service facilities, beyond what could be supplied by normal improvements in the ordinary course of business; or to indifference, poor management or disregard of the rights of consumers, persisting over such a period of time as to establish an inability or unwillingness to render adequate service.[4]

Wasteful duplication refers to "an excess of capacity over need," along with "an excessive investment in relation to productivity or efficiency, or an unnecessary multiplicity of physical properties."[5] Demonstrating an absence of wasteful duplication requires a utility to show "that a thorough review of all alternatives has been performed," and "[a]ll relevant factors [have been] balanced."[6]

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[2] KRS 278.020(1).
[3] *Kentucky Utils. Co. v. Pub. Serv. Comm'n*, 252 S.W.2d 885, 890 (Ky. 1952).
[4] *Id*.
[5] *Id*.
[6] Final Order, *In re the Application of Big Rivers Electric Corporation for Approval of its 2012 Environmental Compliance Plan*, Case No. 2012-00063, at 14-15 (Oct. 1, 2012) (citations omitted).

B. EKPC System

Q. Who does EKPC serve?

A. According to EKPC's December 2024 *Load Forecast*, EKPC's 16 owner-member cooperatives served 530,007 residential customers, 36,937 small commercial customers, and 194 large commercial or industrial customers in 2023.[7] Total 2023 annual sales comprised 6.6 terawatt-hours ("TWh") residential, 1.9 TWh small commercial, and 4.2 TWh large commercial—with substantially smaller shares of sales to seasonal customers, and public buildings and lighting.[8]

Q. Does EKPC expect growth in customer demand over time?

A. Yes, EKPC expects significant growth in customer demand in all three major customer classes. In the 2025 to 2030 period, EKPC predicts 1.1% annual growth in residential customers' annual electric demand, 0.2% for small commercial customers, and 3.2% for large commercial customers.[9] Below in my testimony I call into question EKPC's annual customer demand and Winter Peak load, raising the possibility that both forecasts may be overestimated, resulting in the Company aiming for the wrong target when assessing its needs for new supply resources.

Q. What resources are owned or operated by EKPC?

A. According to the latest U.S. Energy Information Administration ("EIA") data, EKPC owns 3,653 MW of nameplate capacity, comprising: natural gas fired combustion turbines (1,679

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[7] Application Ex. 3, Direct Testimony of Julia J. Tucker on Behalf of East Kentucky Power Cooperative, Inc., Case No. 2024-00370 (Nov. 20, 2024) ("Tucker Direct"), Attach. JJT-2, Power Supply Analytics Department, *2025-2029 Load Forecast*, at 35-39 (Dec. 2024) ("Attach. JJT-2").
[8] *Id.* at 4.
[9] *Id.* at 2.

MW), conventional steam coal (1,952 MW), landfill gas (13.8 MW), and solar PV (8.5 MW).[10]

Q. Has EKPC filed CPCN requests for any additional resources apart from the Cooper and Spurlock CPCNs sought in this proceeding?

A. Yes. EKPC has filed a CPCN request in Case No. 2024-00310 regarding a new 216 MW reciprocating internal combustion engine ("RICE") facility (called "Liberty RICE"), which is currently still pending before the Commission. In April 2024, EKPC also filed an application for CPCNs in Case No. 2024-00129 for two proposed solar facilities, which were approved by the Commission in December 2024. Finally, EKPC has stated its intent to file, in the first quarter of 2025, a long-term hydro PPA and CPCNs for a possible four new solar facilities.[11]

V. ANNUAL AND PEAK DEMAND FORECASTS

Q. Please provide an overview of your assessment of EKPC's annual and peak demand forecast used in this CPCN application.

A. EKPC's annual customer demand forecast rises steeply over the next 15 years. Past EKPC annual demand projections have overestimated customer demand by millions of megawatt-hours ("MWh"). EKPC's Winter Peak forecast is substantially higher than PJM's expectations for EKPC Winter Peak load and relies on unverified and opaque assumptions regarding near-term (2025-2029) large customer load. In addition, EKPC increases its Winter

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[10] U.S. Energy Info. Admin., Form EIA-860 (2023), https://www.eia.gov/electricity/data/eia860/ (2023 ZIP file, 3_1_Generator_Y2023, "Operable" tab).
[11] Responses to Joint Intervenors' First Information Request to East Kentucky Power Cooperative, Inc. dated December 20, 2024, Case No. 2024-00370, Question 65 (Jan. 10, 2025) ("EKPC Resp. to JI Q1-65").

Peak load forecast using a new 7% Winter Reserve Margin, that appears to duplicate other efforts by the Company and PJM to react to recent Winter storms.

A. Review of Annual Demand Forecast

Q. What does EKPC forecast in growth in demand by customer class?

A. EKPC anticipates total energy sales to increase from 15.4 to 18.4 TWh, or by 1.3% annually from 2025-2039. For residential customers, sales are expected to increase by 1% each year. For small commercial customers, sales are expected to increase by 0.2% each year. Finally, for large commercial/industrial customers, sales are projected to increase by 1.6% each year.[12]

Q. How does this expected growth compare to EKPC's recent history of growth?

A. Overall, EKPC expects higher growth in customer demand than it has seen in the past. EKPC’s anticipated MWh sales growth from 2025-2039 is in stark contrast to the negative growth for residential and small commercial customers (a 2.1% and 0.5% decline, respectively, from 2018-2023). For large commercial customers, EKPC expects sales growth to fall from 4.3% in 2018 through 2023, down to 3.2% in 2025 to 2030, and 1.6% in 2025 to 2039.

[12] Attach. JJT-2 at 2.

Figure 1. EKPC energy sales growth by class

Energy Sales Growth by Class

Time Period	Residential	Seasonal	Small Commercial	Public Buildings	Large Commercial	Public Street / Highway Lighting	Total Retail Sales	Net Total Requirements
2018 - 2023	-2.1%	11.5%	-0.5%	-2.0%	4.3%	-2.4%	0.0%	-0.2%
2025 - 2030	1.1%	-0.1%	0.2%	0.0%	3.2%	0.1%	1.8%	1.9%
2013 - 2023	-0.5%	13.5%	0.0%	0.0%	3.4%	-2.3%	0.7%	0.6%
2025 - 2035	1.0%	-0.1%	0.1%	0.0%	1.9%	0.1%	1.2%	1.4%
2009 - 2023	-0.2%	-16.4%	0.5%	0.3%	2.9%	-1.1%	0.8%	0.6%
2025 - 2039	1.0%	0.0%	0.2%	0.1%	1.6%	0.1%	1.1%	1.3%

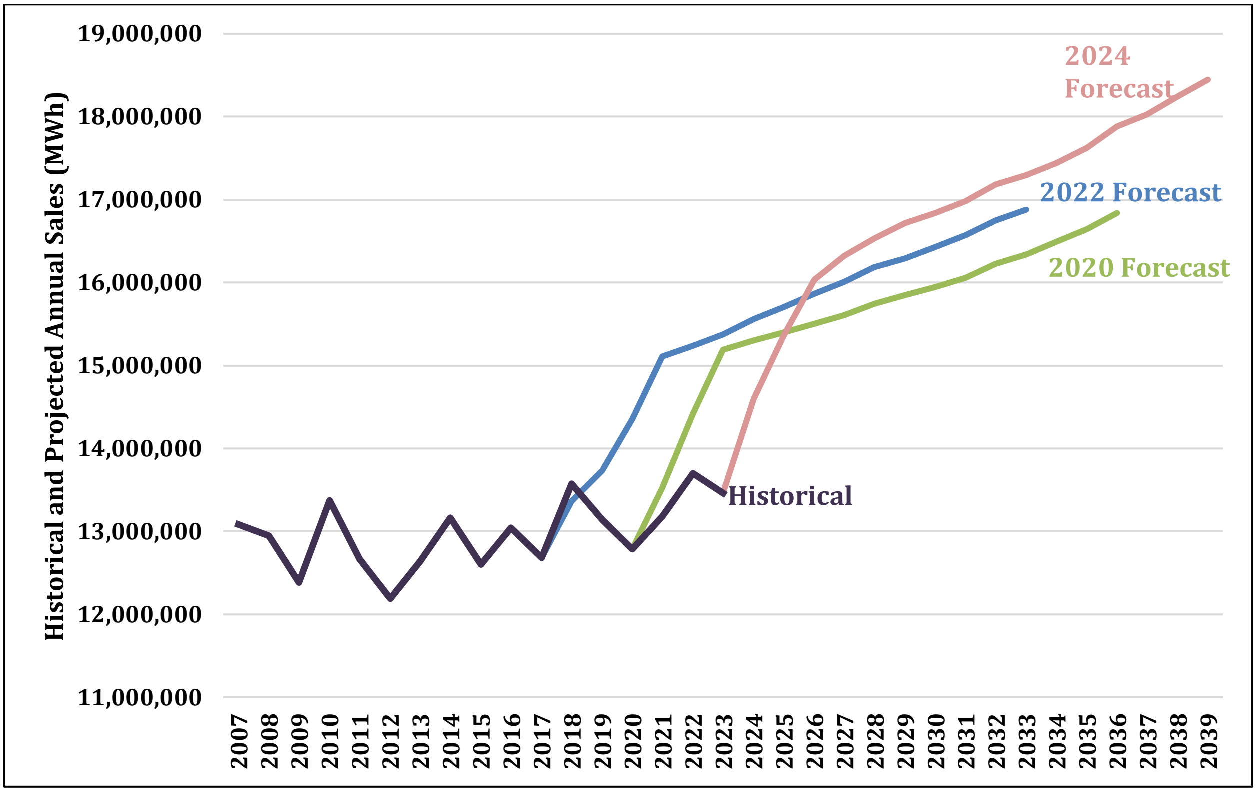
Note: Net Total Requirements include owner-member office use, distribution losses, EKPC facilities use, and transmission losses. For forecast years, Net Total Requirements also include incremental projections for EVs and Demand Side Management / Energy Efficiency (DSM/EE).

Source: Reproduced from Attach. JJT-2 at 2

Q. Have EKPC's projections of future annual demand corresponded well to its actual historical demand after the fact?

A. No. A review of EKPC's last three annual demand projects (2020, 2022, and 2024, see Figure 2) shows each new projection exceeded EKPC's actual sales (shown in bold). Actual 2023 and 2024 sales were millions of MWhs below projections: Both the 2020 and 2022 forecasts projected sales exceeding 15 million MWhs while EKPC's actual sales remain in the 13 million MWh range. EKPC's 2024 forecast once again projects sales exceeding 15 million MWhs starting in 2025, driven in great part by large commercial load growth for which little explanation has been provided to the Commission and stakeholders.

Figure 2. EKPC historical and projected annual sales (MWh)



Source: Attach. JJT-3

Q. How much additional large commercial customer load does EKPC predict over the next ten years?

A. EKPC anticipates new large commercial customers' demand will increase by 182 MW by 2029, and 241 MW by 2039. This growth in peak demand represents 32 new large commercial customers joining by 2029, and a cumulative 71 new customers by 2039.[13]

[13] EKPC Resp. to JI Q1-31, p.3.

Q. On what basis does EKPC predict this substantial increase in large commercial customer demand?

A. EKPC predicts that large commercial customer annual demand will increase by more than 17% from 2023 to 2026 (21,774 MWh to 25,628 MWh) because "new large commercial loads are larger on average than for historical existing consumers," citing Table 1 below.[14]

Table 1. EKPC large commercial customers

Year	New Consumer Count (Non Cumulative)	Average Load per New Consumer MWh (Non Cumulative)	New Consumer Increased Demand MW (Cumulative)	New Consumer Increased Energy MWh (Cumulative)
2024	11	7,175	13	78,924
2025	7	49,427	72	424,916
2026	2	145,222	126	715,359
2027	3	51,465	156	869,754
2028	5	12,877	166	934,140
2029	4	29,516	182	1,052,205
2030	2	9,198	185	1,070,601
2031	4	9,198	191	1,107,393
2032	5	9,198	199	1,153,383
2033	3	9,198	203	1,180,977
2034	3	9,198	208	1,208,571
2035	4	9,198	214	1,245,363
2036	7	9,198	224	1,309,749
2037	3	9,198	229	1,337,343
2038	5	9,198	236	1,383,333
2039	3	9,198	241	1,410,927

Note that in the above table new consumers are counted in the year they first arrive, even if not at full production or if the consumer starts late in the year. For example, a consumer starting at half production in October 2024 and achieving full production by 2027 is considered a new consumer in 2024.

Source: EKPC Resp. JI Q1-31

Q. What type of analysis did EKPC perform to arrive at its predictions of future large commercial customer load?

A. EKPC explains in its 2024 Load Forecast that it does not use the same data-driven regression analysis for its short-term large commercial customers' load that it does for its residential and small commercial customers' load. (Short-term refers to the period up to and included 2029.[15]) Instead, for short-term large commercial sales predictions it relies "on the input of

[14] EKPC Resps. to JI Q1-35(f), and JI Q1-31(c).
[15] EKPC Resp. to JI Q1-31(a).

the owner-members" who have "knowledge of their key accounts and the presence of industrial parks, project usage for existing large loads, and advise of new consumers or consumers that are leaving."[16] In addition, "input from EKPC's Economic Development staff may also be included."[17] For long-term large customer load, EKPC uses a regression analysis based on historical industrial growth in member territories.[18]

Q. On what data did EKPC rely in developing its predictions of future large commercial customer load?

A. EKPC did not share with the Commission and stakeholders the assumptions and methods it relied on to forecast this growth in large commercial customers. The Company states that its revision of its preliminary load forecast, particularly adjustments to the large commercial class expecting growth through 2029, "is confidential information between the Owner-Member and large commercial consumers" and was "mutually agreed upon by EKPC and Owner-Member President/CEO and staff."[19]

Q. What potential new data centers or other specific large load additions is EKPC aware of in its territory?

A. EKPC states that "the rise of data centers as part of the economic development in the state is also a factor in the increase needed capacity,"[20] and that it "expect[s] that some large data center load will eventually materialize."[21] The Company concedes, however, that "no firm

[16] Attach. JJT-2 at 16.
[17] *Id*.
[18] *Id*.
[19] Responses to Joint Intervenors' Supplemental Requests for Information to East Kentucky Power Cooperative, Inc. dated January 17, 2025, Case No. 2024-00370, Question JI 2-22, at 1-2 (Jan. 31, 2025) ("EKPC Resp. to JI Q2-22").
[20] Mosier Direct at 6:7-10.
[21] Responses to Attorney General's First Information Request to East Kentucky Power Cooperative, Inc. dated December 16, 2024, Case No. 2024-00370, Question 7 (Jan. 3, 2025) ("EKPC Response to AG Q1-7").

commitments have been made to date" from data centers,[22] and that its 2024 Load Forecast "does not specifically include any data center load."[23] As such, any service for new data center load "would be above and beyond the forecast and generation requested in this application,"[24] and "any new generation required for new data centers would be addressed in separate filings."[25]

Q. Does EKPC's track record of overestimating its future annual demand and its lack of transparency regarding its forecasting assumptions raise questions regarding the accuracy of these forecasts?

A. Yes, these issues raise the concern that EKPC may have overestimated its annual customer demand and, therefore, be proposing more generation capacity than is necessary to keep the lights on.

B. Meeting Winter Peak

Q. How does EKPC's Winter Peak forecast from its 2024 Load Forecast compare to that of its 2022 Load Forecast?

A. EKPC's 2024 Winter Peak forecast is consistently higher compared to its 2022 and 2020 forecasts. EKPC now projects base case Winter Peak demand to be 3,870 MW by 2035 compared to the 2022 Integrated Resource Plan's ("IRP") forecasted 3,586 MW in the same year (see Figure 3).[26]

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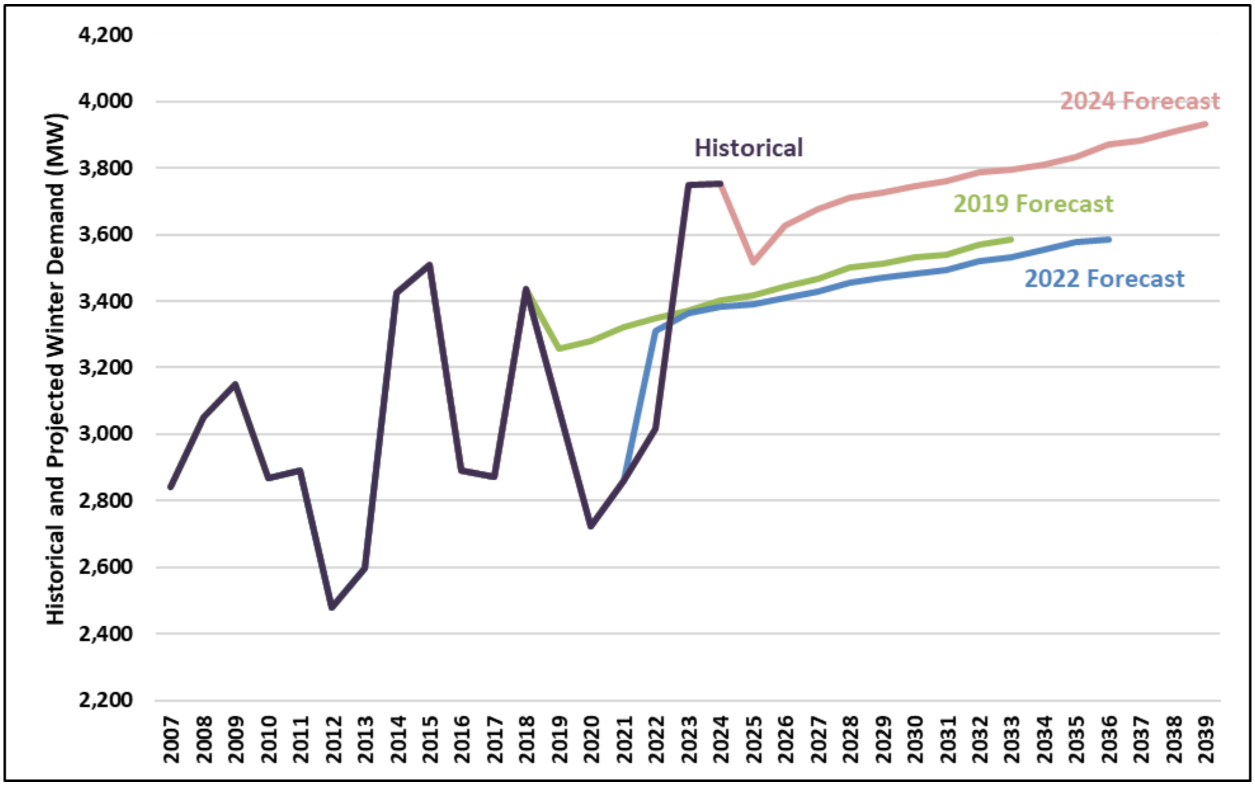
[22] *Id*.
[23] Mosier Direct at 6:7-10.
[24] EKPC Resp. to AG Q1-7.
[25] Responses to Nucor's First Information Request to East Kentucky Power Cooperative, Inc. dated December 20, 2024, Case No. 2024-00370, Question 2 (Jan. 3, 2025) ("EKPC Response to Nucor Q1-2").
[26] Tucker Direct, Attach. JJT-3, EKPC Forecast Vintage Comparisons.

Figure 3. EKPC Winter Peak load historical and forecasts (MW)



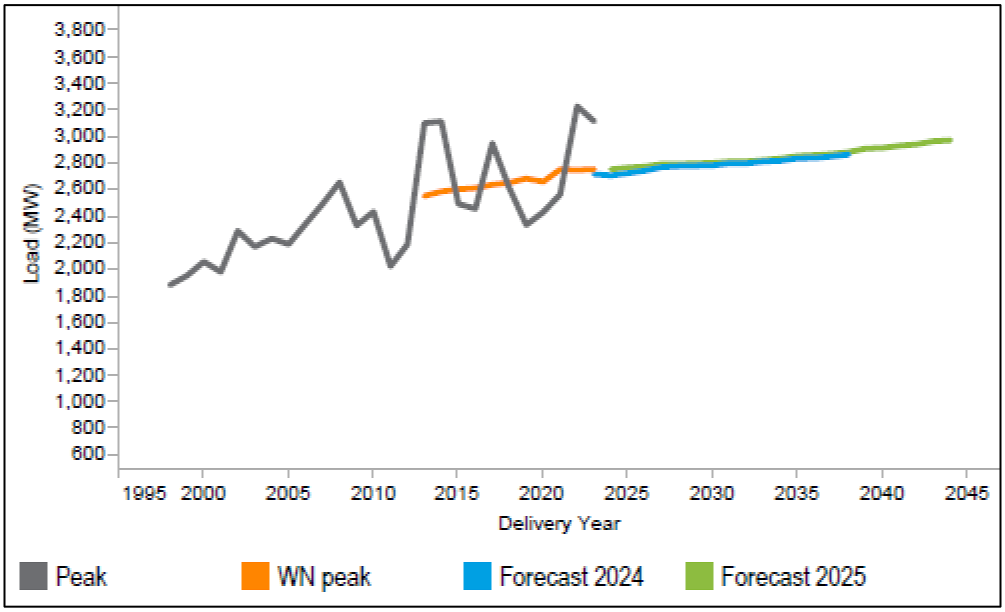
Source: Attach. JJT-3

Q. How does PJM's forecast of EKPC's expected Winter Peak load compare to EKPC's own forecasts?

A. EKPC projects substantially more load than PJM expects for the EKPC territory. PJM expects 2,900 MWs of Winter Peak from EKPC by 2035, compared to the Company's own forecast of 3,870 MW (see Figure 4).[27] PJM's forecasts of peak demand are used in its regional reliability planning.

[27] Exhibit EAS-2, PJM, *2025 PJM 2025 Long-Term Load Forecast*, at 33 (Jan. 24, 2025).

Figure 4. PJM's 2025 Winter Peak load forecast for EKPC



Source: Exhibit EAS-2 at 33

Q. To what does EKPC attribute its forecasted increase in Winter Peak demand?

A. EKPC attributes its forecasted increased in Winter Peak load in part to the peak records set by Winter Storm Gerri in 2024, and Winter Storm Elliott in 2022, stating that "These storms highlighted that EKPC is short on generation to meet the Commissions expectations for serving its Owner Member's loads plus capacity planning reserves… It also reinforced the need for a long-term grid reliability fix for south central Kentucky that was jeopardized during both storms."[28]

[28] Mosier Direct at 7:1-4.

Q. What reserve margin does EKPC add on to its Winter Peak load forecasts?

A. EKPC adds a 7% reserve margin to its winter peak forecast "to account for unknown risks in weather and generation availability."[29] (In its 2022 IRP, the Company assumed a 0% reserve margin.[30])

Q. What modeling adjustments has EKPC made in the wake of recent winter storms?

A. EKPC has increased its Winter reserve margin and increased its load forecasts. In addition, EKPC has updated its effective load carrying capability ("ELCC") values to represent PJM's new, more conservative estimates.[31]

Q. Do all three of those adjustments have the same impact of increasing forecasted Winter Peak requirements?

A. Yes. Higher Winter reserve margins and higher Winter load forecasts both increase EKPC's Winter Peak supply requirements. PJM's new ELCC capacity accreditation values have a similar effect, reducing renewables' and Battery Energy Storage Systems' ("BESS") projected contribution to Winter Peak supply and, therefore, increasing the amount of Winter Peak requirements that must be met by other resources. Each of these adjustments are motivated by the same goal—accounting for unknown risks in weather and generation availability. Taken together, these adjustments appear to be double- or even triple-counting the steps needed to ensure continued reliability and resource adequacy in the wake of Winter Storms Elliott and Gerri.

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[29] Tucker Direct at 13:12-14.
[30] *Id*. at 14:6-8.
[31] *Id.* at 15:7-19.

Q. Does EKPC provide any explanation or calculation of the interaction between these closely related adjustments, or a description of their combined effects?

A. No.

Q. In how many hours each year has EKPC's Winter Peak demand exceeded installed capacity?

A. EKPC's Winter Peak exceeded installed capacity in 1 hour in 2022, 0 hours in 2023, and 2 hours in 2024.[32]

Q. In future years, how many hours per year does EKPC expect forecasted Winter Peak demand to exceed its current installed capacity?

A. Assuming normal weather, EKPC anticipates that Winter Peak demand will exceed its current installed capacity for 0 hours each year from 2025 through 2029, and by 1 hour each year from 2030 through 2034.[33] Assuming extreme weather, EKPC anticipates that Winter Peak demand will exceed its installed capacity for 1 hour each year in 2025 and 2026, 3 hours in 2027, 8 hours in 2028, 1 hour in 2029, 2 hours in 2030, and 0 hours each year from 2031 through 2034.[34]

Q. Is it the case that EKPC proposals to invest in new resources in this CPCN are claimed by the Company as necessary to meet potential shortfalls in Winter Peak capacity?

A. Yes. EKPC emphasizes "two successive winters that set all-time peak" as a key part of the "rationale and assumptions underlying the recommendation for the projects presented."[35]

[32] EKPC Resp. to JI Q1-12(d) and JI Q2-9(a).
[33] EKPC Resp. to JI Q1-12(e).
[34] EKPC Resp. to JI Q2-9(b).
[35] Mosier Direct at 5.

Q. Are the resources proposed in this CPCN application peaking resources?

A. No, EKPC is proposing a baseload CPCN and modifications to maintain existing resources, and not peaking resources best suited to addressing shortfalls in Winter Peak supply like battery storage, solar plus storage, demand response, or even new gas combustion turbines.

Q. Could EKPC instead purchase capacity from PJM or invest in alternative peaking resources to meet that 1- to 8-hour per year shortfall?

A. Yes. EKPC does not provide a comparison of the costs of purchasing market capacity from PJM for 1 to 8 hours per year to the costs of its proposed investments. EKPC also fails to appropriately consider or model alternative peaking resources such as storage, storage plus solar, or demand response.

Q. Does EKPC's track record of overestimating its future Winter Peak and PJM's much lower forecast of EKPC's Winter Peak raise questions regarding the accuracy of the Company's forecasts?

A. Yes, these issues raise the concern that EKPC may have overestimated its Winter Peak load and its Winter Peak requirements and, therefore, be proposing more generation capacity than necessary.

VI. SUPPLY ALTERNATIVES

Q. Please provide a summary of your findings regarding EKPC's assessment of supply alternatives.

A. My review of EKPC's resource analysis found that the Company has not performed any type of analysis sufficient to identify and propose new or modified resources that meet but do not exceed any gaps in existing service without creating wasteful duplication. Nor has the Company completed any review of alternatives that could be considered thorough or conclusive. Instead, the Company makes broad simplifying assumptions to exclude most alternatives to its proposed Cooper CCGT without the benefit of appropriate modeling tools and ignores key alternatives providing essential benefits elsewhere including battery storage, solar plus storage, and demand response. Similarly, the Company fails to provide analysis of the relative costs to ratepayers of retiring the Cooper 2 unit instead of conducting costly modifications.

A. Supply Alternatives for Cooper CCGT

Q. Did EKPC consider alternative supply-side resources when making its determination that the proposed Cooper CCGT plant was the most appropriate and least-cost resource for ratepayers?

A. Yes, but only in a qualitative manner. EKPC made a qualitative assessment of nuclear, coal, and renewables as alternative supply-side resources when determining that the proposed Cooper CCGT plant was most appropriate to serve its "need for additional low cost, dispatchable energy as well as capacity."[36] The Company did not, however, carry out any modeling or other quantitative assessment of the costs and benefits of such resources before rejecting them.

Q. Did EKPC consider alternative demand-side resources when making its determination that the proposed Cooper CCGT plant was the most appropriate and least-cost resource for ratepayers?

A. No. EKPC does not identify higher levels of demand response and energy efficiency as a potential alternative in its qualitative discussion of options for meeting its claimed winter peak demand need. Joint Intervenor witness Roumpani addresses issues regarding the levels

[36] Tucker Direct at 22-23.

of demand response and energy efficiency that EKPC could achieve and the savings that such levels would provide ratepayers.

Q. What supply-side alternatives to a CCGT does EKPC conclude—without modeling—are inappropriate for consideration?

A. EKPC concluded that all alternative supply-side resource options—that is, nuclear, coal, renewables, and other types of gas-fired resources—were insufficient for further consideration.

Q. Why does EKPC reject nuclear as a potential alternative resource option?

A. EKPC's justification for rejecting nuclear as a potential alternative is that the technology is still in its early development stages and not yet proven:

> EKPC did consider nuclear, however, the technologies being developed today that would be of appropriate size for the EKPC system are not yet proven. The Electric Power Research Institute ("EPRI") says a technology needs to be repeated in at least ten different applications to be considered duplicative and proven. The small modular reactors are not at that level yet. EKPC is not of sufficient size or financial position to be able to incur that type of new development risk.[37]

Q. Why does EKPC reject coal as a potential alternative resource option?

A. EKPC rejects coal as a potential alternative, flagging the cost of environmental compliance as the primary obstacle: "New coal units are not feasible in today's environmental climate given the cost of compliance with the plethora of environmental regulations."[38]

[37] *Id.*
[38] *Id.* at 23.

Q. Why does EKPC reject renewables, such as solar, as a potential alternative resource option?

A. EKPC assumes renewables are inappropriate for addressing the Company's need for dispatchable energy: "Renewables most certainly have a place in the system, but they do not provide dispatchable, base load energy."[39] EKPC also claims that renewables are unable to serve as capacity resources to contribute to the Company's ability to meet winter peak load:

> The most prolific renewable resource available in the EKPC system is solar energy. EKPC has a need for dependable winter peak load generation. Solar energy is not available to EKPC during its winter peaks which either occurs early in the morning or later in the evening, both times when the sun is not shining. [40]

Q. How did EKPC select the new Cooper CCGT as the preferred new resource?

A. EKPC's assessment is limited to a narrative description of a process of elimination of all resource types other than the CCGT and the natural gas co-firing modifications.

Q. Did EKPC perform integrated system modeling to identify preferred, least-cost resources in this CPCN application?

A. No. According to EKPC Witness Tucker, EKPC's last long-term optimization modeling was conducted for its 2022 Integrated Resource Plan ("IRP").[41] With regards to the present proceeding, "[a]n optimization run was not specifically completed to consider new generation and retirements of existing units."[42]

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[39] *Id.*
[40] *Id.*
[41] Responses to Staff's First Information Request to East Kentucky Power Cooperative, Inc. dated December 20, 2024, Case No. 2024-00370, Question 7 (Jan. 3, 2025) ("EKPC Resp. to Staff Q1-7").
[42] *Id.*

Q. What is long-term optimization modeling?

A. Long-term optimization modeling—as conducted in EKPC's 2022 IRP—compares a utility's expected supply- and demand-side capacity resources to its customer demand, and performs optimization modeling to identify a least-cost portfolio of resources that meets all regulatory or legal requirements. Sometimes referred to as "resource expansion" modeling, EKPC acknowledges that it did not conduct long-term optimization modeling to identify the resources proposed in these CPCNs.[43]

Q. Does EKPC describe important changes to the underlying assumptions used in its 2022 IRP that have occurred over the last two years?

A. Yes. EKPC explains that it has experienced two severe winter storms, and that it "has multiple planning objectives which have increased in complexity and risk exposure in recent years."[44] Various factors that have contributed to such increased complexity include issues surrounding meeting winter peak load, new federal greenhouse gas regulations, PJM's Effective Load Carrying Capability ("ELCC") values,[45] new tax credits and other support for clean energy, and EKPC's 2025 New Era financing application.[46]

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[43] EKPC Supp. Resp. to JI Q2-6.
[44] EKPC Resp. to Staff 1-7.
[45] EKPC Resp. to Staff Q1-12(c).
[46] EKPC Resp. to Staff Q1-1; *see also* EKPC Resp. to JI Q2-20 (EKPC's 2022 IRP "did not account for tax credits or other energy-related programs and funding streams authorized, modified, or extended by the Inflation Reduction Act," such as the New Era program.).

Q. In your expert opinion, do changes in peak load, environmental regulation, capacity credit, tax credits or funding for clean energy, or New ERA funding assumptions have the potential to change the findings of long-term optimization modeling?

A. Yes. Important changes in underlying assumptions, including changes to expectations regarding peak load, environmental regulations, capacity credits, tax credits and other funding for clean energy, and New ERA funding have the potential to change the findings of long-term optimization modeling—including recommendations taken from modeling regarding preferred amounts or technology types for new resource additions.

Q. How does EKPC explain its decision to select and request CPCN approval for resources that have not been evaluated for cost efficiency on a system-wide basis?

A. EKPC explains that its most recent 2022 IRP is based on out-of-date assumptions regarding key parameters. The Company then appears to justify its failure to perform long-term optimization modeling with a list of reasons that—in its opinion—obviate the need for least-cost planning while simultaneously setting out a methodology for an alternative process of elimination selection process. In essence, EKPC asserts that optimization modeling was not necessary because it claims that no other resources were viable alternatives to the resources proposed in this and the other current CPCNs for gas resources (Case No. 2024-000310):

1) Coal retirements will not be considered: "EKPC will not consider retiring existing coal until it becomes mandatory based on costs and operating limitations."[47]

2) New nuclear is too expensive: "New nuclear is not currently financially feasible for a system such as EKPC's."[48]

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[47] *Id.*
[48] *Id.*

3) New coal cannot meet federal environmental regulations: "New coal is no longer a viable option based on environmental requirements."[49]

4) Stand-alone solar and wind are not viable capacity resources: "Solar or wind require storage options to be comparable to a dispatchable unit . . . ."[50]

5) Storage is too expensive: "[C]urrent battery technologies do not support the financial or operational characteristics to compare favorably to other alternatives."[51]

Therefore, explains EKPC, only gas generation can and should be considered. Then, without modeling or other quantitative analysis, the Company concludes that combined cycle units are the only option because they offer better efficiencies for operation as base load generation: "Combined cycle is more efficient with a better heat rate as compared to a simple cycle combustion turbine."[52]

Q. Is EKPC's "process of elimination" planning method appropriate to present as evidence in a Kentucky PSC CPCN application?

A. No. EKPC's process of elimination method provides an overly simplified resource comparison, offers no system model perspective, and should not be characterized as producing a least-cost result. EKPC's surprising decision to skip all system optimization modeling in favor of a brief written assertation that the least-cost resource is already known is a serious detriment to its petition. Without access to appropriate resource comparisons and optimization modeling it is not possible for the Commission, stakeholders, or their third-party

[49] *Id.*
[50] *Id.*
[51] EKPC Resp. to Staff Q1-7.
[52] *Id.*

experts to review and evaluate EKPC's claims, as would be appropriate and expected in a public process.

Q. Is the production cost modeling conducted by EKPC for this CPCN application a sufficient substitute to long-term optimization modeling?

A. No. EKPC's production cost modeling was conducted to establish operational costs and was conducted with a new CCGT already selected (that is, as a fixed assumption and not selected in an optimization process).[53] This modeling does not provide a systematic comparison of resources or result in least-cost recommended resource additions.

Figure 4 shows EKPC's historical and projected future capacity additions with fixed resource additions presented in this CPCN application, the Liberty RICE units proposed for 2029, and solar additions beginning in 2026.

[53] EKPC Resp. to Staff Q1-19(b) ("EKPC did not provide potential resources for the model to choose from . . . .").

Figure 5. EKPC system capacity and peak demand (MW) [BEGIN CONFIDENTIAL

[redacted]

END CONFIDENTIAL] *Sources: (1) Attach. JJT-2 at 3 and JJT-4, EKPC Expansion Plan 2024; (2) U.S. EIA 2023 Form EIA-860; (3) Case 2022-00098, EKPC 2022 IRP at 65; (4) CONFIDENTIAL EKPC 2022 IRP.*

Q. According to EKPC's predictions, would its winter peak load exceed its existing and planned resources?

A. Yes, but there are a few important caveats. First, I raise several concerns regarding the reasonableness of EKPC winter load forecasts and reserve margin assumptions. Second, PJM predicts much lower winter peak load for EKPC, as shown above in Figure 4. Third, as I discuss above, EKPC has not performed system-wide long-range optimization modeling substantiating its conclusions. Finally, EKPC has not considered alternative supply- and demand-side resources and/or market purchases as feasible pathways to meeting any shortfall.

Q. Has EKPC carried out a Net Present Value of Revenue Requirements (NPVRR) analysis of the Cooper CCGT proposed in this CPCN application?

A. No. EKPC fails to provide an NPVRR analysis supporting its CPCN application.

Q. Is an NPVRR analysis typically provided as a part of long-term optimization modeling in CPCN and IRP proceedings?

A. Yes. As EKPC explains: "Traditional planning methodology utilizes comparisons of all available generation technologies, runs them through an optimization analysis and then develops Present Value of Revenue Requirements (PVRR) comparisons of the best alternatives."[54]

Q. What is the purpose of an NPVRR analysis in utility planning?

A. In utility planning and modeling, resource costs are typically expressed in NPVRR terms to facilitate comparisons across resources and, in so doing, identify preferred or least-cost resources.

Q. How does EKPC explain its failure to conduct NPVRR analysis?

A. EKPC explains that it skipped the NPVRR analysis because it was short of time and—in its opinion—had only one viable resource to assess: "This [NPVRR] methodology is predicated on having ample time to meet the expected need and having multiple alternatives for supply."[55]

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[54] EKPC Resp. to JI Q1-10.
[55] *Id.*

Q. Does the available evidence support the contention that EKPC lacked the time to carry out an NPVRR analysis or long-term optimization modeling of the proposed Cooper CCGT for this Application?

A. No. EKPC filed the Application in this proceeding on November 20, 2024. The Company submitted the CCGT project to enter the PJM interconnection queue on January 24, 2024.[56] In addition, the only modeling file produced by EKPC in this proceeding is, according to the name of the file, dated May 3, 2024.[57] This timeline suggests that there was ample time for EKPC to carry out an NPVRR analysis and optimization modeling of the proposed Cooper CCGT in advance of this proceeding.

Q. What insights or key information are missed when NPVRR analysis and long-term optimization modeling are not conducted?

A. NPVRR analysis and long-term optimization modeling are essential to the identification of a least-cost resource plan and, with it, least-cost resources to propose for investment. Without this analysis, proposed resources cannot be said with any foundation to be least cost or the best choice for ratepayers.

Q. In the most recent long-term optimization modeling conducted by EKPC in its 2022 IRP, what resources are recommended for investment?

A. EKPC's 2022 IRP recommends the addition of a seasonal PPA in 2022; new renewable resources in 2023, 2024, 2026, 2027, 2031 and 2032; and a new 225 MW peaking resource in 2033.[58]

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[56] Application Ex. 6, Direct Testimony of Darrin Adams on Behalf of East Kentucky Power Cooperative, Inc., Case No. 2024-00370, at 10:3-7 (Nov. 20, 2024) ("Adams Direct").
[57] EKPC Resp. to Staff Q1-24, Attachment "*CONFIDENTIAL – Staff1-24 – 3MAY24*".
[58] EKPC 2022 IRP at 168, Tbl.8-5.

Q. Does EKPC's 2022 IRP preferred resource portfolio include any baseload (or "intermediate") resources?

A. No.[59]

Q. Does EKPC's 2024 Load Forecast indicate a need for baseload resources?

A. No. Assuming normal weather, EKPC anticipates that Winter Peak demand will exceed current installed capacity for 0 hours each year from 2025 through 2029, and by 1 hour each year from 2030 through 2034.[60] Such limited duration peak capacity shortfalls would likely be better addressed through a peaking resource (or demand response to reduce such peaks) rather than generation built for baseload operation.

Q. Do any of the plans modeled in EKPC's 2022 IRP call for the addition of baseload resources in any year?

A. No.[61]

Q. Is the new Cooper CCGT proposed in this CPCN application baseload or peaking resources?

A. EKPC is proposing the new Cooper CCGT as a baseload resource: "EKPC's intention is to utilize this facility as a base load unit, meaning EKPC does not anticipate daily cycling of this unit."[62] Production cost modeling presented in this CPCN application shows Cooper CCGT operating with a **[BEGIN CONFIDENTIAL** [redacted] **END CONFIDENTIAL]**

[59] *Id.*
[60] EKPC Resp. to JI Q1-12(e).
[61] EKPC 2022 IRP at 168, Tbl.8-5.
[62] Application at 7-8.

capacity factor in 2030 and a **[BEGIN CONFIDENTIAL** [redacted] **END CONFIDENTIAL]** from 2031 through 2039.[63]

Q. Has EKPC performed analysis that would facilitate the identification of the selection of the most cost-effective size for a new supply resource?

A. No, it has not.

Q. How would a utility typically determine what resource types (baseload, peaking, renewables, seasonal) it needed to meet customer demand and load in future years?

A. Resource needs—including resource type—are typically determined using system-wide long-term optimization modeling.

Q. EKPC has not updated its long-term optimization modeling since 2022 and explains that its 2022 IRP modeling is outdated. How did EKPC determine what types of resources are needed to meet customer needs in this CPCN application?

A. EKPC explains that after using the "process of elimination" method described above—in place of least-cost modeling—it next evaluated what type of resource was needed. "The next question would be if the system needed more peaking, intermediate or baseload generation."[64] EKPC explains that it compared a production cost modeling run in which CCGT investment was predetermined (sometimes called "baked in") with a so-called "'do nothing' scenario," which appears (based on EKPC's very limited description) to be the same production cost modeling with the same fixed resources but eliminating the new CCGT.[65] As

[63] EKPC Resp. to Staff Q1-24, Attachment "*Staff DR1.24 – Summary - 3MAY24 – corrected (Confidential).xlxs*.. Tab "Source Base Annual – 3MAY24, line 4979.
[64] EKPC Resp. to JI Q1-10.
[65] *Id.*

the Company states in a discovery response, "EKPC modeled a CCGT compared to the market, which would be EKPC's 'do nothing' scenario. That comparison demonstrated the value of adding a CCGT to the system and the results have been provided in this case."[66]

Q. Does EKPC anticipate a shortfall in energy or capacity that could not be met with market purchases?

A. Apparently not, given EKPC's decision to model a "do nothing" scenario in which it would rely on market and capacity purchases in lieu of the proposed CCGT. .

Q. Would purchasing Winter Peak capacity put EKPC at risk that its demand could not be met by market sources if multiple jurisdictions face coincident Winter Peaks?

A. No. Planning for coincident peak load across all of its members is one of the central functions of the PJM ISO. That approach preserved reliability in PJM during both Winter Storms Elliott and Gerri, and in response to those storms, PJM has made several key changes to its region-wide resource capacity assumptions, Winter resource planning processes, and reliability modeling to provide further reliability assurances. In January 2025, PJM reached an all-time record for its Winter demand at 145,000 MW and still exported 8,000 MW to neighboring regions,[67] showing that once again PJM had sufficient capacity and generation available to ensure that EKPC met its needs during a winter peak event.

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[66] *Id.*

[67] PJM Inside Lines, *Jan. 22 Update: Extreme Cold Produces PJM Record for Winter Electricity Demand: System Performing Well To Keep the Lights On* (Jan.22, 2025), https://insidelines.pjm.com/jan-22-update-extreme-cold-produces-pjm-record-for-winter-electricity-demand/.

Q. Can the comparison of two production cost modeling runs (one with a new CCGT and one without) provide a justification for the identification of a CCGT (or baseload resources more generally) as a preferred or necessary resource type?

A. No. The two-run modeling comparison described by EKPC cannot identify a needed resource type or a preferred resource. This modeling exercise can only identify the costs and benefits of adding the CCGT, all else held equal. It carries no information whatsoever regarding the need for a baseload resource or the need for a CCGT. Similarly, it provides no information regarding what resource(s) would be "best" or least cost for ratepayers in meeting the identified need.

Q. How does EKPC support its application for a baseload resource?

A. EKPC appears to offer no explanation of its decision to pursue a CCGT application other than the two-run modeling comparison, which does not provide a rationale for the choice. EKPC notes also a "qualitative value" of investment in a new CCGT explaining that expected retirements outpace planned additions: "The qualitative value of adding a CCGT to the system is also a driving force for the decision to construct such a unit. Environmental regulations continue to pressure existing coal units into retirement and new dispatchable plants are not being added at a pace to keep up with retirements."[68]

Q. Are there any common supply- or demand-side resources that EKPC provides no discussion or consideration of in its CPCN application?

A. Yes. EKPC does not consider battery energy storage systems ("BESS")—either as standalone or paired with solar resources—as alternative supply-side resources in its CPCN application.

[68] EKPC Resp. to JI Q1-10.

In addition, EKPC does not consider higher levels of demand response as an additional resource to address its winter peak.

Q. Does EKPC's CPCN application present a cost comparison of BESS versus its proposed resources?

A. No. EKPC concludes that BESS is not an appropriate resource without the benefit of modeling.

Q. Did EKPC's include BESS in its production cost modeling for this CPCN?

A. No.

Q. Did EKPC's perform long-term optimization modeling that included BESS resources available for selection?

A. No.

Q. Why does EKPC exclude BESS as a potential alternative resource option?

A. EKPC has offered a variety of reasons for excluding BESS. First, in his direct testimony, EKPC witness Mosier claimed that the types of storage needed to meet EKPC's winter peaking needs are not cost competitive, stating that:

> [W]hile costs for utility scale [BESS] have dramatically declined in the last decade, it still remains uncompetitive at $450,000/MWh for a 100MW capacity and minimum of 4–10-hour discharge capability needed for EKPC's winter peaking needs. It is important to note that unlike wind and solar, BESS was excluded from the USDA's New ERA program. Without this grant opportunity, BESS could not compete with solar and hydro resources, nor with more traditional forms of dispatchable generation.[69]

[69] Mosier Direct at 13:9-16.

In response to Joint Intervenors' information request 2-28, EKPC asserts that BESS was excluded from consideration by the Company because the technology is "relatively new and unproven" and concerns about the ability to charge storage during extreme weather events.

> EKPC did not consider BESS, either standalone or combined with solar, as capacity options for its system. The technology is relatively new and unproven, it is costly based on the estimates received, and storage systems of any technology that must be re-charged during peak periods are not reliable peak capacity options.[70]

Q. Is EKPC correct that BESS was excluded from the USDA's New ERA program?

A. No. When asked in discovery the basis for its claim that BESS was excluded, EKPC backtracked on that claim, conceding that the federal Notice of Funding Opportunity ("NOFO") for the New ERA program stated that eligible projects included "Energy Storage Systems in support of GHG emission reductions or Renewable Energy Systems."[71] The NOFO further explained that "all proposals must promote the reliability and resiliency of rural electric systems" and that plans "may include Energy Storage Systems . . . and other strategies to ensure the reliable provision of energy."[72]

Q. Have other rural electric cooperatives been awarded New ERA financial support for battery storage projects?

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[70] EKPC Resp. to JI Q2-28.
[71] EKPC Resp. to JI Q1-15(a), citing *Notice of Funding Opportunity for Empowering Rural America (New ERA) Program,* Docket No. RUS-23-Electric-0005, Fed. Reg. Doc. 2023-10392 (May 16, 2023), which was produced in this proceeding as "*JI1-15-NOFO.pdf*" ("NOFO").
[72] NOFO at pdf p.14.

A. Yes. In a December 19, 2024 press release, the U.S. Department of Agriculture announced the awarding of a total of $4.37 billion in New ERA grants and loans to 10 cooperatives.[73] Six of the awards were for projects that included battery energy storage.

Q. Did EKPC submit a New ERA application that could have included BESS?

A. Yes. EKPC applied for and has been awarded New ERA grants and loans for a set of solar, hydroelectric PPA, and transmission projects, for which the Company has stated its intent to seek a CPCN from this Commission in the first quarter of 2025.[74] While EKPC objected to disclosing its New ERA application in this proceeding,[75] there is little doubt that BESS would have been eligible for New ERA funding had EKPC chosen to include it as part of the Renewable Energy System for which the Company successfully sought New ERA funding.

Q. Is the $450,000/MWh cost cited by Witness Mosier[76] a reasonable cost estimate for BESS?

A. No. For one thing, EKPC has provided virtually no evidentiary support for the cost estimate. In response to a request for such evidence, EKPC produced a single email chain with an individual at the National Renewables Cooperative Organization ("NRCO") identifying a range of costs based on the "most recent RFP" he had seen.[77] According to EKPC, "NRCO did not provide any additional analysis, report or documentation supporting the BESS estimate."[78]

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[73] Exhibit EAS-3, U.S Dept. of Agric., *USDA Announces Another Round of Historic Investments to Increase Access to Clean, Affordable Energy Across the Country: Investments in Rural Electric Cooperatives Will Lower Costs and Support Jobs in Rural Communities* (Dec. 19, 2024).
[74] EKPC Resp. to Staff Q2-1; EKPC Resp. to Staff Q2-2; https://kyelectric.coop/2024/10/29/ekpc-announces-federal-funding/
[75] EKPC Resp. to JI Q2-5.
[76] Mosier Direct at 13.
[77] EKPC Resp. to JI Q1-14; EKPC Resp. to JI Q2-10 and Attachment entitled "*JI 2.10.pdf*".
[78] EKPC Resp. to JI Q2-10, Confidential JI2.10.pdf.

In addition, the $450,000/MWh cost estimate cited by EKPC appears to be [**BEGIN CONFIDENTIAL**] [redacted] [**END CONFIDENTIAL**] cited by NRCO.[79]

Finally, it is important to note that EKPC's BESS cost estimate does not account for the Investment Tax Credit ("ITC") for energy storage provided under the Inflation Reduction Act. Assuming prevailing wage and apprenticeship requirements are met, a BESS project would be eligible for a 30 percent ITC, and the project could be eligible for 10 percent tax credit adders if it is located in an energy community or meets certain domestic content. EKPC, however, acknowledges that it "did not evaluate the impact of the Inflation Reduction Act's ITC on the cost of a utility-scale BESS."[80]

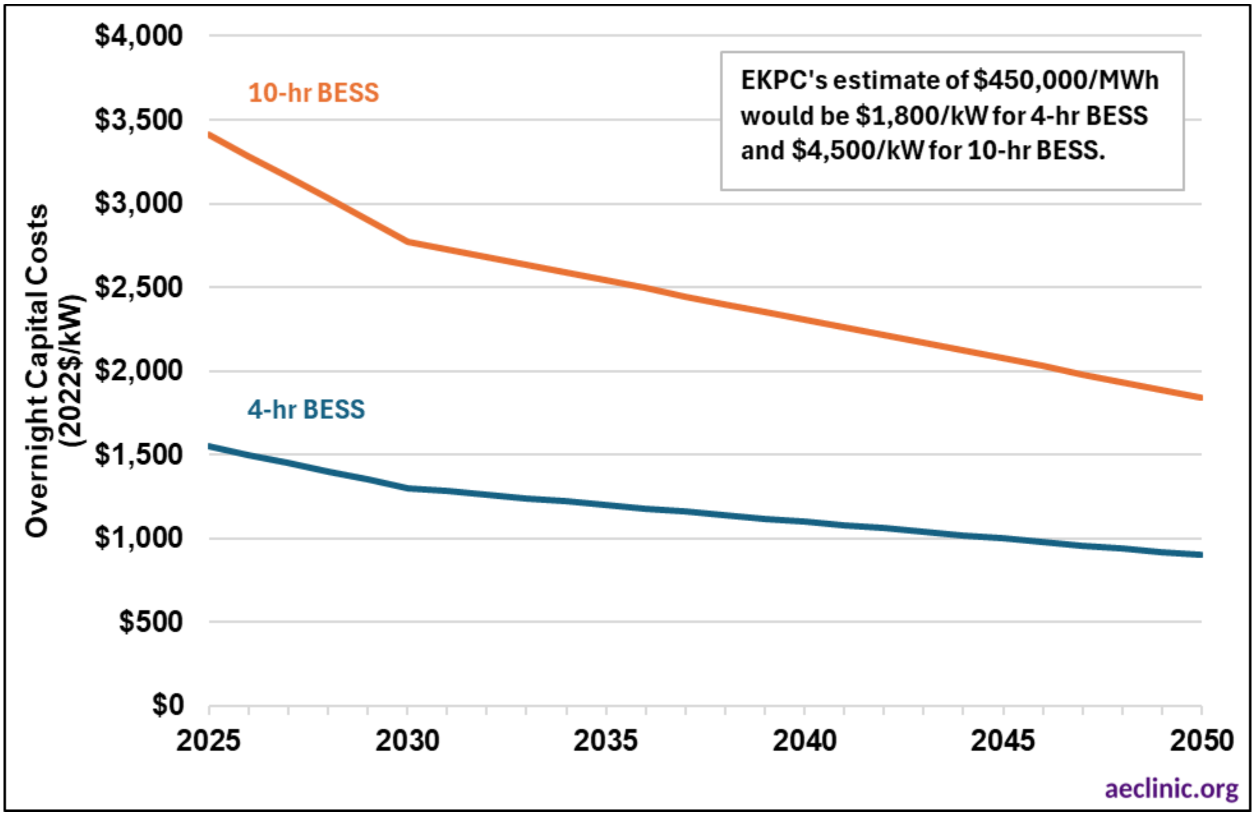
Q. Do other sources show lower BESS costs than what EKPC assumed?

A. Yes, the National Renewable Energy Laboratory ("NREL") finds lower BESS costs than EKPC's prediction. Importantly, NREL also excludes ITC from its cost estimates. EKPC's $450,000/MWh cost estimate is equivalent to $1,800 per kW for a 4-hour system or $4,500 per kW for a 10-hour system (see **Error! Reference source not found.**). To convert EKPC's per-MWh cost estimate to be on a per-kW basis, I multiplied it by the duration of the BESS system, then divided by 1,000 to convert from MW to kW. For 4-hour BESS, EKPC's cost estimate equates to $1,800 per kW. Similarly, for 10-hour BESS, EKPC's cost estimate equates to $4,500 per kW. In comparison, NREL's 2024 ATB Moderate Case presents 4-hour BESS costs that range from $1,551 per kW in 2025 down to $899 per kW in 2050.

[79] *Id.*
[80] EKPC Resp. to JI Q2-10.

Similarly, NREL's 10-hour BESS costs range from $3,411 per kW to $1,843 per kW over the same period.

Figure 6. 2024 NREL ATB Moderate Case BESS costs (2022$/kW)



Source: National Renewable Energy Laboratory, 2024 Annual Technology Baseline [Workbook].[81]

Q. Did EKPC issue an RFP open to BESS resources to establish their current real-world costs and operational characteristics?

A. No. EKPC did not issue an RFP open to BESS: "EKPC has not solicited for BESS or solar + storage facilities and EKPC has not received bids for BESS or solar + storage facilities."[82]

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[81] Nat'l Renewable Energy Lab., *2024 Annual Technology Baseline [Workbook]* (June 25, 2024),*:* https://data.openei.org/files/6006/2024%20v2%20Annual%20Technology%20Baseline%20Workbook%20Errata%207-19-2024.xlsx [retrieved from Nat'l Renewable Energy Lab., *Electricity Annual Technology Baseline (ATB) Data Download*, https://atb.nrel.gov/electricity/2024/data (last visited Feb. 14, 2025)].
[82] EKPC Resp. to JI Q2-29.

Q. Do you agree that BESS technology is "relatively new and unproven"?

A. No. U.S. Energy Information Administration data shows 16,653 MW of BESS resources operating across 41 states, and another 46,950 MW of proposed resources.[83] BESS is used as a capacity resource all around the United States.

Q. What evidence did EKPC provide demonstrating that BESS cannot provide peak capacity?

A. To my knowledge, EKPC provided no information demonstrating this limitation.

Q. In its response to AG Q1-10 EKPC notes that pumped storage in PJM could not be recharged during Winter Storm Elliott because there was not sufficient excess generation available. Does the Company provide any evidence that BESS with or without solar pairing is subject to the same operation constraints as pumped storage?

A. No, it does not.

Q. Could storage, either standalone or paired with solar, help EKPC meet its Winter Peak demand?

A. Yes. Utilities throughout the United States are using both stand-along and solar plus storage resources to help meet Winter Peak needs. EKPC's cursory and largely undocumented assessment that BESS is too costly to consider in modeling does not meet the standard of modeling and resource selection appropriate in a CPCN application.

[83] U.S. Energy Info. Admin., Form EIA-860 (2023), https://www.eia.gov/electricity/data/eia860/ (2023 ZIP file, 3_1_Generator_Y2023, "Operable" tab).

Q. Are you aware of any examples of BESS resources provided useful services at winter peak?

A. Yes. According to a 2024 study conducted by Aurora Energy Research, BESS are the fastest-growing technology in ERCOT's energy mix and are increasingly essential to sustaining system reliability paired with solar and flexible gas generation. Typically, BESS provides key Ancillary Services that support the grid, allowing gas plants to instead generate more energy in the market. BESS have been a crucial resource during extreme events. For instance, BESS prevented blackouts and averted load shedding during a September 6, 2023 event when emergency conditions occurred in ERCOT. Similarly, BESS allowed for more gas generation in the January 2024 winter freeze –saving an estimated $750 million in system costs.[84]

Q. Does EKPC provide any evidence demonstrating a lack of coincidence between solar generation and Winter peak in Kentucky?

A. No, it does not. JI1-12 attachment shows peak system load for Winter Storm Gerri occurring around 8/9 am on January 17, 2024.[85] **[BEGIN CONFIDENTIAL** [redacted]

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[84] Exhibit EAS-4, Connor McMann, *Role of Battery Energy Storage Systems (BESS) in the ERCOT market*, Aurora Energy Research (May 2024).

[85] EKPC Resp. to JI Q1-12, Attachment entitled "*EKPC_JI1-12_Load during Elliott and Gerri.xlsx* ["Gerri" tab]".

[redacted] **END CONFIDENTIAL]**

NREL's Solar Power Data for Integration Studies provides modeled estimates of power production across the different coordinate locations in Kentucky. The files from this resource are provided for utility-scale and distributed solar resources and include actual, day-ahead, and 4-hour ahead forecasts of solar generation for hypothetical solar units ranging in installed capacity from 10 MW to 120 MW in different areas of Kentucky. NREL's 120 MW plant estimates are available at two Kentucky locations corresponding to White Sulphur, KY and Sheridan, KY. According to the data, the actual estimates for utility-scale solar PV in Kentucky at 8:00 AM/9:00 AM range from 0 MW to 52 MW, based on weather experienced in 2006.[87] These data suggest that, in fact, solar could be available at winter peak. Nonetheless, PJM assigns a very small ELCC to solar resources, limiting their use as a resource for meeting supply requirements at peak. Solar plus storage resources, however, do not require coincident peak to act as a capacity resource. In recognition of this difference, PJM's 2024/2025 ELCC Class Ratings for stand-alone solar range from 33 to 50 percent whereas its Ratings for solar plus storage range from 68 to 75 percent.[88]

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[86] EKPC CONFIDENTIAL Resp. to JI Q2.34, Burns McDonnell, *EKPC Solar Generation Program. Proposal* at 5-29 (Aug. 10, 2023).

[87] NREL, *Solar Power Data for Integration Studies*, tabs "Eastern States/Kentucky" (2006),https://www.nrel.gov/grid/solar-power-data.html.

[88] PJM, *Effective Load Carrying Capability (ELCC) Class Ratings* (2023), https://www.pjm.com/-/media/DotCom/planning/res-adeq/elcc/elcc-class-ratings-for-2024-2025.pdf.

Q. In your expert opinion, is EKPC's rationale for excluding BESS as a potential alternative resources valid?

A. No. In my opinion, the appropriate way to include or eliminate resources for proposal in a CPCN is an all-resource RFP followed by long-term optimization modeling that fully and fairly accounts for all of the attributes of the resource.

Q. Has EKPC pursued EIR funding available to lower BESS costs?

A. EKPC has not considered important federal funding streams. First, the exclusion of an ITC from the utility-scale BESS cost per MWh provided by NRCO to EKPC[89] results in an overestimate of BESS costs. Similarly, the EIR program, which provides financing to "retool, repower, repurpose, or replace" energy infrastructure to reduce or eliminate greenhouse gas emissions,[90] was not sought as a funding resource for EKPC[91]—leading to an overestimate of renewable energy costs. EKPC also initially claimed that "BESS was excluded from the USDA's New ERA program"[92] yet as explained above, several other co-ops in the nation successfully funded BESS projects through New ERA.[93]

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[89] EKPC Resp. to JI Q1-14.

[90] U.S. Dept. of Energy, *Energy Infrastructure Reinvestment: Title 17 Clean Energy Financing – Energy Infrastructure Reinvestment*, https://www.energy.gov/lpo/energy-infrastructure-reinvestment (last visited Feb. 14, 2025).

[91] EKPC Resp. to JI Q1-6.

[92] Mosier Direct at 13:12-16.

[93] Exhibit EAS-3.

Q. In your expert opinion, has EKPC made its case that a new Cooper CCGT is needed to address inadequacy of existing service, that the proposed investment does not amount to wasteful duplication, and that it has performed its due diligence by conducting a thorough review of alternatives?

A. No. As explained in the previous section of my testimony, there are serious questions regarding the size and duration of any winter peak demand capacity shortfall for EKPC. Even assuming for sake of argument, however, that EKPC has reasonably projected that need, the Company has not conducted the modeling and analysis necessary to demonstrate that a CCGT is the best and least-cost option for meeting whatever unmet need exists. Instead, EKPC asserts that it is so.

B. Supply Alternatives for Cooper 2

Q. Did EKPC consider alternative supply-side resources when making its determination that the proposed Cooper 2 co-firing modification was the most appropriate and least-cost resource for ratepayers?

A. No.

Q. How did EKPC select the Cooper 2 co-firing modification for CPCN proposal?

A. EKPC's asserts that co-firing at Cooper 2 is necessary ("required to meet the requirements"[94]) but does not appear to explain its process for determining that necessary investment, or an investment that—in comparison to alternatives—provides a least-cost resource for ratepayers.

[94] Mosier Direct at 14:18-21.

Q. Did EKPC perform integrated system modeling to identify Cooper 2 co-firing modifications for proposal in this CPCN application?

A. No.

Q. Has EKPC carried out Net Present Value of Revenue Requirements (“NPVRR”) analysis of the Cooper 2 co-firing modification proposed in this CPCN application?

A. No.

Q. Would a modified Cooper 2 co-firing with gas supply additional peaking resources?

A. No. EKPC asserts that modification of Cooper Unit 2 to co-fire with gas will not change its operational characteristics: “Electrically, the Cooper co-firing and the Spurlock co-firing units will have the same operating characteristics as they do today.”[95] However, EKPC’s production cost modeling providing in this CPCN application anticipates a large increase in Cooper 2 capacity factors (see **Error! Reference source not found.**).[96]

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[95] Application at 7-8.
[96] EKPC Resp. to JI Q1-27(e).

Figure 7. EKPC proposed resource capacity factors [BEGIN CONFIDENTIAL

[redacted]

END CONFIDENTIAL]

Source: EKPC Resp. to JI Q1-5; Attachment Staff DR1.24 – Summary - 3MAY24 – corrected (Confidential).xlxs; REDACTED_BY-1 EKPC Cooper Combined Cycle Project Scoping Report; Application Attach. BY-1, Confidential Pages from BY-1 Cooper Combined Cycle Project Scoping Report.pdf. at p. 4

Q. What environmental rules and regulations does EKPC cite in concluding that the proposed Cooper 2 co-firing modifications are necessary?

A. EKPC's Cooper 2 coal-fired unit is subject to the U.S. Environmental Protection Agency's Clean Air Act Section 111(d) rule (i.e., called the new "GHG Rule" in EKPC's application). To comply with the new GHG Rule at its existing coal-fired units, EKPC must choose one of three compliance pathways: (1) retire (and replace); (2) co-fire with natural gas; or (3) install carbon capture and sequestration ("CCS") technology. EKPC Witness Purvis outlines the details of these three compliance pathways in his testimony:

> The EPA GHG finalized rule allows operators of existing coal-fired power plants to elect by January 1, 2030, to choose between a "do nothing" option and retire the unit by January 1, 2032. For coal units that prefer to operate longer, they have the option to select "medium-term" that allows existing coal fired operators to elect to "co-fire coal" with 40% natural gas between January 1, 2032, until one day before January 1, 2039. For coal units that need to operate beyond January 1, 2039, they need to select adding carbon capture and sequestration.[97]

Although ongoing litigation of the GHG Rule raises uncertainties, EKPC contends that it "must prudently plan to comply."[98] With that, EKPC proposes co-firing Cooper 2 with natural gas as the most appropriate compliance pathway for the Company to pursue:

> For existing coal fired units at Cooper 2 and Spurlock's 1-4, EKPC plans to comply with this new rule by electing the medium-term option on January 1, 2030, to co-fire coal with 40% natural gas from 2032 through 2039.[99]

Q. Did EKPC consider other compliance pathways for Cooper Unit 2, such as retiring and replacing the unit with supply- and/or demand-side alternatives?

A. No. EKPC did not provide the costs and benefits of the co-fire compliance pathway in comparison to retiring and replacing Cooper Unit 2.

Q. Did you assess the expected costs of the continued operation of Cooper 2 in comparison to its expected revenues?

A. No, I was unable to perform this comparison. EKPC did not provide Cooper 2's fixed O&M and capital costs for 2025 through 2029 in response to Joint Intervenors' request. EKPC also did not provide Cooper 2's historical costs separately from those of Cooper 1. Assuming that

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[97] Application Ex. 7, Direct Testimony of Jerry Purvis on Behalf of East Kentucky Power Cooperative, Inc., Case No. 2024-00370, at 10:3-9 (Nov. 20, 2024) ("Purvis Direct").
[98] Purvis Direct at 11:2.
[99] *Id.* at 10:21-23.

Cooper 1 and 2's historical costs were proportional to their respective levels of generation, Cooper 2 costs far exceeded its revenues from 2019 through 2024.

Q. In your expert opinion, has EKPC made its case that co-firing at Cooper 2 is economically preferable to retiring the unit, that the proposed investment does not amount to wasteful duplication, and that it has performed its due diligence by conducting a thorough review of alternatives?

A. No. In my opinion, EKPC has failed to demonstrate that co-firing modifications at Cooper 2 are economically preferable to retiring and replacing the unit. No modeling has been conducted to compare co-firing modification with either retirement or alternative resources. To the extent that a need exists, the Company has not demonstrated that all three projects (Cooper CCGT, Liberty RICE, and Cooper 2 co-firing) are necessary, or that co-firing modifications at Cooper 2 are the best or least-cost solution for ratepayers.

VII. IMPACTS ON RATEPAYERS

Q. What impacts will each of the new resources proposed for CPCN approval have on ratepayer costs?

A. EKPC did not provide individual ratepayer impacts for each investment the Cooper CCGT and Cooper 2 co-firing modifications, stating that "[t]he proposed projects were not modeled individually, but as a package."[100]

[100] EKPC Resp. to JI Q1.11.

Q. Can a CPCN application for a particular resource be evaluated based on the rate impacts of a package of resources that includes it?

A. No. EKPC claims to have assembled a package of resources that "are all carefully balanced to wholistically reduce EKPC's carbon intensity and encourage development while also preserving reliability and keeping rates competitive"[101] but does not provide the Commission and stakeholders with the materials that would be necessary to evaluate that claim.

Q. What estimate of rate impacts does EKPC provide?

A. EKPC's rate impact estimate includes not only Cooper CCGT, Cooper 2, and Spurlock co-firing modifications, but also a proposed RICE unit and New ERA-funded renewables. EKPC explains that it "does not have a calculation project by project of the cost or benefit to members," but claims that its "projections indicate that EKPC will be able to implement the complete proposed portfolio of projects (RICE, Cooper CC, Co-firing and New ERA renewables) which meets generation needs and environmental compliance requirements with modest rate increases, averaging less than 2% per year over the next 20 years."[102]

Q. What does EKPC's projected annual increase in rates amount to over 20 years?

A. EKPC expects its rates to **[BEGIN CONFIDENTIAL]** [redacted] **[END CONFIDENTIAL]** over the next 20 years.[103]

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[101] Mosier Direct at 8:17-20.
[102] EKPC Resp. to JI Q1-11.
[103] CONFIDENTIAL EKPC 2024 Financial Forecast at 8.

Q. Did EKPC provide calculations and background materials showing how it calculated a less than 2% annual increase in customer rates?

A. Only to a limited extent. The Joint Intervenors requested that EKPC explain its methods of calculating this rate increase and provide modeling input and output files, workbooks and other materials related to that calculation in JI 2-8. EKPC's reply was to produce its 2024 Financial Forecast, which includes outputs and some explanation of inputs from the Company's model forecasting rate impacts but does not provide detailed methods, assumptions, or calculations.

Q. What information on rate impacts does EKPC's 2024 Financial Forecast provide?

A. EKPC's 2024 Financial Forecast provides system revenue and costs, member sales, and a "cost to member systems" dollar per MWh value.

Q. How do the member sales forecasted in EKPC's 2024 *Financial Forecast* compare to sales assumed in the production cost modeling produced in this CPCN proceeding?

A. That is unclear. The production cost modeling produced in this CPCN proceeding includes **[BEGIN CONFIDENTIAL]** [redacted] **[END CONFIDENTIAL]**.

Q. How would a substantially higher sales forecasts influence EKPC's rate impact estimates?

A. A higher sales forecast would increase both system costs and revenues from customer sales. On balance, a higher sales forecast would likely result in lower projected cost to member systems. For example, **[BEGIN CONFIDENTIAL]** [redacted] **[END CONFIDENTIAL]**

Figure 8. EKPC cost to member systems ($ per MWh)[BEGIN CONFIDENTIAL

[redacted]

END CONFIDENTIAL]

Sources: CONFIDENTIAL EKPC 2024 Financial Forecast; Confidential-JI2.8.c2.xlxs; Staff DR1.24 – Summary - 3MAY24 – corrected (Confidential).xlxs.

VIII. RECOMMENDATIONS AND CONCLUSION

Q. In light of your review of this CPCN application, what actions do you recommend to the Commission?

A. I recommend that the Commission:

1. Reject EKPC's CPCN application for the Cooper CCGT project on the grounds that EKPC has not adequately supported its winter peak demand forecast, failed to provide the modeling and analytical support needed to justify the CCGT, and failed to demonstrate that the CCGT is superior to other available alternatives such as battery storage, demand response, or peaking resources.

2. In the alternative, if the Commission finds it necessary to approve the CPCN for the Cooper CCGT project, the Commission should also require EKPC to file within one year a re-evaluation of the CCGT project, including the following analyses:

    a. A new Load Forecast, including a transparent justification for expected increases in large customer load and its new 7 percent Winter reserve margin; a comparison to PJM's forecasts for EKPC; a combined analysis of all recent changes affecting the Company's needs for Winter supply resources including load forecasting methods, the inclusion of a Winter reserve margin, and various measures taken by PJM; and quantitative modeling of reliability metrics and reporting number and duration of projected capacity shortfalls and service interruptions.

    b. Issuance and reporting on the results of an all-resource RFP for supply- and demand-side resources to assure that accurate, up-to-date market prices and availabilities underpin its resource analysis.

    c. Performance of modeling that includes current market cost estimates for all potential supply- and demand-side resources, without a pre-modeling round of qualitative elimination of potential resources.

    d. Updated system-wide long-term optimization modeling with multiple scenarios, portfolios, and testing of sensitivities and uncertainties.

    e. Report on any updated cost estimates for the CCGT Project, and provide both an estimated rate impact and NPVRR analysis of proceeding with the Project.

3. Provide clear direction that the modeling and analytical steps identified in 2.a-e above must be provided by EKPC as part of the application for any future CPCN application.

4. Reject EKPC's CPCN application for the Cooper 2 Co-firing modification on the grounds that EKPC has not demonstrated satisfactorily that the modification is necessary on the basis of inadequacy of existing service, does not represent wasteful duplication, and is superior to other available alternatives, such as retirement of the unit.

Q. Does this conclude your testimony?

A. Yes.

VERIFICATION

The undersigned, Elizabeth A. Stanton being first duly sworn, deposes and says that she has personal knowledge of the matters set forth in the foregoing testimony and that the information contained therein is true and correct to the best of her information, knowledge, and belief, after reasonable inquiry.

Elizabeth Stanton
____

Subscribed and sworn to before me by ELIZABETH STANTON this 13th day of FEBRUARY, 2025.

MATTHEW LEONAGGEO
Notary Public

My commission expires: APRIL 22, 2026

MATTHEW B. LEONAGGEO
COMMISSION # 50037033
NOTARY PUBLIC - NEW JERSEY
Comm. Expires April 22, 2026

EXHIBIT EAS-1

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PROFESSIONAL EXPERIENCE

Applied Economics Clinic, Boston, MA. *Executive Director and Principal Economist*, February 2017 – Present.

The Applied Economics Clinic provides technical expertise to public service organizations working on topics related to the environment, consumer rights, the energy sector, and community equity. Dr. Stanton is the Founder and Director of the Clinic (www.aeclinic.org).

Liz Stanton Consulting, Arlington, MA. Independent Consultant, August 2016 – January 2017.

Providing consulting services on the economics of energy, environment and equity.

Synapse Energy Economics Inc., Cambridge, MA. *Principal Economist*, 2012 – 2016.

Consulted on issues of energy economics, environmental impacts, climate change policy, and environmental externalities valuation.

Stockholm Environment Institute - U.S. Center, Somerville, MA. *Senior Economist*, 2010 – 2012; *Economist*, 2008 – 2009.

Wrote extensively for academic, policy, and general audiences, and directed studies for a wide range of government agencies, international organizations, and nonprofit groups.

Global Development and Environment Institute, Tufts University, Medford, MA. *Researcher*, 2006 – 2007.

Political Economy Research Institute, University of Massachusetts-Amherst, Amherst, MA. *Editor and Researcher – Natural Assets Project*, 2002 – 2005.

Center for Popular Economics, **University of Massachusetts-Amherst**, Amherst, MA. *Program Director*, 2001 – 2003.

EDUCATION

University of Massachusetts-Amherst, Amherst, MA

Doctor of Philosophy in Economics, 2007

New Mexico State University, Las Cruces, NM

Master of Arts in Economics, 2000

School for International Training, Brattleboro, VT

Bachelor of International Studies, 1994

AFFILIATIONS

Global Development and Environment Institute, Tufts University, Medford, MA.

Senior Fellow, Visiting Scholar, 2007 – 2020

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Tufts University, Medford, MA

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College of New Rochelle, New Rochelle, NY

Assistant Professor, Department of Social Sciences, 2007 – 2008

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Adjunct Professor, Social Sciences Department, 2006

Castleton State College and the Southeast Vermont Community Learning Collaborative, Dummerston, VT

Adjunct Professor, 2005

School for International Training, Brattleboro, VT

Adjunct Professor, Program in Intercultural Management, Leadership, and Service, 2004

CV dated January 2025

EXHIBIT EAS-2

2025

PJM Long-Term Load Forecast Report

Posted Date: January 24, 2025

Prepared by PJM Resource Adequacy Planning Department

For Public Use

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TO Zones and Subzones

Abbreviation	Zone Name	Date Incorporated
AE	Atlantic Electric zone	
AEP	American Electric Power zone	Oct. 1, 2004
APP	Appalachian Power, sub-zone of AEP	
APS	Allegheny Power zone	April 1, 2002
ATSI	American Transmission Systems, Inc. zone	June 1, 2011
BGE	Baltimore Gas & Electric zone	
CEI	Cleveland Electric Illuminating, sub-zone of ATSI	
COMED	Commonwealth Edison zone	May 1, 2004
CSP	Columbus Southern Power, sub-zone of AEP	
DAY	Dayton Power & Light zone	Oct. 1, 2004
DEOK	Duke Energy Ohio/Kentucky zone	January 1, 2012
DLCO	Duquesne Lighting Company zone	January 1, 2005
DOM	Dominion Virginia Power zone	May 1, 2005
DPL	Delmarva Power & Light zone	
EKPC	East Kentucky Power Cooperative zone	June 1, 2013
FE-East	The combination of FirstEnergy's Jersey Central Power & Light, Metropolitan Edison, and Pennsylvania Electric zones (formerly GPU)	
INM	Indiana Michigan Power, sub-zone of AEP	
JCP&L	Jersey Central Power & Light zone	
KP	Kentucky Power, sub-zone of AEP	

Abbreviation	Zone Name	Date Incorporated
METED	Metropolitan Edison zone	
MP	Monongahela Power, sub-zone of APS	
OEP	Ohio Edison, sub-zone of ATSI	
OP	Ohio Power, sub-zone of AEP	
OVEC	Ohio Valley Electric Corporation zone	December 1, 2018
PECO	PECO Energy zone	
PED	Potomac Edison, sub-zone of APS	
PEPCO	Potomac Electric Power zone	
PL	PPL Electric Utilities, sub-zone of PLGroup	
PLGroup/PLGRP	Pennsylvania Power & Light zone	
PENLC	Pennsylvania Electric zone	
PP	Pennsylvania Power, sub-zone of ATSI	
PS	Public Service Electric & Gas zone	
RECO	Rockland Electric (East) zone	March 1, 2002
TOL	Toledo Edison, sub-zone of ATSI	
UGI	UGI Utilities, sub-zone of PLGroup	
WP	West Penn Power, sub-zone of APS	

Glossary

Term / Abbreviation	Definition
Battery Storage	Devices that enable generated energy to be stored and then released at a later time. (Also Battery Energy Storage System – BESS)
Contractually Interruptible	Load Management from customers responding to direction from a control center
Cooling Load	The weather-sensitive portion of summer peak load
Direct Control	Load Management achieved directly by a signal from a control center
Heating Load	The weather-sensitive portion of winter peak load
Net Energy	Net Energy for Load, measured as net generation of main generating units plus energy receipts minus energy deliveries
PRD	Price Responsive Demand
Unrestricted Peak	Peak load prior to any reduction for load management or voltage reduction.
Zone	Areas within the PJM Control Area, as defined in the PJM Reliability Assurance Agreement

Executive Summary

This report presents an independent load forecast prepared by PJM staff.

- The report includes a 20 year long-term forecasts of peak loads, net energy, load management, distributed solar generation, plug-in electric vehicles, and battery storage for each PJM zone, region, locational deliverability area (LDA), and the total RTO.

- New to the report this year is a table for the total load associated with adjustments to summer peak loads (Table B-9b available on the PJM Website). All tables are now provided in excel format for ease of use.

- Residential, Commercial, and Industrial sector models were estimated with data from 2014 through 2023. Hourly models were estimated with data from 2015 to August 2024. Weather scenarios were simulated with data from years 1993 through 2023, generating 403 scenarios.

- The economic forecast used was Moody's Analytics' September 2024 release.

Energy Information Administration & Vendor Data

The Energy Information Administration (EIA) did not publish an Annual Energy Outlook (AEO) update in 2024 as they revamp models and make improvements to capture emerging technologies. Therefore, the 2023 update of Itron's end-use data provides the basis for appliance saturation rates, efficiency, and intensity and is consistent with the EIA's 2023 AEO. PJM obtained additional information from certain zones on Residential saturation rates based on their own load research. Details on zones providing information are presented in the supplement.

Consultant forecasts for behind the meter solar/battery and electric vehicles including light, medium & heavy duty were provided by S&P Global.

- The behind the meter solar/battery values were derived by PJM from a forecast obtained from SPGCI
- The electric vehicle values were derived by PJM from a forecast obtained from SPGCI

Compared to the 2024 Load Report, the 2025 PJM RTO summer peak forecast shows the following changes for three years of interest:

Next Year:		
Delivery	RPM Auction	RTEP Study
2025	**2026**	**2030**
+651 MW	**+2,134** MW	**+16,010**MW
(0.4%)	*(1.4%)*	*(9.5%)*

Load Adjustments

The forecasts of the following zones have been adjusted to account for large, unanticipated load changes, market adjustments, and peak shaving adjustments (see **Tables B-9** and **B-9b** and the supplement for details available on the PJM Website):

Zones	Adjusted to account for:
AEP	growth in data center load and a chip processing plant
APS, ATSI, BGE, DAYTON, PECO, and PL	growth in data center load
COMED	growth in data center load and an electric vehicle battery plant
DEOK	adjusted to account for growth in a steel facility
DOM	growth in data center load and a voltage optimization program
PS	growth in data center load and port electrification
EKPC	a peak shaving program that commenced in the 2023 DY
ATSI and DOM	Non-Retail Behind-the-Meter Generation (NRBTMG) transitioning to participation as Demand Response in the Reliability Pricing Model

Summer & Winter Summary

Summer peak load growth for the PJM RTO

- Projected to average 3.1% per year over the next 10-year period and 2.0% over the next 20 years.
- Summer peak is forecasted to be 209,923 MW in 2035, a 10-year increase of 55,779 MW, and reaches 228,544 MW in 2045, a 20-year increase of 74,400 MW.
- Annualized 10-year growth rates for individual zones range from 0.1% to 6.3%; median of 0.7%.

Winter Peak Load Growth – PJM RTO

- Projected to average 3.8% per year over the next 10-year period, and 2.4% over the next 20 years.
- The PJM RTO winter peak load in 2034/35 is forecasted to be 198,175 MW, a 10-year increase of 62,048 MW, and reaches 218,760 MW in 2044/45, a 20-year increase of 82,633 MW.
- Annualized 10-year growth rates for individual zones range from 0.1% to 6.0%; median of 1.6%.

Net Energy Load Growth – PJM RTO

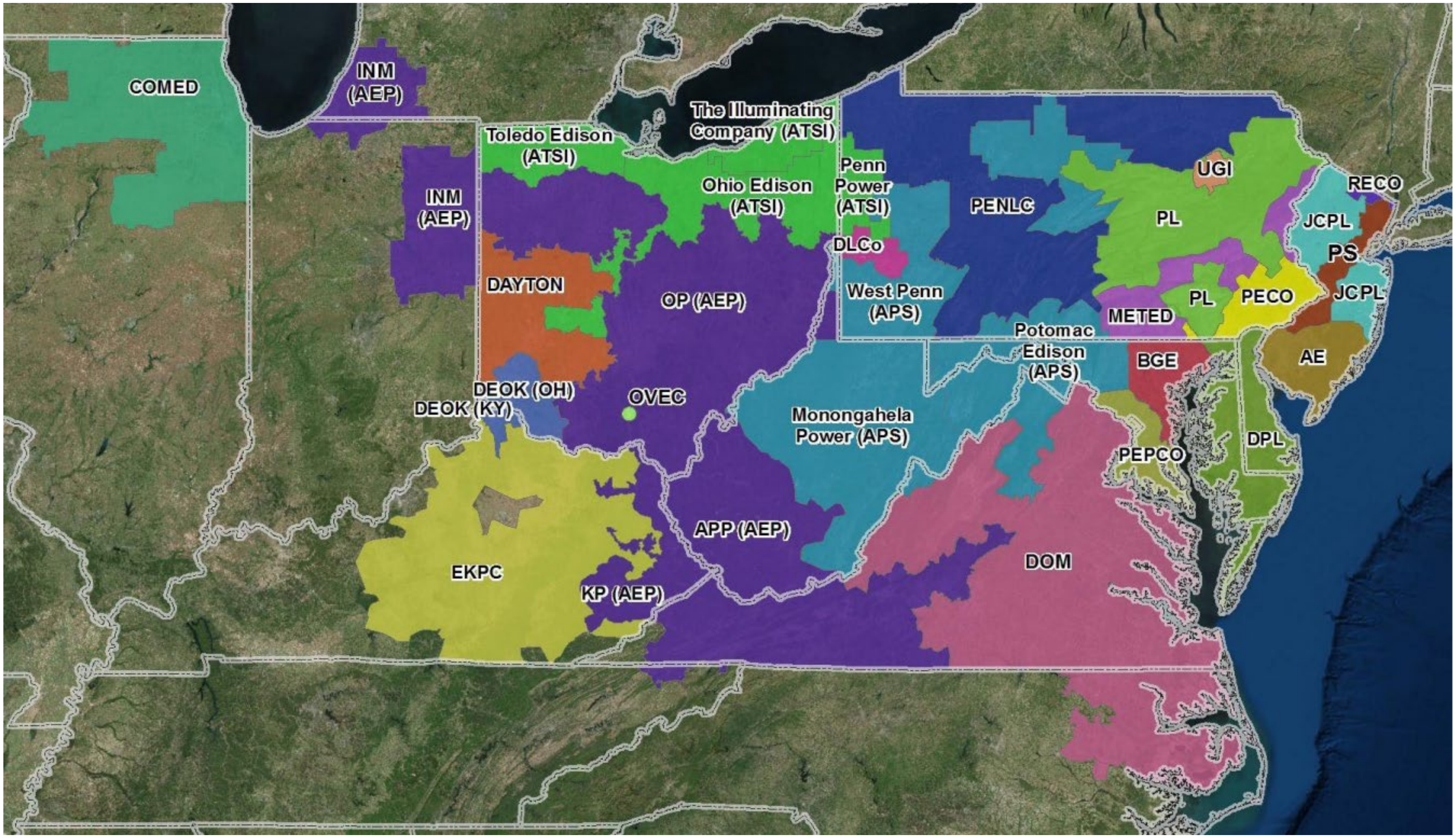
- Projected to average 4.8% per year over the next 10-year period, and 2.9% over the next 20-years.
- Total PJM RTO energy is forecasted to be 1,328,045 GWh in 2035, a 10-year increase of 495,264 GWh, and reaches 1,482,068 GWh in 2045, a 20-year increase of 649,287 GWh.
- Annualized 10- year growth rates for individual zones range from 0.2% to 8.4%; median of 1.6%.

NOTE:

Unless noted otherwise, all peak and energy values are non-coincident, unrestricted peaks, which represent the peak load or net energy after reductions for distributed solar generation and battery storage (in summer peak), additions for plug-in electric vehicles, and prior to reductions for load management impacts.

All compound growth rates are calculated from the first year of the forecast.

PJM Map


COMED
INM (AEP)
INM (AEP)
Toledo Edison (ATSI)
The Illuminating Company (ATSI)
Ohio Edison (ATSI)
Penn Power (ATSI)
PENLC
UGI
RECO
PL
JCPL
PS
DLCo
DAYTON
OP (AEP)
West Penn (APS)
PL
PECO
JCPL
METED
Potomac Edison (APS)
BGE
AE
DEOK (OH)
DEOK (KY)
OVEC
Monongahela Power (APS)
PEPCO
DPL
APP (AEP)
DOM
EKPC
KP (AEP)

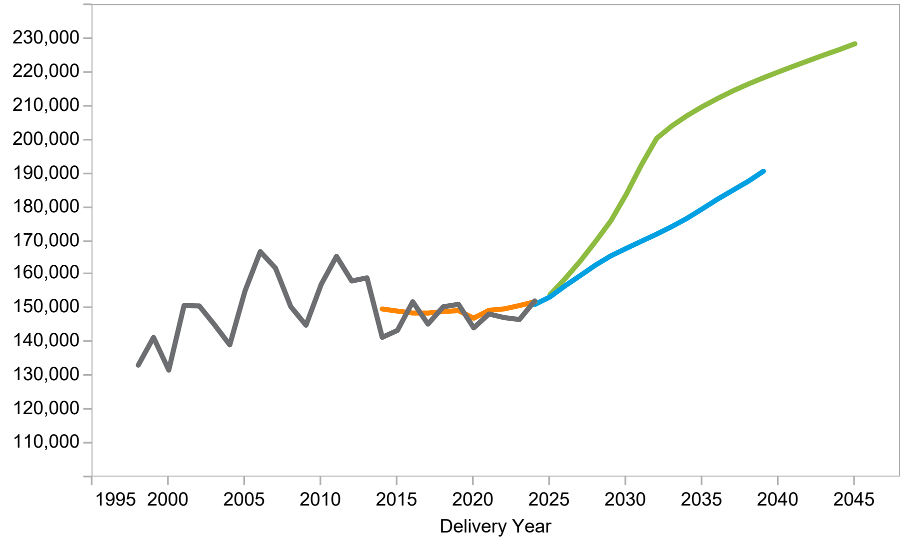
PJM RTO, LDA, and Zonal Dashboards

Click below to jump to an LDA or PJM Zone's data page

PJM RTO	MAAC	E-MAAC	S-MAAC	PJM Western
AE	BGE	DPL	JCPL	METED
PECO	PENLC	PEPCO	PL	PS
RECO	UGI	AEP	APS	ATSI
COMED	DAYTON	DEOK	DLCO	EKPC
DOM				

PJM RTO

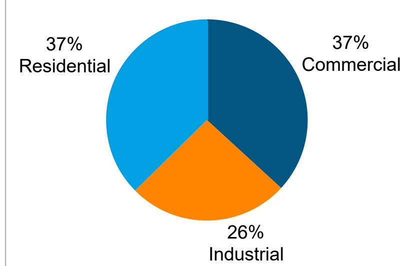
Summer Peak



Weather - Annual Average 1993-2023

Avg Summer Daily Temp	*74.3*
Avg Summer Max Temp	*95.2*
Avg Winter Daily Temp	*34.3*
Avg Winter Min Temp	*4.1*

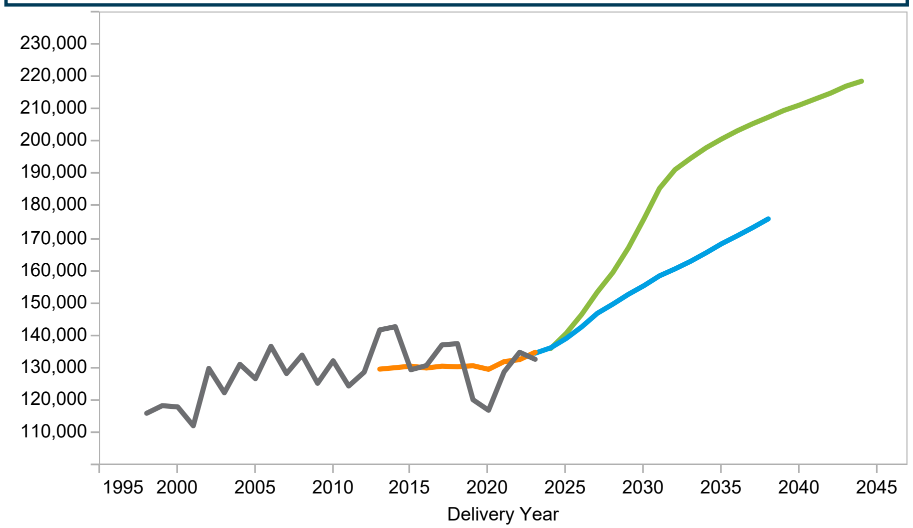
RCI Makeup



Zonal 10/15/20 Year Load Growth

SUMMER	3.1%	2.4%	2.0%
WINTER	3.8%	2.9%	2.4%

Winter Peak



Peak WN peak Forecast 2024 Forecast 2025

LDAs

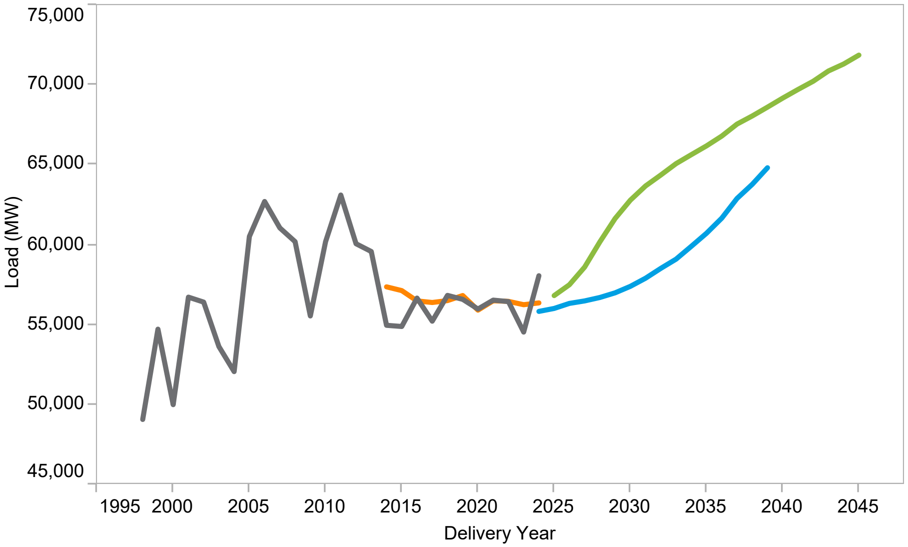
PJM Mid-Atlantic
Eastern MAAC
Southern MAAC
Central MAAC
Western MAAC
PJM West

Zones

AE	DAYTON	JCPL	PEPCO
AEP	DEOK	METED	PL
APS	DLCO	OVEC	PS
ATSI	DOM	PECO	RECO
BGE	DPL	PENLC	UGI
COMED	EKPC		

PJM Mid-Atlantic (MAAC)

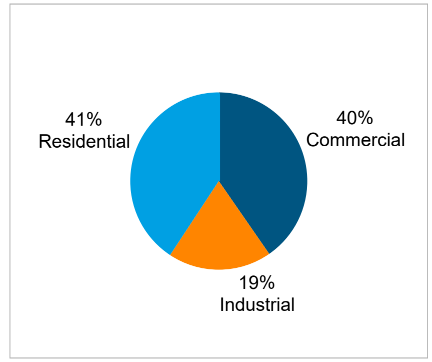
Summer Peak



Weather - Annual Average 1993-2023

Avg Summer Daily Temp	*74.8*
Avg Summer Max Temp	*96.3*
Avg Winter Daily Temp	*35.1*
Avg Winter Min Temp	*6.6*

RCI Makeup



Zonal 10/15/20 Year Load Growth

SUMMER	1.5%	1.3%	1.2%
WINTER	2.7%	2.2%	1.9%

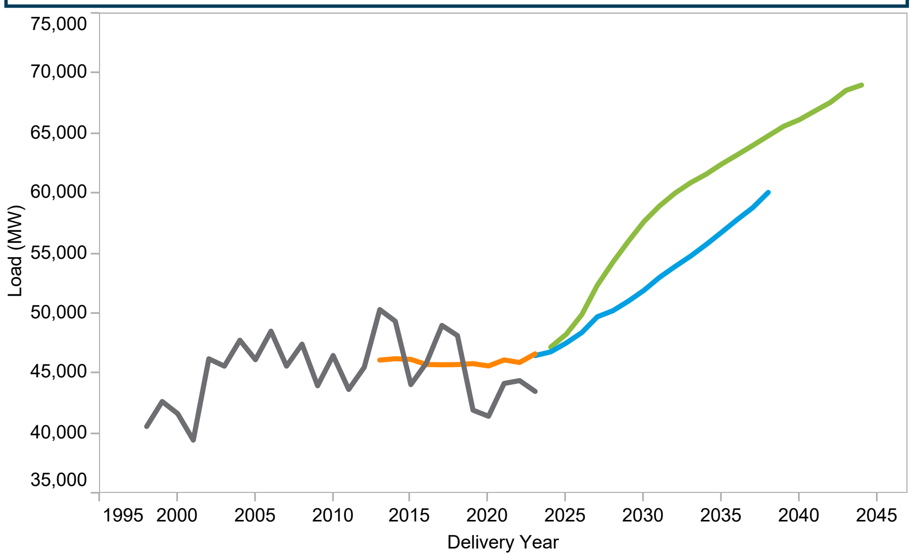
Zones

AE	JCPL	PENLC	PSEG
BGE	METED	PEPCO	RECO
DPL	PECO	PL	UGI

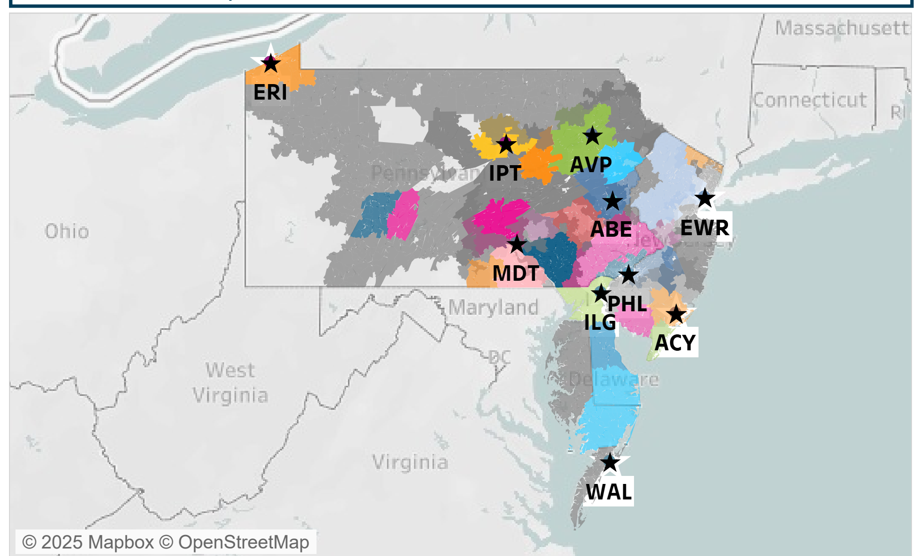
LDAs

E-MAAC	C-MAAC
S-MAAC	W-MAAC

Winter Peak



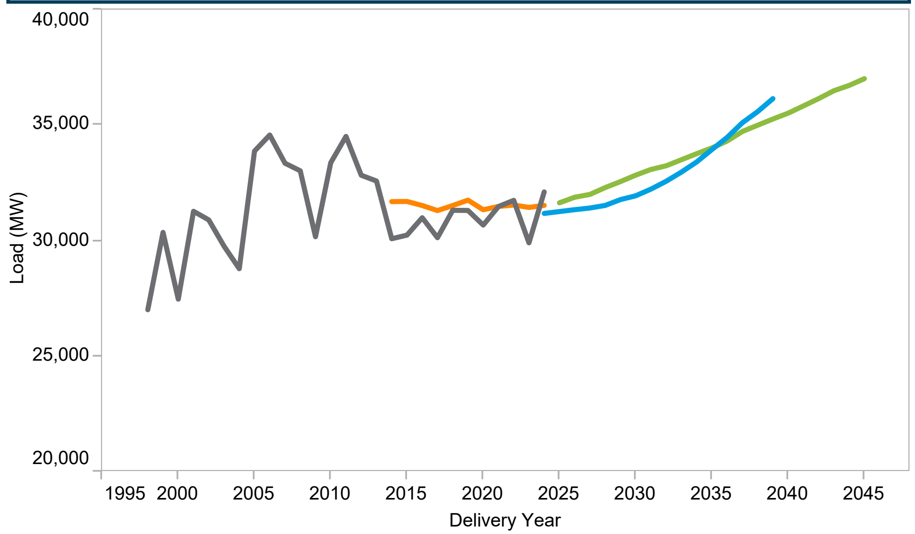
Metropolitan Statistical Areas and Weather Stations



Peak WN peak Forecast 2024 Forecast 2025

PJM Eastern Mid-Atlantic (E-MAAC)

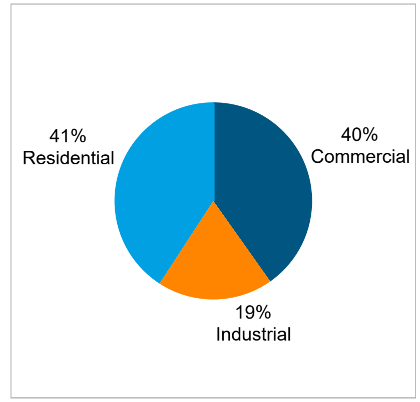
Summer Peak



Weather - Annual Average 1993-2023

Avg Summer Daily Temp	*75.7*
Avg Summer Max Temp	*97.5*
Avg Winter Daily Temp	*36.4*
Avg Winter Min Temp	*7.9*

RCI Makeup



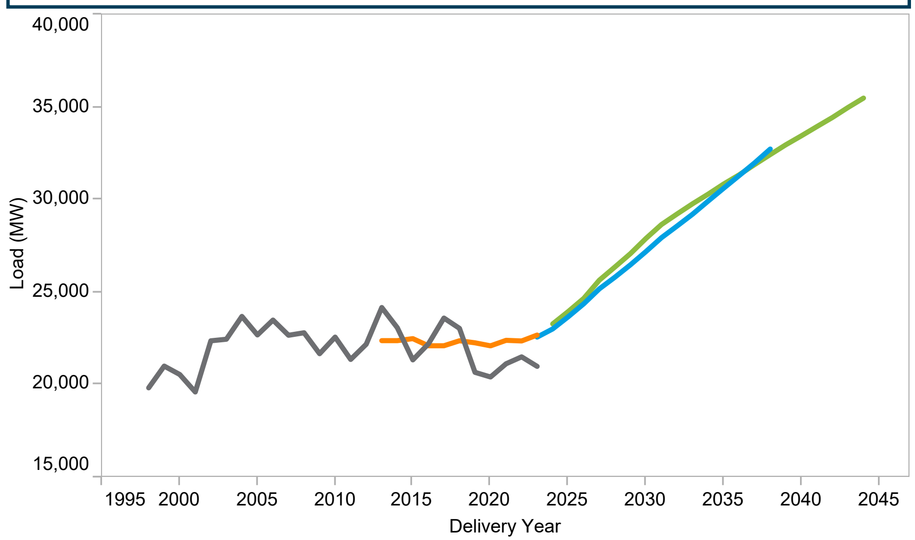
Zonal 10/15/20 Year Load Growth

SUMMER	0.7%	0.8%	0.8%
WINTER	2.7%	2.3%	2.1%

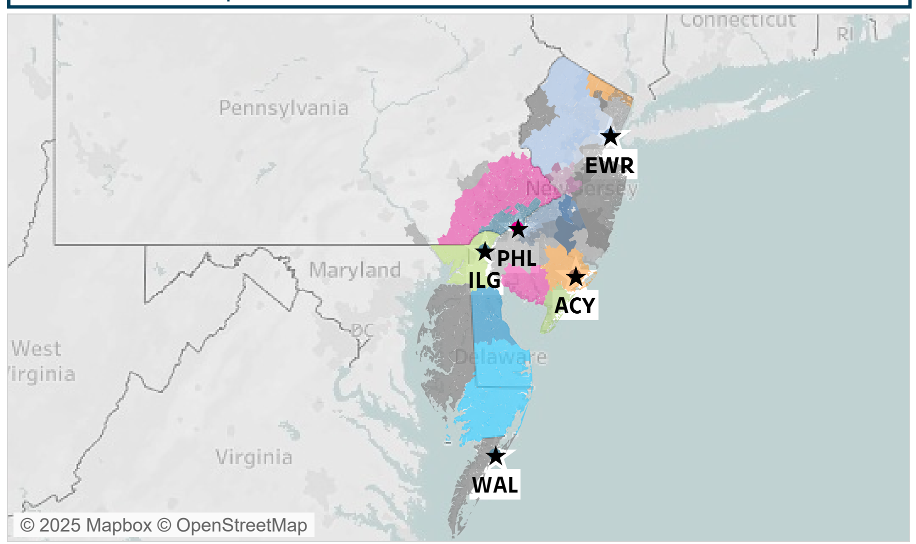
Zones

AE DPL JCPL PECO PS RECO

Winter Peak



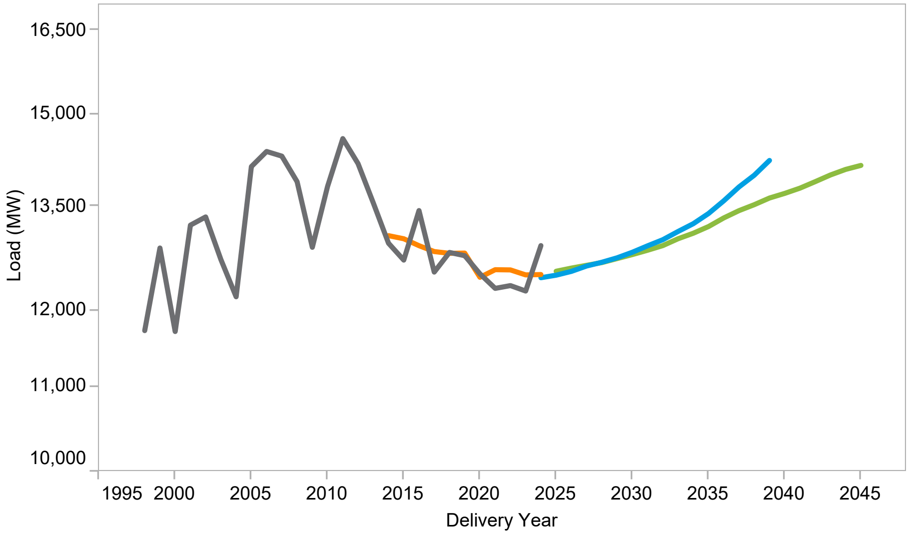
Metropolitan Statistical Areas and Weather Stations



Peak WN peak Forecast 2024 Forecast 2025

PJM Southern Mid-Atlantic (S-MAAC)

Summer Peak



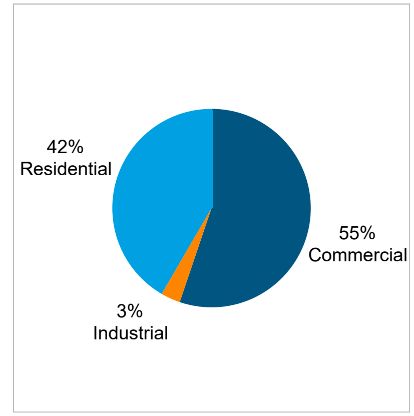
Weather - Annual Average 1993-2023

Avg Summer Daily Temp	*77.1*
Avg Summer Max Temp	*98.0*
Avg Winter Daily Temp	*38.1*
Avg Winter Min Temp	*10.4*

Zonal 10/15/20 Year Load Growth

SUMMER	0.5%	0.6%	0.6%
WINTER	0.8%	0.8%	0.7%

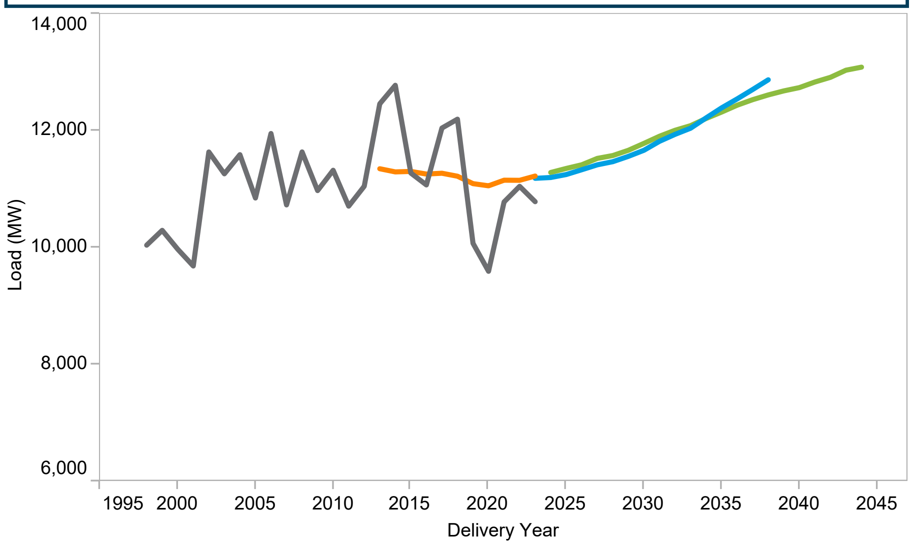
RCI Makeup



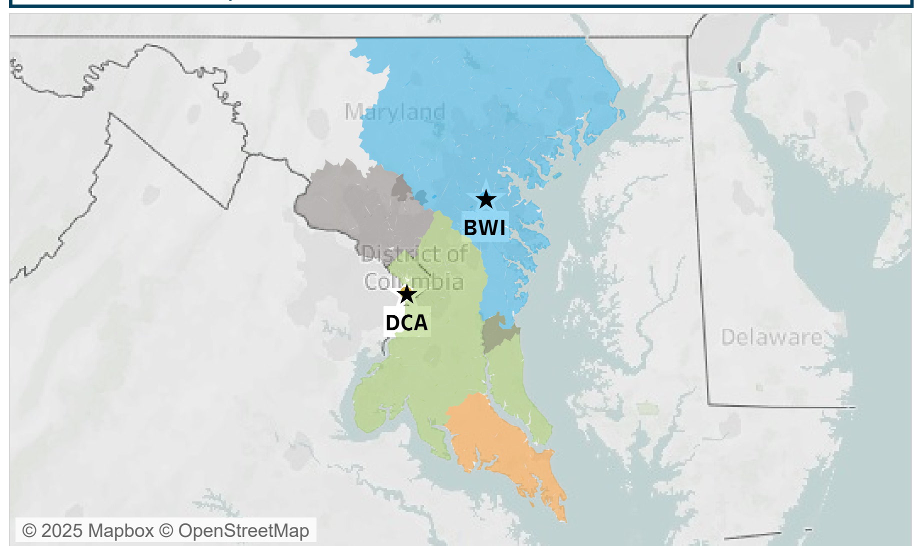
Zones

BGE PEPCO

Winter Peak



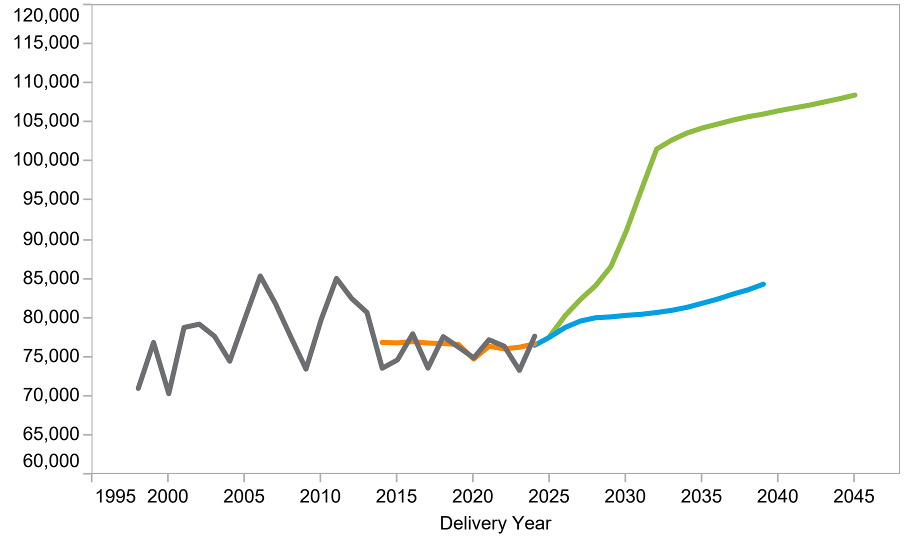
Metropolitan Statistical Areas and Weather Stations



Peak WN peak Forecast 2024 Forecast 2025

PJM Western

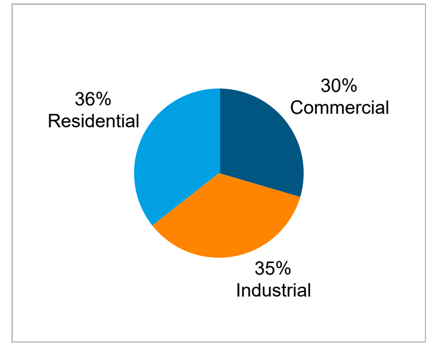
Summer Peak



Weather - Annual Average 1993-2023

Avg Summer Daily Temp	73.2
Avg Summer Max Temp	93.2
Avg Winter Daily Temp	32.2
Avg Winter Min Temp	-0.7

RCI Makeup



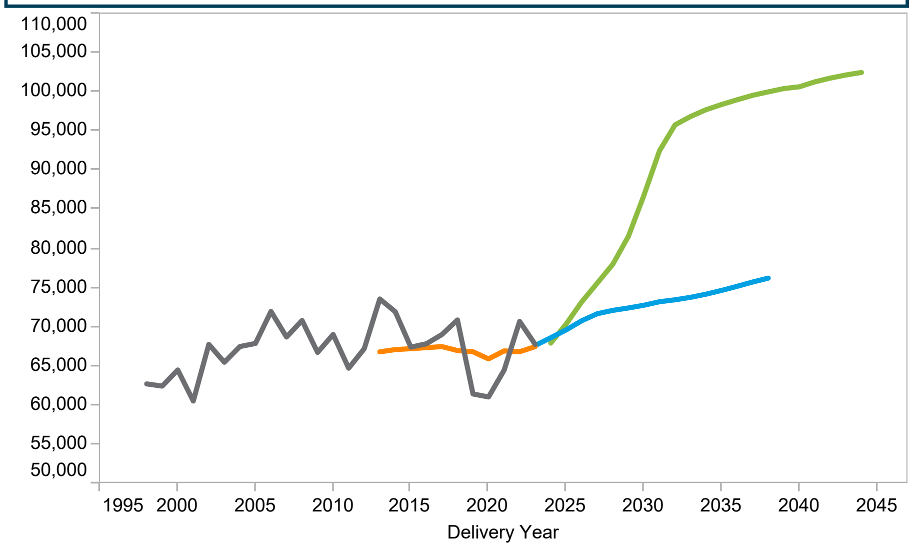
Zonal 10/15/20 Year Load Growth

SUMMER	3.0%	2.1%	1.7%
WINTER	3.7%	2.6%	2.1%

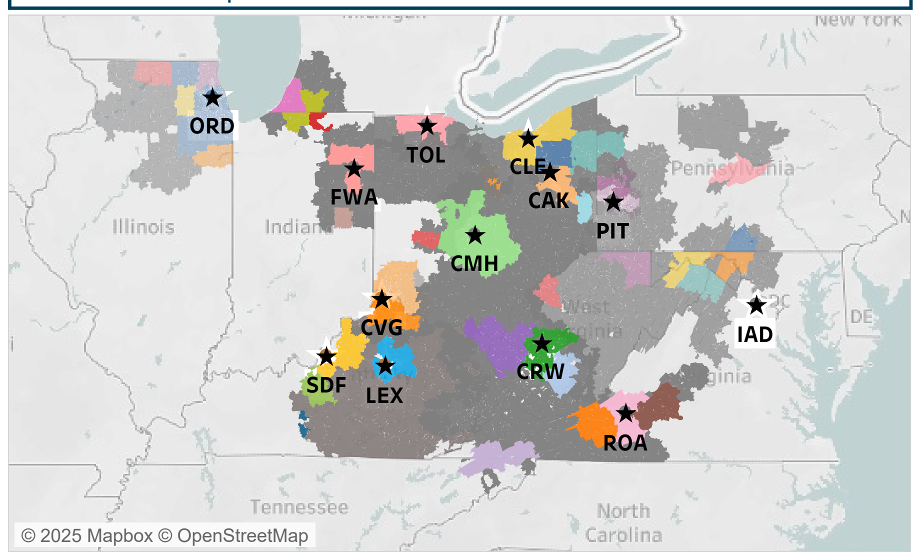
Zones

AEP	COMED	DLCO
APS	DAYTON	EKPC
ATSI	DEOK	OVEC

Winter Peak



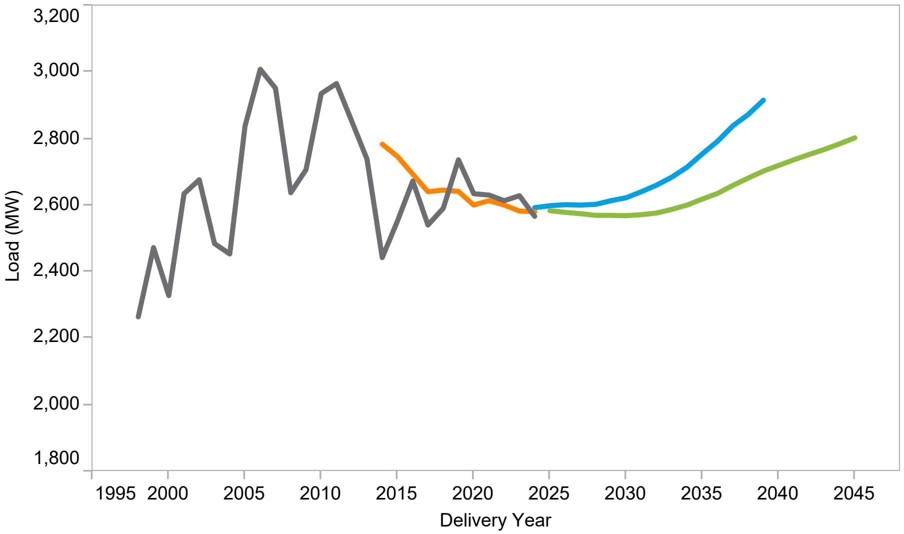
Metropolitan Statistical Areas and Weather Stations



Peak WN peak Forecast 2024 Forecast 2025

Atlantic Electric (AE)

Summer Peak



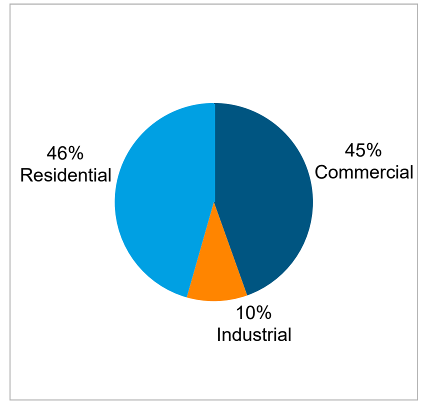
Weather - Annual Average 1993-2023

Avg Summer Daily Temp	*74.3*
Avg Summer Max Temp	*97.0*
Avg Winter Daily Temp	*36.8*
Avg Winter Min Temp	*6.1*

Zonal 10/15/20 Year Load Growth

SUMMER	0.1%	0.3%	0.4%
WINTER	2.4%	2.3%	2.2%

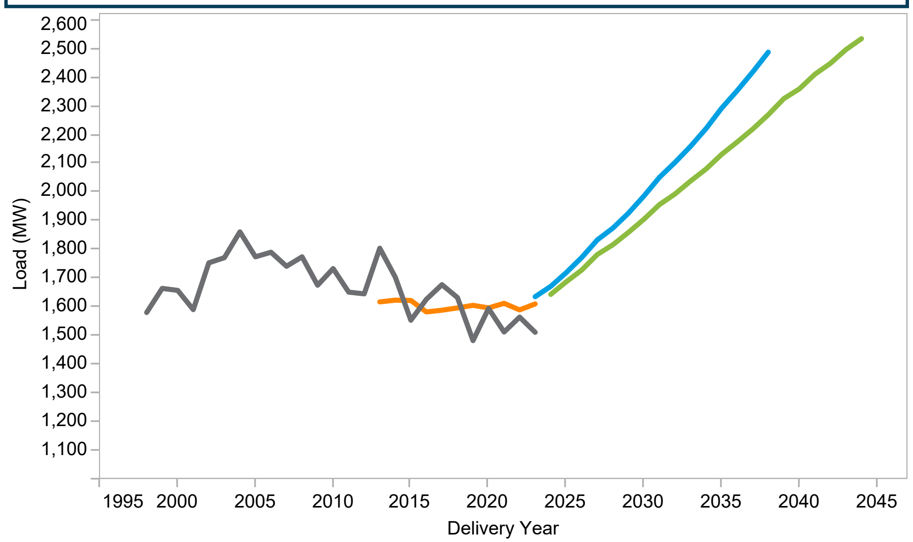
RCI Makeup



LDAs

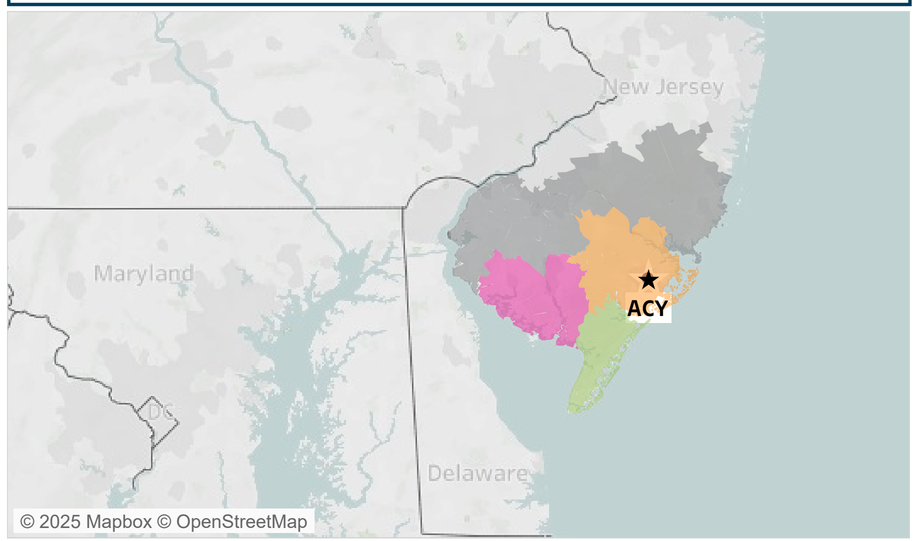
EASTERN MID-ATLANTIC PJM MID-ATLANTIC PJM RTO

Winter Peak



Peak WN peak Forecast 2024 Forecast 2025

Metropolitan Statistical Areas and Weather Stations

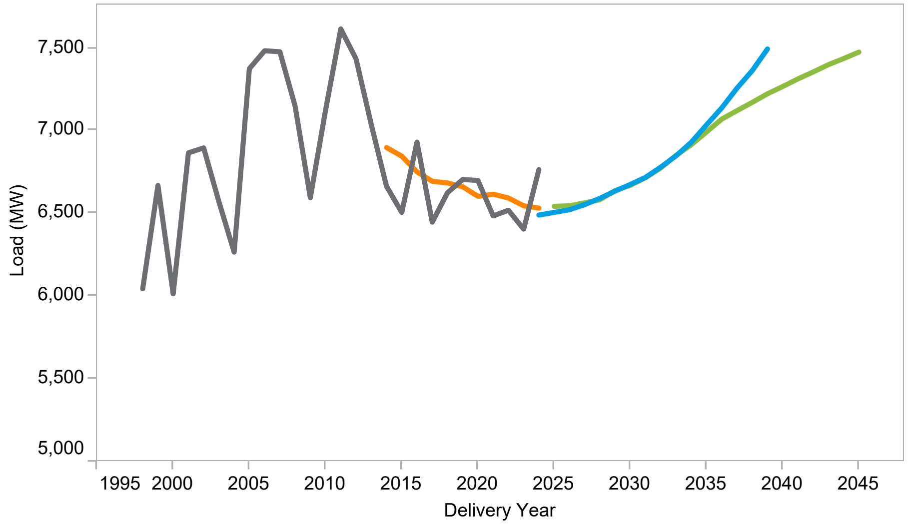


MSA

AE - Non-Metro
Atlantic City-Hammonton, NJ
Ocean City, NJ
Vineland-Bridgeton, NJ

Baltimore Gas & Electric (BGE)

Summer Peak



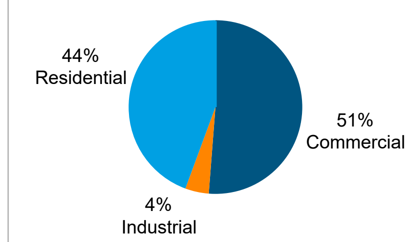
Weather - Annual Average 1993-2023

Avg Summer Daily Temp	*76.1*
Avg Summer Max Temp	*98.0*
Avg Winter Daily Temp	*36.9*
Avg Winter Min Temp	*8.0*

Zonal 10/15/20 Year Load Growth

SUMMER	0.7%	0.7%	0.7%
WINTER	1.0%	1.0%	0.9%

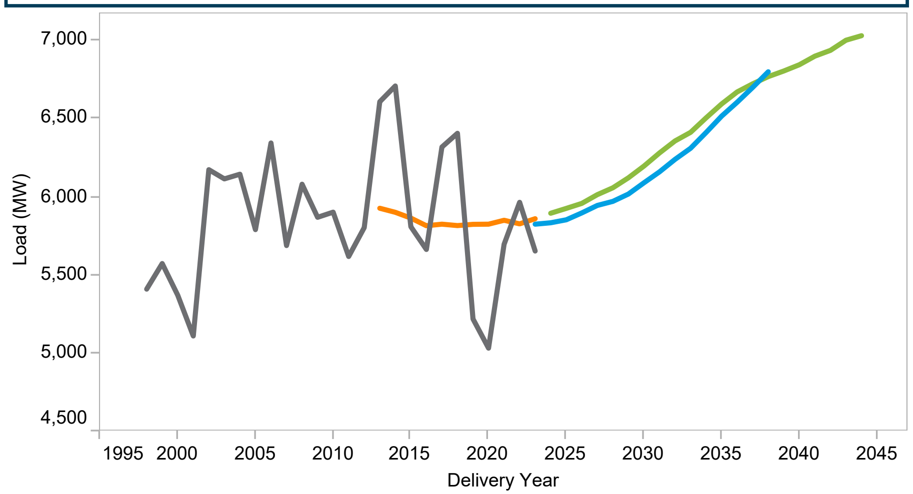
RCI Makeup



LDAs

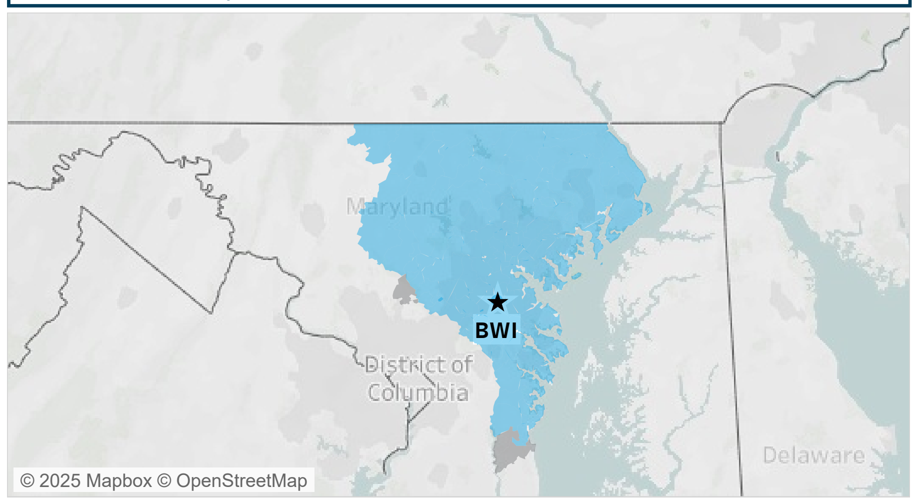
CENTRAL MID-ATLANTIC PJM MID-ATLANTIC PJM RTO SOUTHERN MID-ATLANTIC

Winter Peak



Peak WN peak Forecast 2024 Forecast 2025

Metropolitan Statistical Areas and Weather Stations

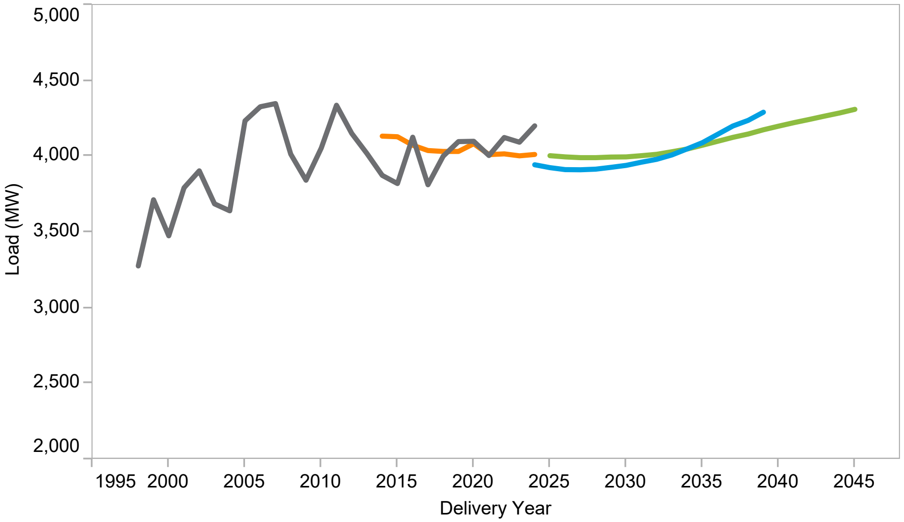


MSA

- Baltimore-Columbia-Towson, MD
- BGE - Non-Metro

Delmarva Power and Light (DPL)

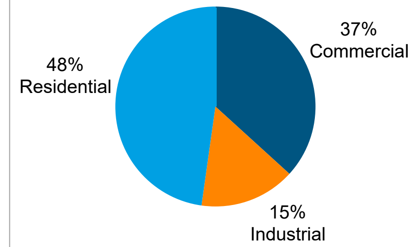
Summer Peak



Weather - Annual Average 1993-2023

Avg Summer Daily Temp	*75.5*
Avg Summer Max Temp	*95.1*
Avg Winter Daily Temp	*37.2*
Avg Winter Min Temp	*9.7*

RCI Makeup



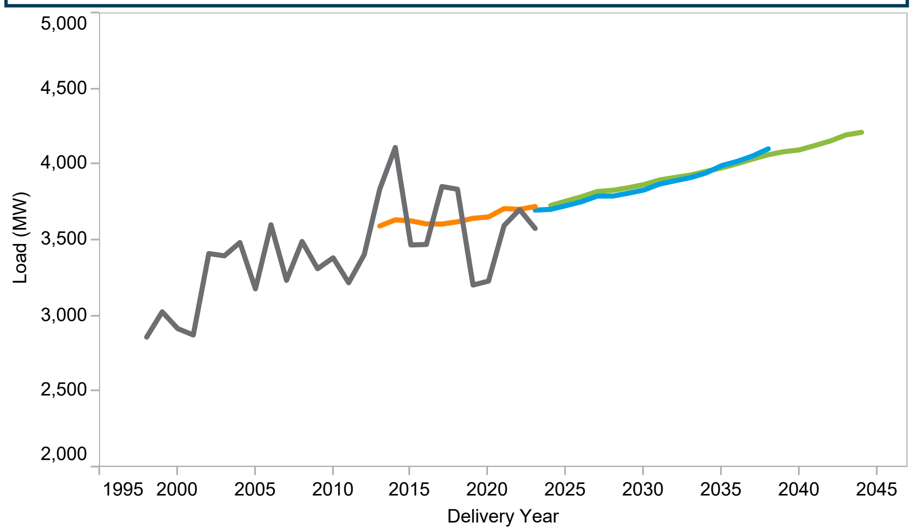
Zonal 10/15/20 Year Load Growth

SUMMER	0.2%	0.3%	0.4%
WINTER	0.6%	0.6%	0.6%

LDAs

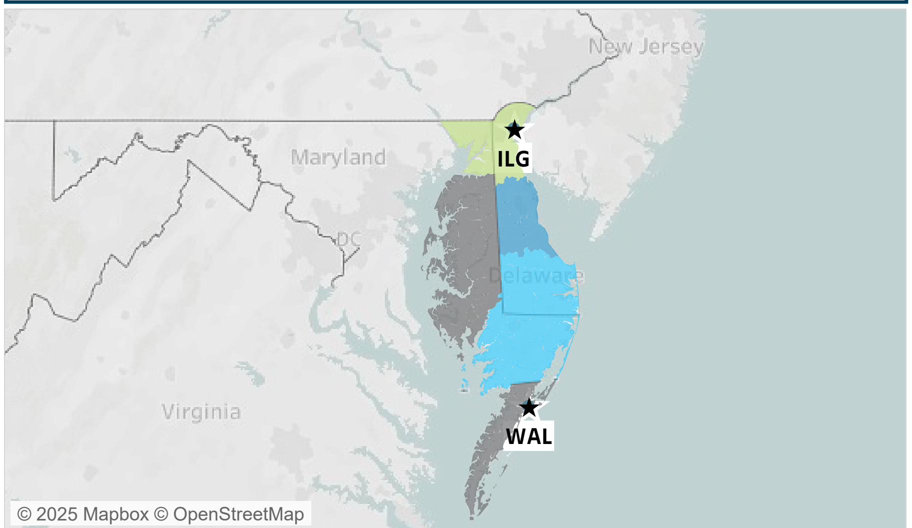
EASTERN MID-ATLANTIC PJM MID-ATLANTIC PJM RTO

Winter Peak



Peak WN peak Forecast 2024 Forecast 2025

Metropolitan Statistical Areas and Weather Stations

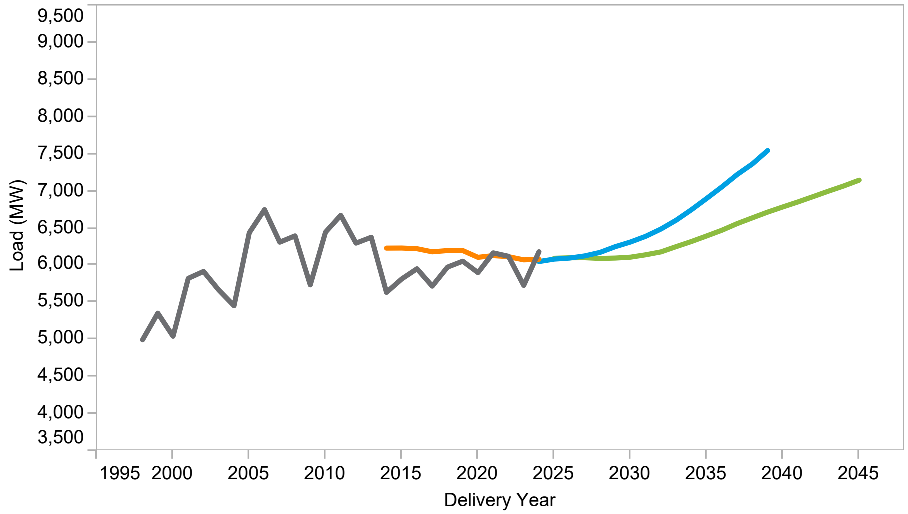


MSA

Dover, DE
DPL - Non-Metro
Salisbury, MD-DE
Wilmington, DE-MD-NJ

Jersey Central Power and Light (JCPL)

Summer Peak



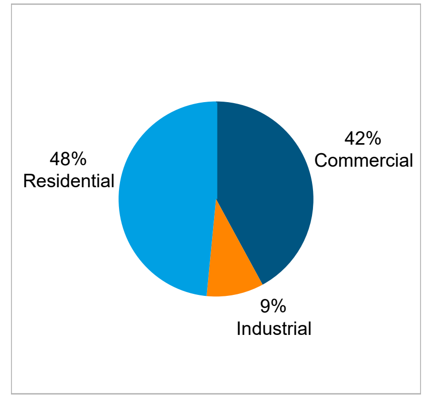
Weather - Annual Average 1993-2023

Avg Summer Daily Temp	*75.7*
Avg Summer Max Temp	*98.1*
Avg Winter Daily Temp	*36.1*
Avg Winter Min Temp	*7.5*

Zonal 10/15/20 Year Load Growth

SUMMER	0.5%	0.7%	0.8%
WINTER	3.9%	3.6%	3.3%

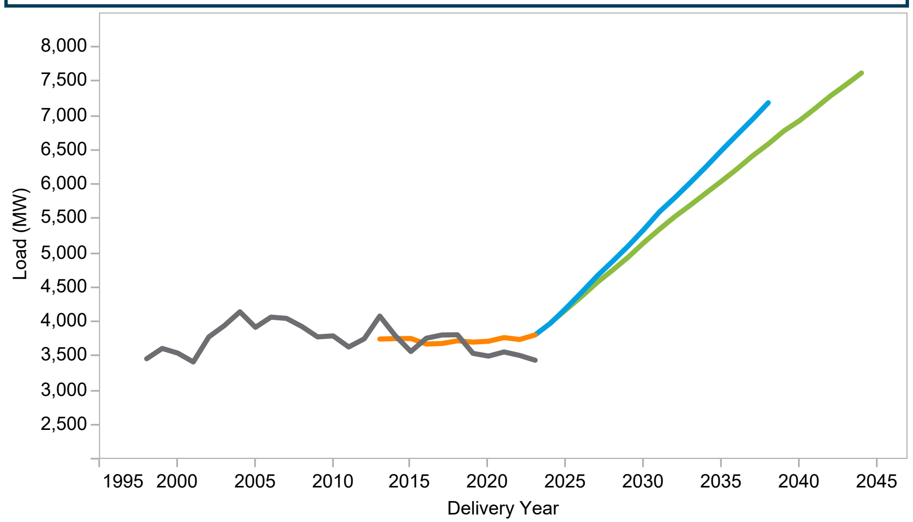
RCI Makeup



LDAs

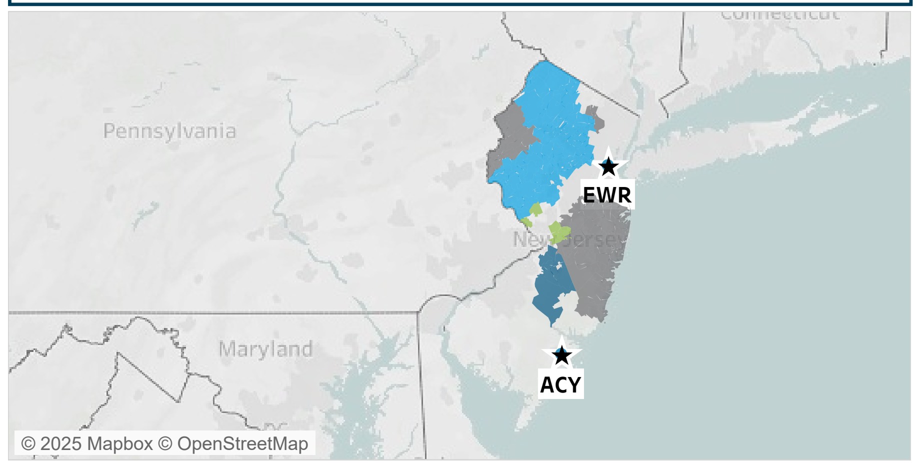
EASTERN MID-ATLANTIC GPU PJM MID-ATLANTIC PJM RTO

Winter Peak



Peak WN peak Forecast 2024 Forecast 2025

Metropolitan Statistical Areas and Weather Stations

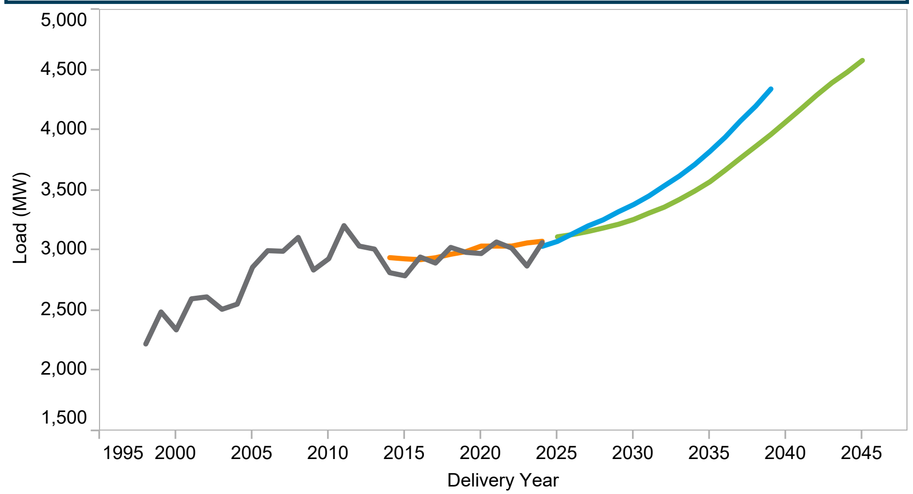


MSA

- Camden, NJ
- JCPL - Non-Metro
- Newark, NJ-PA
- Trenton, NJ

Metropolitan Edison (METED)

Summer Peak



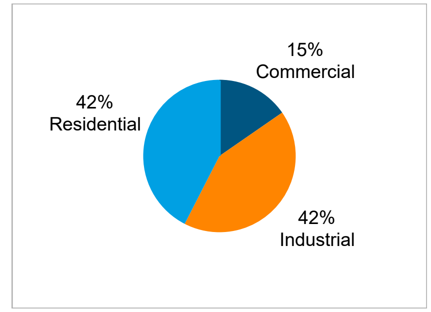
Weather - Annual Average 1993-2023

Avg Summer Daily Temp	*74.7*
Avg Summer Max Temp	*95.8*
Avg Winter Daily Temp	*34.6*
Avg Winter Min Temp	*6.7*

Zonal 10/15/20 Year Load Growth

SUMMER	1.4%	1.8%	1.9%
WINTER	1.6%	2.0%	2.1%

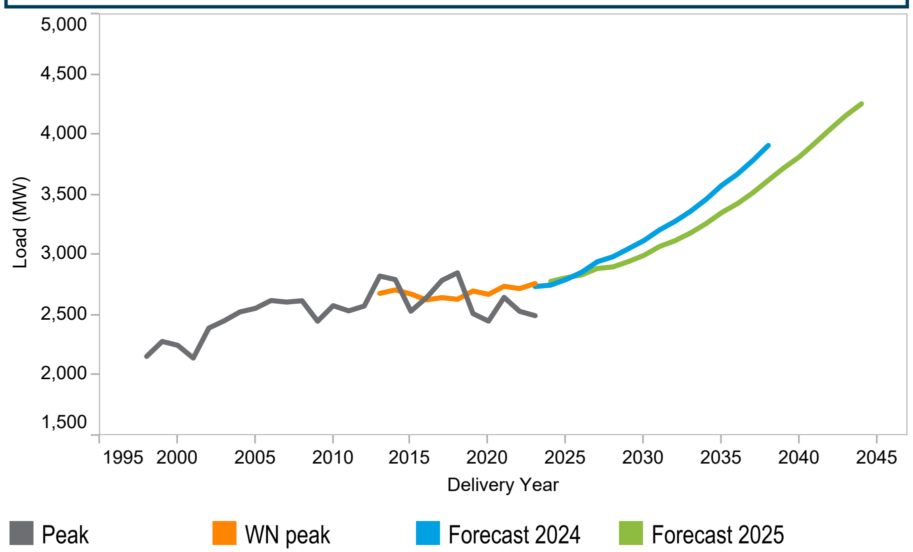
RCI Makeup



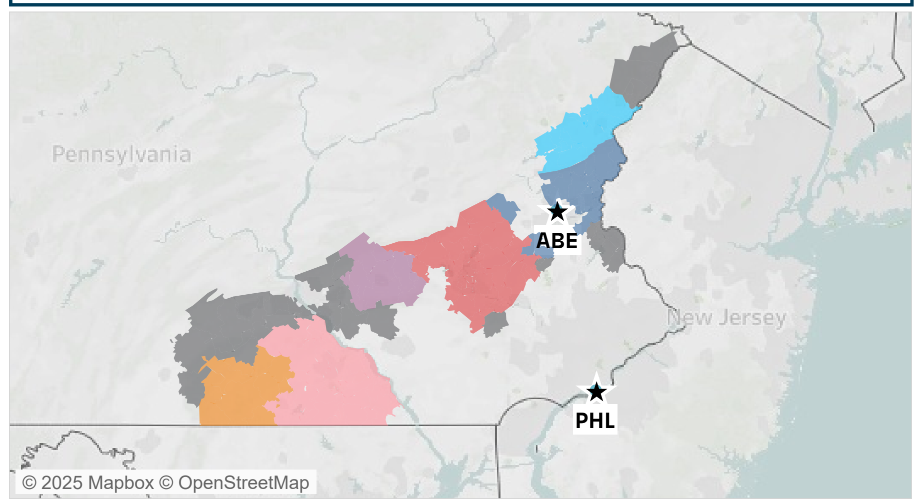
LDAs

CENTRAL MID-ATLANTIC GPU PJM MID-ATLANTIC PJM RTO WESTERN MID-ATLANTIC

Winter Peak



Metropolitan Statistical Areas and Weather Stations

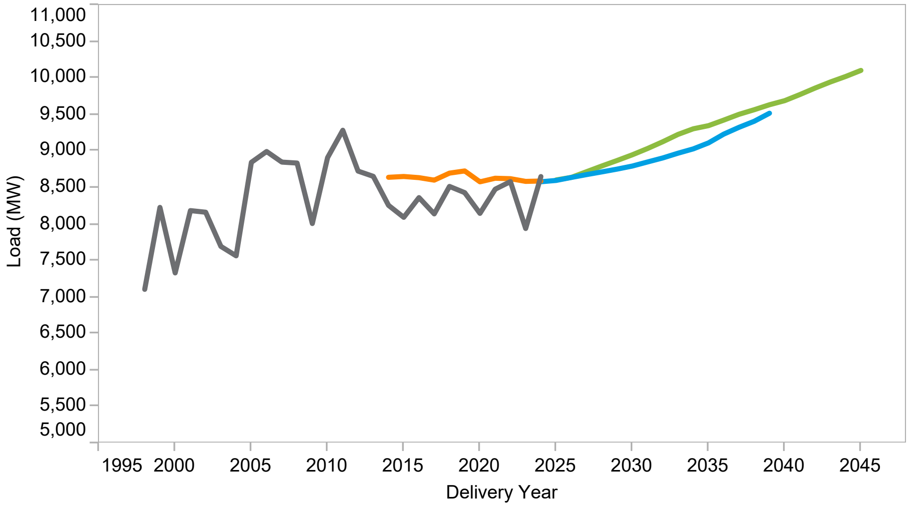


MSA

- Allentown-Bethlehem-Easton, PA-NJ
- East Stroudsburg, PA
- Gettysburg, PA
- Lebanon, PA
- METED - Non-Metro
- Reading, PA
- York-Hanover, PA

PECO Energy (PECO)

Summer Peak



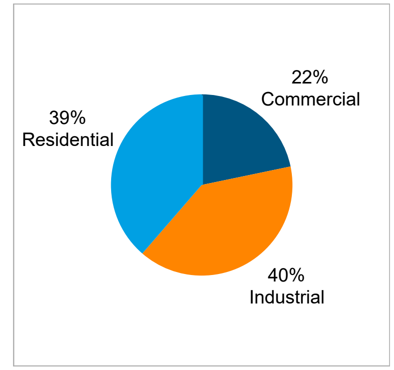
Weather - Annual Average 1993-2023

Avg Summer Daily Temp	*76.6*
Avg Summer Max Temp	*97.1*
Avg Winter Daily Temp	*36.8*
Avg Winter Min Temp	*9.4*

Zonal 10/15/20 Year Load Growth

SUMMER	0.8%	0.8%	0.8%
WINTER	1.3%	1.1%	1.0%

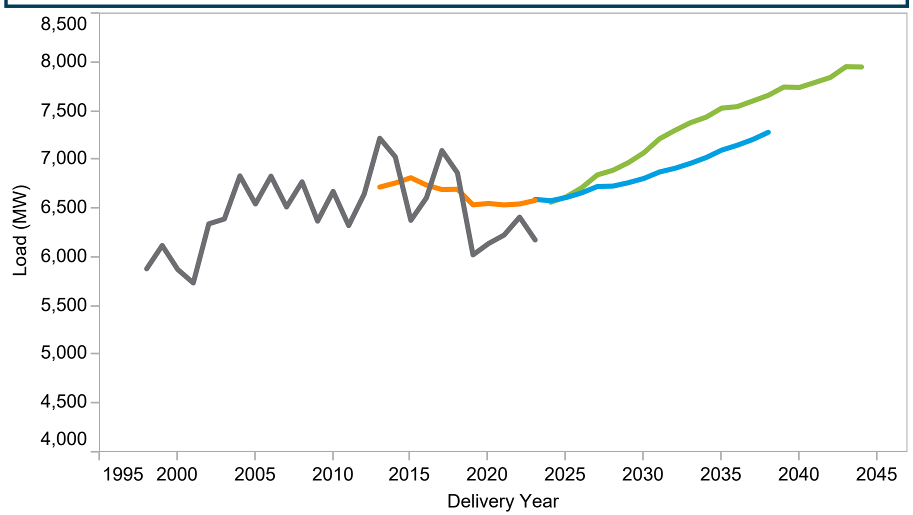
RCI Makeup



LDAs

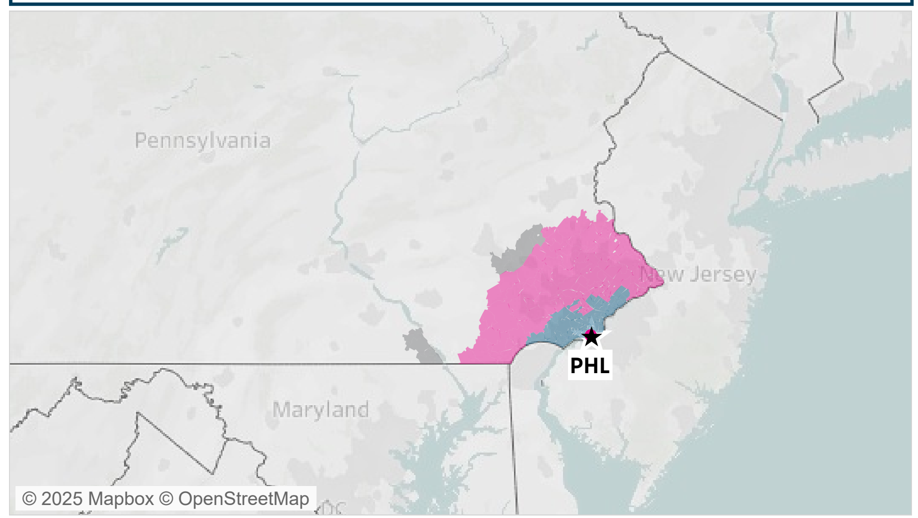
EASTERN MID-ATLANTIC PJM MID-ATLANTIC PJM RTO

Winter Peak



Peak WN peak Forecast 2024 Forecast 2025

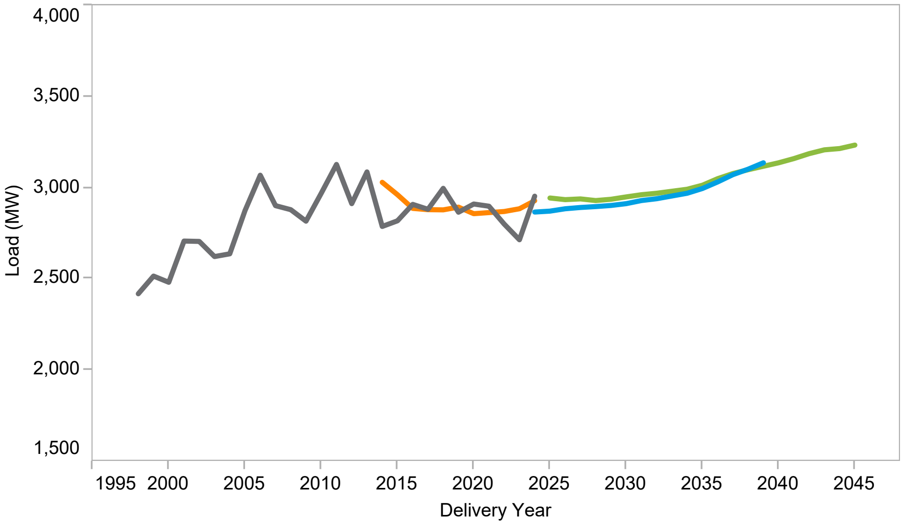
Metropolitan Statistical Areas and Weather Stations



MSA
- Montgomery County-Bucks County-Chester County, PA
- PECO - Non-Metro
- Philadelphia, PA

Pennsylvania Electric Company (PENLC)

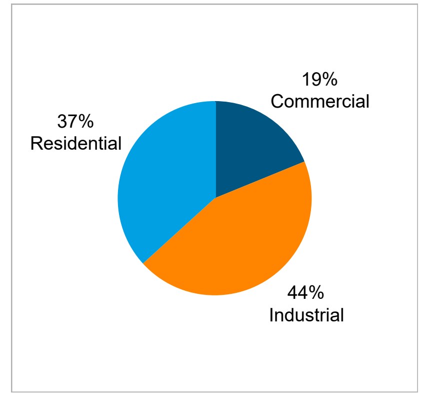
Summer Peak



Weather - Annual Average 1993-2023

Avg Summer Daily Temp	*71.1*
Avg Summer Max Temp	*91.7*
Avg Winter Daily Temp	*30.5*
Avg Winter Min Temp	*2.1*

RCI Makeup



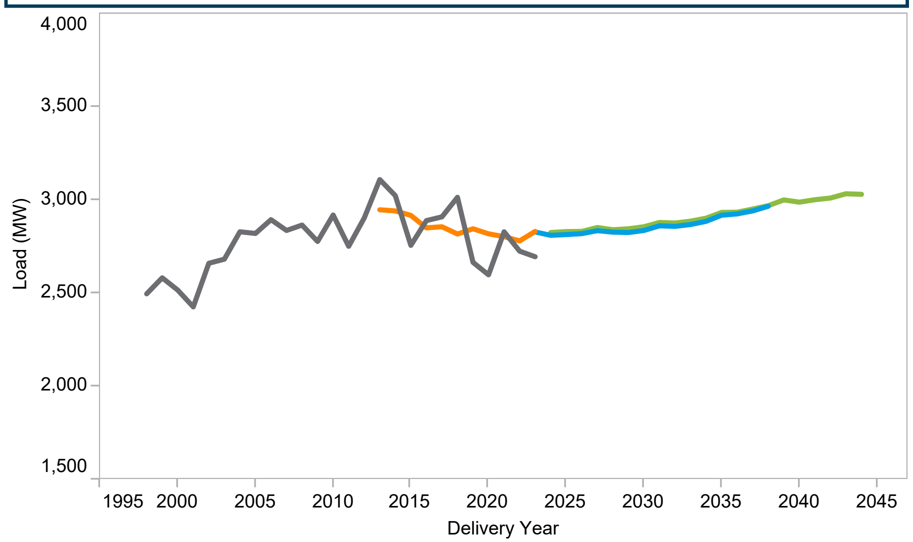
Zonal 10/15/20 Year Load Growth

SUMMER	0.2%	0.4%	0.5%
WINTER	0.3%	0.4%	0.4%

LDAs

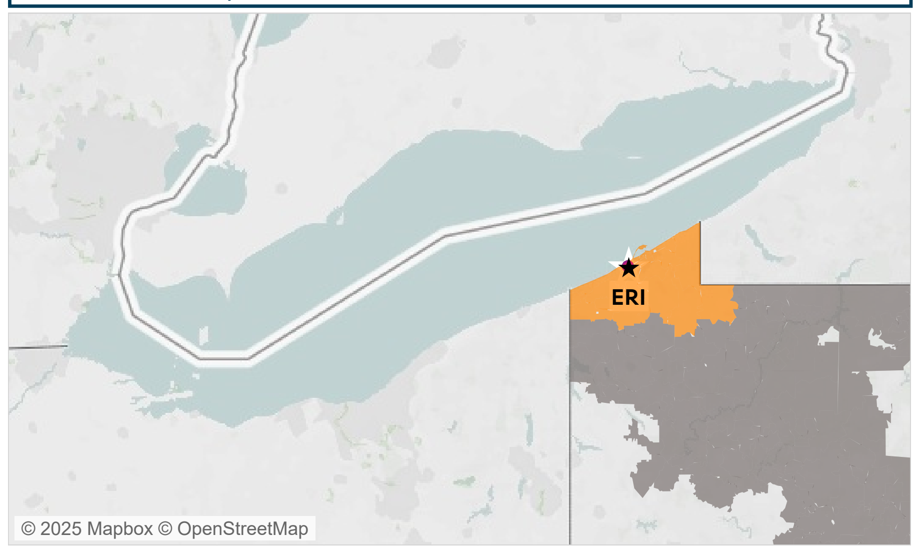
GPU PJM MID-ATLANTIC PJM RTO WESTERN MID-ATLANTIC

Winter Peak



Peak WN peak Forecast 2024 Forecast 2025

Metropolitan Statistical Areas and Weather Stations

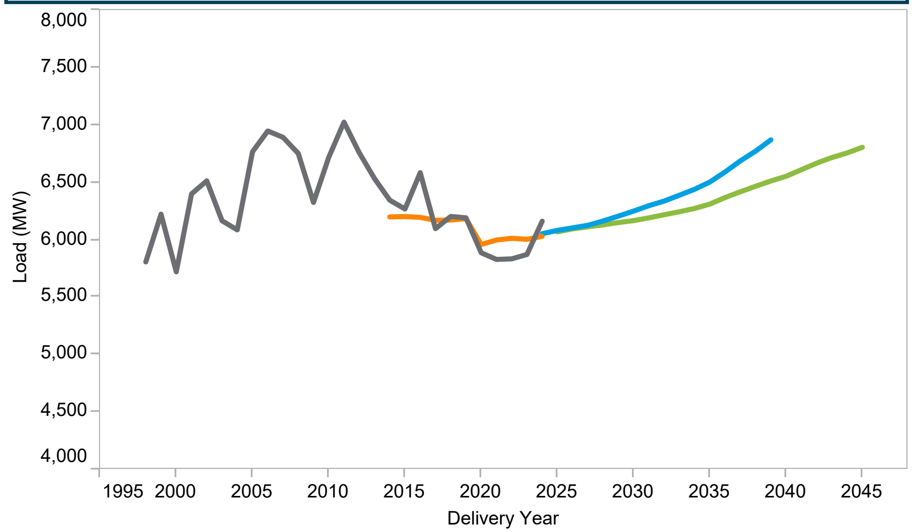


MSA

- Altoona, PA
- Erie, PA
- Johnstown, PA
- PENLC - Non-Metro

Potomac Electric Power (PEPCO)

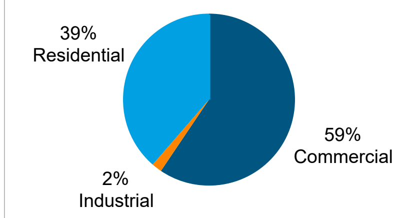
Summer Peak



Weather - Annual Average 1993-2023

Avg Summer Daily Temp	*78.1*
Avg Summer Max Temp	*98.0*
Avg Winter Daily Temp	*39.2*
Avg Winter Min Temp	*12.8*

RCI Makeup



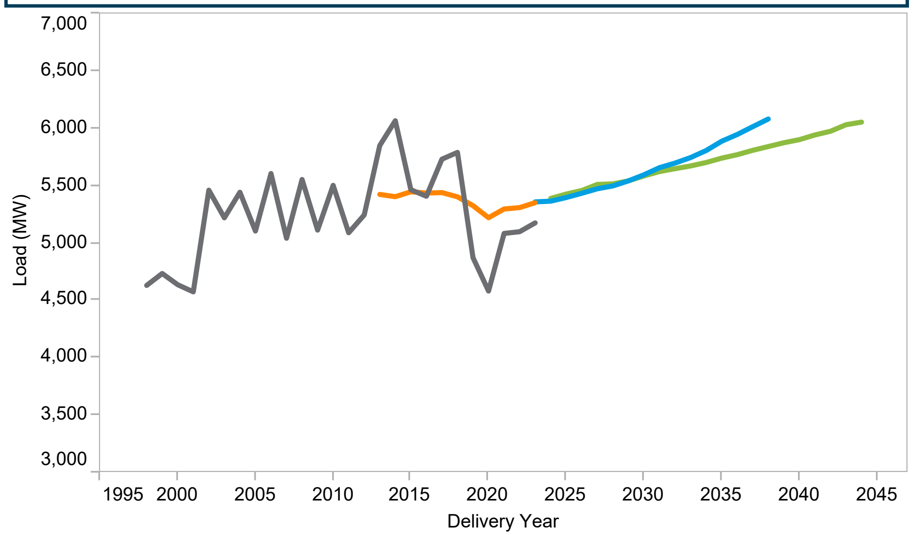
Zonal 10/15/20 Year Load Growth

SUMMER	0.4%	0.5%	0.6%
WINTER	0.6%	0.6%	0.6%

LDAs

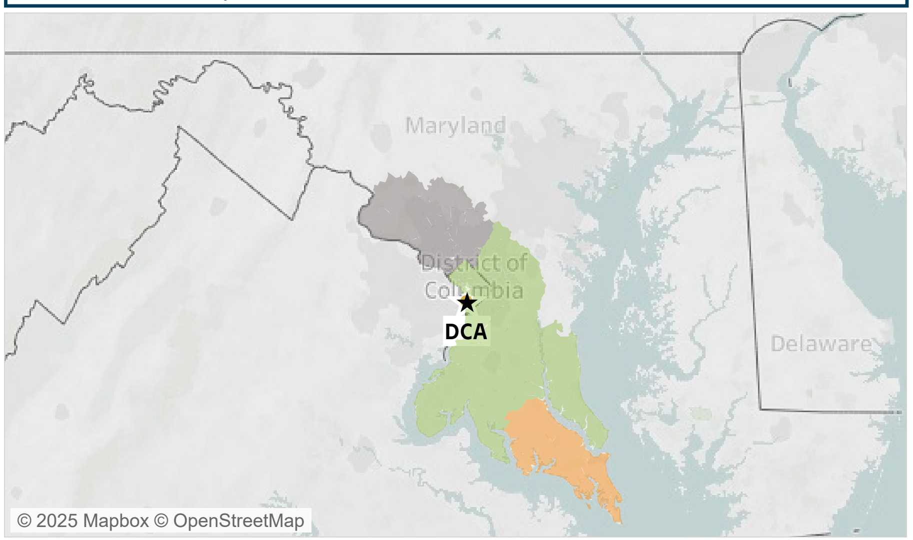
CENTRAL MID-ATLANTIC PJM MID-ATLANTIC PJM RTO
SOUTHERN MID-ATLANTIC

Winter Peak



Peak WN peak Forecast 2024 Forecast 2025

Metropolitan Statistical Areas and Weather Stations

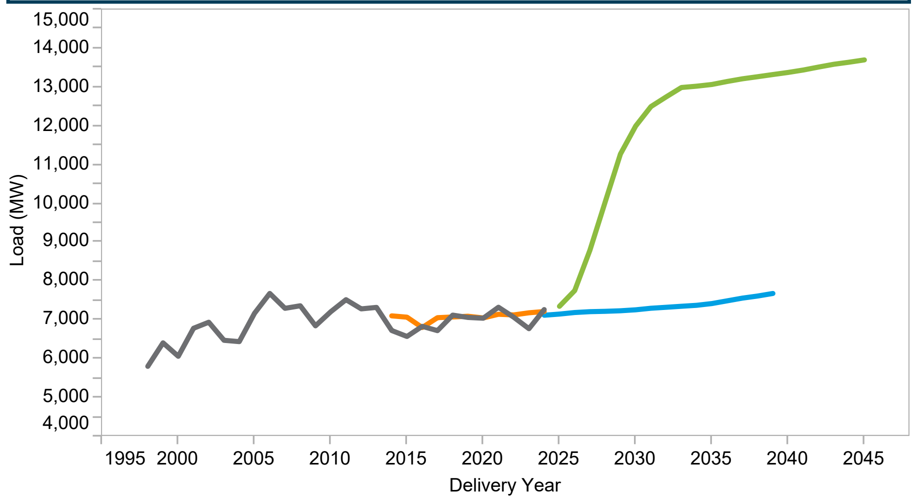


MSA

- California-Lexington Park, MD
- Washington-Arlington-Alexandria, DC-VA-..
- PEPCO - Non-Metro

PPL Electric Utilities (PL)

Summer Peak



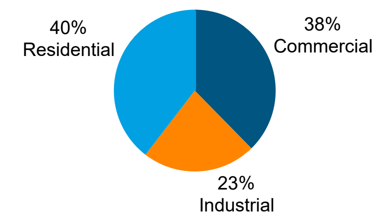
Weather - Annual Average 1993-2023

Avg Summer Daily Temp	*72.4*
Avg Summer Max Temp	*94.2*
Avg Winter Daily Temp	*31.7*
Avg Winter Min Temp	*2.9*

Zonal 10/15/20 Year Load Growth

SUMMER	5.9%	4.1%	3.2%
WINTER	5.8%	4.0%	3.0%

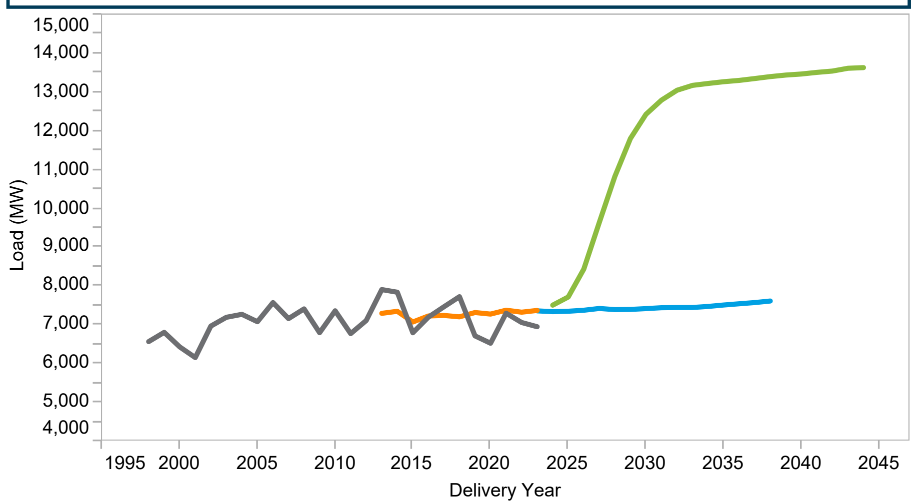
RCI Makeup



LDAs

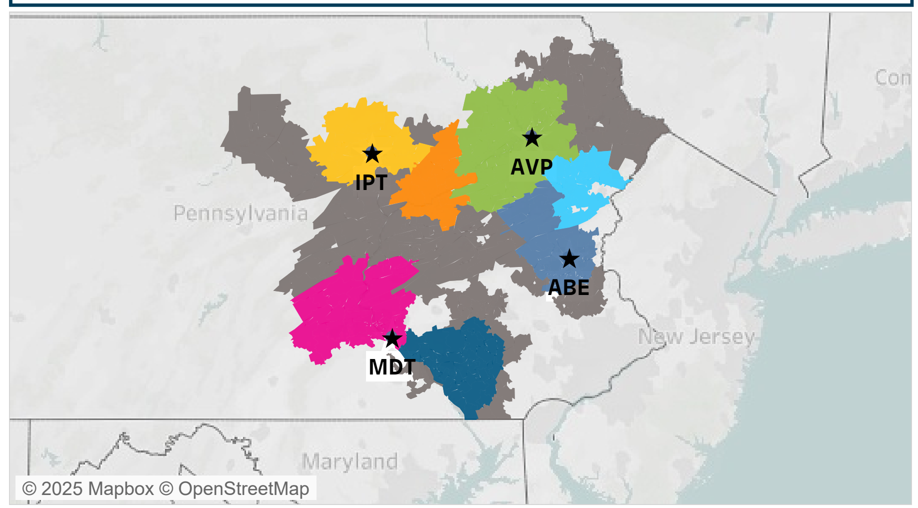
CENTRAL MID-ATLANTIC PJM MID-ATLANTIC PJM RTO
PLGRP WESTERN MID-ATLANTIC

Winter Peak



Peak WN peak Forecast 2024 Forecast 2025

Metropolitan Statistical Areas and Weather Stations

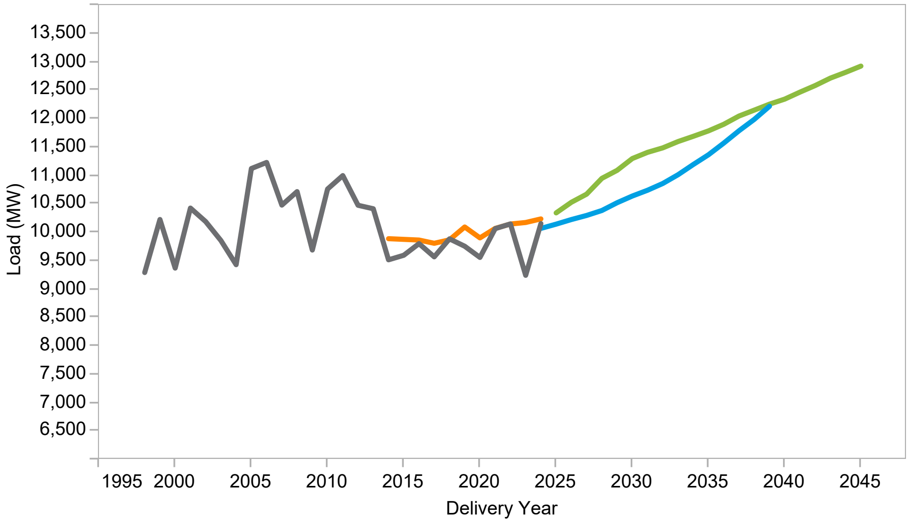


MSA

- Allentown-Bethlehem-Easton, PA-NJ
- Bloomsburg-Berwick, PA
- East Stroudsburg, PA
- Harrisburg-Carlisle, PA
- Lancaster, PA
- PL - Non-Metro
- Scranton--Wilkes-Barre--Hazleton, PA
- Williamsport, PA

Public Service Electric & Gas (PS)

Summer Peak



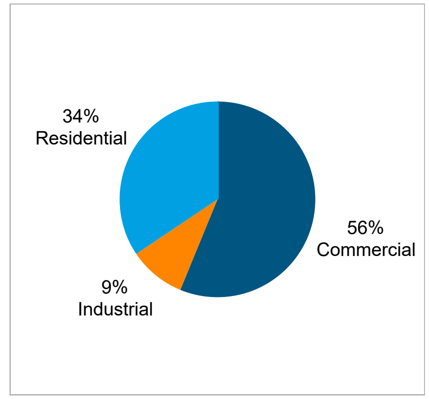
Weather - Annual Average 1993-2023

Avg Summer Daily Temp	*76.1*
Avg Summer Max Temp	*98.9*
Avg Winter Daily Temp	*35.8*
Avg Winter Min Temp	*7.4*

Zonal 10/15/20 Year Load Growth

SUMMER	1.3%	1.2%	1.1%
WINTER	4.0%	3.3%	2.9%

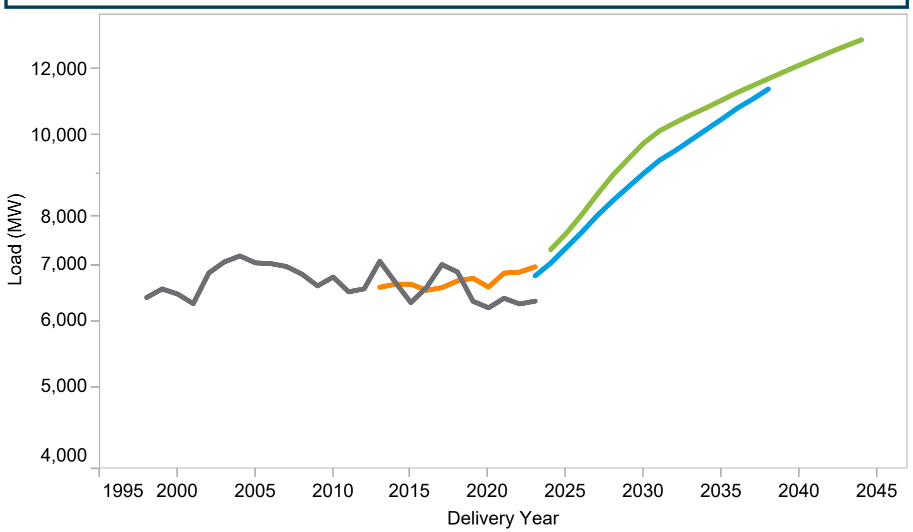
RCI Makeup



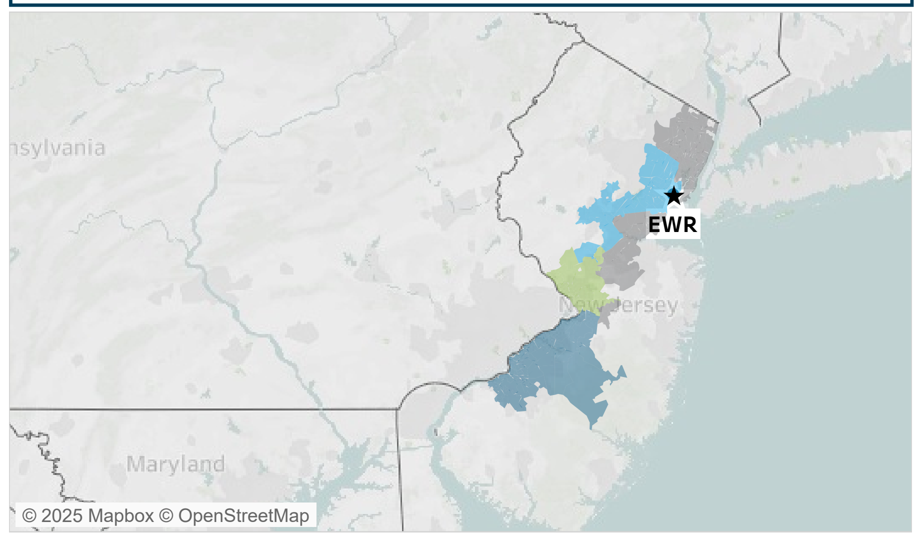
LDAs

EASTERN MID-ATLANTIC PJM MID-ATLANTIC PJM RTO

Winter Peak



Metropolitan Statistical Areas and Weather Stations



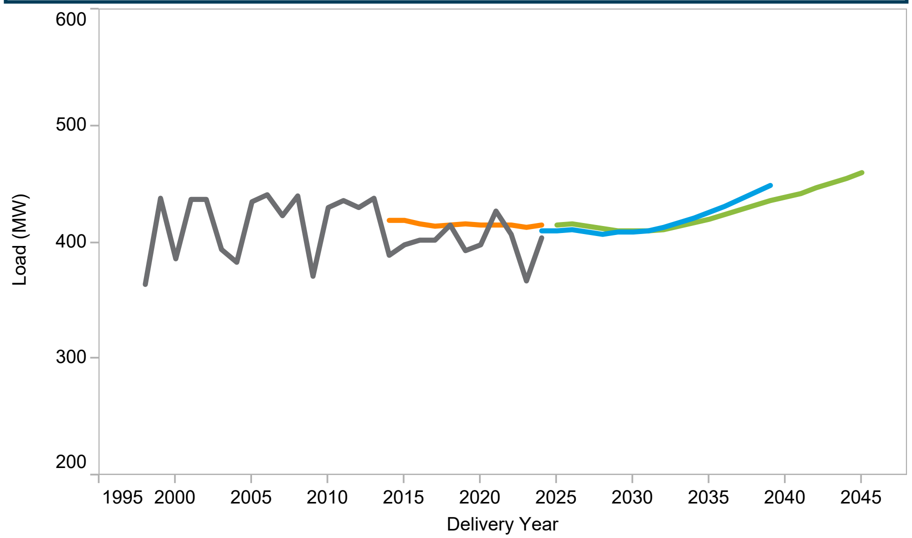
Peak WN peak Forecast 2024 Forecast 2025

MSA

- Camden, NJ
- Newark, NJ-PA
- PS - Non-Metro
- Trenton, NJ

Rockland Electric Company (RECO)

Summer Peak



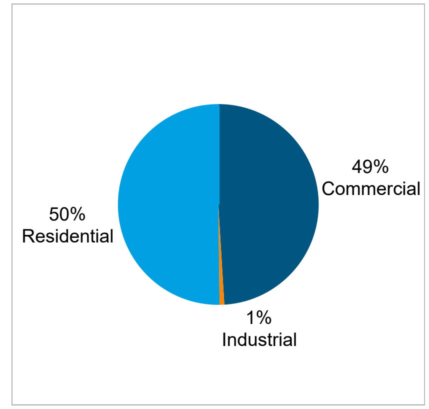
Weather - Annual Average 1993-2023

Avg Summer Daily Temp	*76.1*
Avg Summer Max Temp	*98.9*
Avg Winter Daily Temp	*35.8*
Avg Winter Min Temp	*7.4*

Zonal 10/15/20 Year Load Growth

SUMMER	0.1%	0.4%	0.5%
WINTER	2.6%	2.5%	2.3%

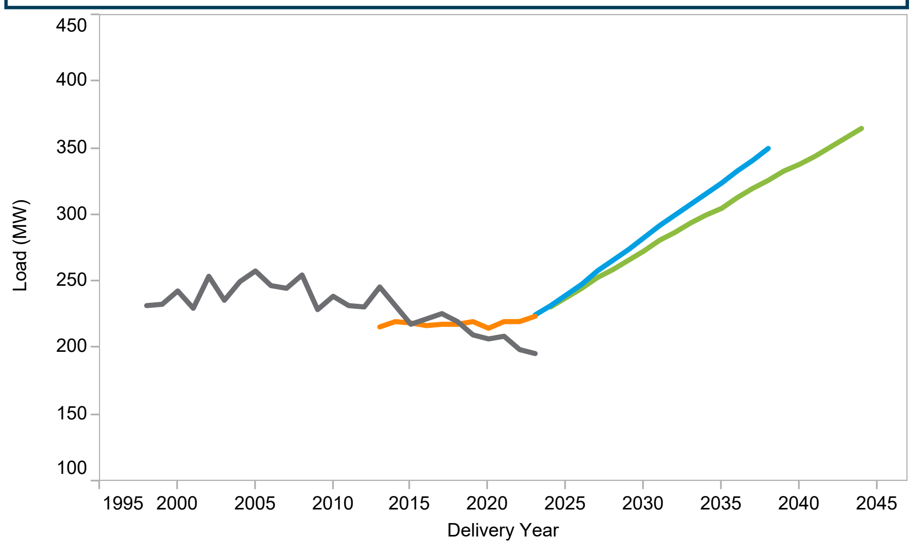
RCI Makeup



LDAs

EASTERN MID-ATLANTIC PJM MID-ATLANTIC PJM RTO

Winter Peak



Peak WN peak Forecast 2024 Forecast 2025

Metropolitan Statistical Areas and Weather Stations

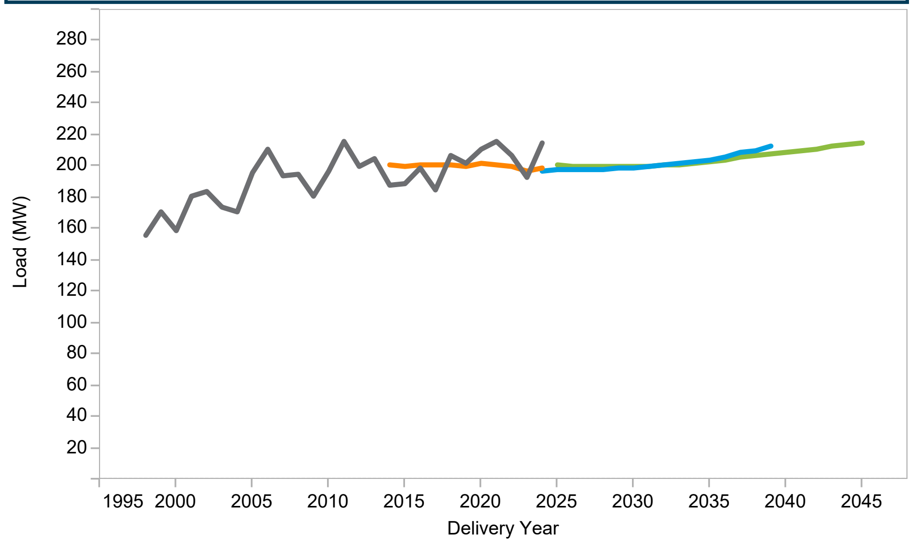
MSA

New York-Jersey City-White Plains, NY-NJ

Newark, NJ-PA

UGI Energy Services (UGI)

Summer Peak



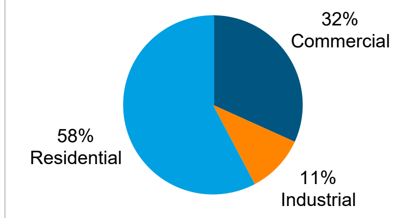
Weather - Annual Average 1993-2023

Avg Summer Daily Temp	*70.6*
Avg Summer Max Temp	*93.2*
Avg Winter Daily Temp	*30.1*
Avg Winter Min Temp	*-1.0*

Zonal 10/15/20 Year Load Growth

SUMMER	0.1%	0.3%	0.3%
WINTER	0.1%	0.3%	0.3%

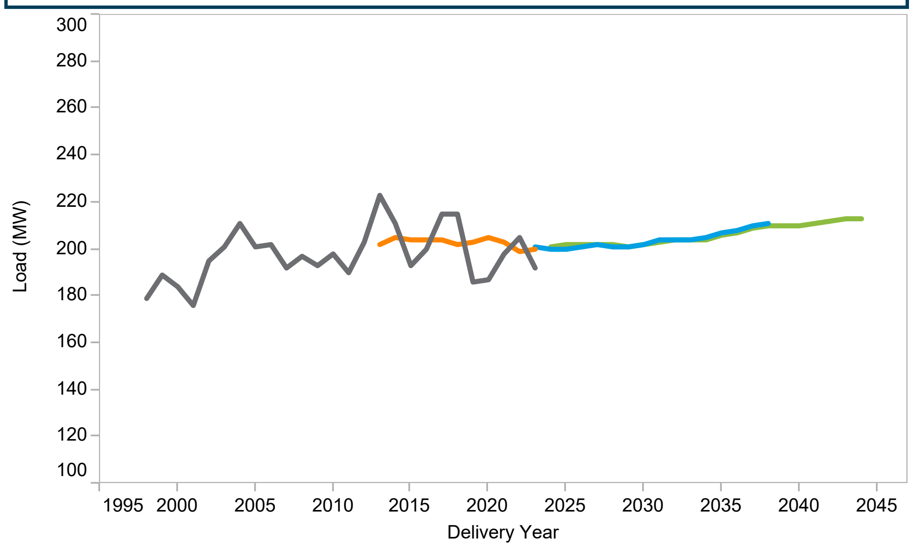
RCI Makeup



LDAs

CENTRAL MID-ATLANTIC PJM MID-ATLANTIC PJM RTO PLGRP WESTERN MID-ATLANTIC

Winter Peak



Peak WN peak Forecast 2024 Forecast 2025

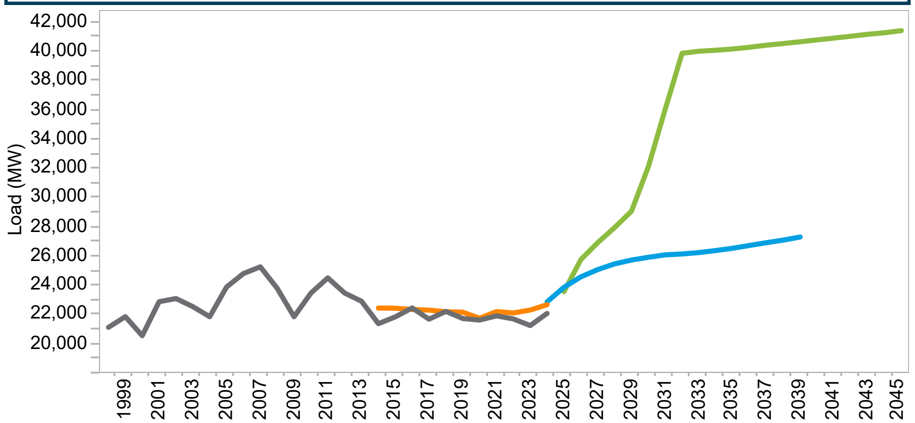
Metropolitan Statistical Areas and Weather Stations

MSA

Scranton--Wilkes-Barre--Hazleton, PA

American Electric Power (AEP)

Summer Peak



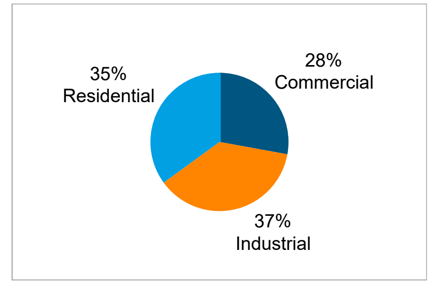
Weather - Annual Average 1993-2023

Avg Summer Daily Temp	*73.2*
Avg Summer Max Temp	*92.3*
Avg Winter Daily Temp	*33.4*
Avg Winter Min Temp	*2.9*

Zonal 10/15/20 Year Load Growth

SUMMER	5.5%	3.7%	2.9%
WINTER	5.9%	4.0%	3.1%

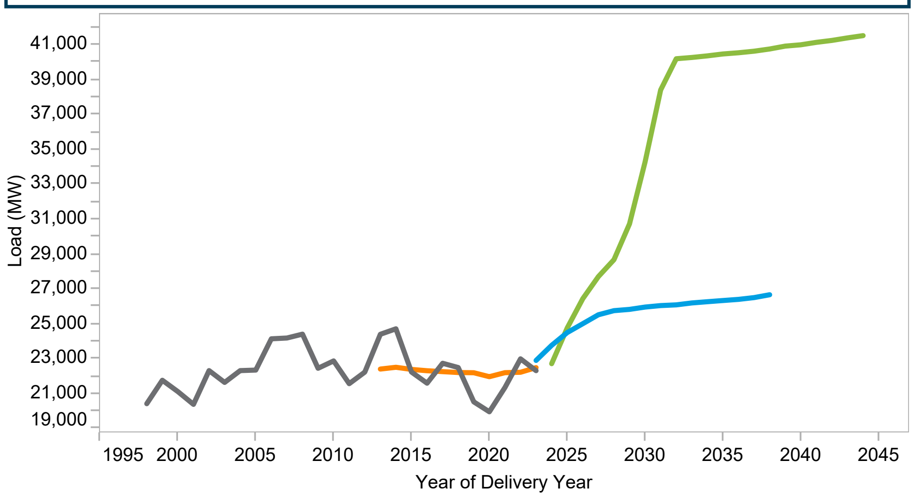
RCI Makeup



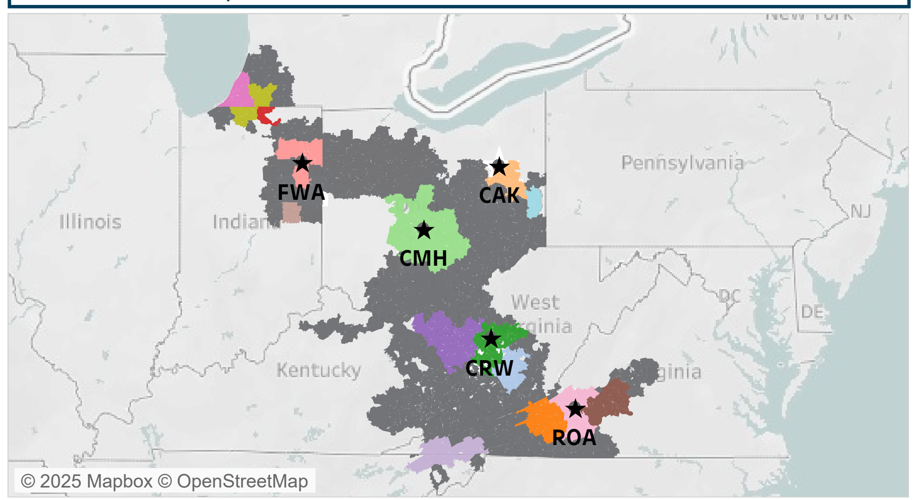
LDAs

PJM RTO PJM WESTERN

Winter Peak



Metropolitan Statistical Areas and Weather Stations



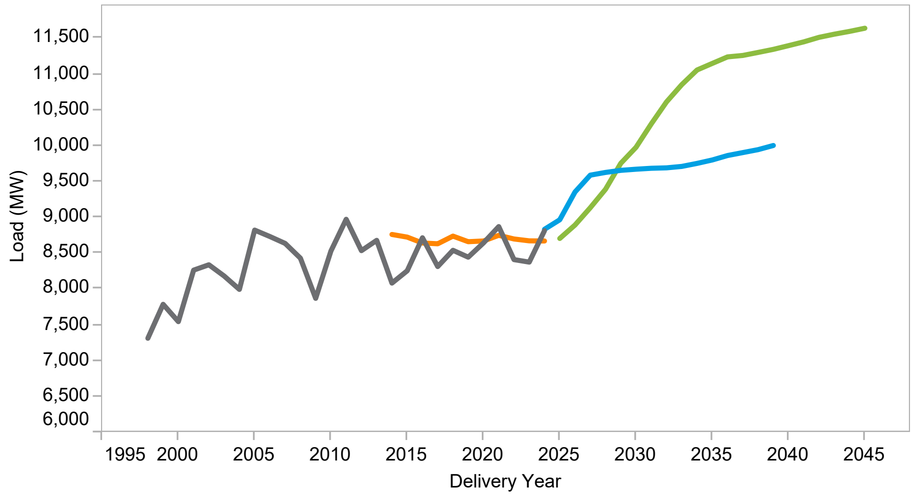
- Peak
- WN peak
- Forecast 2024
- Forecast 2025

MSA

- AEP - Non-Metro
- Beckley, WV
- Blacksburg-Christiansburg-Radford, VA
- Canton-Massillon, OH
- Charleston, WV
- Columbus, OH
- Elkhart-Goshen, IN
- Fort Wayne, IN
- Huntington-Ashland, WV-KY-OH
- Kingsport-Bristol-Bristol, TN-VA
- Lynchburg, VA
- Muncie, IN
- Niles-Benton Harbor, MI
- Roanoke, VA
- South Bend-Mishawaka, IN-MI
- Weirton-Steubenville, WV-OH

Allegheny Power Systems (APS)

Summer Peak



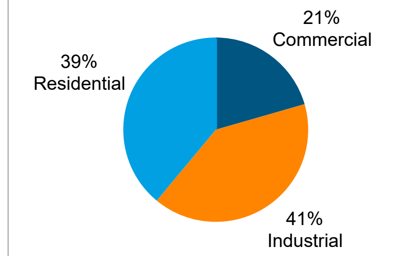
Weather - Annual Average 1993-2023

Avg Summer Daily Temp	*72.8*
Avg Summer Max Temp	*92.6*
Avg Winter Daily Temp	*33.1*
Avg Winter Min Temp	*2.4*

Zonal 10/15/20 Year Load Growth

SUMMER	2.5%	1.8%	1.5%
WINTER	2.6%	1.9%	1.5%

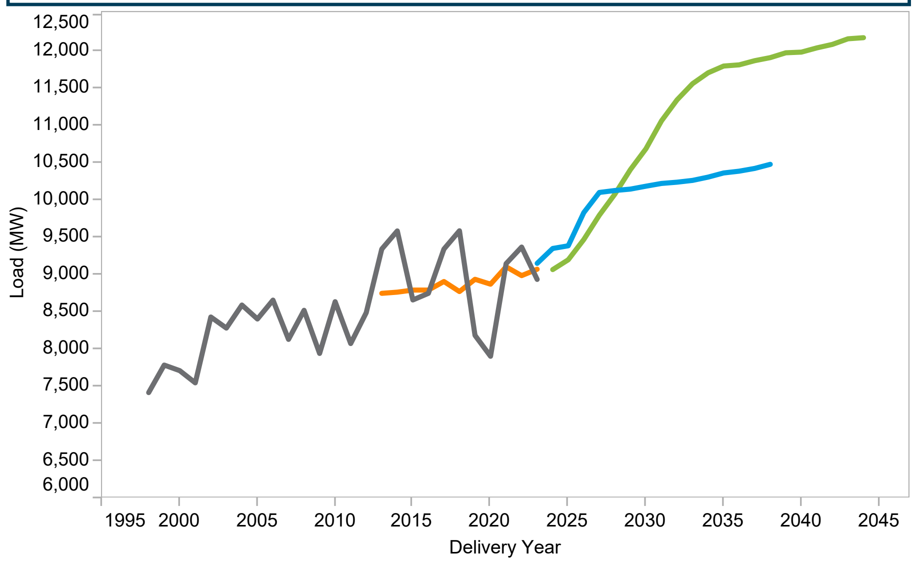
RCI Makeup



LDAs

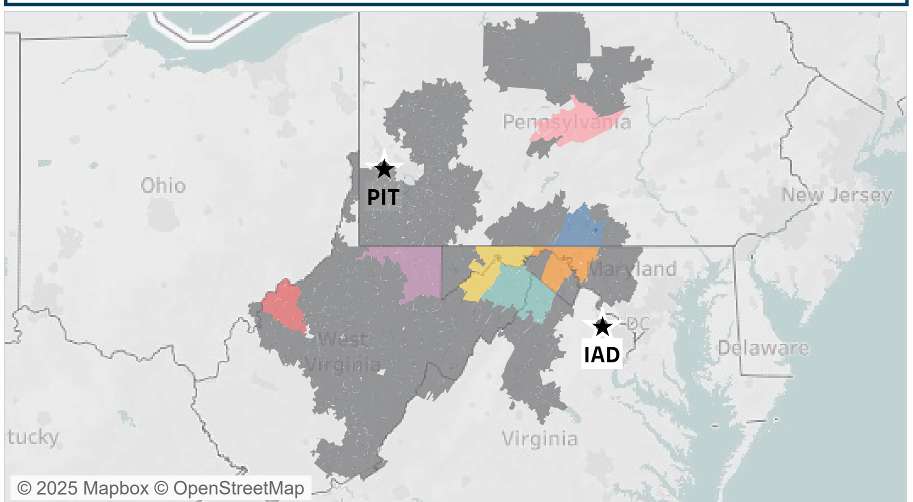
PJM RTO PJM WESTERN

Winter Peak



Peak WN peak Forecast 2024 Forecast 2025

Metropolitan Statistical Areas and Weather Stations

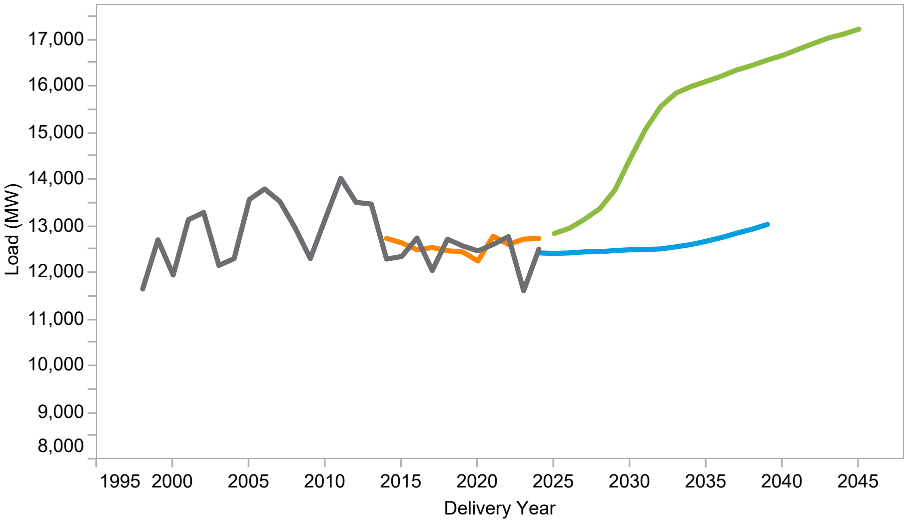


MSA

- APS - Non-metro
- Chambersburg-Waynesboro, PA
- Cumberland, MD-WV
- Hagerstown-Martinsburg, MD-WV
- Morgantown, WV
- Parkersburg-Vienna, WV
- State College, PA
- Winchester, VA-WV

American Transmission Systems, Inc (ATSI)

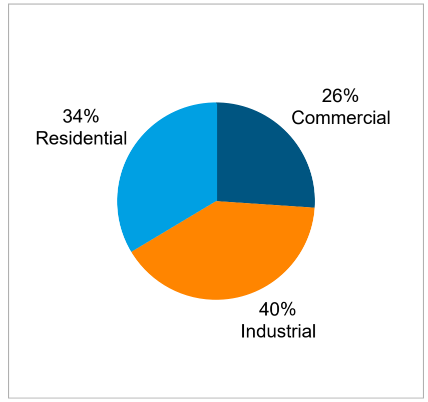
Summer Peak



Weather - Annual Average 1993-2023

Avg Summer Daily Temp	*71.6*
Avg Summer Max Temp	*91.9*
Avg Winter Daily Temp	*30.2*
Avg Winter Min Temp	*-1.0*

RCI Makeup



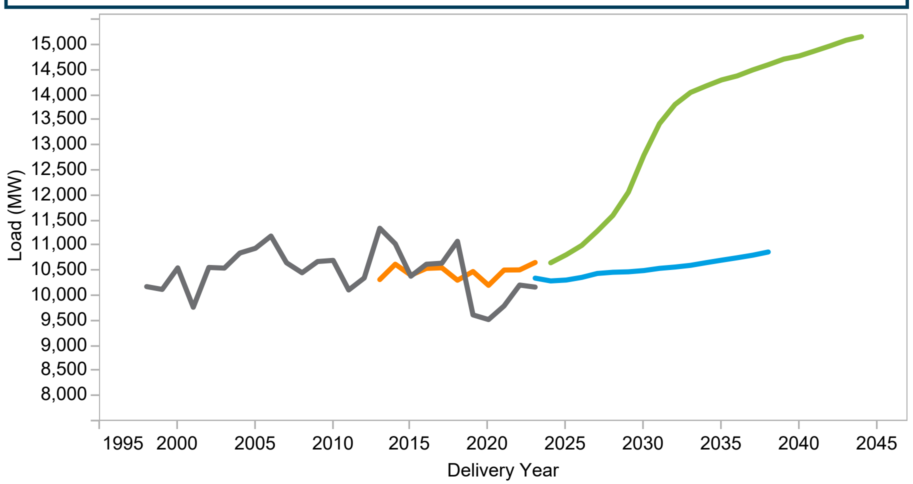
Zonal 10/15/20 Year Load Growth

SUMMER	2.3%	1.8%	1.5%
WINTER	2.9%	2.2%	1.8%

LDAs

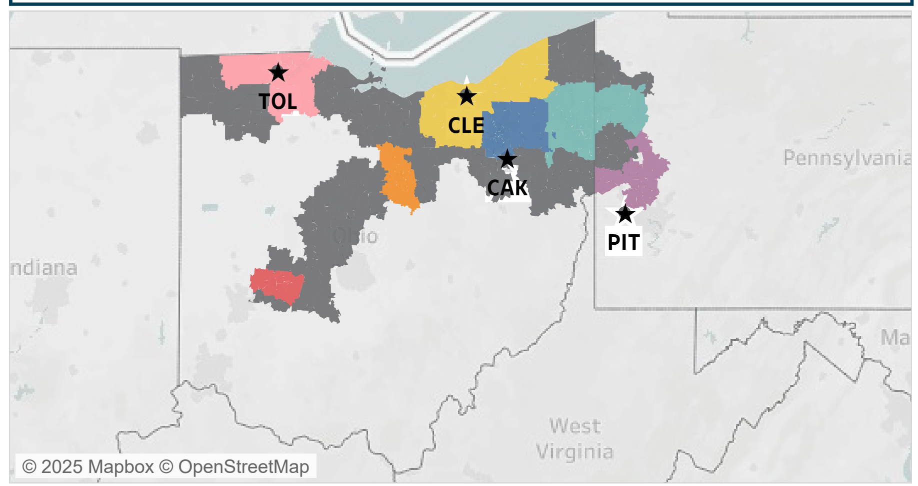
PJM RTO PJM WESTERN

Winter Peak



Peak WN peak Forecast 2024 Forecast 2025

Metropolitan Statistical Areas and Weather Stations

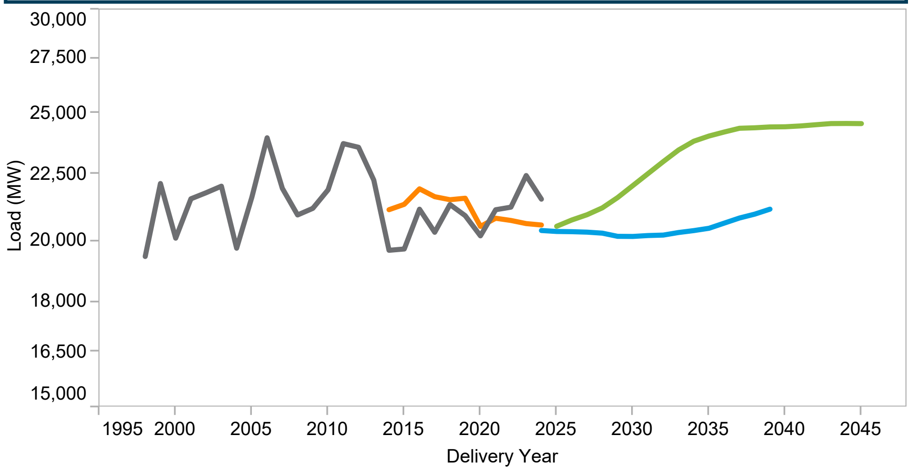


MSA

- Akron, OH
- ATSI - Non-Metro
- Cleveland-Elyria, OH
- Mansfield, OH
- Pittsburgh, PA
- Springfield, OH
- Toledo, OH
- Youngstown-Warren-Boardman, OH-PA

Commonwealth Edison (COMED)

Summer Peak



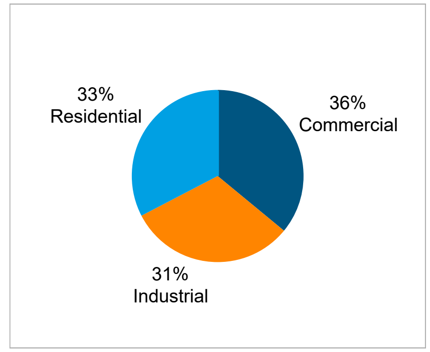
Weather - Annual Average 1993-2023

Avg Summer Daily Temp	*73.0*
Avg Summer Max Temp	*95.5*
Avg Winter Daily Temp	*27.8*
Avg Winter Min Temp	*-7.1*

Zonal 10/15/20 Year Load Growth

SUMMER	1.6%	1.2%	0.9%
WINTER	2.9%	2.2%	1.8%

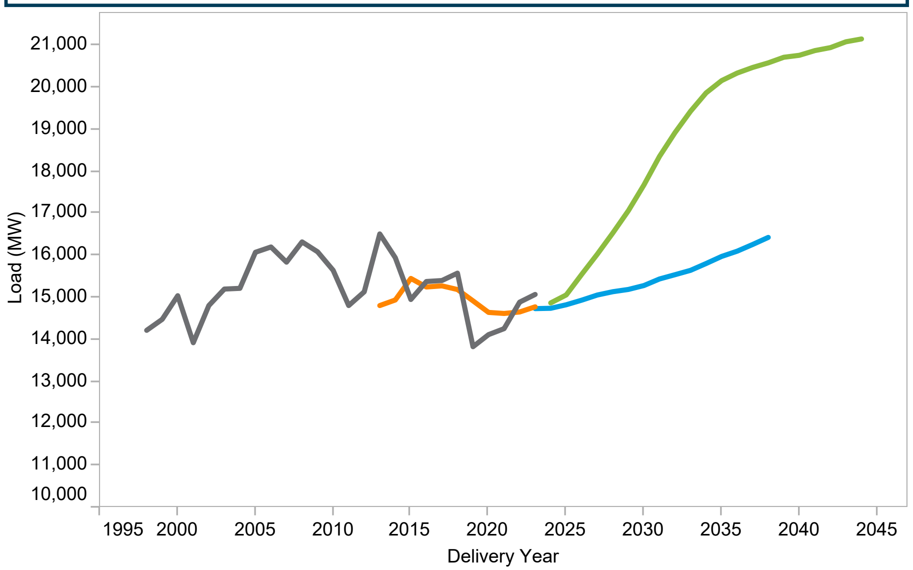
RCI Makeup



LDAs

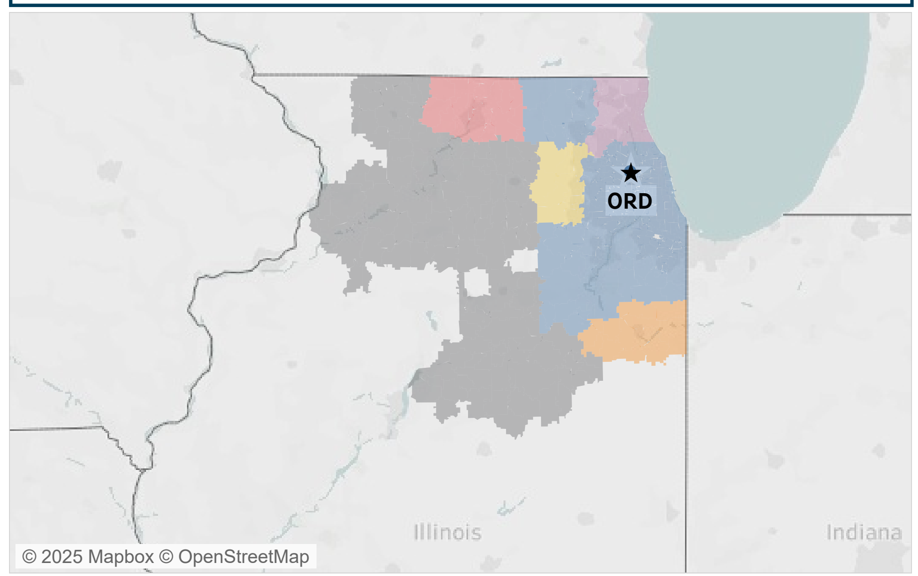
PJM RTO PJM WESTERN

Winter Peak



Peak WN peak Forecast 2024 Forecast 2025

Metropolitan Statistical Areas and Weather Stations

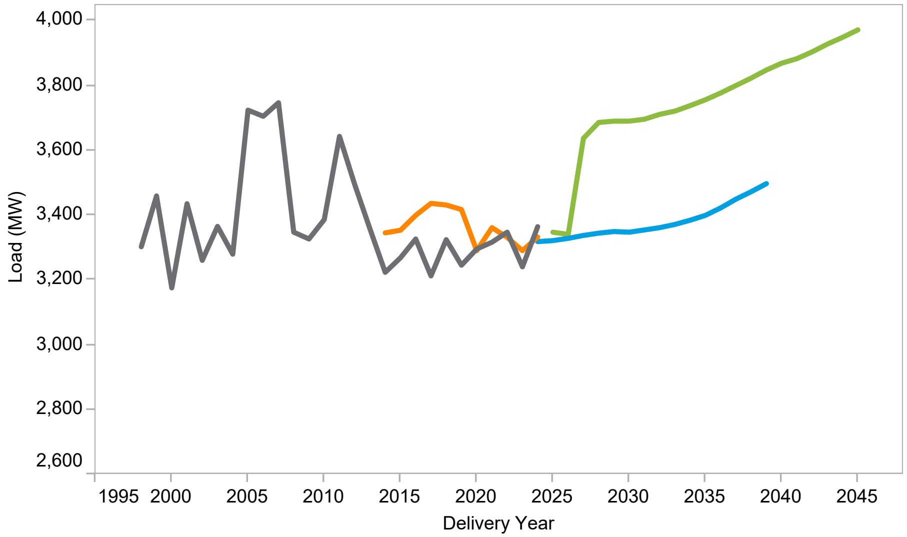


MSA

- Chicago-Naperville-Arlington Heights, IL
- Chicago-Naperville-Elgin, IL-IN-WI
- COMED - Non-Metro
- Kankakee, IL
- Lake County-Kenosha County, IL-WI
- Rockford, IL

Dayton Power and Light (DAYTON)

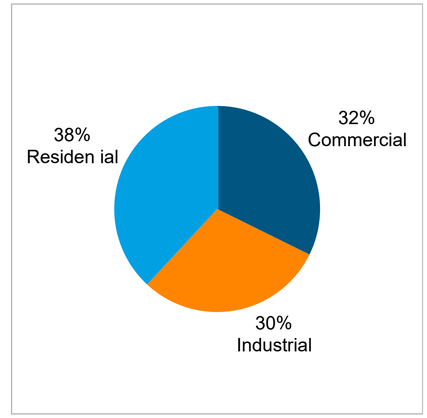
Summer Peak



Weather - Annual Average 1993-2023

Avg Summer Daily Temp	*73.2*
Avg Summer Max Temp	*93.2*
Avg Winter Daily Temp	*31.3*
Avg Winter Min Temp	*-3.0*

RCI Makeup



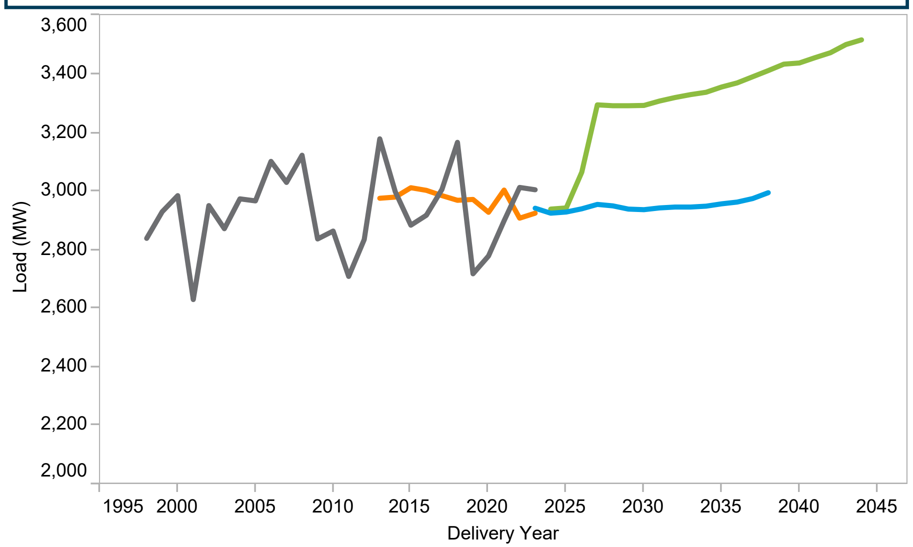
Zonal 10/15/20 Year Load Growth

SUMMER	1.2%	1.0%	0.9%
WINTER	1.3%	1.0%	0.9%

LDAs

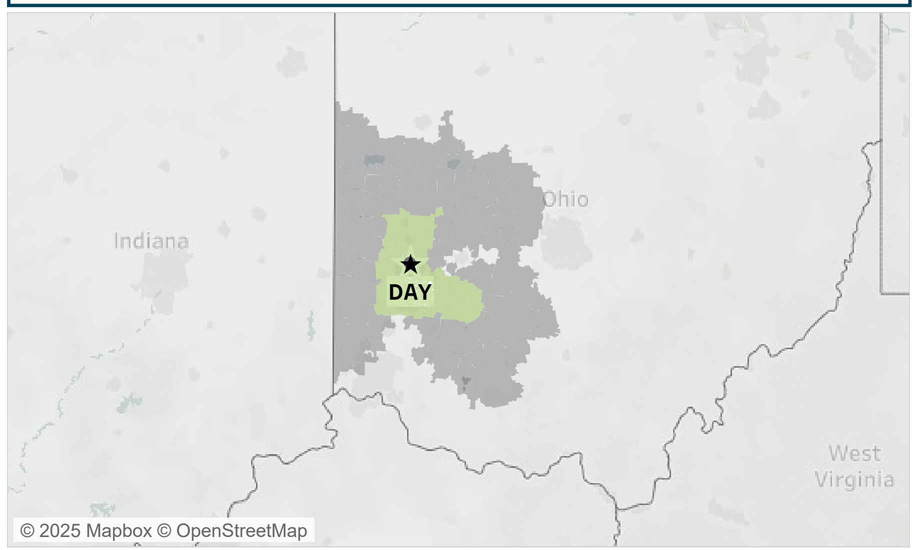
PJM RTO PJM WESTERN

Winter Peak



Peak WN peak Forecast 2024 Forecast 2025

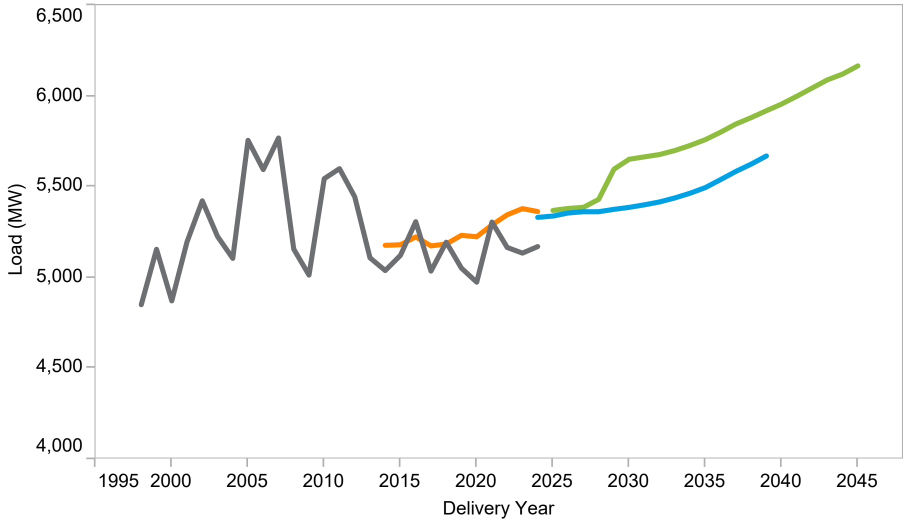
Metropolitan Statistical Areas and Weather Stations



MSA
DAY - Non-Metro
Dayton, OH

Duke Energy Ohio and Kentucky (DEOK)

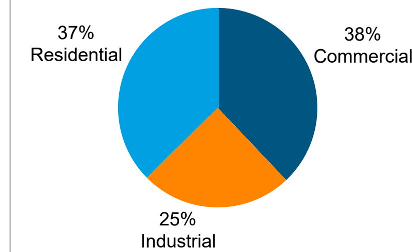
Summer Peak



Weather - Annual Average 1993-2023

Avg Summer Daily Temp	74.4
Avg Summer Max Temp	94.2
Avg Winter Daily Temp	34.1
Avg Winter Min Temp	-1.1

RCI Makeup



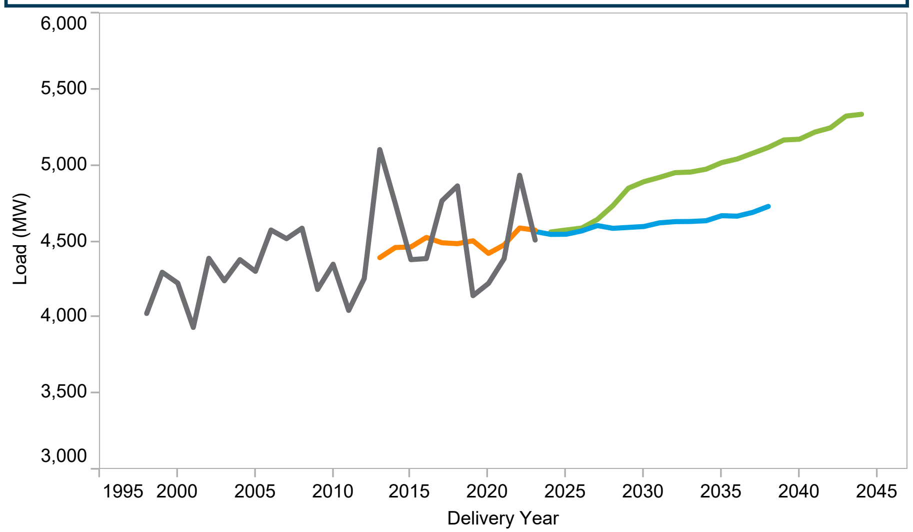
Zonal 10/15/20 Year Load Growth

SUMMER	0.7%	0.7%	0.7%
WINTER	0.9%	0.8%	0.8%

LDAs

PJM RTO PJM WESTERN

Winter Peak



Peak WN peak Forecast 2024 Forecast 2025

Metropolitan Statistical Areas and Weather Stations

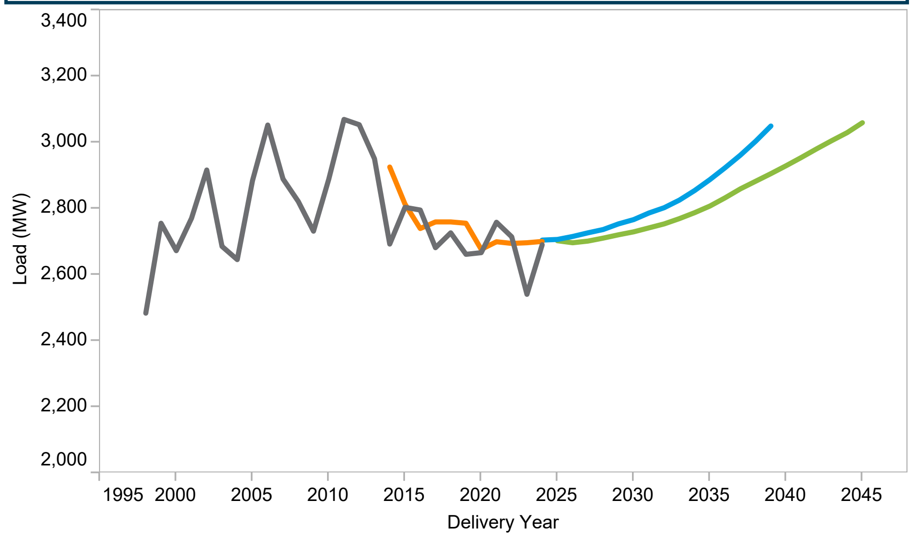
MSA

Cincinnati, OH-KY-IN

DEOK - Non-Metro

Duquesne Light Company (DLCO)

Summer Peak



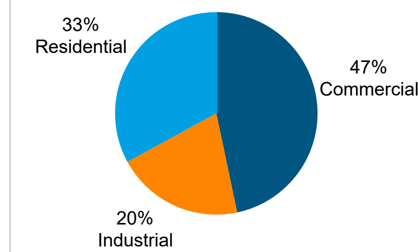
Weather - Annual Average 1993-2023

Avg Summer Daily Temp	*71.7*
Avg Summer Max Temp	*91.8*
Avg Winter Daily Temp	*31.7*
Avg Winter Min Temp	*-0.8*

Zonal 10/15/20 Year Load Growth

SUMMER	0.4%	0.5%	0.6%
WINTER	0.7%	0.8%	0.8%

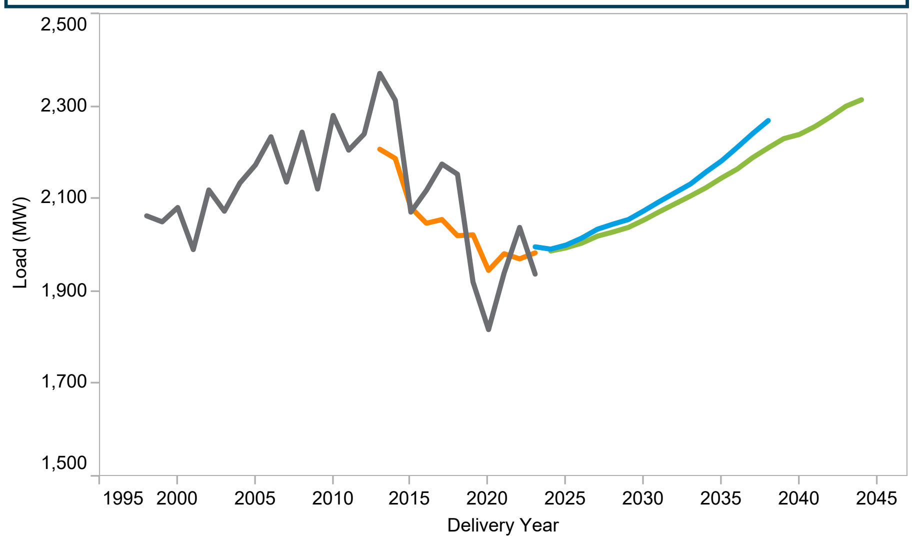
RCI Makeup



LDAs

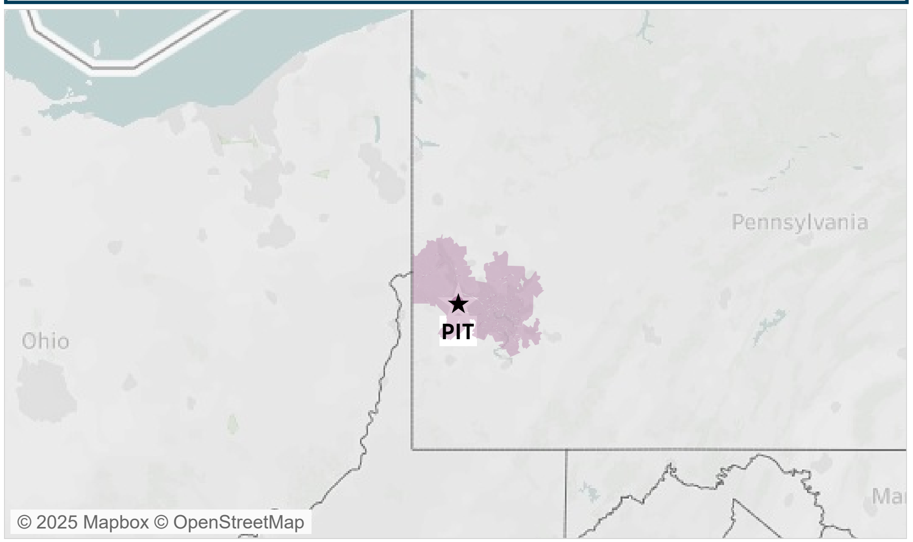
PJM RTO PJM WESTERN

Winter Peak



Peak WN peak Forecast 2024 Forecast 2025

Metropolitan Statistical Areas and Weather Stations

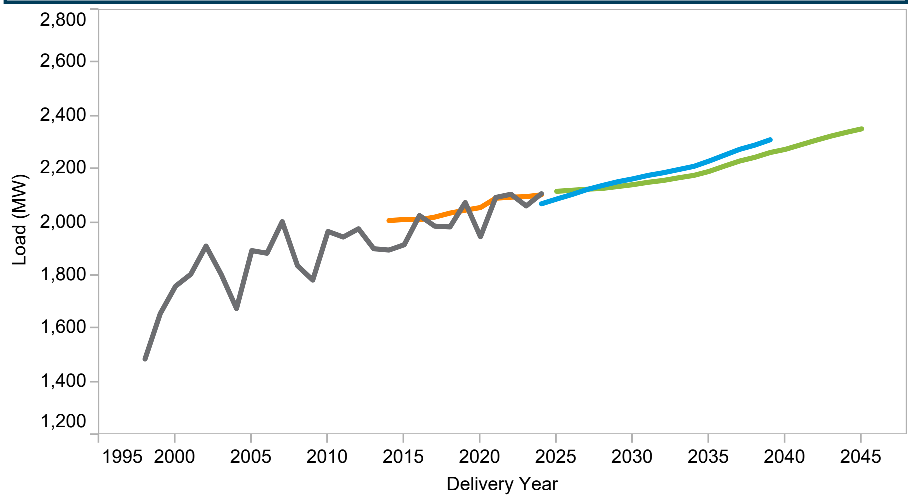


MSA

Pittsburgh, PA

East Kentucky Power Cooperative (EKPC)

Summer Peak



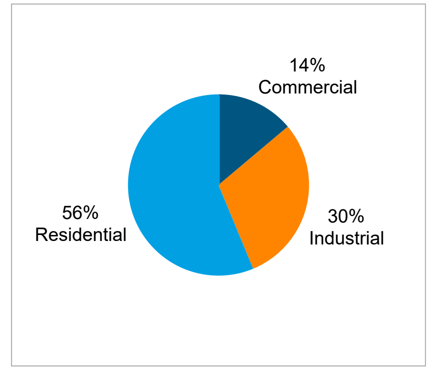
Weather - Annual Average 1993-2023

Avg Summer Daily Temp	*75.5*
Avg Summer Max Temp	*94.4*
Avg Winter Daily Temp	*36.1*
Avg Winter Min Temp	*2.4*

Zonal 10/15/20 Year Load Growth

SUMMER	0.3%	0.5%	0.5%
WINTER	0.3%	0.4%	0.4%

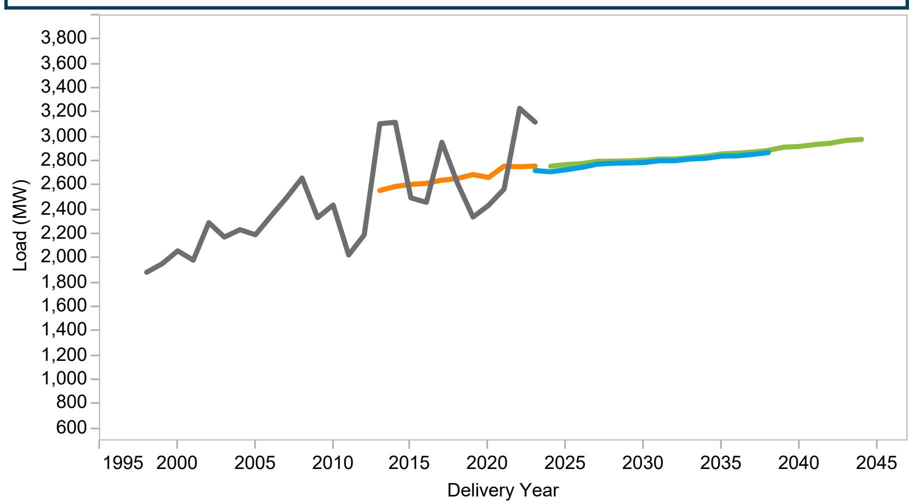
RCI Makeup



LDAs

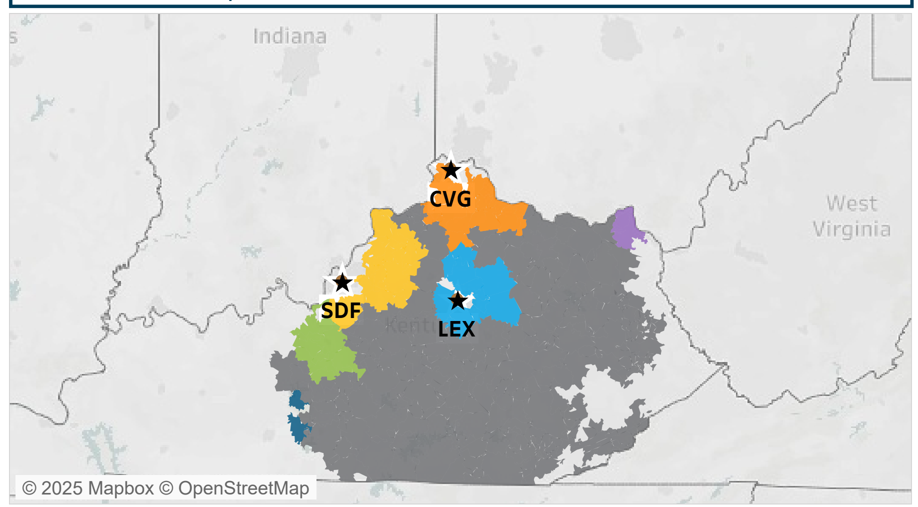
PJM RTO PJM WESTERN

Winter Peak



Peak WN peak Forecast 2024 Forecast 2025

Metropolitan Statistical Areas and Weather Stations

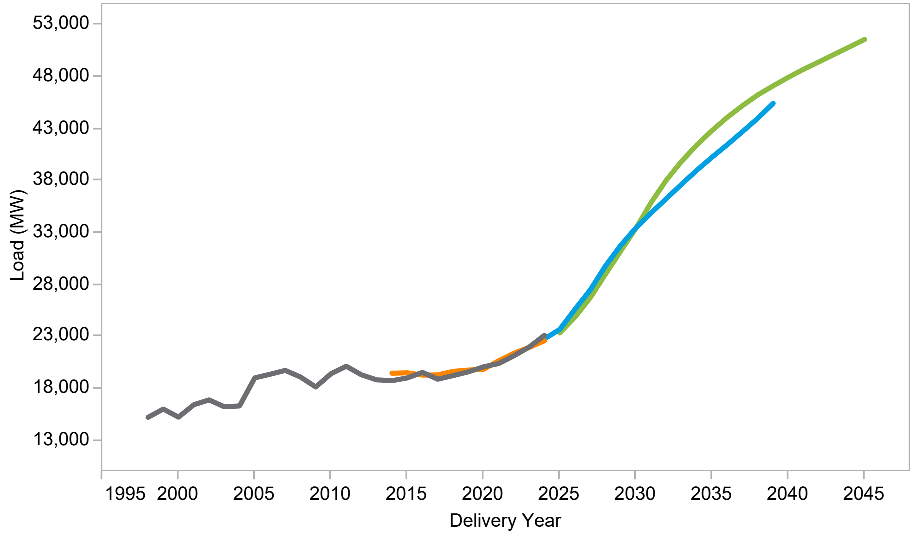


MSA

- Bowling Green, KY
- Cincinnati, OH-KY-IN
- EKPC - Non-Metro
- Elizabethtown-Fort Knox, KY
- Huntington-Ashland, WV-KY-OH
- Lexington-Fayette, KY
- Louisville/Jefferson County, KY-IN

Dominion (DOM)

Summer Peak



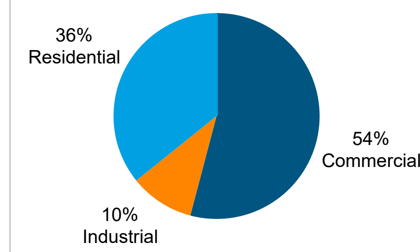
Weather - Annual Average 1993-2023

Avg Summer Daily Temp	*77.0*
Avg Summer Max Temp	*97.0*
Avg Winter Daily Temp	*40.5*
Avg Winter Min Temp	*12.4*

Zonal 10/15/20 Year Load Growth

SUMMER	6.3%	4.9%	4.0%
WINTER	6.0%	4.7%	3.9%

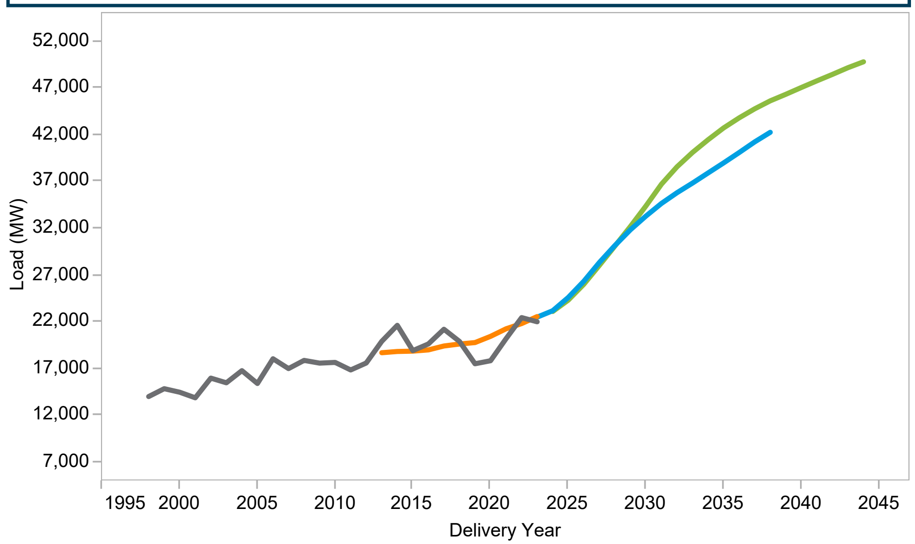
RCI Makeup



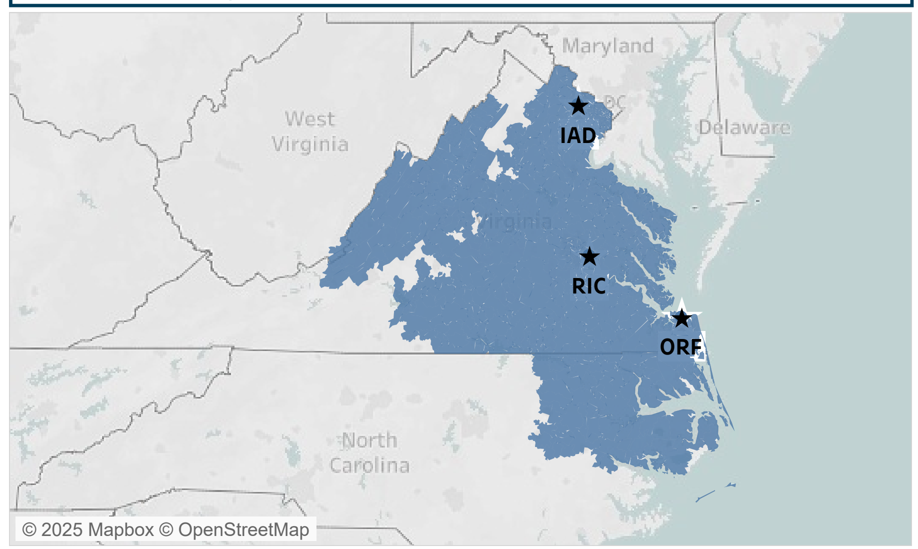
LDAs

PJM RTO

Winter Peak



Metropolitan Statistical Areas and Weather Stations



Peak WN peak Forecast 2024 Forecast 2025

MSA

Virginia Commonwealth Economics

EXHIBIT EAS-3

U.S. Department of Agriculture

PRESS RELEASE

USDA Announces Another Round of Historic Investments to Increase Access to Clean, Affordable Energy Across the Country

Investments in Rural Electric Cooperatives Will Lower Costs and Support Jobs in Rural Communities

PUBLISHED: December 19, 2024

SHARE:

Agriculture Secretary Tom Vilsack today announced awards for more than $4.37 billion in clean energy investments.

RAMSEY, Minn., Dec. 19, 2024 – Agriculture Secretary Tom Vilsack today announced awards for more than $4.37 billion in clean energy investments through the United States Department of Agriculture's (USDA) Empowering Rural America (New ERA) Program. Rural electric cooperatives will use the funding to support thousands of jobs, lower electricity costs for businesses and families and reduce climate pollution by millions of tons each year.

New ERA was made possible by President Biden's Inflation Reduction Act, the largest investment in rural electrification since President Franklin Delano Roosevelt signed the Rural Electrification Act into law in 1936. New ERA program funding is available to member-owned rural electric cooperatives, which have been the backbone of America's rural power delivery for nearly a century.

"USDA is committed to enhancing the quality of life and improving air and water in our rural communities," Secretary Vilsack said. "The Inflation Reduction Act's historic investments enable USDA to partner with rural electric cooperatives to strengthen America's energy security and lower electricity bills for hardworking families, farmers and small business owners."

Rural Utilities Service Administrator Andy Berke highlighted the new investments at the Ramsey, Minnesota, headquarters of **Connexus Energy**, the state's largest electric cooperative. Connexus will use nearly $170 million in New ERA grant funding to procure over 282 megawatts of renewable hydro, solar and wind energy. The cooperative also will purchase 20 megawatts of battery energy storage. These projects will lower costs for its members in rural Minnesota, support nearly 400 jobs and reduce climate pollution by more than 1.1 million tons each year.

Connexus is one of 10 rural electric cooperatives receiving funding in today's announcement. USDA is awarding $4.37 billion in loans and grants to cooperatives based in Arizona, Colorado, Florida, Georgia, Minnesota, Nebraska, and Texas. The investments will support at least 5,000 jobs and reduce climate pollution by over 11 million tons each year. For example:

- **CORE Electric Cooperative** will use a $225 million investment to procure 550 megawatts of wind and solar energy, and 100 megawatts of battery energy storage for rural communities in Colorado. The project is expected to support short- and long-term jobs, stabilize costs for members and help meet the state's net-zero climate pollution goals.
- **Georgia Transmission Corporation** will use an up to $325 million investment for several projects, including new transmission lines and upgrades to existing transmission assets in approximately 20 rural communities across Georgia.
- **Nebraska Electric G&T** will use a $200 million investment to procure 725 megawatts of wind and solar energy in Butler, Burt and Custer counties. The project will supply enough electricity to

power 170,000 homes each year, reduce climate pollution by over 2.2 million tons per year and support as many as 425 jobs.

- **Oglethorpe Power Corporation** will use a $331.5 million investment to refinance outstanding loans for the retired Hal B. Wansley coal plant. The refinancing will result in average annual savings of $7.7 million in expenses from 2025 to 2044, which will be passed to the 38 member cooperatives it serves.
- **San Miguel Electric Cooperative, Inc.** will use a more than $1.4 billion investment to procure 600 megawatts of clean, renewable energy through solar voltaic panels and a battery energy storage system to power 47 counties across rural South Texas. The project will reduce climate pollution by more than 1.8 million tons each year, equivalent to removing 446,000 cars from the road each year, and support as many as 600 jobs.
- **Seminole Electric Cooperative, Inc.** will use a more than $1.3 billion investment to procure 700 megawatts of energy resources through a combination of utility-scale solar and battery energy storage projects across rural portions of Florida. This project will support roughly 3,400 jobs and reduce greenhouse gas emissions by more than 3.5 million tons annually, which is the equivalent of removing 740,000 cars from the road each year.
- **Trico Electric Cooperative Inc.** will use a more than $43 million investment to procure 80 megawatts of solar energy and 80 megawatts of battery energy storage in rural Arizona. The project will supply enough electricity to power nearly 11,000 homes each year, reduce climate pollution by over 132,000 tons each year and support as many as 256 jobs.
- **United Power** will use a nearly $262 million investment to offset the cost of its transition to a clean energy portfolio that will provide more than 760 megawatts of renewable energy resources in rural Colorado. United Power's green portfolio currently represents over 300 megawatts of solar, hydropower and wind energy, including one project providing tax benefits and workforce opportunities in a disadvantaged county. The New ERA investment will help the cooperative reduce climate pollution by over 2.1 million tons each year.

- **Yampa Valley Electric Association** will use a nearly $50 million investment to procure up to 150 megawatts of solar energy and 75 megawatts of battery energy storage for northwestern Colorado and southwestern Wyoming. The project will support disadvantaged communities, promote jobs skills through an expanded scholarship program and reduce climate pollution by 255,000 tons each year.

In addition to the 10 cooperatives receiving loans and grants today, USDA has selected six other cooperatives to move forward in the process to receive New ERA funding. These include:

- Grand Valley Rural Power Lines Inc., Mountain Parks Electric Inc. and San Miguel Power Association Inc. in Colorado,
- 1803 Electric Cooperative Inc. in Louisiana,
- Pacific Northwest Generation Cooperative in Oregon, and
- Inland Power and Light Company in Washington and Idaho.

Additional details on all funding recipients and selectees are available on the New ERA website.

Including today's announcements, USDA has awarded funding to 15 cooperatives as part of the New ERA program to benefit rural electric cooperatives and their members. This funding represents almost $9 billion in New ERA-financed grants and loans. These projects will support good-paying jobs, lower energy costs for rural Americans, significantly reduce pollution and enhance the resiliency of the nation's electric grid. One in five rural Americans stands to benefit from these clean energy investments.

USDA expects to make additional New ERA award announcements in the coming weeks.

New ERA is a covered program in the President's Justice40 Initiative, which aims to ensure 40% of the overall benefits of certain federal climate, clean energy and other investment areas flow to disadvantaged communities that are marginalized by underinvestment and overburdened by pollution.

USDA Rural Development provides loans and grants to help expand economic opportunities, support jobs and improve the quality of life for millions of Americans in rural areas. This assistance supports infrastructure improvements; business development; housing; community facilities such as schools, public safety and healthcare; and high-speed internet access in rural, Tribal and high-poverty areas. Visit the Rural Data Gateway to learn how and where these investments are impacting rural America.

USDA touches the lives of all Americans each day in so many positive ways. Under the Biden-Harris Administration, USDA is transforming America's food system with a greater focus on more resilient local and regional food production, fairer markets for all producers, ensuring access to safe, healthy and nutritious food in all communities, building new markets and streams of income for farmers and producers using climate-smart food and forestry practices, making historic investments in infrastructure and clean energy capabilities in rural America, and committing to equity across the Department by removing systemic barriers and building a workforce more representative of America. To learn more, visit www.usda.gov.

To subscribe to USDA Rural Development updates, visit GovDelivery subscriber page.

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EXHIBIT EAS-4

AURORA
ENERGY RESEARCH

Role of Battery Energy Storage Systems (BESS) in the ERCOT market

Aurora Energy Research

May 2024

Executive Summary

AURORA

1 **BESS are the fastest-growing technology in ERCOT's energy mix and will be increasingly critical to maintaining system reliability along with flexible gas generation**

- From 2020, installed BESS capacity in ERCOT has grown nineteen-fold from virtually nothing to ~4,000 MW as of January 2024. Solar, the second fastest growing generation technology, increased 4.5x over the same period, from 4GW to 22GW[1].
- With solar generation increasingly powering the grid during the day, much greater BESS capacity and flexible gas generation will be needed for the ERCOT grid to manage large ramping requirements in the evening and maintain reliability.

2 **On regular days, BESS have provided key Ancillary Services, allowing gas plants to shift to generating more energy in the market**

- BESS increasingly provide Ancillary Services aimed at maintaining grid conditions and providing backup power while steadily reducing the costs of these services.
- With greater BESS participation in AS, gas has generated more wholesale power: capacity factors and overall gas generation have increased since 2020.

3 **BESS have been critical during extreme events, averting load shedding on September 6th, 2023, and saving an estimated $750 million in system costs by enabling more gas generation in the January 2024 winter freeze**

- By freeing an equal amount of gas capacity for power generation, BESS participation in Ancillary Services saved $750 million in day-ahead costs, or $683 million in real-time costs, across Jan 15-16, 2024.
- BESS kept the lights on and averted a load shedding event by dispatching nearly 2GW when ERCOT operating reserves reached their minimum on September 6th, 2023 and emergency conditions (EEA2) were declared.

1) ERCOT December 2023 Capacity, Demand, and Reserves (CDR) Report.
Sources: ERCOT, Aurora Energy Research

BESS have quickly become an indispensable part of ERCOT's mix with 4GW of installed capacity and another 4.4GW expected this year

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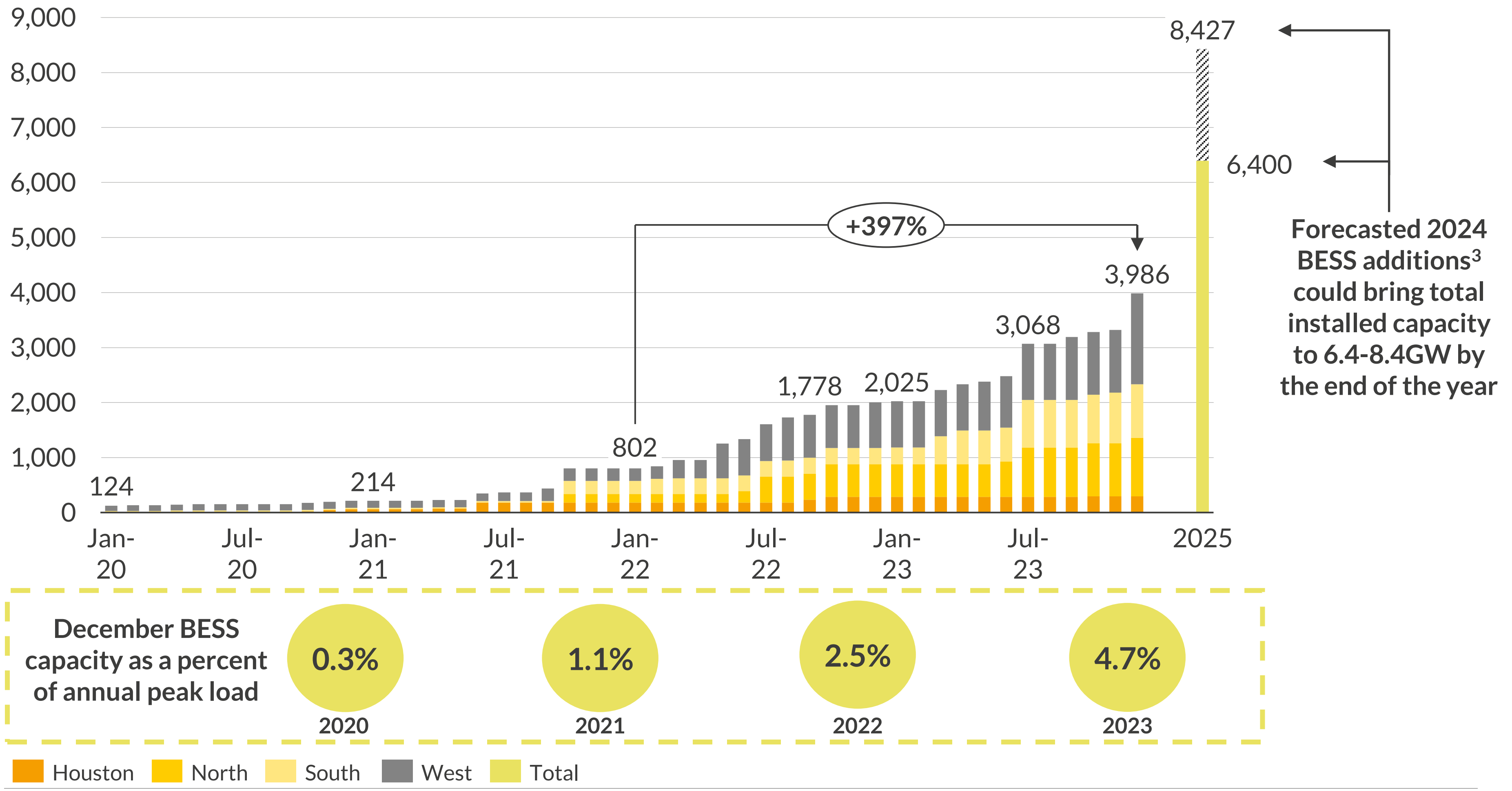
BESS capacity growth in ERCOT[1]
MW

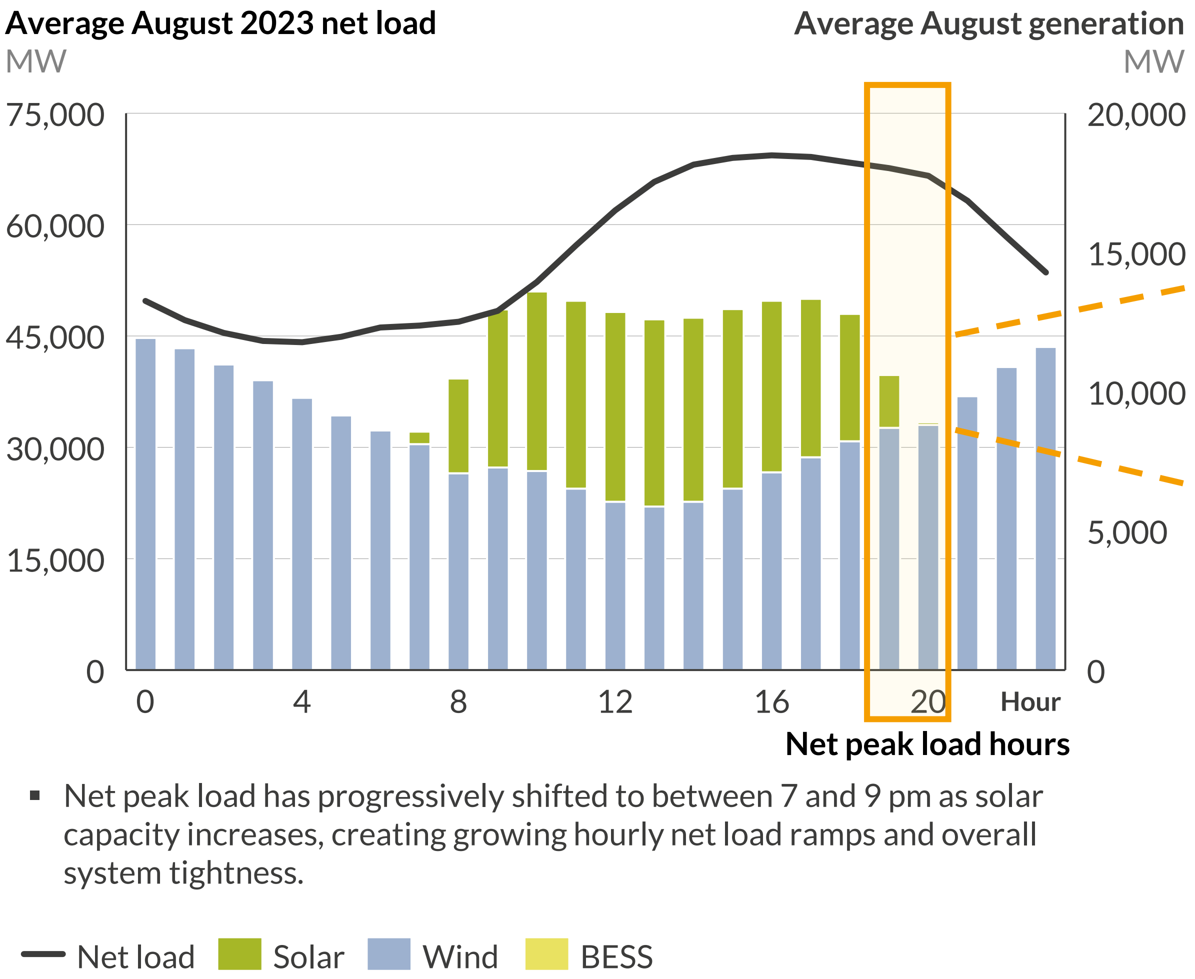


- From October to December 2023, 16 new battery storage projects totalling 796MW of new capacity started commercial operations.[2]
- BESS capacity additions are expected to continue at a rapid pace. 2.4GW of new BESS build has been approved for energization and ERCOT projects as much as 4.4GW of new capacity by the end of 2024.[3]
- Acting as both load and generation, BESS charge when power is cheap and demand is low, and discharge when power is expensive and demand is high.

1) Data from the ERCOT March 2024 GIS report and December 2023 CDR report. 2) Recent operationa projects commissioned in October, November, and December above 10MW. 3) 6.4GW comes from current insta ed capacity p us 2.4GW approved for energization according to March GIS report, whi e ERCOT s December 2023 CDR report sees 8.4GW capacity by the end of 2024.
Sources: Aurora Energy Research, ERCOT

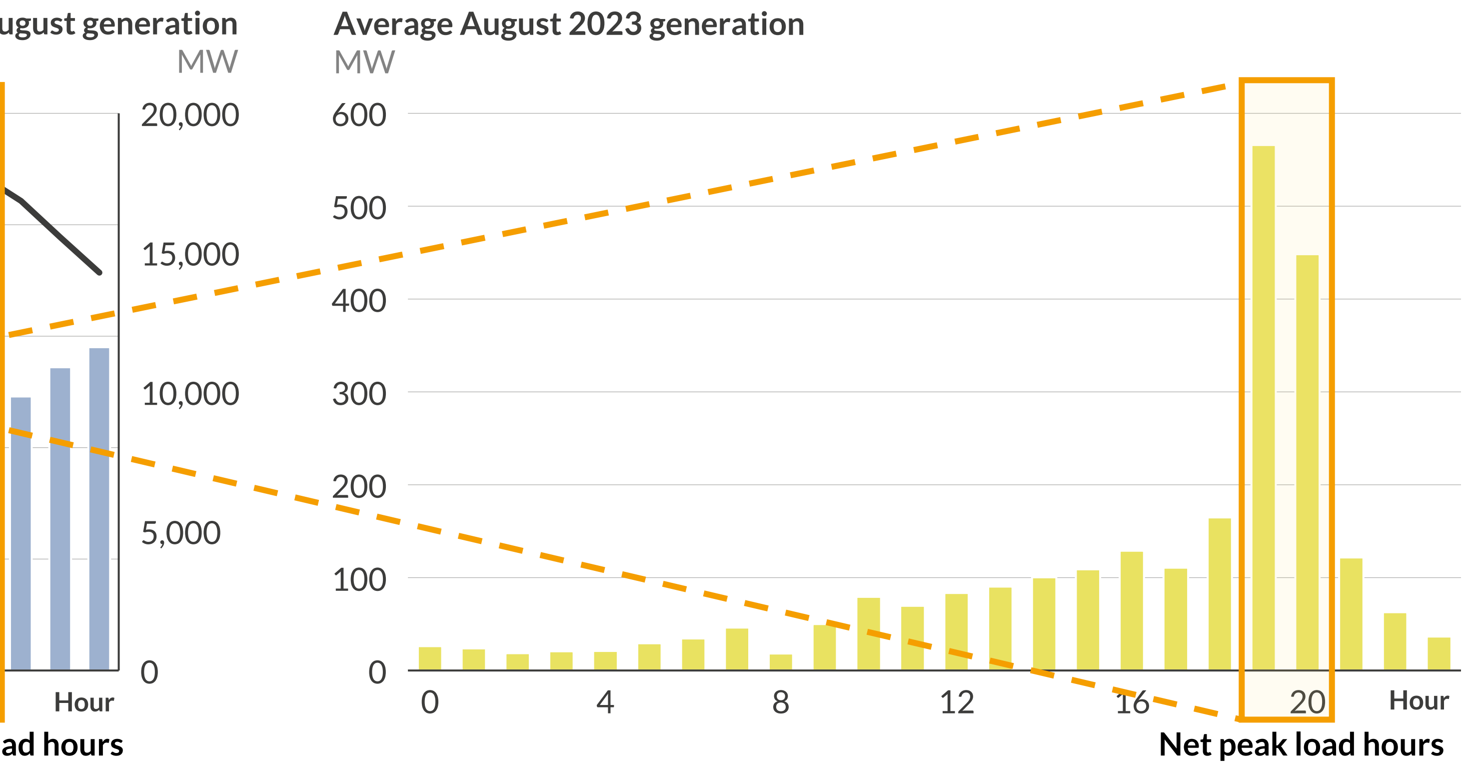
BESS shift energy to critical hours in the evening, meeting system demand when solar generation falls

1 **Daily net peak load has been shifting to 7-9PM when solar generation stops and power demand is highest**



- Net peak load has progressively shifted to between 7 and 9 pm as solar capacity increases, creating growing hourly net load ramps and overall system tightness.

2 **Most BESS in ERCOT are 1- or 2-hour systems and primarily discharge their power during net peak load**



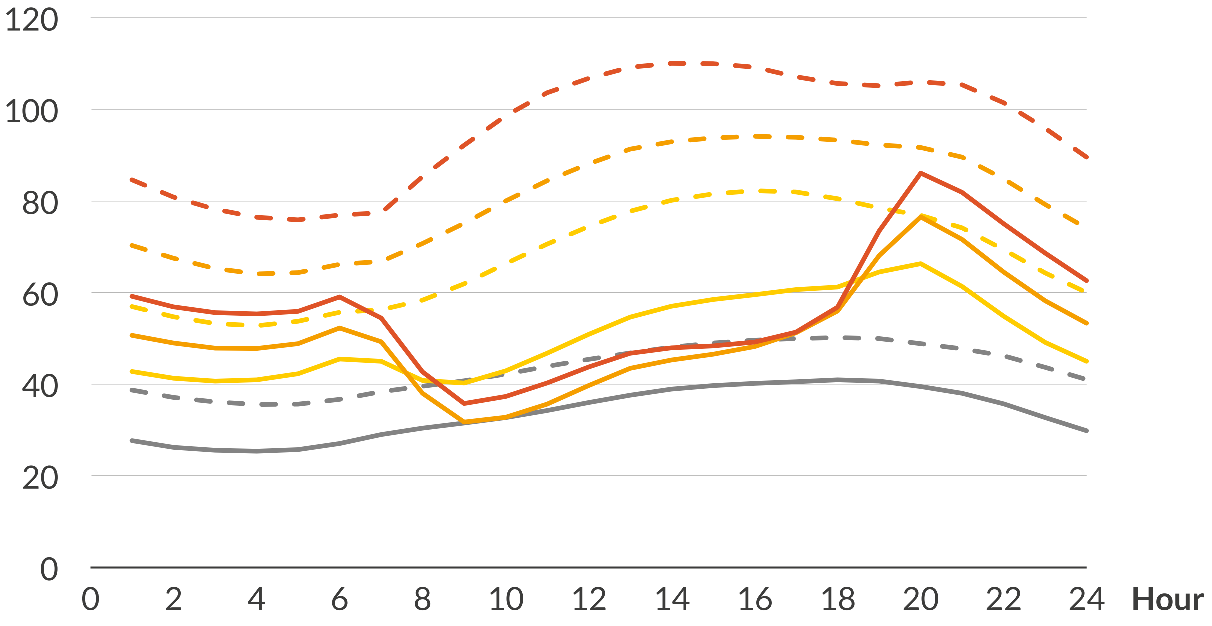
- BESS tend to deliver their power at net peak load when demand is high, solar generation ends, and gas generation resources are strained.
- While BESS make up only ~4% of current capacity, dispatch patterns in peak months foreshadow how they will increasingly help meet daily demand.

Sources; Aurora Energy Research, ERCOT

As load grows and more solar comes online, ERCOT will face growing hourly net load ramps that must be met by flexible technologies

1 **As solar buildout accelerates, the "duck curve" will appear and grow more exaggerated**

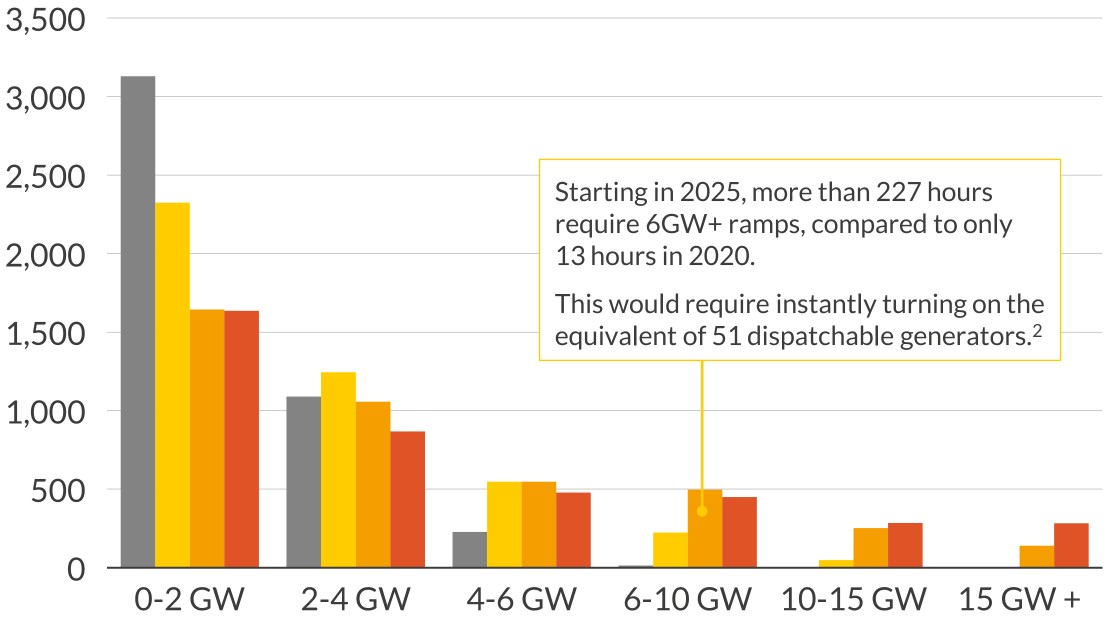
Total and net load average shape in August
GW



- With high population growth and rapid solar development in Texas, net load ramps in the evening will grow much steeper in the next 5-20 years.

2 **Ramping requirements will increase accordingly, seeing more than 20% of hours with ramping greater than 6GW starting in 2035**

Frequency distribution of hourly ramping requirement[1]
Number of hours



- Growing net load ramps underscore the need for greater system flexibility, which dispatchable technologies like BESS and gas provide efficiently.

ERCOT's recently published load growth forecast suggests that net load ramps in the evening may grow even faster than depicted above, underscoring the short-term need for additional dispatchable capacity.

2020 2025 2035 2045 Total load Net load

1) Ramping requirement is the abso ute difference in net oad between consecutive hours. Net oad is ca cu ated as the difference between tota oad and generation from renewab es (wind and so ar). 2) Assuming an average dispatchab e p ant size of 118MW running at fu capacity.
Sources: Aurora Energy Research, ERCOT

Flexible gas and BESS technologies will be necessary in ERCOT to maintain reliability, and up to 44GW may be needed by 2035

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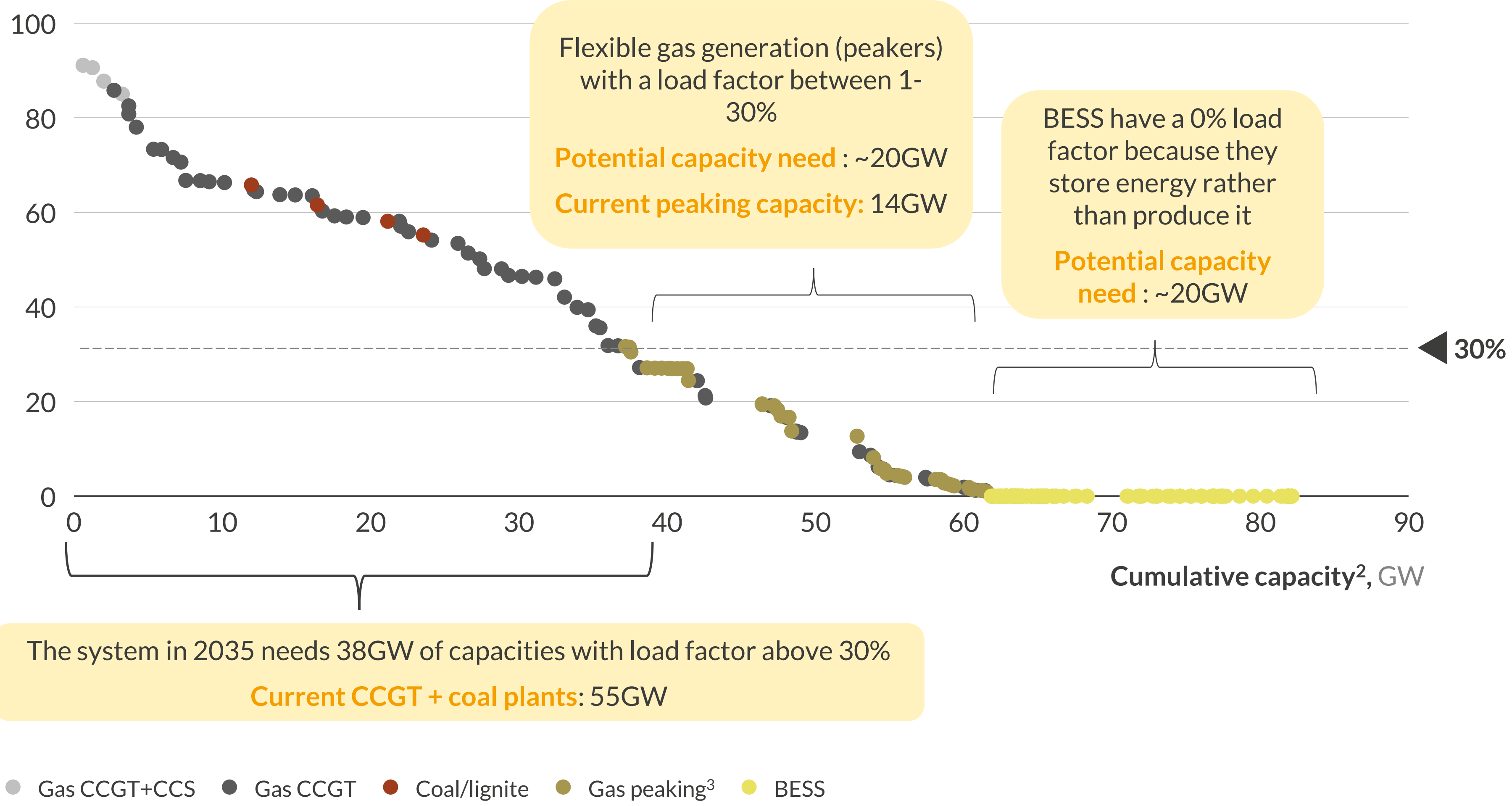
Annual capacity factors for dispatchable plants[1] in 2035, ordered highest to lowest

%



- ERCOT may need at least 44GW of capacity with capacity factors lower than 30%; most growth will be necessary for plants that can operate at low-capacity factors, such as gas peaking plants.
- BESS, which can earn a large share of annual revenues from just a few of the highest priced days, are also well situated to operate at lower capacity factors.
- CCGTs are unlikely to operate in such low-capacity factors due to physical constraints (more costly to system and technology to ramp).
- Gas peakers[3] run at lower load factors than CCGTs and coal; it is easier for these technologies to ramp and are often dispatched last.

1) Dispatchab e capacities inc ude peaking gas, battery energy storage systems, CCGTs, coa and ignite. Exc udes nuc ear and renewab es. BESS shown with a capacity factor of 0%. 2) Showing summer de-rated capacities for therma p ants. 3) Gas peakers inc udes CT and IC.

Sources: Aurora Energy Research, ERCOT

BESS have increasingly and efficiently provided critical Ancillary Services in ERCOT, reducing average prices in off-peak months.

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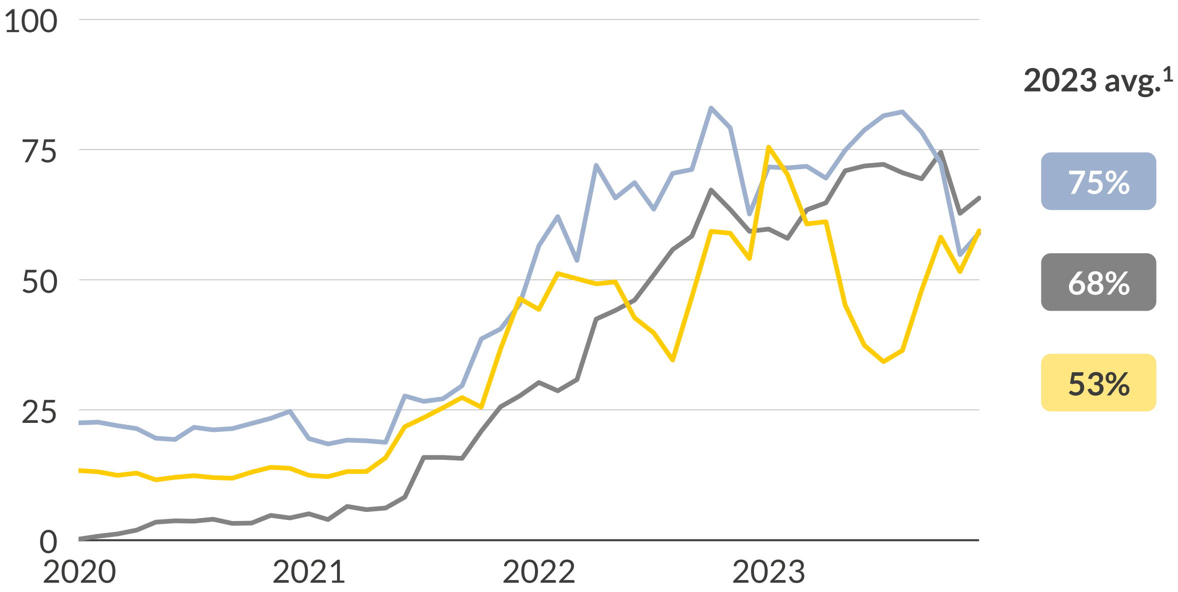
1 BESS are making up a growing portion of key Ancillary Services[1] such as Regulation and RRS in ERCOT

Awards for BESS as percentage of all generation awards[1]

%



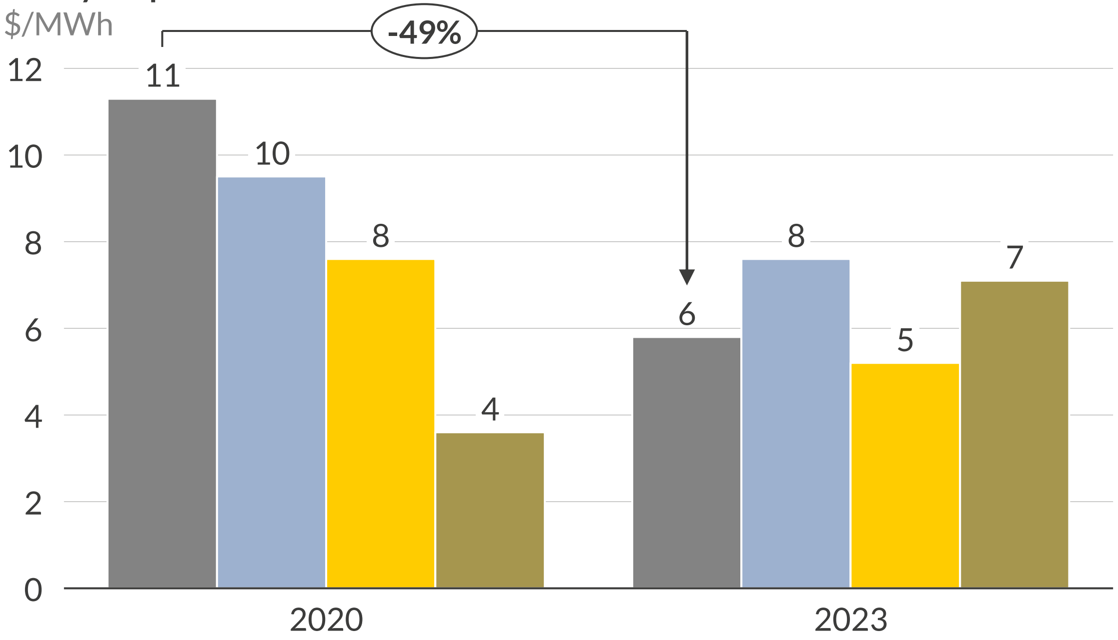
- Ancillary services are purchased by ERCOT in the day-ahead market to balance the next day's supply and demand of electricity on the grid and mitigate real time operational issues.
- BESS make up a large percentage of RRS and Regulation Services, reaching as high as 74% in RRS and 65% of regulation services in October 2023. BESS made up 8% of ECRS awards in the same month.

RRS   Reg Up   Reg Down

2 For these Ancillary Services[1], average prices in non-Summer months[2] have declined with greater BESS penetration

Yearly AS prices

$/MWh



- As BESS have been procured for greater shares of Ancillary Services, average AS prices in off-peak months have declined from 2020 averages.
- The only AS to see a price increase from its 2020 average is Non-Spin, a service in which BESS rarely participate due to higher minimum state of charge requirements and lower prices.

RRS   RegUp   RegDown   Non-Spin

1) Exc uding ECRS and Non-Spin from these graphs. 2) Exc udes June, Ju y, August, and September va ues for each year.

Sources: Aurora Energy Research, ERCOT

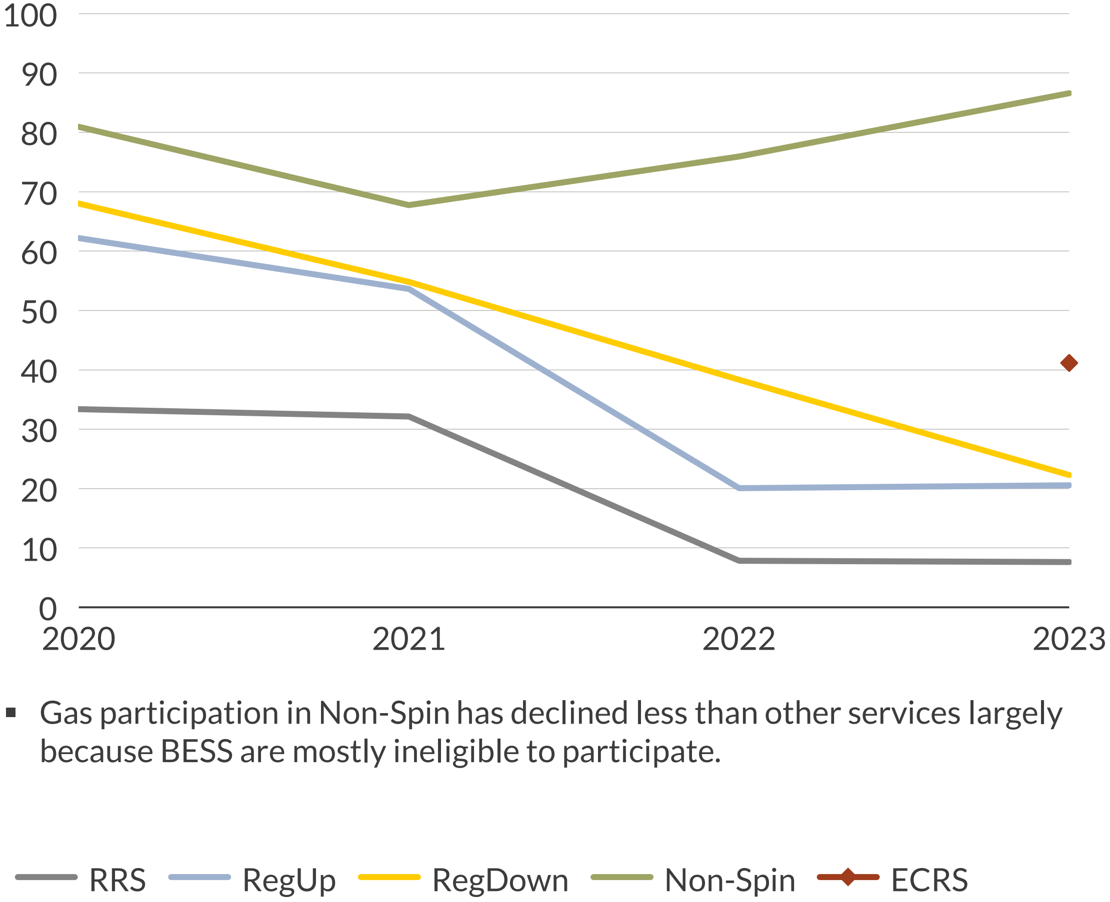
But BESS have not displaced gas, which has increased its overall generation through higher participation in real-time and day-ahead energy markets

AURORA

1 **Gas generator participation in key Ancillary Services (Regulation, RRS) has declined since 2020**

Awards for gas as percentage of all generation[1] awards

%

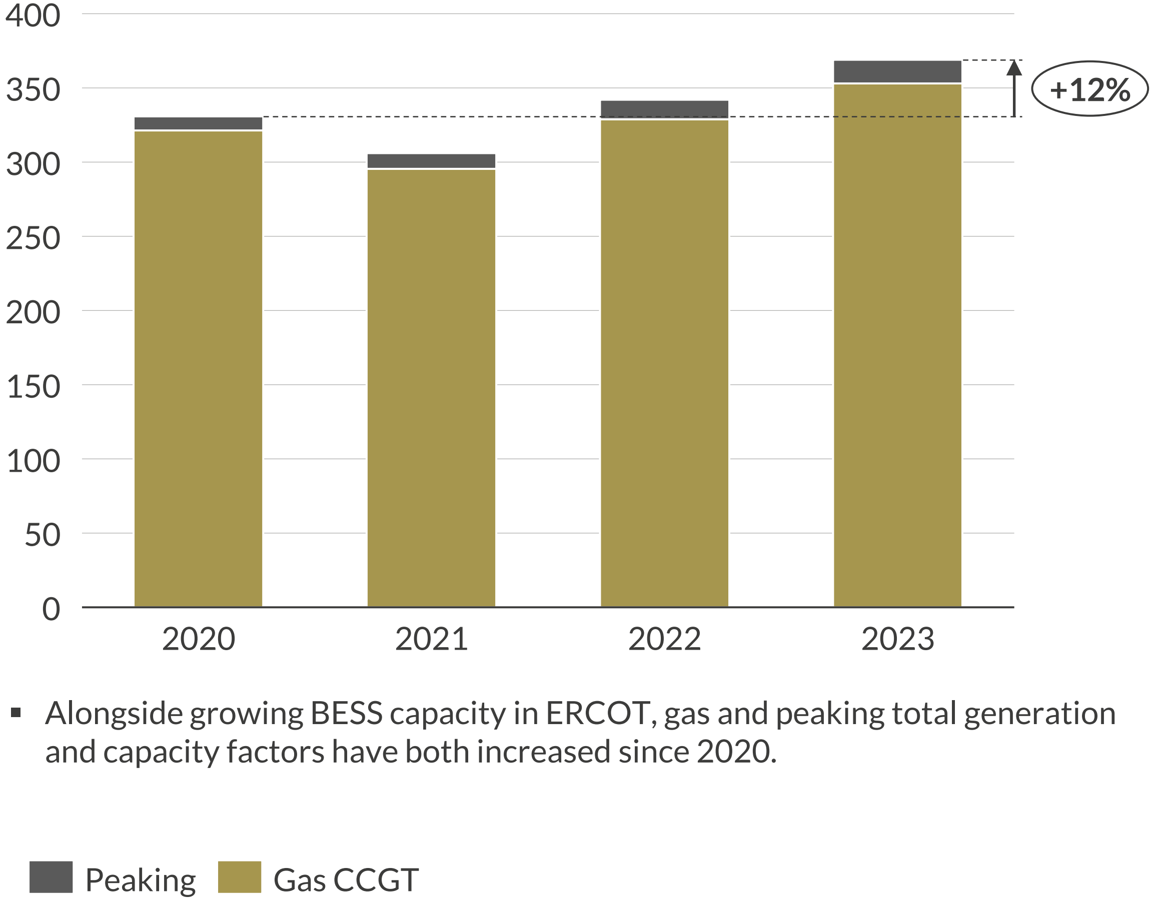


- Gas participation in Non-Spin has declined less than other services largely because BESS are mostly ineligible to participate.

2 **Gas-CCGT and Peaking resources have generated more power than ever, despite the rapid growth of renewables and BESS capacity**

Total generation

TWh



- Alongside growing BESS capacity in ERCOT, gas and peaking total generation and capacity factors have both increased since 2020.

1) Anci ary Services can a so be fu fi ed by Contro ab e Load Resources (CLR); the above ana ysis considers on y the generation side of the ERCOT market.

Sources; Aurora Energy Research, ERCOT

In 2023, BESS provided critical energy during the hours of highest system stress, preventing ERCOT from having to shed any load

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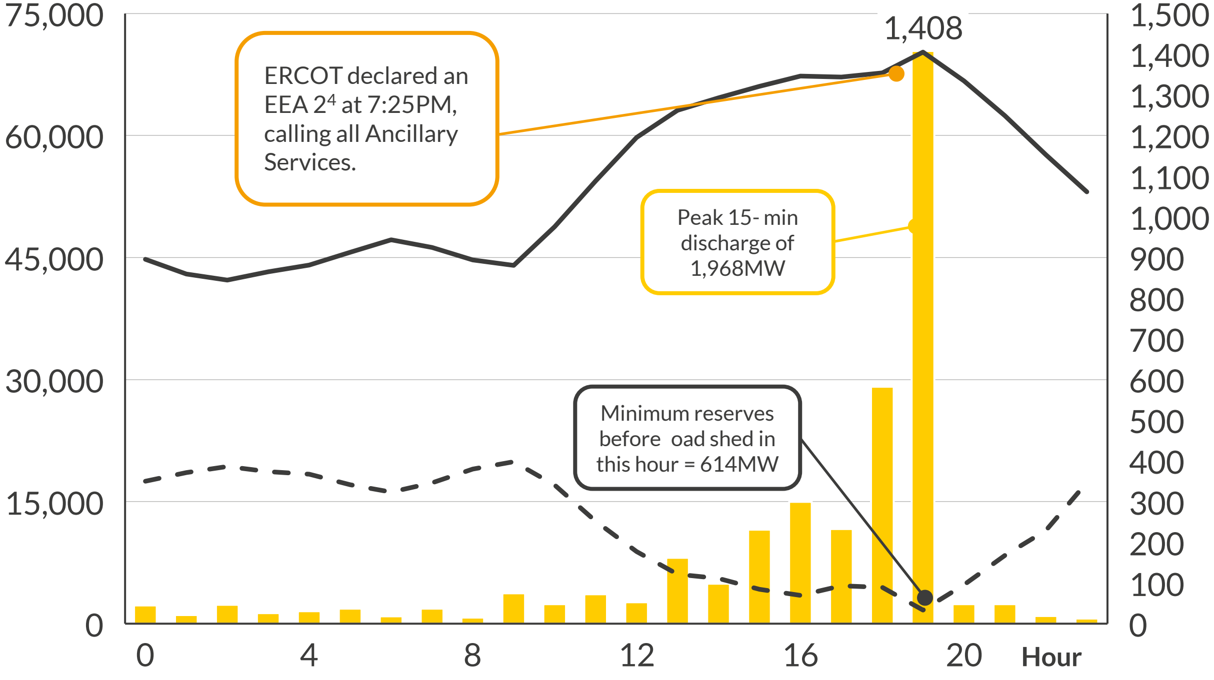
1 **September 6th, 2023: ERCOT BESS discharged their energy between 6-8pm, right as system reserve margins were tightest**

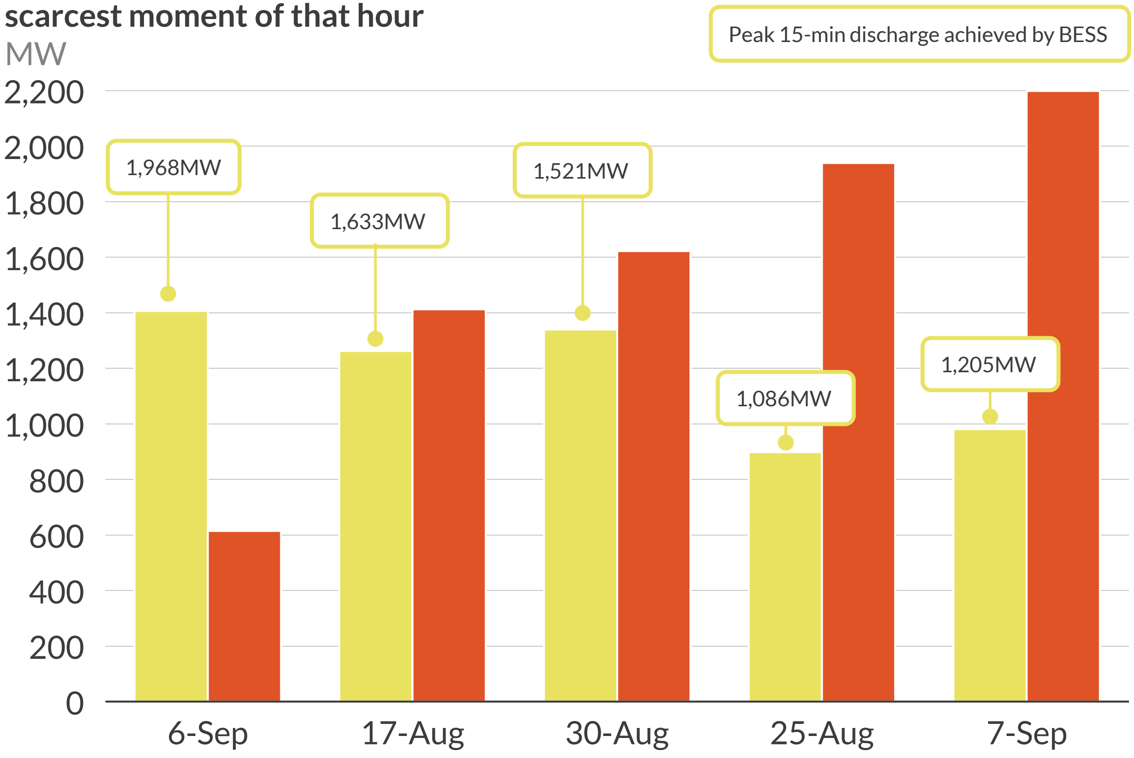
2 **Across the five scarcest days[1] of 2023, BESS discharged most of their power at the hour when reserves were at their lowest point**

ERCOT wide load and margins[2] MW | **ERCOT wide BESS generation** MWh



- BESS dispatched nearly 1.5GWh of power between 7 and 8 PM in response to ERCOT calling all Ancillary Services amid low operating margins, helping to restore normal grid frequency and preventing serious damage to the grid.

Average hourly BESS generation and operating reserves before EEA3 event[3] at scarcest moment of that hour
MW



- On September 6th, 2023, without BESS dispatch, ERCOT's operational reserves would have fallen below the 1,500 MW threshold, forcing the ISO to start shedding load to protect the integrity of the grid.

Net Load — Average Remaining Physical Reserves (PRC) before EEA3[5] — BESS Generation

BESS Generation — Minimum Remaining Physical Reserves (PRC) before EEA3[4]

1) Individua days with the owest hour y operating reserves (mu tip e hours in the same day are not shown). 2) Margins, a so ca ed operating reserves, are the difference between on ine operating capacity and avai ab e off ine capacity. 3) An Energy Emergency A ert 3 is issued when operating reserves drop be ow 1,500MW, triggering a oad shed event.4) Ca cu ated as the minimum operating reserves from each hour minus 1,500MW. 5) Ca cu ated as average operating reserves from each hour minus 1,500MW.

Sources: Aurora Energy Research, ERCOT

In the mornings of January 14-15, 2024, 3GW of BESS capacity in Ancillary Services freed up an equivalent 3GW of natural gas to provide critical energy

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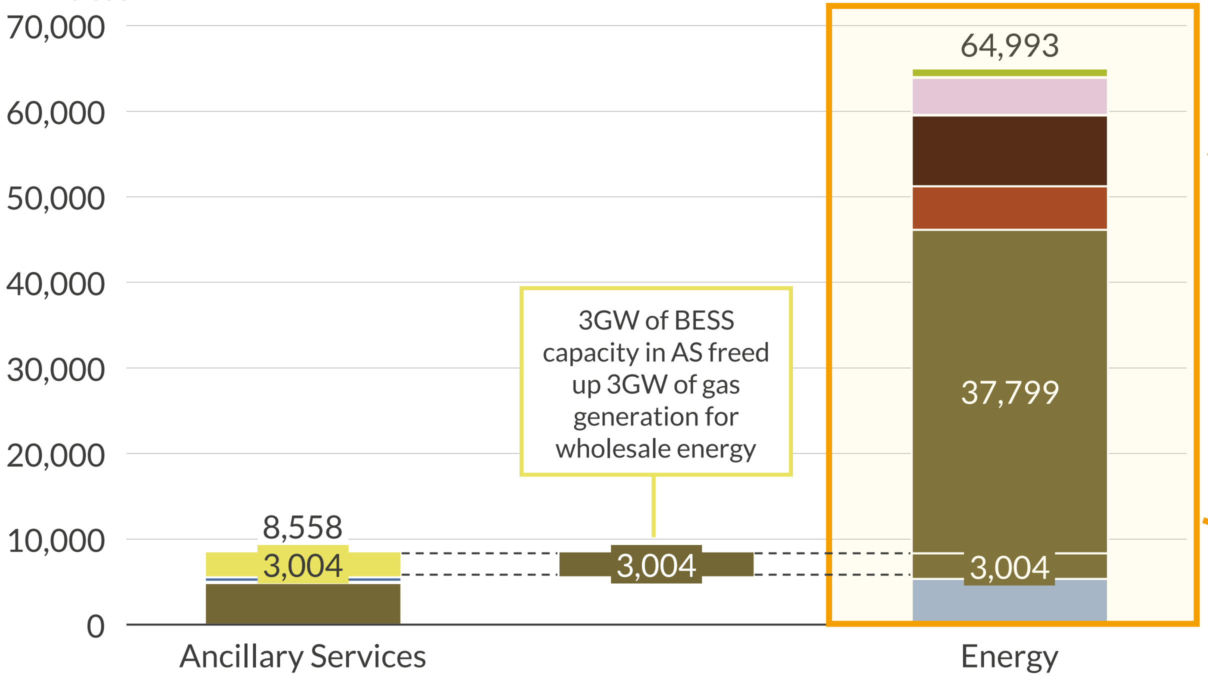
1 In tight morning hours[1] on January 14th and 15th, BESS overwhelmingly participated in AS while gas provided energy to the grid

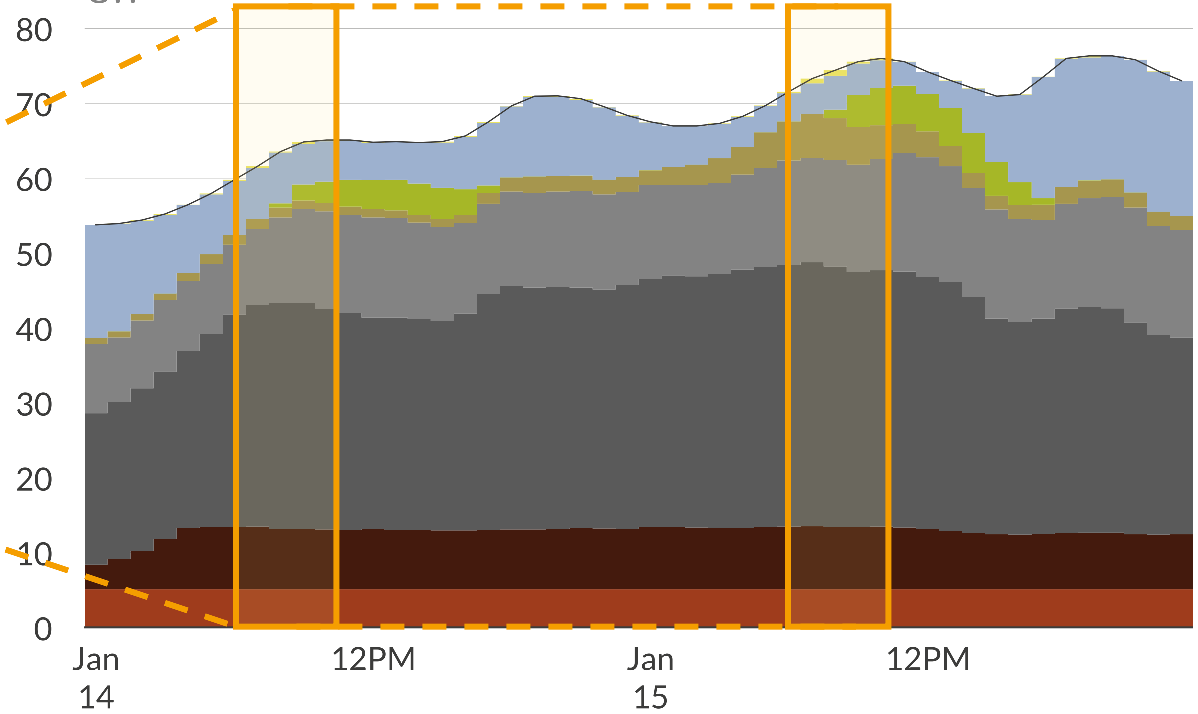
Total power generation in AS and energy markets[2], by technology



- Across these two days in January with very low wind generation and high load stemming from freezing temperatures, BESS committed an hourly average of 2.8 GW of capacity every hour to Ancillary Services, allowing least-cost CCGT generators to primarily generate power for wholesale markets.

2 On these freezing and low-wind days in January, thermal resources generated most of the energy needed to meet demand

Load and generation on Jan 14th and Jan 15th, 2024



- With BESS providing most Ancillary Services on days of system tightness, thermal generators sell greater shares of energy to the grid, helping to push down system-wide real-time prices.

Onshore wind | Gas-fired[3] | Nuclear | Coal | Hydro Storage | Lignite | BESS | Solar PV | CCGT | Other Gas | Peaking | Load

1) Ana ysis inc udes hours between 6:00AM and 10:00AM when wind generation was ow and system conditions were tightest. 2) Anci ary Services awards and energy generation for January 14 and 15, 2024 3) Gas-fired (for the efthand graph) is a combination of Gas-CCGT, OCGT, and Peakers.

Sources: Aurora Energy Research, ERCOT

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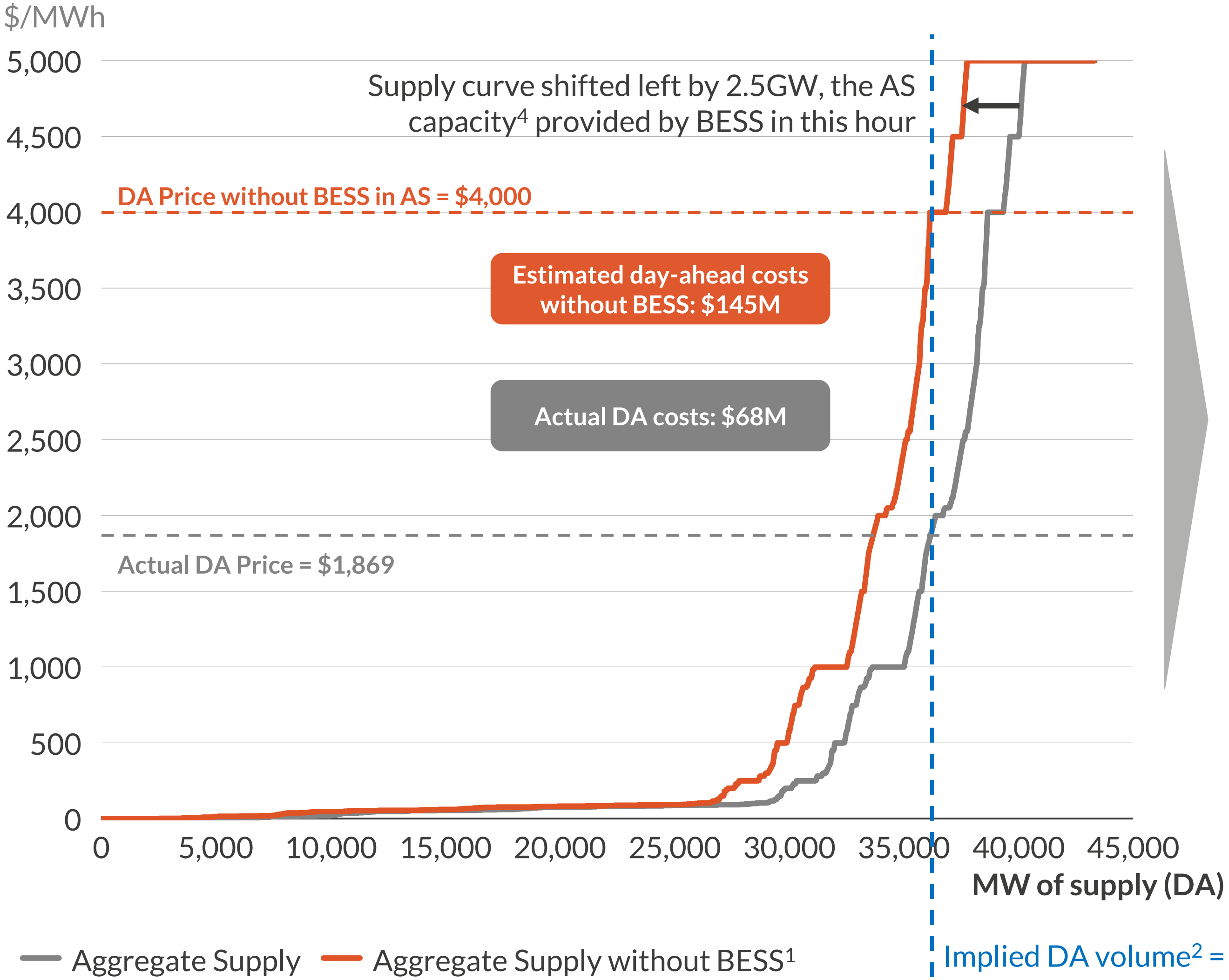
BESS saved $750 million in day-ahead or $683 million in real-time costs in two days, averaging 2.1GW of Ancillary Services per hour

Day-ahead (DA) aggregate supply market-clearing prices from 7-8AM on January 16th, 2024



Day-Ahead Market Savings	OR	Real-Time Market Savings
Single hour (7-8 am) savings created by BESS **$77M**		Single hour (7-8 am) savings created by BESS **$94.7M**
Cumulative January 15-16 savings created by BESS **$750M**		Cumulative January 15-16 savings created by BESS **$683M**

- On January 16th from 7-8 AM, amid freezing winter weather and peak power demand, BESS saved $77M in day-ahead system costs by providing 2.5GW of Ancillary Services.
- Doing so directly enabled an equal amount of fast-ramping gas generation to participate in the energy market, helping keep prices low for consumers across Texas.
- Across January 15th and 16th, BESS saved a total of $750M in costs to the day-ahead market ($352 million on Jan 15th and $398 million on Jan 16th).
- If every freed up thermal generator participated in the real-time instead of day-ahead market, BESS still would have saved a total of $683M in real-time system costs.

1) Without the BESS capacity in Anci ary Services (AS), an equiva ent capacity of fast-ramping gas generation wou d have been required to provide AS and removed from the DA or RT aggregate supp y 2) Imp ied Day-Ahead vo ume is ca cu ated as the point where actua DA price equa s the price of the margina p ant s energy bid 3) Assuming demand remains static.4) Inc udes RRS, ECRS, Non-Spin, and RegUp services. Sources: ERCOT, Aurora Energy Research ana ysis

Details and disclaimer

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