PUBLIC VERSION

STATE OF NORTH CAROLINA
UTILITIES COMMISSION
RALEIGH

BEFORE THE NORTH CAROLINA UTILITES COMMISSION

In the Matter of:	)	
	)	
Biennial Consolidated Carbon Plan	)	DOCKET NO. E-100, SUB 190
and Integrated Resource Plans of	)	
Duke Energy Carolinas, LLC, and	)	
Duke Energy Progress, LLC, Pursuant	)	
to N.C.G.S. § 62-110.9 and	)	
§ 62-110.1(c)	)	

DIRECT TESTIMONY AND EXHIBITS OF

JAMES F. WILSON

ON BEHALF OF

SOUTHERN ALLIANCE FOR CLEAN ENERGY, SIERRA CLUB, NATURAL RESOURCES DEFENSE COUNCIL, AND NORTH CAROLINA SUSTAINABLE ENERGY ASSOCIATION

MAY 28, 2024

TABLE OF CONTENTS

EXHIBITS

I. Introduction and Qualifications

Q: Please state your name, position, and business address for the record.

A: My name is James F. Wilson. I am an economist and independent consultant doing business as Wilson Energy Economics. My business address is 4800 Hampden Lane Suite 200, Bethesda, Maryland 20814.

Q: Please describe your experience and qualifications.

A: I have forty years of consulting experience, primarily in the electric power and natural gas industries. Much of my work has pertained to the economic and policy issues arising from the introduction of competition into these industries, including restructuring policies, market design, market analysis and market power. Other recent engagements have included resource adequacy and capacity markets, contract litigation and damages, forecasting and market evaluation, and pipeline rate cases and evaluating allegations of market manipulation. I also spent five years in Russia in the early 1990s advising on the reform, restructuring, and development of the Russian electricity and natural gas industries for the World Bank and other clients. With regard to the load forecasting and resource adequacy topics that are the focus of this testimony, I have been involved in these issues, particularly in the PJM Interconnection, L.L.C. region for many years, and have testified on these issues many times in various state proceedings. In particular, I have followed the growing data center industry and its power needs since data centers became a significant source of load growth in Virginia in about 2016.

I have submitted affidavits and presented testimony in proceedings of the FERC, state regulatory agencies, and U.S. district court. I hold a B.A. in Mathematics from Oberlin College and an M.S. in Engineering-Economic Systems from Stanford University. My curriculum vitae, summarizing my experience and listing past testimony, is attached as Exhibit JFW-1.

Q: On whose behalf are you testifying in the proceeding?

A: I am testifying on behalf of Southern Alliance for Clean Energy, Sierra Club, Natural Resources Defense Council, and the North Carolina Sustainable Energy Association.

Q: Have you previously testified before the North Carolina Utilities Commission?

A: Yes. In some of the recent Duke Energy Carolinas, LLC ("DEC") and Duke Energy Progress, LLC ("DEP") (collectively, "Companies" or "Duke") Integrated Resource Planning and avoided cost dockets, I have reviewed the electric load forecasts and filed reports.[1] In recent dockets I have also reviewed the resource adequacy studies and filed reports.[2]

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[1] Wilson, James F., *Review and Evaluation of the Load Forecasts for the Duke Energy Carolinas and Duke Energy Progress 2018 Integrated Resource Plans*, filed February 12, 2019 as Attachment 3 to Initial Comments of the Southern Alliance for Clean Energy in North Carolina Utilities Commission Docket No. E-100 Sub 157 ("Wilson 2019 Load Forecast Report"); Wilson, James F., *Review and Evaluation of the Peak Load Forecasts for the Duke Energy Carolinas and Duke Energy Progress 2016 Integrated Resource Plans*, filed February 7, 2017 as Attachment A to the Comments of Southern Alliance for Clean Energy, Natural Resources Defense Council and the Sierra Club, in North Carolina Utilities Commission Docket No. E-100 Sub 147 ("Wilson 2017 Load Forecast Report").

[2] Wilson, James F., *Review and Evaluation of the 2020 Resource Adequacy Studies Relied Upon for the Duke Energy Carolinas and Duke Energy Progress 2020 Integrated Resource Plans,* February 5, 2021, filed March 1, 2021 as Attachment 5 to the Partial Initial Comments of Southern Alliance For Clean Energy, Sierra Club, and Natural Resources Defense Council in North Carolina Utilities Commission Docket No. E-100, Sub 165; *Review and Evaluation of Resource Adequacy*

Q: Are you sponsoring any exhibits in this proceeding?

A: Yes. In addition to my CV, I am sponsoring a report, Review and Evaluation of the Load Forecasts and Resource Adequacy Study for the Duke Energy Carolinas and Duke Energy Progress 2023-2024 Carbon Plan and Integrated Resource Plan, attached as Exhibit JFW-2.

II. Testimony Overview

Q: What is the purpose and scope of your direct testimony in this proceeding?

A: The purpose and scope of my direct testimony are to (1) review and provide analysis and recommendations regarding the Companies' load forecasts and (2) review and provide analysis and recommendations regarding the Companies' resource adequacy study. The Companies filed testimony supporting their 2023-2024 Carbon Plan Integrated Resource Plan ("CPIRP") on September 1, 2023. The CPIRP electric load forecast was presented in Appendix D, supported by the direct testimony of a panel of witnesses: Glen Snider, Michael Quinto, Thomas Beatty, and Ben Passty ("Snider Panel Direct"). The resource adequacy analysis and reserve

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and Solar Capacity Value Issues with regard to the Duke Energy Carolinas and Duke Energy Progress 2018 Integrated Resource Plans and Avoided Cost Filing, filed February 12, 2019 as Attachment 4 to Initial Comments of the Southern Alliance for Clean Energy in North Carolina Utilities Commission Docket No. E-100, Sub 157, also filed September 11, 2019 as Exhibit B to Direct Testimony on behalf of the South Carolina Coastal Conservation League and Southern Alliance for Clean Energy in South Carolina Public Service Commission Docket Nos. 2019-185-E and 2019-186-E; Wilson, James F., *Review and Evaluation of the Reserve Margin Determinations for the Duke Energy Carolinas and Duke Energy Progress 2016 Integrated Resource Plans*, Attachment B to the Comments of Southern Alliance for Clean Energy, Natural Resources Defense Council and the Sierra Club, filed February 7, 2017 in North Carolina Utilities Commission Docket No. E-100, Sub 147.

margins for the CPIRP were based upon a resource adequacy study ("2023 RA Study") prepared for DEC and DEP by Astrapé Consulting.[3]

The electric load forecast is foundational to a utility's resource planning. It serves as the basis for each utility's determination of the total generating capacity required over the CPIRP planning horizon. The CPIRP filing was updated with supplemental testimony to present a revised electric load forecast ("Fall Forecast"), which led to supplemental resource portfolios that were submitted on January 31, 2024 ("Updated CPIRP"). The revisions to the electric load forecast were first introduced by supplemental testimony of Glen Snider filed November 30, 2023 and the Updated CPIRP was supported with supplemental testimony of the above-mentioned panel of witnesses on January 31, 2024 ("Snider Panel Supplemental."). My testimony and expert report review and evaluate the Companies' Fall Forecasts relied upon for the Updated CPIRP, and propose alternative electric load forecasts that are more prudent and reasonable for planning purposes.

Q: What materials have you reviewed in order to prepare your report and testimony?

A: I reviewed the CPIRP, supporting files, and discovery responses.

[3] Astrapé Consulting, *2023 Resource Adequacy Study for Duke Energy Carolinas & Duke Energy Progress,* August 15, 2023.

III. Summary of Load Forecast Issues

Q: Please summarize the key load forecast issues addressed in your report.

A: In recent years, peak load growth has been weak in the Carolinas and across most of the country, and forecasts have repeatedly been revised downward. However, in many regions recently, and now in the Carolinas, electric load forecasts are being revised upward. This is primarily driven by the expanding demand for data centers to support internet traffic and artificial intelligence processing; electrification of some industrial facilities also contributes to the anticipated growth. The Companies have substantially raised their load forecasts based on such potential very large load additions, which are all over 20 MW; DEC and DEP have raised their forecasts for 2028 by 1,115 MW and 684 MW, respectively. While the Companies consider these new customers "economic development successes," a substantial fraction is data centers and data mining that produce very few jobs, as discussed further in my report.

The Companies' econometric forecasts of the future loads of all customers other than the anticipated large load additions are in a broad reasonable range and are not evaluated in detail in my report. My report focuses instead on the large load additions that Duke added on top of the econometric forecast.

Q: Have these large load additions led the Companies to change their resource plans?

A: Yes. The anticipated large new loads have led the Companies to delay plans for carbon emissions reductions and to propose significant amounts of new gas-fired resources:

> "… it is reasonable to assume that the Updated 2023 Fall Load Forecast will drive the need for new supply-side resources across all available technologies (to the extent greater amounts are executable), consistent with the "all of the above" approach reflected in the initial Near-Term Action Plan… the Companies are considering a range of potentially accelerated actions due to the increasing load forecast, including… new natural gas resources in both North Carolina and South Carolina.."

Q: What are your conclusions about the large load additions?

A: With respect to the anticipated large load additions, many of these potential future customers are not committed to the Carolinas or to specific load amounts, so the additions to the forecast based on these potential customers are highly uncertain and rather speculative. I recommend approaching these very large potential new customers under a different process than smaller customers.

Q: Have you prepared alternative forecasts of the Companies' peak loads?

A: Yes. I have prepared alternative forecasts with more modest and prudent projections of these large new customers' loads that are more appropriate for planning purposes.

Q: Please describe the process you recommend the Companies and Commission follow with respect to these very large potential customers.

A: My report recommends that the Companies and the Commission create a new customer class for the very large new customers (perhaps 20 MW and larger), and approach this class in the following manner. As a preliminary screen, it may be determined that the anticipated large new loads beyond what is captured in the econometric forecasts may not in the aggregate drive substantial changes to the integrated resource plan. This will be the case when the Companies have excess capacity, which can occur when past load forecasts have been too high, as has frequently been the case in recent years. In such instances, the new loads can simply be included in the load forecast, as has been the Companies' practice for all integrated resource plans before the CPIRP.

When instead the anticipated large new loads in the aggregate would cause substantial changes to the plan and large investments, as is the case with the CPIRP, the process should be as follows (details of these proposals are further discussed in my report):

a. First, the Companies should encourage each very large new customer to consider self-providing generation firmness rather than relying on the Companies for firm supply service. The customer could build behind-the-meter generation, perhaps a microgrid, or contract with an independent generator, or include batteries, or stand ready to reduce their loads when needed; many approaches are available. The future loads of such customers could be reflected in the Companies' load forecast

with their off-setting supplies reflected in the Companies' resource plans; alternatively, both the loads and associated supplies would not be included in the Companies' planning.

b. Should a potential large new customer decline to pursue self-generation and seek firm supply service from the Companies, the customer would be offered a firm power purchase agreement committing the customer to high levels of consumption and payment for an extended period, perhaps ten years. The anticipated future load of customers who enter into such take-or-pay type agreements would be added to the load forecasts and the incremental load would be reflected in resource plans.

c. If a large potential new customer declines to self-provide and is also unwilling to enter into a long-term commitment, the customer's service request would be placed on hold subject to prioritization and further clarification of aggregate demand and supply conditions and the Companies' ability to serve aggregate requests without a substantial change in the resource plan.

d. Of the requests placed on hold, true economic development projects (such as manufacturing sites) would be prioritized over requests that do not represent significant economic development, such as data centers and data mining, given the clear and important distinctions between these types of projects. The customers placed on hold would be encouraged to

reconsider their choices with respect to self-provision of firmness or contracting for firmness.

Put another way, the Companies would not undertake major changes to their supply plans and major investments based on potential large new customers who are unwilling to enter into long-term contracts that would ensure they bear an appropriate share of the cost of the investments should their loads not materialize. Such a process is consistent with approaches some utilities facing very large aggregate requests in other jurisdictions are pursuing, as discussed in more detail in my report.

Q: The process you recommend is not currently in place. How have you prepared your alternative load forecasts?

A: Lacking at present such a process to firm up and thin out the service requests, I recommend somewhat larger discounts for the very large requests for load forecast purposes. While the Companies have applied discounts to the large new load requests, my report explains several additional reasons for further discounting them well beyond what the Companies have applied. My alternative forecasts are based on these larger discounts.

IV. Summary of Resource Adequacy Issues

Q: Please summarize your evaluation of the 2023 RA Study.

A: With regard to the 2023 RA Study, I note that it is merely an update of the 2020 study, so it is not surprising that it exhibits many of the same flaws that I identified in my 2021 review of the 2020 study. In particular, the 2023

RA Study substantially overstated winter resource adequacy risk, primarily due to the following flaws in the analysis:

a. An inaccurate approach to estimating the impact of extreme cold on loads, extrapolating based on observations at milder temperatures; and

b. Overstating the likely frequency of extreme cold, by using 43 years of temperature data (1980-2022), weighted equally without adjusting for temperature trends, which includes many instances of very extreme cold that have not been seen in these areas, or only rarely, for decades.

V. Conclusion and Recommendations

Q: How does Duke's proposed large customer additions to its load forecast interact with its proposed increased winter Planning Reserve Margin driven by the 2023 Resource Adequacy Study?

A: The excessive reserve margins recommended by the 2023 RA Study combine with the very high load forecasts based on somewhat speculative large load additions to result in excessive capacity needs.

Q: Given your evaluation, what recommendations do you have for the Commission with regard to future Duke Energy CPIRP proceedings?

A: My evaluation leads to the following suggestions for future CPIRP proceedings:

a. The Companies and the Commission should plan to address potential very large load additions in the manner described in this report.

b. The Companies should engage professional forecasters to perform a study and develop multiple longer-term scenarios of their future loads with a focus on very large load additions, including data center, data mining, and manufacturing loads; preferably, such research and forecasting would be done on a broader geographic basis. The forecast scenarios may reflect different assumptions about economic growth, and whether the Companies require long-term contracts for very large customers, among other key assumptions.

c. The Companies should study the relationship between extreme winter weather and load and develop more sophisticated methods for estimating the potential impact of future extreme winter weather on load. The research should consider likely customer behavior under extreme cold, such as the possibility that some schools and businesses may remain closed. The Companies should also consider, in addition to other winter demand response programs, seeking agreements from customers to remain closed when temperatures fall below a very extreme threshold.

Q: Does this complete your direct testimony?

A: Yes.

CERTIFICATE OF SERVICE

I certify that the parties of record on the service list have been served with the Direct Testimony and Exhibits of James F. Wilson on behalf of the Southern Alliance for Clean Energy, Sierra Club, Natural Resources Defense Council, and the North Carolina Solar Energy Association either by electronic mail or by deposit in the U.S. Mail, postage prepaid.

This the 28th day of May, 2024.

/s/ David L. Neal
David L. Neal

EXHIBIT JFW-1

James F. Wilson CV

James F. Wilson
Principal, Wilson Energy Economics

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SUMMARY

James F. Wilson is an economist with over 40 years of consulting experience, primarily in the electric power and natural gas industries. Many of his assignments have pertained to the economic and policy issues arising from the interplay of competition and regulation in these industries, including restructuring policies, market design, market analysis and market power. Other recent engagements have involved resource adequacy and capacity markets, contract litigation and damages, forecasting and market evaluation, pipeline rate cases and evaluating allegations of market manipulation. Mr. Wilson has been involved in electricity restructuring and wholesale market design for over twenty years in California, PJM, New England, Russia and other regions. He also spent five years in Russia in the early 1990s advising on the reform, restructuring and development of the Russian electricity and natural gas industries.

Mr. Wilson has submitted affidavits and testified in Federal Energy Regulatory Commission and state regulatory proceedings. His papers have appeared in the *Energy Journal*, *Electricity Journal*, *Public Utilities Fortnightly* and other publications, and he often presents at industry conferences.

Prior to founding Wilson Energy Economics, Mr. Wilson was a Principal at LECG, LLC. He has also worked for ICF Resources, Decision Focus Inc., and as an independent consultant.

EDUCATION

MS, Engineering-Economic Systems, Stanford University, 1982

BA, Mathematics, Oberlin College, 1977

RECENT ENGAGEMENTS

- Analysis of provisions to enhance resource fuel security in day-ahead and real-time wholesale electricity markets.
- Evaluated peak electric load forecasts and enhancements to load forecasting methodologies.
- Evaluated a probabilistic analysis to determine the electric generating capacity reserve margin to satisfy resource adequacy criteria.
- Evaluated the potential impact of an electricity generation operating reserve demand curve on a wholesale electricity market with a capacity construct.
- Developed wholesale capacity market enhancements to accommodate seasonal resources and resource adequacy requirements.
- Evaluation of wholesale electricity market design enhancements to accommodate state initiatives to promote state environmental and other policy objectives.
- Evaluation of proposals for natural gas distribution system expansions.
- Various consulting assignments on wholesale electric capacity market design issues in PJM, New England, the Midwest, Texas, and California.
- Cost-benefit analysis of a new natural gas pipeline.
- Evaluation of the impacts of demand response on electric generation capacity mix and emissions.

- Panelist on a FERC technical conference on capacity markets.
- Affidavit on the potential for market power over natural gas storage.
- Executive briefing on wind integration and linkages to short-term and longer-term resource adequacy approaches.
- Affidavit on the impact of a centralized capacity market on the potential benefits of participation in a Regional Transmission Organization (RTO).
- Participated in a panel teleseminar on resource adequacy policy and modeling.
- Affidavit on opt-out rules for centralized capacity markets.
- Affidavits on minimum offer price rules for RTO centralized capacity markets.
- Evaluated electric utility avoided cost in a tax dispute.
- Advised on pricing approaches for RTO backstop short-term capacity procurement.
- Affidavit evaluating the potential impact on reliability of demand response products limited in the number or duration of calls.
- Evaluated changing patterns of natural gas production and pipeline flows, developed approaches for pipeline tolls and cost recovery.
- Evaluated an electricity peak load forecasting methodology and forecast; evaluated regional transmission needs for resource adequacy.
- Participated on a panel teleseminar on natural gas price forecasting.
- Affidavit evaluating a shortage pricing mechanism and recommending changes.
- Testimony in support of proposed changes to a forward capacity market mechanism.
- Reviewed and critiqued an analysis of the economic impacts of restrictions on oil and gas development.
- Advised on the development of metrics for evaluating the performance of Regional Transmission Organizations and their markets.
- Prepared affidavit on the efficiency benefits of excess capacity sales in readjustment auctions for installed capacity.
- Prepared affidavit on the potential impacts of long lead time and multiple uncertainties on clearing prices in an auction for standard offer electric generation service.

EARLIER PROFESSIONAL EXPERIENCE

LECG, LLC, Washington, DC 1998–2009.
Principal

- Reviewed and commented on an analysis of the target installed capacity reserve margin for the Mid Atlantic region; recommended improvements to the analysis and assumptions.
- Evaluated an electric generating capacity mechanism and the price levels to support adequate capacity; recommended changes to improve efficiency.
- Analyzed and critiqued the methodology and assumptions used in preparation of a long run electricity peak load forecast.
- Evaluated results of an electric generating capacity incentive mechanism and critiqued the mechanism's design; prepared a detailed report. Evaluated the impacts of the mechanism's flaws on prices and costs and prepared testimony in support of a formal complaint.
- Analyzed impacts and potential damages of natural gas migration from a storage field.
- Evaluated allegations of manipulation of natural gas prices and assessed the potential impacts of natural gas trading strategies.
- Prepared affidavit evaluating a pipeline's application for market-based rates for interruptible transportation and the potential for market power.
- Prepared testimony on natural gas industry contracting practices and damages in a contract dispute.
- Prepared affidavits on design issues for an electric generating capacity mechanism for an eastern US regional transmission organization; participated in extensive settlement discussions.

- Prepared testimony on the appropriateness of zonal rates for a natural gas pipeline.
- Evaluated market power issues raised by a possible gas-electric merger.
- Prepared testimony on whether rates for a pipeline extension should be rolled-in or incremental under Federal Energy Regulatory Commission ("FERC") policy.
- Prepared an expert report on damages in a natural gas contract dispute.
- Prepared testimony regarding the incentive impacts of a ratemaking method for natural gas pipelines.
- Prepared testimony evaluating natural gas procurement incentive mechanisms.
- Analyzed the need for and value of additional natural gas storage in the southwestern US.
- Evaluated market issues in the restructured Russian electric power market, including the need to introduce financial transmission rights, and policies for evaluating mergers.
- Affidavit on market conditions in western US natural gas markets and the potential for a new merchant gas storage facility to exercise market power.
- Testimony on the advantages of a system of firm, tradable natural gas transmission and storage rights, and the performance of a market structure based on such policies.
- Testimony on the potential benefits of new independent natural gas storage and policies for providing transmission access to storage users.
- Testimony on the causes of California natural gas price increases during 2000-2001 and the possible exercise of market power to raise natural gas prices at the California border.
- Advised a major US utility with regard to the Federal Energy Regulatory Commission's proposed Standard Market Design and its potential impacts on the company.
- Reviewed and critiqued draft legislation and detailed market rules for reforming the Russian electricity industry, for a major investor in the sector.
- Analyzed the causes of high prices in California wholesale electric markets during 2000 and developed recommendations, including alternatives for price mitigation. Testimony on price mitigation measures.
- Summarized and critiqued wholesale and retail restructuring and competition policies for electric power and natural gas in select US states, for a Pacific Rim government contemplating energy reforms.
- Presented testimony regarding divestiture of hydroelectric generation assets, potential market power issues, and mitigation approaches to the California Public Utilities Commission.
- Reviewed the reasonableness of an electric utility's wholesale power purchases and sales in a restructured power market during a period of high prices.
- Presented an expert report on failure to perform and liquidated damages in a natural gas contract dispute.
- Presented a workshop on Market Monitoring to a group of electric utilities in the process of forming an RTO.
- Authored a report on the screening approaches used by market monitors for assessing exercise of market power, material impacts of conduct, and workable competition.
- Developed recommendations for mitigating locational market power, as part of a package of congestion management reforms.
- Provided analysis in support of a transmission owner involved in a contract dispute with generators providing services related to local grid reliability.
- Authored a report on the role of regional transmission organizations in market monitoring.
- Prepared market power analyses in support of electric generators' applications to FERC for market-based rates for energy and ancillary services.
- Analyzed western electricity markets and the potential market power of a large producer under various asset acquisition or divestiture strategies.
- Testified before a state commission regarding the potential benefits of retail electric competition and issues that must be addressed to implement it.

- Prepared a market power analysis in support of an acquisition of generating capacity in the New England market.
- Advised a California utility regarding reform strategies for the California natural gas industry, addressing market power issues and policy options for providing system balancing services.

ICF RESOURCES, INC., Fairfax, VA, 1997–1998.
Project Manager

- Reviewed, critiqued and submitted testimony on a New Jersey electric utility's restructuring proposal, as part of a management audit for the state regulatory commission.
- Assisted a group of US utilities in developing a proposal to form a regional Independent System Operator (ISO).
- Researched and reported on the emergence of Independent System Operators and their role in reliability, for the Department of Energy.
- Provided analytical support to the Secretary of Energy's Task Force on Electric System Reliability on various topics, including ISOs. Wrote white papers on the potential role of markets in ensuring reliability.
- Recommended near-term strategies for addressing the potential stranded costs of non-utility generator contracts for an eastern utility; analyzed and evaluated the potential benefits of various contract modifications, including buyout and buydown options; designed a reverse auction approach to stimulating competition in the renegotiation process.
- Designed an auction process for divestiture of a Northeastern electric utility's generation assets and entitlements (power purchase agreements).
- Participated in several projects involving analysis of regional power markets and valuation of existing or proposed generation assets.

IRIS MARKET ENVIRONMENT PROJECT, 1994–1996.
Project Director, Moscow, Russia

Established and led a policy analysis group advising the Russian Federal Energy Commission and Ministry of Economy on economic policies for the electric power, natural gas, oil pipeline, telecommunications, and rail transport industries (*the Program on Natural Monopolies,* a project of the IRIS Center of the University of Maryland Department of Economics, funded by USAID):

- Advised on industry reforms and the establishment of federal regulatory institutions.
- Advised the Russian Federal Energy Commission on electricity restructuring, development of a competitive wholesale market for electric power, tariff improvements, and other issues of electric power and natural gas industry reform.
- Developed policy conditions for the IMF's $10 billion Extended Funding Facility.
- Performed industry diagnostic analyses with detailed policy recommendations for electric power (1994), natural gas, rail transport and telecommunications (1995), oil transport (1996).

Independent Consultant stationed in Moscow, Russia, 1991–1996

Projects for the WORLD BANK, 1992-1996:

- Bank Strategy for the Russian Electricity Sector. Developed a policy paper outlining current industry problems and necessary policies, and recommending World Bank strategy.
- Russian Electric Power Industry Restructuring. Participated in work to develop recommendations to the Russian Government on electric power industry restructuring.
- Russian Electric Power Sector Update. Led project to review developments in sector restructuring, regulation, demand, supply, tariffs, and investment.
- Russian Coal Industry Restructuring. Analyzed Russian and export coal markets and developed forecasts of future demand for Russian coal.
- World Bank/IEA Electricity Options Study for the G-7. Analyzed mid- and long-term electric power demand and efficiency prospects and developed forecasts.

- Russian Energy Pricing and Taxation. Developed recommendations for liberalizing energy markets, eliminating subsidies and restructuring tariffs for all energy resources.

Other consulting assignments in Russia, 1991–1994:

- Advised on projects pertaining to Russian energy policy and the transition to a market economy in the energy industries, for the Institute for Energy Research of the Russian Academy of Sciences.
- Presented seminars on the structure, economics, planning, and regulation of the energy and electric power industries in the US, for various Russian clients.

DECISION FOCUS INC., Mountain View, CA, 1983–1992
Senior Associate, 1985-1992.

- For the Electric Power Research Institute, led projects to develop decision-analytic methodologies and models for evaluating long term fuel and electric power contracting and procurement strategies. Applied the methodologies and models in numerous case studies, and presented several workshops and training sessions on the approaches.
- Analyzed long-term and short-term natural gas supply decisions for a large California gas distribution company following gas industry unbundling and restructuring.
- Analyzed long term coal and rail alternatives for a midwest electric utility.
- Evaluated bulk power purchase alternatives and strategies for a New Jersey electric utility.
- Performed a financial and economic analysis of a proposed hydroelectric project.
- For a natural gas pipeline company serving the Northeastern US, forecasted long-term natural gas supply and transportation volumes. Developed a forecasting system for staff use.
- Analyzed potential benefits of diversification of suppliers for a natural gas pipeline company.
- Evaluated uranium contracting strategies for an electric utility.
- Analyzed telecommunications services markets under deregulation, developed and implemented a pricing strategy model. Evaluated potential responses of residential and business customers to changes in the client's and competitors' telecommunications services and prices.
- Analyzed coal contract terms and supplier diversification strategies for an eastern electric utility.
- Analyzed oil and natural gas contracting strategies for an electric utility.

TESTIMONY AND AFFIDAVITS

PJM Interconnection, L.L.C., FERC Docket No. ER24-98 (Market Seller Offer Cap), Affidavit in Support of the Protest of the Public Interest Organizations, November 9, 2023; Supplemental Affidavit, December 22, 2023.

PJM Interconnection, L.L.C., FERC Docket No. ER24-99 (Resource Adequacy), Affidavit in Support of the Protest of the Public Interest Entities, November 9, 2023.

Midcontinent Independent System Operator, Inc.’s Reliability Based Demand Curve, FERC Docket No. ER23-2977, Affidavit in Support of the Comments of Public Interest Organizations, November 3, 2023; Supplemental Affidavit in Support of the Comments and Reply of Public Interest Organizations, January 11, 2024.

In the Matter of the Application of Ohio Edison Company, the Cleveland Electric Illuminating Company, and the Toledo Edison Company for Authority to Establish a Standard Service Offer Pursuant to R.C. 4928.143 in the Form of an Electric Security Plan, Public Utilities Commission of Ohio Case No. 23-301-EL-SSO, Direct Testimony on behalf of the Office of the Ohio Consumers’ Counsel, October 23, 2023; testimony at hearings, November 29, 2023.

In the Matter of the Application of Pacific Gas and Electric Company for Adoption of Electric Revenue Requirements and Rates Associated with its 2024 Energy Resource Recovery Account, California Public Utilities Commission Application 23-05-012, Direct Testimony on behalf of Small Business Utility Advocates, September 6, 2023.

Virginia Electric and Power Company's 2023 Integrated Resource Plan filing, Virginia State Corporation Commission Case No. PUR-2023-00066, Direct Testimony on behalf of Appalachian Voices, August 8, 2023; testimony at hearings, September 19, 2023.

In the Matter of the Application of Ohio Power Company for Authority to Establish a Standard Service Offer in the Form of an Electric Security Plan, Public Utilities Commission of Ohio Case No. 23-23-EL-SSO, Direct Testimony on Behalf of the Office of the Ohio Consumers' Counsel, June 9, 2023; Testimony Recommending Modification of the Stipulation, September 20, 2023; testimony at hearings, October 11, 2023.

Essential Power OPP, LLC, et al. v. PJM Interconnection, L.L.C, FERC Docket No. EL23-53 (Winter Storm Elliott complaint cases), Affidavit in Support of the Comments of Sierra Club, May 26, 2023.

PJM Interconnection, L.L.C., FERC Docket No. ER23-1609 (RPM auction delay), Affidavit in Support of the Comments of Sierra Club, May 2, 2023.

In the Matter of the Application of The Dayton Power and Light Company d/b/a AES Ohio for Approval of Its Electric Security Plan, Public Utilities Commission of Ohio Case No. 22-900-EL-SSO, Direct Testimony on Behalf of the Office of the Ohio Consumers' Counsel, April 21, 2023; deposition, April 26, 2023; testimony at hearings May 3, 2023.

PJM Interconnection, L.L.C., FERC Docket No. ER22-2984 (RPM Quadrennial Review), Affidavit in Support of the Comments of the Public Interest Entities, October 21, 2022; Reply Affidavit in Support of the Reply Comments of the Public Interest Entities, November 4, 2022.

In the Matter of the Application of Pacific Gas and Electric Company for Adoption of Electric Revenue Requirements and Rates Associated with its 2023 Energy Resource Recovery Account, California Public Utilities Commission Application 22-05-029, Direct Testimony on behalf of Small Business Utility Advocates, September 7, 2022.

In the Matter of the Application of DTE Electric Company for Approval to Implement a Power Supply Cost Recovery Plan for the 12 months ending December 31, 2022, Michigan Public Service Commission Case No. U-21050, Direct Testimony on behalf of Michigan Environmental Council, August 3, 2022.

In Re: Washington Utilities and Transportation Commission v. Avista Corporation d/b/a Avista Utilities; In the Matter of the Electric Service Reliability Reporting Plan of Avista Corporation d/b/a Avista Utilities; Dockets UE-220053, UG-220054, and UE-210854 (Consolidated), Joint Testimony in Support of the Full Multiparty Settlement on behalf of Small Business Utility Advocates, July 8, 2022; Supplemental Joint Testimony in Support of the Colstrip Tracker and Schedule 99, July 29, 2022; Testimony at hearings September 21, 2022.

In Re: Georgia Power Company's 2022 Integrated Resource Plan and 2022 Application for the Certification, Decertification, and Amended Demand- Side Management Plan; Georgia Public Service Commission Docket Nos. 44160 and 44161; Direct Testimony on behalf of Georgia Interfaith Power & Light and the Partnership For Southern Equity, May 6, 2022; testimony at hearings May 26, 2022.

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January 2024

EXHIBIT JFW-2

Review and Evaluation of the Load Forecasts and Resource Adequacy Study for the Duke Energy Carolinas and Duke Energy Progress 2023-2024 Carbon Plan and Integrated Resource Plan

PUBLIC VERSION

Review and Evaluation of the Load Forecasts and Resource Adequacy Study for the Duke Energy Carolinas and Duke Energy Progress 2023-2024 Carbon Plan and Integrated Resource Plan

Docket No. E-100, Sub 190

Prepared by

James F. Wilson, Wilson Energy Economics

for the

Southern Alliance for Clean Energy, Sierra Club, Natural Resources Defense Council, and North Carolina Sustainable Energy Association

May 28, 2024

TABLE OF CONTENTS

I. INTRODUCTION AND SCOPE OF THIS REPORT

1. Duke Energy Carolinas, LLC ("DEC") and Duke Energy Progress, LLC ("DEP") (collectively, "Companies" or "Duke") filed testimony in support of their proposed 2023-2024 Carbon Plan Integrated Resource Plan ("CPIRP") on September 1, 2023 in North Carolina Utilities Commission ("Commission") Docket No. E-100, Sub 190 and Public Service Commission of South Carolina Docket Nos. 2023-8-E and 2023-10-E. The Companies' original CPIRP electric load forecast was presented in Appendix D, supported by the direct testimony of a panel of witnesses: Glen Snider, Michael Quinto, Thomas Beatty, and Ben Passty ("Snider Panel Direct"). The CPIRP electric load forecast serves as the basis for each utility's determination of the total generating capacity required over the CPIRP planning horizon.

2. The CPIRP filing was augmented with supplemental testimony to present a revised electric load forecast ("Fall Forecast") and adjust the CPIRP accordingly ("Updated CPIRP"). The revisions to the electric load forecast were introduced by supplemental testimony of Glen Snider filed November 30, 2023,[1] and supplemental testimony of the above-mentioned panel of witnesses on January 31, 2024.[2]

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[1] Supplemental Direct Testimony of Glen A. Snider on behalf of Duke Energy Carolinas, LLC and Duke Energy Progress, LLC, Docket No. E-100, Sub 190, at 12 (N.C.U.C. Nov. 30, 2023) (Snider Supplemental).

[2] Supplemental Direct Testimony of Glen Snider, Michael Quinto, Thomas Beatty, and Ben Passty on behalf of Duke Energy Carolinas, LLC and Duke Energy Progress, LLC, Docket No. E-100, Sub 190, at 5 (N.C.U.C. Jan. 31, 2024) (Snider Panel Supplemental).

3. The resource adequacy analysis and reserve margins for the CPIRP were based upon a resource adequacy study ("2023 RA Study") prepared for DEC and DEP by Astrapé Consulting.[3]

4. In some of the Duke's recent IRP dockets, I have reviewed electric load forecasts and filed reports,[4] and I have also reviewed resource adequacy studies and filed reports.[5] My experience and qualifications are summarized in an Appendix to this report and my CV is attached as Exhibit JFW 1.

5. This report reviews and evaluates the Companies' Fall Forecasts that were relied upon for their Updated CPIRP and proposes alternative electric load forecasts that I believe are more prudent and reasonable for planning

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[3] Astrapé Consulting, *2023 Resource Adequacy Study for Duke Energy Carolinas & Duke Energy Progress,* August 15, 2023.

[4] Wilson, James F., *Review and Evaluation of the Load Forecasts for the Duke Energy Carolinas and Duke Energy Progress 2018 Integrated Resource Plans*, filed February 12, 2019 as Attachment 3 to Initial Comments of the Southern Alliance for Clean Energy in North Carolina Utilities Commission Docket No. E-100 Sub 157 ("Wilson 2019 Load Forecast Report"); Wilson, James F., *Review and Evaluation of the Peak Load Forecasts for the Duke Energy Carolinas and Duke Energy Progress 2016 Integrated Resource Plans*, filed February 7, 2017 as Attachment A to the Comments of Southern Alliance for Clean Energy, Natural Resources Defense Council and the Sierra Club, in North Carolina Utilities Commission Docket No. E-100 Sub 147 ("Wilson 2017 Load Forecast Report").

[5] Wilson, James F., *Review and Evaluation of the 2020 Resource Adequacy Studies Relied Upon for the Duke Energy Carolinas and Duke Energy Progress 2020 Integrated Resource Plans,* February 5, 2021, filed March 1, 2021 as Attachment 5 to the Partial Initial Comments of Southern Alliance For Clean Energy, Sierra Club, and Natural Resources Defense Council in North Carolina Utilities Commission Docket No. E-100, Sub 165; *Review and Evaluation of Resource Adequacy and Solar Capacity Value Issues with regard to the Duke Energy Carolinas and Duke Energy Progress 2018 Integrated Resource Plans and Avoided Cost Filing*, filed February 12, 2019 as Attachment 4 to Initial Comments of the Southern Alliance for Clean Energy in North Carolina Utilities Commission Docket No. E-100, Sub 157, also filed September 11, 2019 as Exhibit B to Direct Testimony on behalf of the South Carolina Coastal Conservation League and Southern Alliance for Clean Energy in South Carolina Public Service Commission Docket Nos. 2019-185-E and 2019-186-E; Wilson, James F., *Review and Evaluation of the Reserve Margin Determinations for the Duke Energy Carolinas and Duke Energy Progress 2016 Integrated Resource Plans*, Attachment B to the Comments of Southern Alliance for Clean Energy, Natural Resources Defense Council and the Sierra Club, filed February 7, 2017 in North Carolina Utilities Commission Docket No. E-100, Sub 147.

purposes. This report also reviews and provides analysis and recommendations regarding the 2023 RA Study.

II. SUMMARY AND RECOMMENDATIONS

6. The CPIRP filings include peak load and energy forecasts for the DEC and DEP service territories over the 2024 to 2050 time period. The forecasts encompass residential, commercial and industrial retail customers and also wholesale customer loads. The Companies use econometric models to forecast the residential, commercial and industrial customer classes separately. The forecasts rely upon economic and demographic projections from Moody's Analytics, and projections of appliance efficiencies and saturations from Itron, based on U.S. Energy Information Administration data. Importantly, the CPIRP filing also includes "adjustments" to the forecasts to reflect anticipated large load additions that the Companies believe would not be captured by their econometric projections.[6]

7. In recent years, peak load growth has been weak in the Carolinas and across most of the country, and forecasts have repeatedly been revised downward. However, in many regions recently, and now in the Carolinas, electric load forecasts are being revised upward. This is primarily driven by the expanding demand for data centers to support internet traffic and artificial intelligence processing; electrification of some industrial facilities also contributes to the anticipated growth. The Companies have substantially raised their load forecasts

[6] CPIRP Appendix D pp. 13-15.

based on such potential very large load additions, which are all over 20 MW;[7] DEC and DEP have raised their winter forecasts for 2028 by 1,115 MW and 684 MW, respectively.[8] While the Companies consider these new customers "economic development successes,"[9] a substantial fraction are data centers and data mining that produce very few jobs, as discussed further below. The anticipated large new loads have led the Companies to delay plans for carbon emissions reductions and to propose significant additional amounts of new gas-fired resources:

> "… it is reasonable to assume that the Updated 2023 Fall Load Forecast will drive the need for new supply-side resources across all available technologies (to the extent greater amounts are executable), consistent with the "all of the above" approach reflected in the initial Near-Term Action Plan… the Companies are considering a range of potentially accelerated actions due to the increasing load forecast, including… new natural gas resources in both North Carolina and South Carolina.."[10]

8. The Companies' econometric forecasts of the future loads of all customers other than the anticipated large load additions are in a broad reasonable range and will not be evaluated in detail in this report. With respect to the anticipated large load additions, many of these potential future customers are not committed to the Carolinas or to specific load amounts, so the additions to the forecast based on these potential customers are highly uncertain and rather speculative.[11] This report reviews the Companies' adjustments to their forecasts

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[7] Snider Panel Supplemental at 5.

[8] The Companies' response to Public Staff DR 29-7.

[9] Snider Supplemental at 12.

[10] Snider Supplemental at 9, 10-11.

[11] Even some data center developers are beginning to question utility aggregate forecasts. *See, e.g.*, Microsoft Comments on Georgia Power's 2023 Integrated Resource Plan Update, Docket No.

for anticipated large new loads and provides an alternative forecast with more modest projections that are more appropriate for planning purposes.

9. The Companies state their belief that their "obligation to provide service to new customers necessitates advance planning for customers that are in an advanced stage of engagement."[12] The Merriam Webster dictionary defines "planning" as "the act or process of making or carrying out plans." Thus "planning" can mean just making plans, but it can also mean carrying out plans. For the purpose of making plans, it is certainly appropriate to consider a broad range of possible future load levels, and to think through how the Companies would plan to serve such future loads were they to become committed to the Companies' service territories and seek firm service from the Companies. However, for the purpose of carrying out plans, which in the present context entails substantial changes to earlier plans and large investments, it is appropriate to focus on a more modest forecast of future loads based on firmer amounts, in order to not begin building generation or transmission facilities that may ultimately not be needed or useful, thereby imposing unjustified costs on existing customers. Of course, under-building also entails risks, including the loss of economic development projects or jeopardizing reliability, and the risks of over- and under- building must be balanced.

55378, at 1, 4 (GA. Pub. Serv. Comm'n., Apr. 1, 2024) (expressing concerns that the forecast could lead to "procuring excessive carbon-intensive generation", and recommending that the Georgia Public Service Commission "only approve near-term resource planning decisions in the 2023 IRP Update based primarily on known, mature projects that have made firm commitments to Georgia Power."), *available at* https://psc.ga.gov/search/facts-document/?documentId=218199.

[12] Companies' confidential response to AGO DR 5-6(d). Counsel for the Companies has confirmed that the specific material cited from this data request response is not confidential and does not need to be redacted in the public version of this report.

10. This report recommends that the Companies and the Commission create a new customer class for very large new customers (perhaps 20 MW and larger) and approach this class in the following manner. As a preliminary screen, it may be determined that the anticipated large new loads beyond what is captured in the econometric forecasts may not in the aggregate drive substantial changes to the integrated resource plan. This will be the case when the Companies have excess capacity, which can occur when past load forecasts have been too high, as has frequently been the case in recent years. In such instances, the new loads can simply be included in the load forecast, as has been the Companies practice for all integrated resource plans before the pending CPIRP.

11. When instead the anticipated large new loads in aggregate would cause substantial changes to the plan and large investments, as is the case with Duke's proposed CPIRP, the process should be as follows (details of these proposals are further discussed throughout this report):

a. First, the Companies should encourage each very large new customer to consider self-providing firm generation rather than relying on the Companies for firm supply service. The customer could build behind-the-meter generation, perhaps a microgrid, or contract with an independent generator, or include batteries, or stand ready to reduce their loads when needed; many approaches are available. The future loads of such customers could be reflected in the Companies' load forecast with their committed off-setting supplies and/or demand reductions reflected in the Companies' resource

plans; alternatively, both the loads and associated supplies would not be included in the Companies' planning.

b. Should a potential large new customer decline to pursue self-generation and seek firm supply service from the Companies, the customer would be offered a firm power purchase agreement committing the customer to high levels of consumption and to payment for an extended period, perhaps ten years.[13] The anticipated future load of customers who enter into such take-or-pay type agreements would be added to the load forecasts and the incremental load would be reflected in resource plans.

c. If a potential large new customer declines to self-provide and is also unwilling to enter into a long-term commitment, the customer's service request would be placed on hold subject to prioritization and further clarification of aggregate demand and supply conditions and the Companies' ability to serve aggregate requests without a substantial change in the resource plan.

d. Of the requests placed on hold, true economic development projects (such as manufacturing sites) would be prioritized over requests that do not represent significant economic development, such as data centers and data mining. The customers placed on hold would be

[13] Apparently, the Companies are already considering this approach. *See* Laila Kearney, *Duke Energy seeks take-or-pay power contracts for data centers*, REUTERS (May 7, 2024), https://www.reuters.com/business/energy/duke-energy-seeks-take-or-pay-power-contracts-data-centers-2024-05-07/.

encouraged to reconsider their choices with respect to self-provision of firmness or contracting for firmness.

12. Put another way, the Companies would not undertake major changes to their supply plans and major investments based on potential large new customers who are unwilling to enter into long-term contracts or make other commitments that would ensure they bear the cost of the investments should their loads not materialize. Such a process is consistent with approaches some utilities facing very large aggregate requests in other jurisdictions are pursuing, as discussed further later in this report.

13. Lacking at present such a process to firm up and screen out speculative service requests, this report recommends somewhat larger discounts for the very large requests for load forecast purposes. While the Companies have applied discounts to the large new load requests, a later section of this report provides several additional reasons for further discounting well beyond what the Companies have applied.

14. With regard to the 2023 RA Study, I note that it is merely an update of the 2020 study, so it is not surprising that it exhibits many of the same flaws that I identified in my 2021 review of the 2020 study. In particular, the 2023 RA Study substantially overstated winter resource adequacy risk, primarily due to the following flaws in the analysis:

a. An inaccurate approach to estimating the impact of extreme cold on loads, extrapolating based on observations at milder temperatures; and

b. Overstating the likely frequency of extreme cold, by using 43 years of temperature data (1980-2022), weighted equally without adjusting for temperature trends, which includes many instances of very extreme cold that have not been seen in these areas, or only rarely, for decades.

15. The excessive reserve margins recommended by the 2023 RA Study combine with the very high load forecasts based on somewhat speculative large load additions to result in excessive capacity needs.

16. The remainder of this report is organized as follows. Section III discusses recent trends in the Companies' peak loads and the Companies' prior and current load forecasts. Section IV describes the Companies' proposed large load additions: the types of customers and their current levels of commitment. Section V discusses ways these customers could mitigate their need for firm utility service and impact on the grid through self-provision of reliability and other approaches. Section VI provides additional reasons for discounting these load requests beyond the discounts applied by the Companies. In Section VII, I present alternative load forecasts based on larger discounts to the new service requests. Section VIII provides a critique of the 2023 RA Study.

III. COMPARISONS OF PEAK LOAD FORECASTS TO RECENT TRENDS

17. This evaluation begins with a review of the recent trends in weather-adjusted summer and winter peak loads and of recent forecasts. Actual peak loads will tend to vary substantially from year to year, primarily due to the presence or absence of the type of extremely hot or cold weather that can cause the highest summer or winter peak loads, respectively. Weather-adjusted peak loads are estimates of what the peak load would have been in a historical period had the peak occurred on a day with the typical peak-causing weather. Weather-adjusted historical peak loads remove the impact of weather variability and reveal the underlying peak load trend due to other factors such as economic and demographic trends, changes in industry and end-use technologies, and energy efficiency. Peak load forecasts are generally considered median or 50-50 forecasts (meaning that the forecasters consider the actual future peak load to be equally likely to exceed, or to fall short of, the forecast value); similarly, a weather-adjusted historical peak is generally also considered a median value for the past period. Peak load forecasts can be compared to the trends in weather-adjusted historical peaks, and we should expect the forecasts to be generally consistent with those trends unless there are specific reasons for the forecast to diverge, such as a large change in the anticipated rate of economic growth.

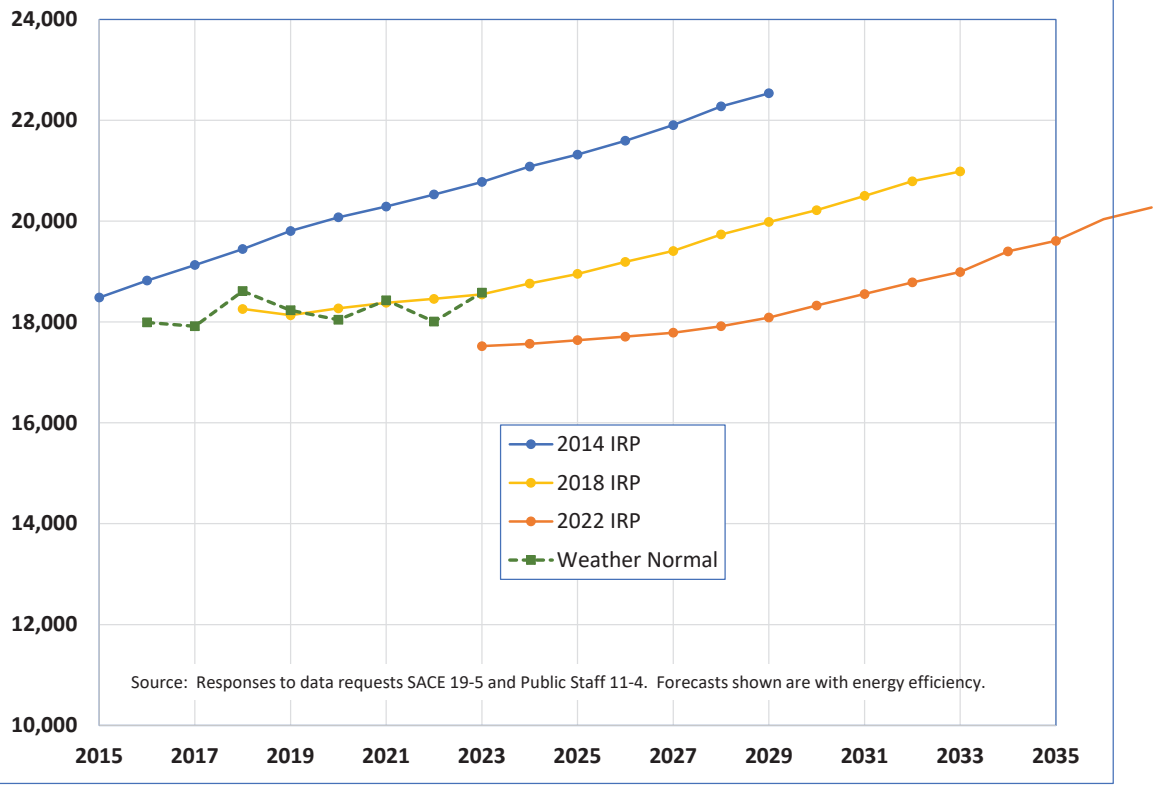
18. DEC and DEP provided summer and winter peak load forecasts[14] with and without the load-reducing impacts of future energy efficiency program implementation. This report's comparisons will be based on the peak load

[14] Companies' response to Public Staff DR 1-7, updated.

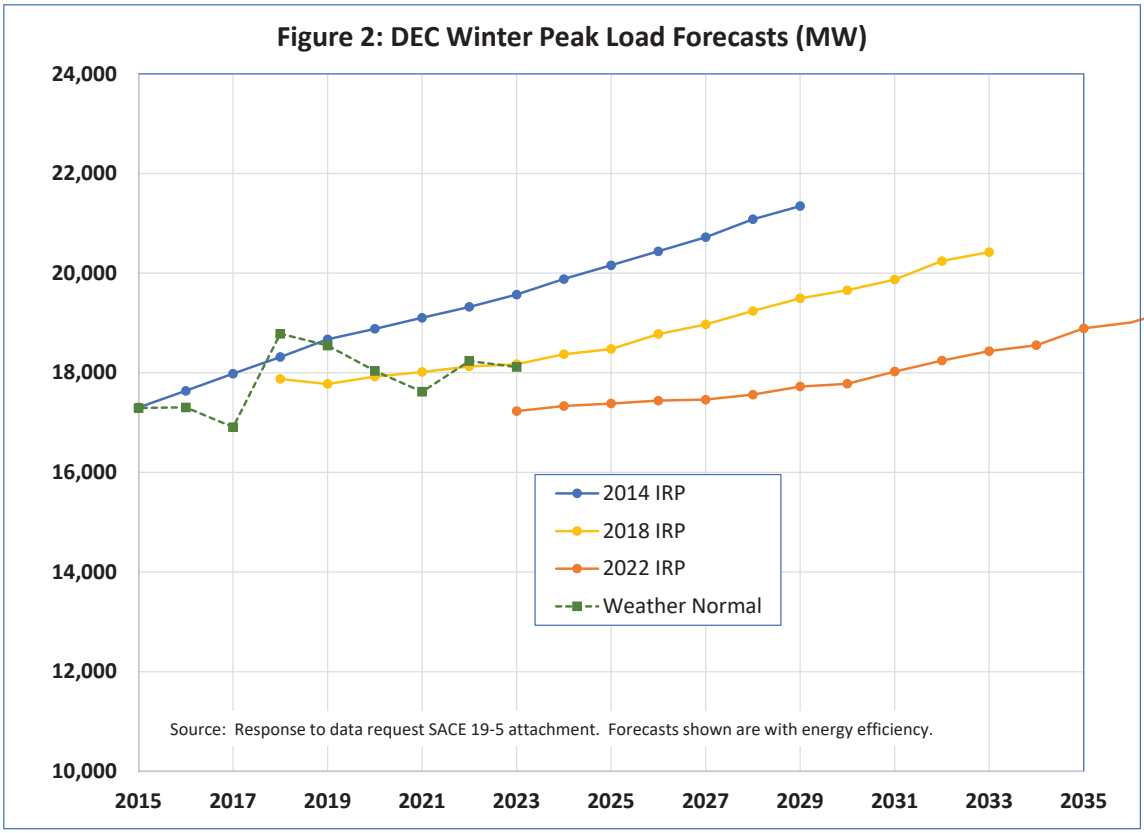
forecasts with the forecast impacts of the future implementation of these programs, whose additional impacts are in any case rather small in the first years of the forecast. DEC and DEP also provided historical actual and weather-adjusted peak loads.[15]

19. Figures 1 and 2 show DEC's recent summer and winter weather-normalized peak loads, respectively, and a few of DEC's past forecasts. Peak loads have been quite flat over 2018-2023 on a weather-normalized basis, while recent forecasts anticipate growth.

Figure 1: DEC Summer Peak Load Forecasts (MW)



[15] Companies' response to Public Staff DR 1-7, CPIRP Appendix D, Figures D-11 - D-14, pp. 26-27.

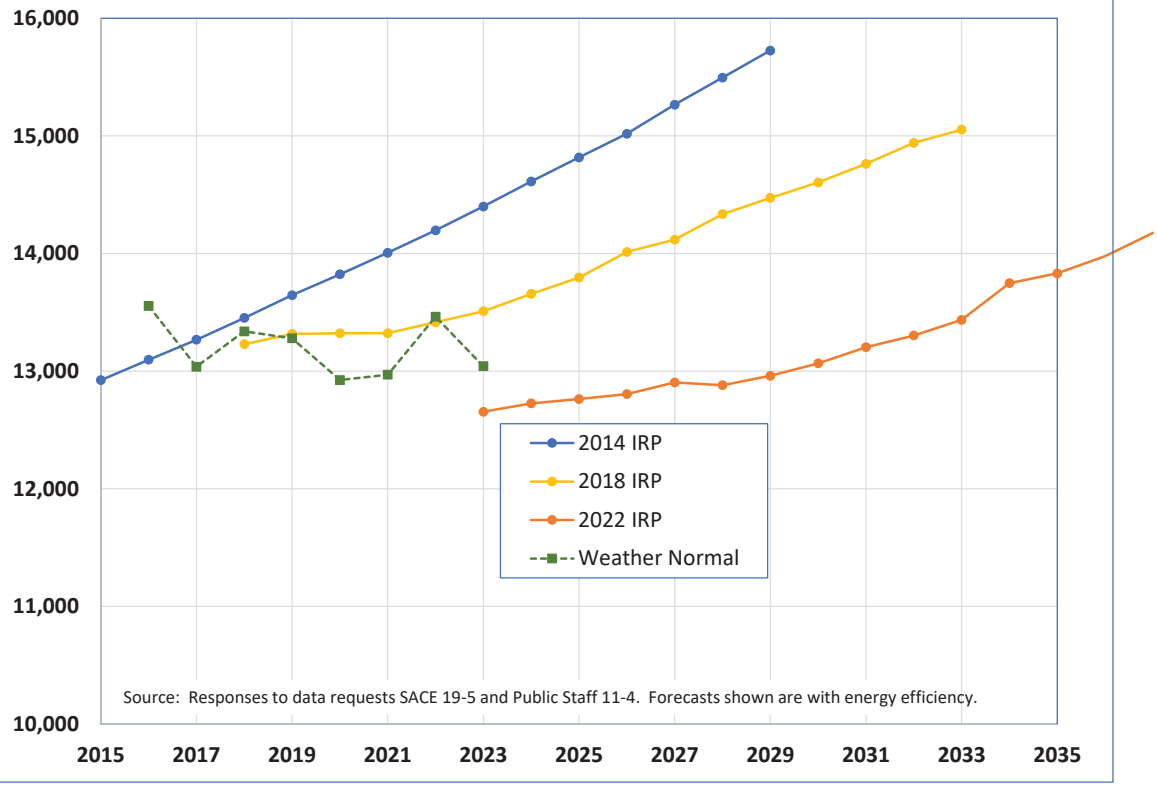


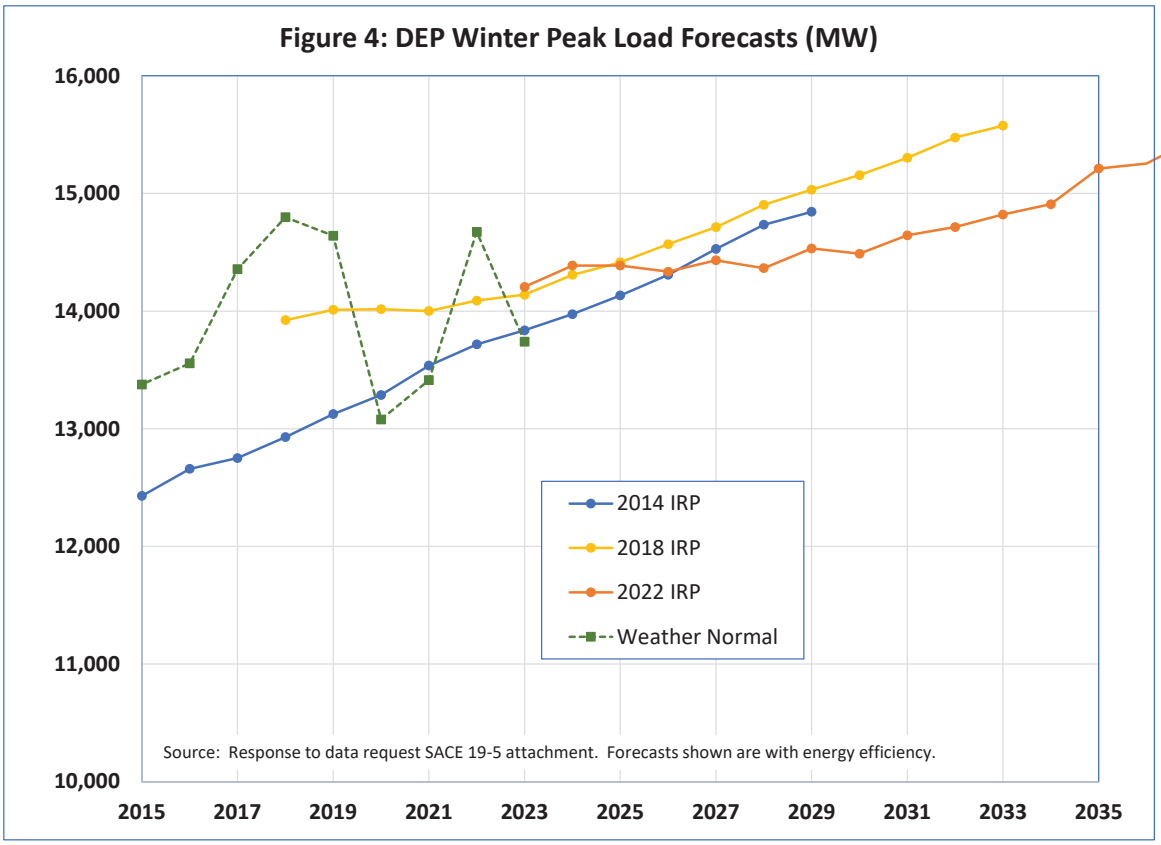
20. The 2022 forecasts appear lower than the trends in the recent weather-normalized peaks. However, the weather-normalized peaks may be somewhat overstated. The weather-normalized values average 688 MW higher than the actual peaks for summer and 484 MW higher than the actual peaks for winter over the 2011 to 2022 period.[16] Taking this into account, the 2022 forecasts were reasonably consistent with the past trends.

[16] Companies' response to Public Staff DR 1-7, workpapers to CPIRP Figures D-11, D-12.

21. Figures 3 and 4 show the same information for DEP; here too, peak loads have been rather flat while forecasts have anticipated increases. As for DEC, the DEP summer weather-normalized values average higher than actuals (208 MW), explaining the apparent gap between the 2022 forecast and the trend in the weather-normalized values. The DEP winter weather-normalized values are quite volatile, which suggests an ineffective methodology for removing weather effects.

Figure 3: DEP Summer Peak Load Forecasts (MW)





22. Figure 5 presents the updated CPIRP forecast (Fall Forecast) for DEC's summer peak loads. The Fall Forecast has DEC's peak loads growing from close to 18,000 MW in recent years to nearly 22,000 MW in 2031. The vast majority of this growth is based on adjustment of the econometric forecasts to add the anticipated loads of large, new, energy-intensive industries and businesses. The blue line shows the forecast without these adjustments for anticipated large new customers, including one such large customer in a wholesale customer's territory.[17] The growth rate shown in the blue line, for existing customers, is modest, although it still shows a bit of a break from recent trends, and it is still

[17] A large data center in the Central Electric Cooperative service territory has been treated as a large load addition for the purposes of this report (labeled "CEC dc" in the report figures).

substantially higher than the 2022 forecast. The modest growth in demand by existing customers is consistent with the favorable economic forecast: the latest Moody's Analytics forecast provided through discovery[18] from November 2023, anticipates [BEGIN CONFIDENTIAL] [redacted] [END CONFIDENTIAL] in gross domestic product over the coming decade, compared to an average of 2.2% growth over the past decade.

[BEGIN CONFIDENTIAL]

[END CONFIDENTIAL]

[18] Companies' confidential response to Public Staff DR 29-5.

23. Figure 6 shows DEC's updated winter peak forecast, and the same observations apply – nearly all the growth is in the form of additions; the forecast without these additions is more modest but still shows more growth than in recent years and is still above the 2022 forecast.

[BEGIN CONFIDENTIAL]

[END CONFIDENTIAL]

24. Figures 7 and 8 show the same information for DEP. Again, the Fall Forecast shows large growth due to additions to the econometric forecasts; without these additions the growth is more modest, and much closer to the 2022 forecast.

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[END CONFIDENTIAL]

25. I conclude that the DEC and DEP summer and winter forecasts for existing customers (that is, without the large load additions) fall within a broad reasonable range for these customers. Accordingly, the remainder of this report will focus on the adjustments to the forecasts based on the anticipated large load additions.

IV. THE COMPANIES' ANTICIPATED LARGE LOAD ADDITIONS

26. The CPIRP Spring 2023 forecast was the first time the Companies adjusted their econometric load forecasts based on anticipated large new customers.[19] While the Companies were initially unwilling to reveal the industries and businesses represented by these potential new customers,[20] a later response to a data request revealed that of the 27 anticipated large new customers, "the customers' target markets can be broken down as follows: 6 are Data Centers, 5 are Automotive/Transportation, 8 are Batteries, 2 are Industrial Manufacturing, 2 are Life Sciences, 1 is Aerospace, 1 is Energy, 1 is Food & Beverage, and 1 is Logistics."[21]

27. Another response to a data request categorized the large new loads as Manufacturing, Data Centers, and Data Mining.[22] While the manufacturing sites can reasonably be considered "economic development" and to have the associated positive impacts on local communities and the North Carolina economy, data centers and data mining do not represent much economic development. Data centers, once in operation, have far fewer employees per MW of served load than do other commercial and industrial customers. For instance, Ohio Power Company, operating in central Ohio where many data centers have been built, found that while other commercial and industrial customers employ

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[19] Companies' response to Public Staff DR 45-4.

[20] Companies' confidential response to SACE DR 7-2-2 (identifying only whether the businesses were commercial or industrial).

[21] Companies' response to SACE DR 15-1, Supplemental Response 2/9/2024.

[22] Companies' confidential response to Public Staff DR 29-11. Counsel for the Companies has confirmed that the specific material cited from this data request response is not confidential and does not need to be redacted in the public version of this report.

approximately 25 direct full time equivalent jobs per MW (and this creates additional indirect employment), data centers employ less than 1 direct job per MW.[23]

28. Data Mining is the third category, which was included in the 6 Data Centers in the above list of industries.[24] Crypto currency (e.g., bitcoin) miners convert electricity to bitcoin when it is profitable to do so, which depends on how electricity prices compare to bitcoin prices at any time (S&P Global tracks this price spread under the name "Bitcoin Quarq Spread"[25]).

29. Among existing customers, the DEC forecast shows a very substantial increase in the forecast for wholesale customer Central Electric Cooperative, Inc. ("CEC") due to a possible data center that might open in 2026.[26] I have treated this anticipated large increase in CEC demand as another large load addition.

30. As noted above, the Companies state their belief that their "obligation to provide service to new customers necessitates advance planning for customers

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[23] Direct Testimony of Lisa O. Kelso on behalf of Ohio Power Company, In the Matter of the Application of Ohio Power Company for New Tariffs Related to Data Centers and Mobile Data Centers, Ohio Public Utilities Commission Case No. 24-508-EL-ATA, at 9 (May 13, 2024), *available at* https://dis.puc.state.oh.us/DocumentRecord.aspx?DocID=4f125529-34db-4fbd-8e46-d199c65b1db0.

[24] Companies' response to SACE DR 20-2; Companies' confidential response to Public Staff DR 29-11 (showing that data mining represents [BEGIN CONFIDENTIAL] [END CONFIDENTIAL] of the 2026 adjustment to DEC peak load).

[25] *See, e.g.*, *S&P Global Commodity Insights Launches First-of-Kind Platts Bitcoin Quarq Spreads*, S&P GLOBAL (May 19, 2022), https://www.spglobal.com/commodityinsights/en/about-commodityinsights/media-center/press-releases/2022/051922-sp-global-commodity-insights-launches-quarq-spreads.

[26] Companies' response to SACE DR 22-1-2.

that are in an advanced stage of engagement." [27] The Companies also acknowledge that being in an "advanced stage of engagement" with a customer does not "constitute a binding, irrevocable obligation to pursue service at the initially estimated maximum demand."[28] Very few of the potential new customers even have Electric Service Agreements ("ESAs") at this time; only [BEGIN CONFIDENTIAL] [redacted] [END CONFIDENTIAL]of the anticipated MW are backed by ESAs.[29] The ESAs do not commit the customer to much in the way of Minimum Charges. The minimum charges are only intended to recover "demand related costs."[30] As of March 2024, the minimum charges amounted to only [BEGIN CONFIDENTIAL] [redacted] [END CONFIDENTIAL] per month.[31]

31. The Companies' forecasts of the future loads of these potential new customers are provided by the customers themselves. The Companies recognize that the econometric projections based on economic and demographic forecasts from Moody's Analytics anticipate some of this economic development.[32] To address the potential for double-counting between the econometric forecasts and the large load additions, the Companies apply discounts in the 30% to 60% range

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[27] Companies' confidential response to AGO DR 5-6(d). Counsel for the Companies has confirmed that the specific material cited from this data request response is not confidential and does not need to be redacted in the public version of this report.

[28] *Id.* Counsel for the Companies has confirmed that the specific material cited from this data request response is not confidential and does not need to be redacted in the public version of this report.

[29] Companies' response to SACE DR 20-1-2 Confidential Supplemental Response 3/26/2024. A draft ESA was provided in the Companies' response to SACE DR 15-1 Supplemental.

[30] Companies' confidential supplemental response to SACE DR 20-1. Counsel for the Companies has confirmed that the specific material cited from this data request response is not confidential and does not need to be redacted in the public version of this report.

[31] Companies' response to SACE DR 20-1-1 Confidential Supplemental Response.

[32] CPIRP Appendix D, Electric Load Forecast, pp. 13-14.

to the customer forecasts.[33] As I explain below, the Companies' approach does not sufficiently consider the probability that a significant amount of the potential large new customer load is already embedded in the underlying econometric forecast or will not materialize at the scale or time that Duke anticipates.

V. MITIGATING THE IMPACT OF LARGE NEW LOADS ON CAPACITY NEEDS AND OTHER CUSTOMERS

32. The Companies state that they have made some efforts to work with the new large customers to minimize their impacts on capacity needs and existing customers:[34]

> "… the Companies have had preliminary discussions with certain potential large customers about the impact of their projected load requirements on the Companies' generation systems, including conceptual discussions about ways to partner with customers on generation that would optimize the amount of resources needed to serve their new load, including backup generation."

33. However, as noted above the Companies consider the new large customers "economic development successes", and apparently the Companies and local officials consider it very desirable to attract these new loads (even including the data centers that do not represent much economic development). Some of these customers may be evaluating multiple locations across multiple states and have no firm commitment to any one location. Encouraging customers

[33] CPIRP Appendix D, Electric Load Forecast, p. 14.

[34] Companies' confidential response to SACE DR 12-3-3. Counsel for the Companies has confirmed that the specific material cited from this data request response is not confidential and does not need to be redacted in the public version of this report.

to minimize their impact on capacity needs (with demand response,[35] on-site standby generation, batteries, a power purchase agreement with an independent generator, or other approaches) could lead them to choose a different location. In response to data requests, the Companies do not provide evidence that the discussions about minimizing impacts have been very serious or had any results.[36] In fact, of the 27 very large customers noted above, apparently only [BEGIN CONFIDENTIAL] [redacted] [END CONFIDENTIAL] have even discussed backup generation with the Companies.[37]

34. The Companies note recently-approved changes to their service regulations that provide that the Companies may require appropriate "performance and credit provisions in the letter agreements with" customers over 100 MW.[38] Again, through discovery no evidence was provided that anything substantive has been done with this authority.

35. By contrast, some utilities in other states have taken steps to condition any major investments on long-term firm contractual commitments from such customers. For example, Ohio Power Company proposes to build a new high voltage transmission line to be able to serve new data centers but only if the customers sign 10 year take-or-pay type contracts that commit the customers to

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[35] *See, e.g.*, *Supporting power grids with demand response at Google data centers,* GOOGLE CLOUD BLOG (Oct. 3, 2023), https://cloud.google.com/blog/products/infrastructure/using-demand-response-to-reduce-data-center-power-consumption.

[36] Companies' responses to SACE DRs 12-3-3, 15-3-1.

[37] Companies' confidential response to Public Staff DR 51-7.

[38] Companies' response to CIGFUR DR 2-12.

minimum demand levels equal to 90% of their contract capacity.[39] The requested loads for new customers who refuse such a contractual commitment will not be included in the load forecast.

VI. ADDITIONAL REASONS FOR DISCOUNTING CUSTOMER LOAD PROJECTIONS

36. As noted earlier, the Companies applied discounts to the power requests of potential future customers to reflect possible double-counting with the econometric projections. This section explains why these requests should be discounted more heavily than the Companies have done, and proposes alternative discounts leading to alternative, more modest load growth forecasts.

37. The requests and forecasts of future power needs provided by new customers, and forecasts of substantial expansions by existing customers, should be discounted for the following reasons:

a. **Double Counting with Econometric Projections.** The econometric projections, based on economic and demographic projections from Moody's Analytics, anticipate strong economic growth in the coming years, as noted earlier. Through the Companies econometric models, this economic and demographic growth leads to anticipated growth in electric demand, which reflects and overlaps with new customers' projections of their future loads. The discounts the Companies have applied to customer forecasts were intended to

[39] Direct Testimony of Matthew S. McKenzie on behalf of Ohio Power Company, In the Matter of the Application of Ohio Power Company for New Tariffs Related to Data Centers and Mobile Data Centers, Ohio Public Utilities Commission Case No. 24-508-EL-ATA, at 7 (May 13, 2024).

address this concern (and only this concern[40]), although it is difficult to evaluate to what extent the Companies' discounts address even this one concern.

b. **Double Counting with Other Locations.** In addition, developers of data centers and perhaps other energy-intensive facilities typically enter into discussions with local officials and utilities in multiple locations before selecting one or more locations to further develop. Many of these large entities are likely pursuing multiple sites in the Carolinas, Virginia, Georgia, and other locations in parallel; and the largest ones may represent a very high fraction of the anticipated load.[41] Some of the new customers in the Companies' forecasts may represent alternatives to the same proposed project, of which only one if any would be fully developed, and the Companies would not necessarily know this was the case.

c. **Optimistic Projections.** Especially since other utilities, such as Dominion and Ohio Power, have notified data center developers of potential delays in new service, the developers of new data centers

[40] CPIRP Appendix D, Electric Load Forecast, p. 14 ("Astute readers will point out that combining such calculations with the results of an econometric model introduces a possibility of some double counting to the extent that economic forces motivate the individual site adjustments. To mitigate the impact of a possible "double count," the load forecasting team typically adjusts the load forecast by a reduced amount of the full load expectation for each project; this consideration results in a discount of 30%–60%...").

[41] Wilson, James, F. *Direct Testimony on behalf of Appalachian Voices,* in re: Virginia Electric and Power Company's Integrated Resource Plan filing, Virginia Corporation Commission Case No. PUR-2023-00066, at 6 (Va. State Corp. Comm'n., Aug. 8, 2023 ("Wilson 2023 Dominion Testimony"), (citing to Dominion's response to data request APV Set 13-15(a)) ("The Company reports that its two largest customers represent 62% of the Company's forecasted 2030 data center demand; five customers are 80%.").

have been approaching utilities sooner, and with more aggressive schedules, to attempt to ensure such constraints will not delay developing new capacity. The tendency for data center developers to provide very optimistic, high estimates of how much power they will need and when has been recognized since at least 2015.[42]

d. Economic Uncertainties. Even realistic estimates of developers' plans and future loads could change significantly as conditions change. The COVID pandemic, the wars in Ukraine and Gaza, and the economic downturn in China are recent examples of the types of world events that have, or could have, led to a substantial change in economic forecasts. As another example, the U.S. share of electric vehicle sales declined in the first quarter of 2024,[43] and this could delay plans for new manufacturing sites related to electric vehicles. The Companies have taken such macroeconomic headwinds, such as "inflation, supply chain shortages, potential economic downturns, . . . and workforce. . .shortages."[44] into account in forecasting energy efficiency savings; these same factors can lead to delays or cancellations in potential large new customer loads.

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[42] Quanta Technology, *Dominion Northern Virginia Load Forecast,* Oct. 23, 2015, p.13, Attachment JFW-2 to Wilson 2023 Dominion Testimony, p. 29.

[43] *U.S. share of electric and hybrid vehicle sales decreased in the first quarter of 2024,* U.S. ENERGY INFORMATION ADMINISTRATION (May 14, 2024), https://www.eia.gov/todayinenergy/detail.php?id=62063.

[44] Companies' response to SACE, et al. DR 14-2-1 (explaining potential barriers to utility energy efficiency adoption).

e. **Political Uncertainties.** Some of the potential new customers are in industries that benefit from policy incentives or are otherwise potentially influenced by federal and state policies. As noted above, of the 27 large new customers, 5 are in "Automotive/Transportation" and 8 are in "Batteries." Electric vehicles and batteries receive direct and indirect support from government policies intended to increase electrification and reduce carbon emissions. Changing policies could change the attractiveness or need for new facilities. The elections to be held in November 2024 hold the potential to lead to changes in federal and state policies.

f. **Self-Provided Reliability and Other Mitigation.** Another reason to discount these forecasts, to the extent they potentially drive future transmission and generation expansions, is that many of these customers may ultimately choose to self-provide firmness rather than rely on the grid for reliability. At present most data centers have on-site diesel generation which would only be used in emergencies. But going forward, data centers, and perhaps other large energy-intensive facilities, may plan microgrids, battery backup or active standby backup generation that would allow them to reduce loads when needed to help the grid.[45]

[45] *See, e.g.*, Rich Scroggins, Cummins, *Evolution of Data Center Power Use;* Daniel Golding, Structured Research, *The Third Wave of Data Center Power* (2024).

g. **Prudent Planning.** Finally, prudent planning calls for heavily discounting highly uncertain and rather speculative future load additions that are not contractually committed, especially where a specific location has not yet been identified. This is especially appropriate for potential future loads several years out with more uncertainties that could lead the customer's plans to change, and more time for the utility to adjust plans if the customer's forecast is maintained.

38. Note that these reasons also suggest more heavily discounting future loads that are, say, three or more years into the future compared to the coming few years. Near-term projections may be based on firmer commitments from customers and facilities in an advanced state of construction, and there is less time for economic and political uncertainties to lead to major changes in plans. By contrast, looking three or more years out, there is a much greater chance for conditions to change and the customers' plans to be delayed or cancelled.

VII. ALTERATIVE LOAD FORECASTS

39. The Summary and Recommendations section of this report recommends a process that would firm up and screen out speculative service requests from potential very large new customers, by encouraging self-provision of firmness and/or contracting with the Companies on a long-term take-or-pay basis. Absent such a process, I recommend heavily discounting these requests for load forecast purposes. While the Companies have applied discounts to the large new load requests, the prior section of this report explained several additional reasons for further discounting well beyond what the Companies have applied.

40. In light of the many additional reasons not considered by the Companies to discount the projections of the future loads of potential new large customers, this section develops an alternative forecast based on larger discounts leading to more modest increases in demand. First, the discounts the Companies have applied are presented, then the alternative discounts and forecasts are explained and presented.

41. Table 1 presents DEC's full load projections, and the adjustments DEC applied to them to determine the amounts to include in the DEC forecast.[46] The first four lines show the projections based on customer requests; the second group of four lines shows the percentages applied to the full load projections, in nearly all cases negative values; and the final group of four lines shows the amounts added to the load forecast. For example, Table 1 shows that to the customers' requested [BEGIN CONFIDENTIAL] [redacted] [END CONFIDENTIAL] MW

[46] Attachment to the Companies' confidential response to Public Staff DR 29-11.

of data mining load in 2026, DEC applied a [BEGIN CONFIDENTIAL] [redacted] [END CONFIDENTIAL] reduction and included [BEGIN CONFIDENTIAL] [redacted] [END CONFIDENTIAL] MW in its forecast.

[BEGIN CONFIDENTIAL]

[END CONFIDENTIAL]

42. Note that the percent reductions are roughly [BEGIN CONFIDENTIAL] [redacted] [END CONFIDENTIAL] for the first year or two, but then actually decline to 2027 and beyond, with much smaller reductions past 2030, especially for data centers. As explained in the prior section of this report, loads projected to appear years into the future are more uncertain and speculative than the near-term load growth and should be discounted more heavily.

43. Note also that the data center full load values increase sharply in 2030 and 2033 but remain constant in 2031 and 2032. This suggests that the Companies imagine that data centers begin service at their full capacity, when in fact data centers typically take three to five years to ramp up to full capacity.[47]

44. Table 2 provides alternative discounts that I recommend in order to create an alternative, more prudent, forecast of these new loads. The alternative discounts in Table 2 reflect the following concepts:

a. DEC's discounts for 2024, 2025 and 2026 are unchanged. So, the resulting load amounts added to the forecasts are the same for these years.

b. For 2027 through 2029, *incremental* full load amounts in these years are discounted by 50%. The discounts applied to loads appearing in prior years are unchanged.

c. For 2030 and beyond, *incremental* full load amounts in these years are discounted by 70%. The discounts applied to loads appearing in prior years are unchanged.

45. Note that the alternative discounts shown in Table 2 are applied only to the *incremental* full load projection in each year; the discounts applied to new loads in prior years are held constant. Thus, the discount values in Table 2 are not directly comparable to the DEC values in Table 1 where the discount applied to loads that appeared in early years may change over time. The larger discounts for

[47] Wilson 2023 Dominion Testimony p. 25 and Attachment JFW-2, Dominion Energy Supplemental Response to APV Set 05-30(d).

2030 and beyond reflect the considerations discussed in the prior section that suggest that the projections further into the future are more uncertain.

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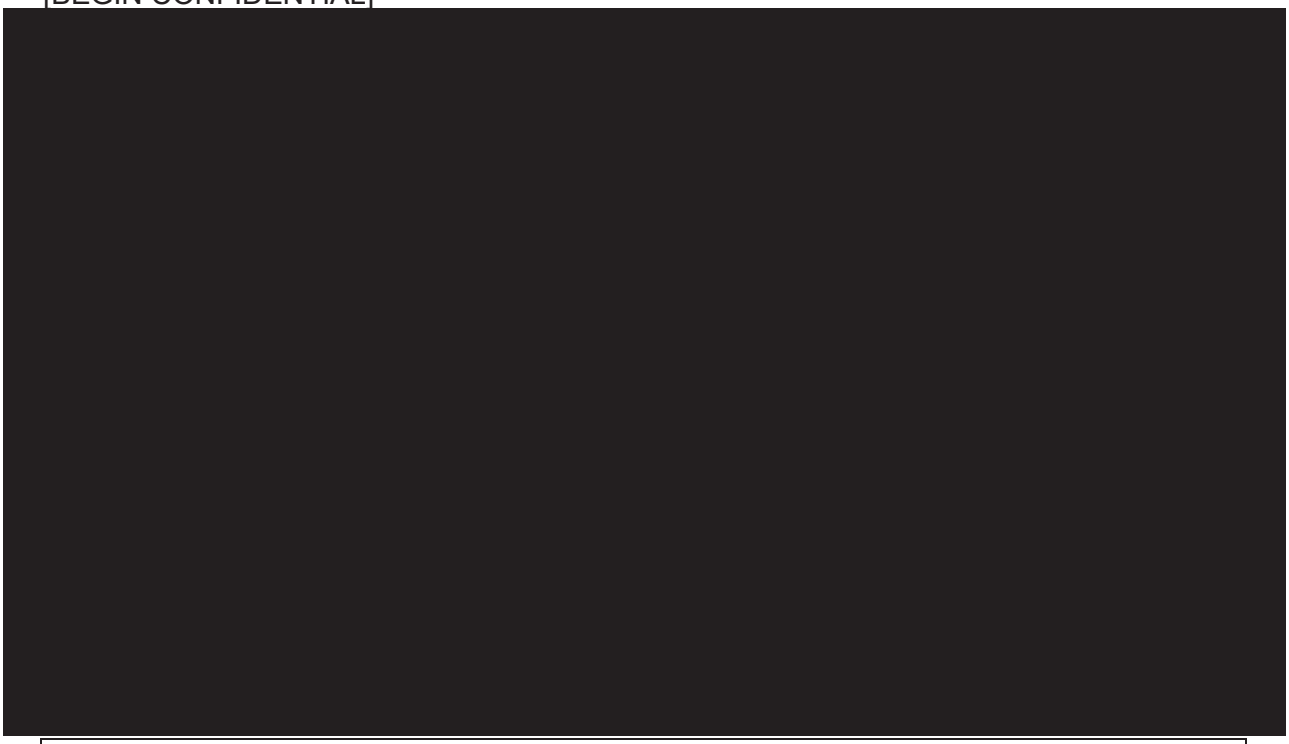

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46. The lower section of Table 2 shows the resulting total amount of load added to the forecast each year, comparable to the lower section of Table 1. The final line shows the difference in the load added to the forecast under the Table 2 Alternative Adjustments compared to DEC's assumptions. The alternative forecast is the same for 2024 to 2026, and the difference grows to over 600 MW by 2030 and over 900 MW in 2033.

47. These alternative adjustments were combined with the Companies' forecasts for all other sectors to create an alternative forecast reflecting somewhat smaller adjustments for the large new loads. Figures 9 and 10 repeat Figures 5 and 6, presenting the DEC summer and winter forecasts, now including the alternative forecasts for DEC. The alternative forecasts are the same as the

Companies' forecasts for 2024, 2025 and 2026, slightly lower in 2027, with the wedge (equal to the last line in Table 2) increasing for years further into the future.

[BEGIN CONFIDENTIAL]

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48. Tables 3 and 4 present the same information for the DEP system. Table 3 presents DEP's load adjustments, and Table 4 presents alternative adjustments based on the same concepts and percentage discounts as applied to create Table 2.

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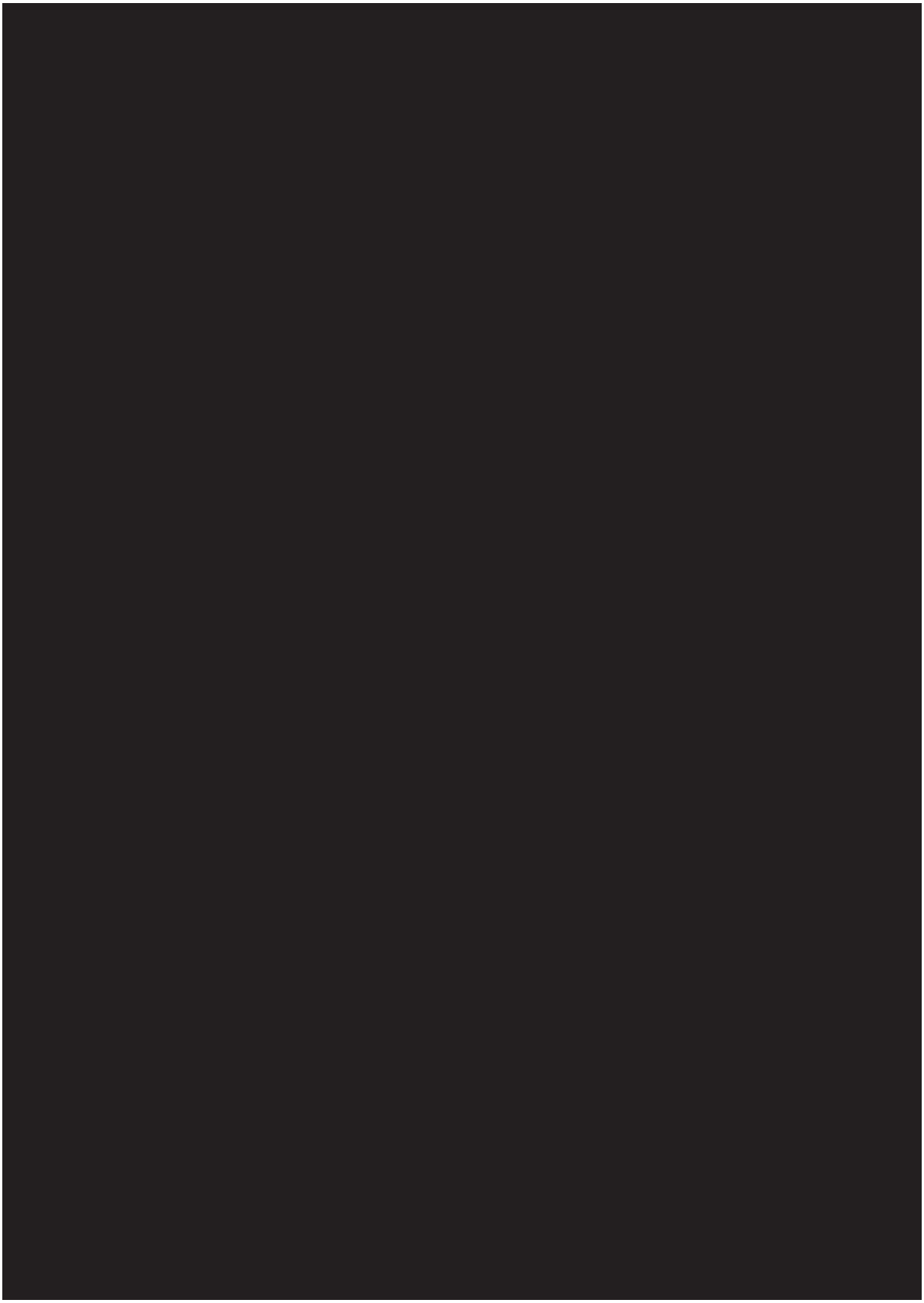
49. Figures 11 and 12 repeat Figures 7 and 8, presenting the DEP summer and winter forecasts, now including the alternative forecasts for DEP. The alternative forecasts are the same as the Companies' forecasts for 2024, 2025 and 2026, slightly lower in 2027, with the wedge increasing for years further into the future.

[BEGIN CONFIDENTIAL]



[END CONFIDENTIAL]

VIII. CRITIQUE OF THE 2023 RA STUDY

50. As noted earlier, the resource adequacy analysis and reserve margins for the CPIRP were based upon the 2023 RA Study prepared for DEC and DEP by Astrapé Consulting. I reviewed and evaluated the previous two DEC and DEP RA Studies (prepared in 2020 and 2016) in reports filed in 2021, 2019 and 2017, raising a number of issues with the studies' assumptions and methodologies. Surprisingly, the 2023 RA Study is presented as merely "an update to the study performed in 2020."[48]

51. In my 2021 report I concluded that the 2020 RA Studies substantially overstated winter resource adequacy risk, primarily due to three flaws in the analysis:

a. An inaccurate approach to estimating the impact of extreme cold on loads, extrapolating based on observations at milder temperatures.

b. Overstating the likely frequency of extreme cold, by using 39 years of temperature data (1980-2018), weighted equally, which includes many instances of very extreme cold that have not been seen in these areas, or only rarely, for decades; and

c. Overstating power plant forced outage rates under extreme cold.

52. I have reviewed the 2023 RA Study and find that it again substantially overstates winter risk, for at least the first two of these three main reasons (I have not evaluated the power plant outage assumptions in this latest report). Nearly all the resource adequacy risk in the 2023 RA Study is in winter, and nearly all of the

[48] 2023 RA Study p. 2.

risk is in winter mornings, not evenings. Because winter mornings drive the results, this report generally focuses on winter mornings.

53. The 2023 RA Study again substantially overstates winter extreme peak loads due to a flawed extrapolation approach for estimating how loads would increase due to extreme temperatures. In the winters of 2014, 2015, 2018, and 2022 there were instances of very low winter temperatures in the DEC and DEP-East service territories. However, the 2023 RA Study used 43 years of historical weather data (1980 to 2022), and far lower temperatures were seen in some years in the 1980s (in the DEC service territory, minus 5 degrees in 1985, and 3, 4, and 5 degrees in 1982, 1983, and 1986, respectively). Therefore, to use the 43 years of weather data to develop the synthetic load shapes for the 2023 RA Study simulations, Astrapé had to model loads under temperatures that have not occurred, or only rarely, in recent decades.

54. The 2023 RA Study generally associated loads with temperatures using a neural network approach. However, for the most extreme temperatures (high or low) for which there are fewer observations, the neural network approach was considered inaccurate, so an additional step, based on regressions, was used to "extrapolate out the load behavior at extreme temperatures." While the 2023 RA Study claims various approaches were tried to improve the extrapolation, it concluded that the approach taken in the 2020 studies remained the best option.

55. The approach entails estimating through regression the amount by which incremental cold apparently increases load. The results of the regressions, expressed in MW/degree, are then used to extrapolate load levels to the very low

temperatures found in the 43-year history. The extreme loads resulting from these regressions account for nearly all of the load loss in the simulations and drive the reserve margins higher than they would otherwise be. While the 2023 RA Study is silent on the temperature ranges used for these regressions, through discovery it was revealed that temperatures up to 17 degrees were included in the DEC regressions for winter mornings, and temperatures up to 20 degrees were included in the DEP-E regressions for winter mornings.[49]

56. There are two main problems with this extrapolation approach that result in substantially overstating loads under extreme cold. First, this extrapolation approach assumes that when temperatures drop to extremely low temperatures (10, 5 degrees and even lower), each additional degree will increase loads by the same amount as occurs at around 15 to 20 degrees. But for the lowest temperatures, the relationship between temperature and load is much weaker. This is logical -- once temperatures drop to the teens, customers are likely already operating space heating equipment at maximum levels; if temperatures fall even lower, few customers have additional equipment they can turn on. In addition, the winter peak loads under extreme temperatures typically occur in the 7 to 9 AM time frame; under the very rare extreme cold conditions, some schools, offices, and other commercial, government and industrial facilities may open late, remain closed, or operate at reduced levels, reducing loads during the early morning peak on such days. Thus, extrapolating based on temperature-load relationships in the 10 to 20 degree range is conceptually flawed, and not a sound way to estimate

[49] Response to SACE 19-1 (workpapers to 2023 RA Study Figures 8, 9 and 10).

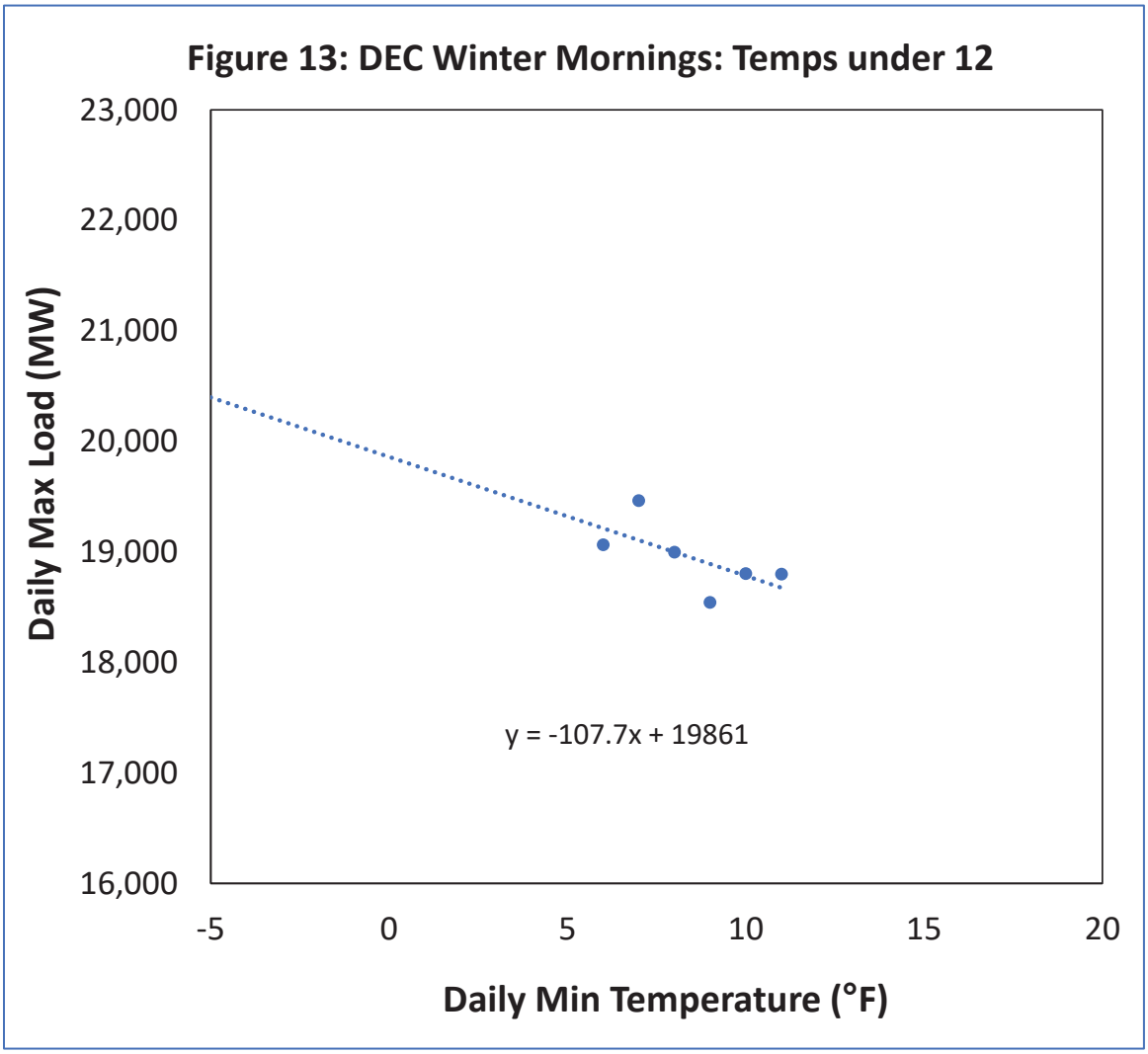
what loads would be under the most extreme temperatures for which there is little or no recent data.

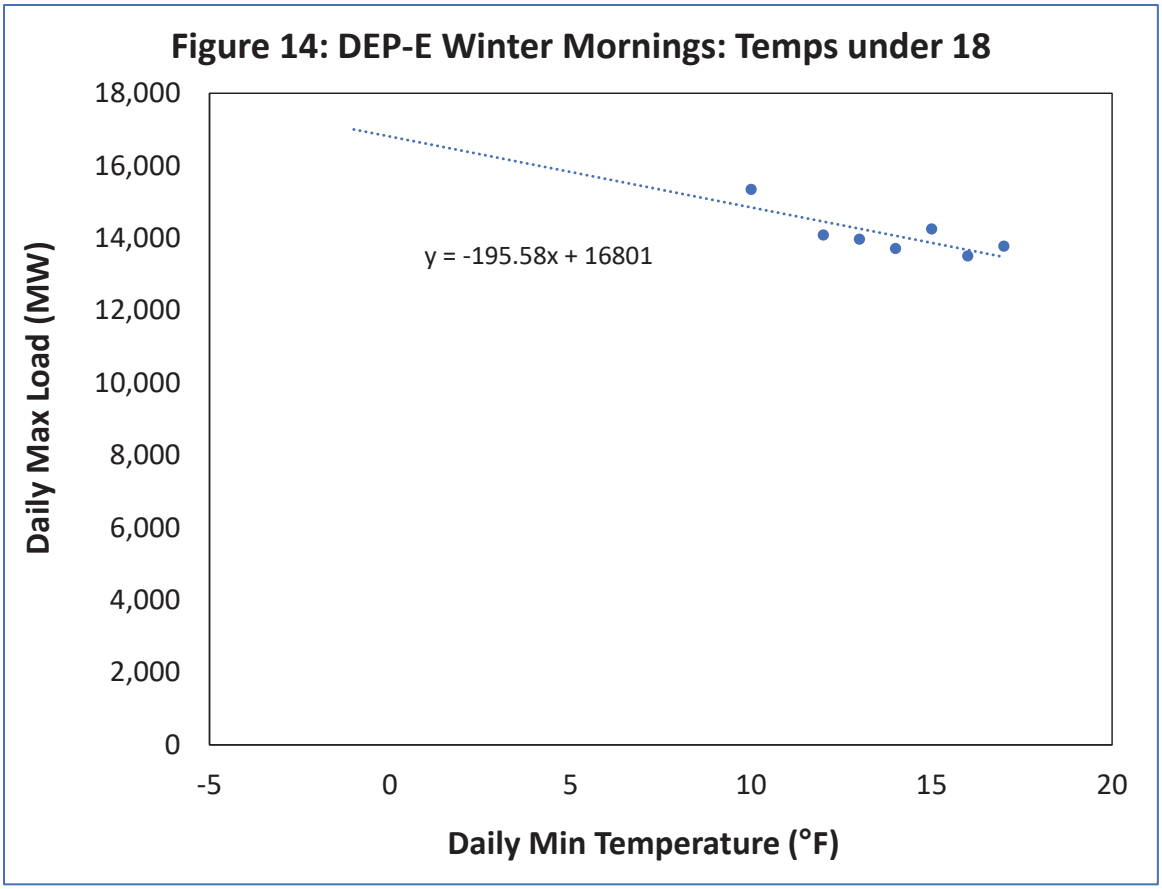
57. The main flaw is in the regression approach itself, the results of which are reflected in 2023 RA Study Figures 8, 9 and 10. The regressions estimate how much load increases for each degree the temperature falls, based on the chosen set of historical observations. The 2023 RA Study used daily minimum temperatures for the regressions and included observations up to 17 degrees (DEC) and 20 degrees (DEP-E) from recent years, as noted above. The value resulting from the regressions for winter mornings in the DEC service territory was 279.67 MW/degree,[50] implying that for each additional degree the temperature falls, DEC's load is assumed to increase by 279.67 MW (roughly 1.5%). Ten additional degrees would increase loads by 2,797 MW, over 14% of the DEC peak load. Similarly, the extrapolation approach suggests that the DEP-East winter morning loads would increase 248.28 MW for each additional degree the temperature drops. The key flaw was to include observations for temperatures up to 20 and 17 degrees for DEC and DEP-E, respectively. The same regression analysis, but excluding the higher temperatures, provides a more reasonable estimate of the impact of incremental cold on load at lower temperatures (although, again, using this estimate to extrapolate to very low temperatures is conceptually flawed and invalid). As I will show next, and also showed in my 2020, 2019 and 2017 RA reports, the impact is far lower when the analysis properly focuses on lower temperatures.

[50] Response to SACE 19-1 (workpapers to 2023 RA Study Figures 8, 9 and 10).

58. I performed the same regressions but excluded the observations at higher temperatures. The results are shown in Figures 13 and 14. For DEC, across the temperature range up to 20 degrees, the relationship was 279.67 MW per degree, as noted above. When the regression is focused on temperatures under 12 degrees, the impact of cold is just 107.7 MW/degree, over 60% lower. While the observations are few, they do fall in line quite well, as shown in Figure 13.

Figure 13: DEC Winter Mornings: Temps under 12





59. For DEP-East, focusing the analysis on temperatures below 18 degrees lowers the estimate from the 248.28 MW/degree value noted above to 195.58, as shown in Figure 14.

60. It is likely that even the lower MW/degree values from the calculations shown in Figures 13 and 14 overstate the additional impact of the most extreme temperatures on loads, because, as suggested above, at the lowest temperatures, space heating appliances are already in full use and some facilities will open late or remain closed.

61. I conclude that the 2023 RA Study greatly overstated loads under extreme cold conditions, due to the flawed extrapolation approach, as discussed above.

62. The 2023 RA Study also overstates the likely frequency of extreme cold in the coming years. The 43 years of temperature data (1980-2022) used in the 2023 RA Study included many instances of extreme cold that have not been seen, or only rarely, for decades. This calls into question how likely we should expect such extreme cold to be going forward, and whether the 2023 RA Study has overstated the frequency of such extreme cold (all years are equally weighted) and resulting high loads. Overstating the likely future frequency of extreme cold amplifies the effect of overstating the impact of extreme cold on winter peak loads discussed in the prior section.

63. In my recent work on forecasting peak loads in various regions, I have repeatedly found, and called attention to, upward trends in temperatures, including upward trends in both summer and winter temperatures. If such upward trends are not taken into account in using the data for resource adequacy analysis, this overstates winter risk relative to summer risk in three ways:

a. Failing to reflect increasing summer extreme temperatures understates summer extreme temperatures and load levels, understating summer risk;

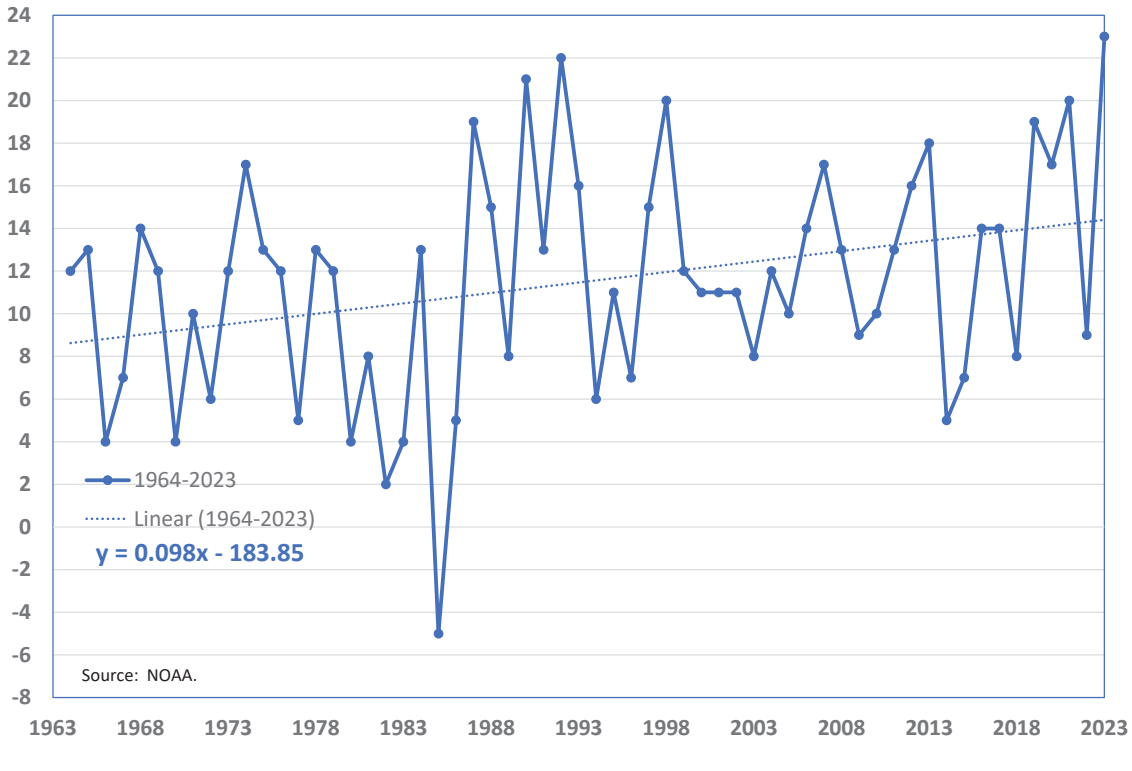
b. Failing to reflect increasing winter temperatures leads to overstating winter load levels (winter loads are higher at lower temperatures) and overstating winter risk; and

c. Estimating the variability of extreme temperatures without reflecting the upward trend over time leads to overstating the variability at any point in time, leading to overstating temperature and load volatility and the

reserve margins needed to meet adequacy targets; this affects winter risk more than summer, because winter loads are more volatile and, in most regions, exhibit a stronger upward trend.

64. I accessed historical daily temperatures for Charlotte Airport (one of the weather station locations with the highest weighting for DEC), and found upward trends in winter annual minimum temperatures, pattern I have seen across the continent. Figure 15 shows 60 years of historical winter minimum temperatures, with the trend line suggestion a one degree increase every ten years. Reflecting that trend would require raising the extraordinary temperature that occurred in 1985 by almost four degrees, which would make a big difference in the associated loads and in RA Study results.

Figure 15: Minimum Annual Temperatures at Charlotte Airport



65. To summarize, the vast majority of the winter load loss in the 2023 RA Study is based on a highly simplified and inaccurate assumption about how loads would increase under the most extreme temperatures, applied to temperatures that have not been seen, or only very rarely, in decades, and whose frequency of occurring is overstated. These assumptions drive the winter risk and reserve margins higher.

IX. SUMMARY AND RECOMMENDATIONS

66. The excessive reserve margins recommended by the 2023 RA Study combine with the very high load forecasts based on somewhat speculative large load additions to result in excessive capacity needs.

67. This evaluation leads to the following suggestions for future CPIRP proceedings:

a. The Companies and the Commission should plan to address potential very large load additions in the manner described in this report.

b. The Companies should engage professional forecasters to perform a study and develop multiple longer-term scenarios of their future loads with a focus on very large load additions, including data center, data mining, and manufacturing loads; preferably, such research and forecasting would be done on a broader geographic basis. The forecast scenarios may reflect different assumptions about economic growth, and whether the Companies require long-term contracts for very large customers, among other key assumptions.

c. The Companies should study the relationship between extreme winter weather and load and develop more sophisticated methods for estimating the potential impact of future extreme winter weather on load. The research should consider likely customer behavior under extreme cold, such as the possibility that some schools and businesses may remain closed. The Companies should also consider, in addition to other winter demand response programs,

seeking agreements from customers to remain closed when temperatures fall below a very extreme threshold.

X. APPENDIX: QUALIFICATIONS OF JAMES F. WILSON

James F. Wilson is an economist and independent consultant doing business as Wilson Energy Economics, with a business address of 4800 Hampden Lane Suite 200, Bethesda, Maryland 20814. Mr. Wilson has 40 years of consulting experience, primarily in the electric power and natural gas industries. His consulting assignments have often pertained to the economic and policy issues arising from the interplay of competition and regulation in these industries, including restructuring policies, market design, market analysis and market power. Many recent engagements have involved electricity peak load forecasting, resource adequacy and capacity markets. His experience and qualifications are further detailed in his CV, available at www.wilsonenec.com.