BEFORE THE NORTH CAROLINA UTILITIES COMMISSION
DOCKET NO. E-2, SUB 1219

In the Matter of	**)**
Application of Duke Energy Progress, LLC	**)**
For Adjustment of Rates and Charges	**)**
Applicable to Electric Service	**)**
In North Carolina	**)**

DIRECT TESTIMONY OF
JAMES VAN NOSTRAND
AND
TYLER FITCH
ON BEHALF OF
VOTE SOLAR

APRIL 13, 2020

BEFORE THE NORTH CAROLINA UTILITIES COMMISSION

* * * * *

TABLE OF CONTENTS

LIST OF ATTACHMENTS

1. INTRODUCTION

A. JAMES M. VAN NOSTRAND

Q. Please state your name, title and employer.

A. My name is James M. Van Nostrand. I am an Energy Policy Expert for EQ Research, a consulting firm based out of Cary, North Carolina. I am also a Professor of Law at the West Virginia University College of Law, where I teach energy and environmental law and Direct the Center for Energy and Sustainable Development.

Q. On whose behalf are you submitting this direct testimony?

A. I am submitting this testimony on behalf of Vote Solar.

Q. Please state your educational and professional experience.

A. Exhibit JMV-TF-1 sets forth my educational background and professional experience.

B. TYLER FITCH

Q. Please state your name, title, and employer.

A. My name is Tyler Fitch. I am Southeast Regulatory Manager for Vote Solar.

Q. On whose behalf are you submitting this direct testimony?

A. I am submitting this testimony on behalf of Vote Solar.

Q. Please state your educational and professional experience.

A. Exhibit JMV-TF-2 sets forth my educational background and professional experience.

C. OVERVIEW OF JOINT TESTIMONY

Q. Does each sponsoring witness adopt the whole of this testimony?

A. Yes. However, Mr. Fitch is not a lawyer and defers to Mr. Van Nostrand regarding any portion of this testimony that could be perceived as requiring legal training to answer.

Q. Please summarize your testimony.

A. This testimony focuses on the Grid Improvement Plan proposed by Duke Energy Progress ("the Company") and its request to recover the costs of the Plan through deferral to a regulatory asset. In particular, our testimony examines the extent to which the Company has integrated the impact of climate change-related risks in its Grid Improvement Plan. Since 2017, risks related to climate change have emerged as a material factor in electric utility operations. Recent developments in climate risk assessment, scrutiny from shareholders, and regulatory momentum underscore the need to manage these risks. Given the exposure faced by the Company to climate change-related risks due to, among other things, the vulnerability of its physical assets to more frequent and intense extreme weather events as well as the impact of increasing temperatures on its system, prudent utility practice requires that these risks be considered as part of any long-term plan for transmission and distribution investments. Our testimony concludes that the Company's analysis of climate change-related risks in connection with its Grid Improvement Plan is woefully inadequate, and the Company likely has fallen short of sustaining its burden of proof to demonstrate that the proposed expenditures associated with the Plan are necessary and reasonable. Our testimony concludes with several recommendations to improve the integration of climate change-related risks in the

Company's long-term system planning, as well as a possible regulatory mechanism that would provide incentives for implementation of these recommendations.

Our testimony reaches the following conclusions:

- Climate-related risks, emerging in many vectors, have a material and substantial bearing on the Company's operations today and will continue to affect operations in the future. Collaborative processes in North Carolina are currently underway to assess these risks and their implications for the electric grid.
- The Company faces demonstrable physical risks from climate change and increasing scrutiny on climate risk management from relevant financial institutions.
- As a potential foundational investment for the 21st century grid, any grid modernization plan should consider best climate resilience practices alongside grid modernization best practices. This includes the fair assessment of distributed energy resources as climate resilience and grid modernization solutions.
- The Grid Improvement Plan, as filed, does not assess or respond to climate-related risks, nor does it adhere to grid modernization best practices. As a result, the Company's proposal does not provide enough information to indicate that the Plan is a prudent investment.

Our testimony includes the following recommendations:

- The North Carolina Utilities Commission ("the Commission") should direct the Company to assess and manage climate-related risks across its operations and assets, in accordance with prudent utility practice.
- The Commission should make clear that it will hold the Company accountable for applying this standard to Grid Improvement Plan investments by the Company.
- The Commission should direct the Company to participate in ongoing Department of Environmental Quality stakeholder processes around grid modernization and integrate data, findings, and recommendations into its grid modernization investments. The Commission should further require that the Company file a report by December 31, 2020 identifying any gaps in knowledge that need to be filled through further collaboration.
- The Commission should require the Company to develop large distribution investments such as the Grid Improvement Plan through an integrated distribution planning ("IDP") or integrated systems & operations planning ("ISOP") process moving forward.
- To the extent that Grid Improvement Plan projects are authorized for deferred accounting, the Commission should impose performance-based conditions on the recovery of such deferred amounts in rates, such as through adjustments to the weighted average cost of capital applied to the unamortized balance of deferred amounts.

Q. How is your testimony organized?

A. The testimony is presented in several sections:

- **Section 2** provides context for the Grid Improvement Plan based on the Company's recent Power/Forward proposal, grid modernization best practices, and the response of the Commission. It also describes Vote Solar's experience as a stakeholder in the Company's Grid Improvement Plan stakeholder process.
- **Section 3** introduces the concept of climate-related risks, and demonstrates the extent to which such risks are at play in the Company's application. Section 3 includes a comprehensive review of the Company's exposure to such risks and best practices for managing them.
- **Section 4** identifies several policy and regulatory developments in North Carolina that may have bearing on any grid modernization process.
- **Section 5** presents a review of the Grid Improvement Plan's development based on grid modernization and climate resilience best practices as well as ongoing North Carolina developments.
- **Section 6** offers a specific discussion of the Company's request for deferred accounting, integrated systems planning, and the role of climate-related risks at the Commission.
- **Section 7** briefly discusses how the Company's customers would benefit from the integration of climate-related risks in long-term system planning.
- **Section 8** provides our conclusions and recommendations to the Commission.

2. POWER/FORWARD, STAKEHOLDER ENGAGEMENT, AND THE DEVELOPMENT OF THE GRID IMPROVEMENT PLAN

Q. Does the Grid Improvement Plan represent the Company's first proposed comprehensive investment plan for its transmission and distribution infrastructure?

A. No. The Company proposed the Power/Forward program in its last rate case.

Q. What was Power/Forward?

A. Power/Forward was a 10-year, $13 billion grid modernization plan for the Duke Energy Carolinas and Duke Energy Progress transmission and distribution system proposed in the Company's 2017 General Rate Case.[1] Like the Grid Improvement Plan, the stated goals of Power/Forward included improving reliability and integrating distributed resources.[2] Although no extraordinary regulatory treatment was sought in the Duke Energy Progress case, the subsequent Duke Energy Carolinas General Rate Case proposed a Grid Reliability and Resiliency Rider or deferral into a regulatory asset for recovering Power/Forward costs.[3]

[1] Direct Testimony of David B. Fountain on behalf of Duke Energy Progress, Docket No. E-2, Sub 1142. Retrieved at: https://starw1.ncuc.net/NCUC/ViewFile.aspx?Id=2e602d93-a288-4a6f-8c7c-d8684a747d91.
[2] Direct Testimony of Robert M. Simpson III on behalf of Duke Energy Progress, Docket No. E-2, Sub 1142. Retrieved at https://starw1.ncuc.net/NCUC/ViewFile.aspx?Id=2e602d93-a288-4a6f-8c7c-d8684a747d91.
[3] Direct Testimony of Jane L. McManeus on behalf of Duke Energy Carolinas, Docket No. E-7, Sub 1146. Retrieved at https://starw1.ncuc.net/NCUC/ViewFile.aspx?Id=4701a724-c7aa-4ff0-bc30-1da295d6f57f.

Q. What was Vote Solar's role in that proceeding?

A. Vote Solar's then Regulatory Director, Dr. Caroline Golin, testified on behalf of the North Carolina Sustainable Energy Association in both the Duke Energy Carolinas and Duke Energy Progress proceedings. Her testimony assessed the appropriate treatment of a capital-intensive proposal, the prudency of the Power/Forward program (according to the program's overall cost-effectiveness) and its satisfaction of grid modernization best practices, namely:

- Clear and Measurable Goals
- Stakeholder Engagement
- Integrated Distribution Planning
- Cost/Benefit Analysis[4]

Dr. Golin's assessment found that Power/Forward was not justified on an economic or engineering basis and that it failed to implement any of the grid modernization best practices listed above. In the Duke Energy Carolinas rate case, Dr. Golin recommended that the Commission deny Duke Energy Carolinas's proposal and proactively establish a separate proceeding for a stakeholder-driven, staff-facilitated process for evaluating grid modernization investments.[5]

---

[4] Direct Testimony of Caroline Golin on Behalf of North Carolina Sustainable Energy Association ("NCSEA"), Docket No. E-2, Sub 1142. Retrieved at https://starw1.ncuc.net/NCUC/ViewFile.aspx?Id=4dc8a933-d7c8-4ace-b9ab-e53b8e5690d5.
[5] Direct Testimony of Caroline Golin on Behalf of NCSEA, Docket No. E-7, Sub 1146. Retrieved at https://votesolar.org/files/2215/1741/2799/Direct_Testimony_of_Caroline_Golin_2.pdf.

Q. Do you agree with Dr. Golin's identification of best practices and establishment of a separate proceeding for grid modernization programs?

A. We do. These best practices are supported by grid modernization experts who have presented them across the Southeast and across the country.[6]

Q. What did the Commission find in its decision on the Power/Forward proposal?

A. The Company did not seek recovery of investments relating to Power/Forward in the previous rate case, but the Commission nevertheless found that "[b]ased on the full record in this docket, the Commission concludes, however, that the Company has not yet provided compelling evidence that the proposed grid investment plan will result in meaningful benefits to ratepayers despite its cost."[7] The Commission noted that it would reconsider the proposal after an agreed-upon technical workshop and the outcome in Duke Energy Carolinas's general rate case proceeding.[8]

---

[6] Alvarez, P., & Stephens, D., (2019, January). Modernizing the Grid in the Public Interest: Getting a Smarter Grid at the Least Cost for South Carolina Customers. *GridLab*. Retrieved at http://gridlab.org/wp-content/uploads/2019/04/GridLab_SC_GridMod.pdf;
Aggarwal, S., & O'Boyle, M., (2017, February). Getting the Most out of Grid Modernization. Energy Innovation. Retrieved at http://ipu.msu.edu/wp-content/uploads/2018/01/Grid-Modernization-Metrics-and-Outcomes-2017.pdf;
Migden-Ostrander, J., & Hauser, S., (2018, September). Grid Modernization and New Utility Business Model. *Regulatory Assistance Project & GridWise Alliance*. Presentation given to Clean Energy Legislative Academy. Retrieved at https://www.raponline.org/wp-content/uploads/2018/09/rap_migden_cnee_legislator_academy_2018_sep_11.pdf;
Migden-Ostrander, J., Littell, D., Shipley, J., Kadoch, C., Sliger, J., (2018, February). Recommendations for Ohio's Power Forward Inquiry. *Regulatory Assistance Project*. Retrieved at https://www.raponline.org/wp-content/uploads/2018/02/rap-recommendations-ohio-power-forward-inquiry-2018-february-final2.pdf.

[7] Order Accepting Stipulation, Deciding Contested Issues, and Granting Partial Rate Increase, Docket No. E-2, Sub 1142 et al. p. 99. Retrieved at: https://starw1.ncuc.net/NCUC/ViewFile.aspx?Id=d2b2a1a0-dae1-45de-af9c-c987d4aeddc8.

[8] *Ibid.* p. 100.

In the Duke Energy Carolinas Rate Case, the Commission noted that, given that the Duke Energy Carolinas controls the timing of the investments and that regulatory lag has not been an issue for these types of investments in the past, a rider would be inappropriate for grid investments.[9] Further, the Commission found that the reasons cited by Duke Energy Carolinas to justify the Program do not qualify as extraordinary:

> "The Commission finds and concludes that the reasons DEC says underlie the need for Power Forward are not unique or extraordinary to DEC, nor are they unique or extraordinary to North Carolina. Weather, customer disruption, physical and cyber security, and aging assets are all issues the Company… [has] to confront in the normal course of providing electric service. The Commission further finds that … a number of the Power Forward programs and projects … are the kinds of activities in which the Company engages or should engage on a routine and continuous basis. Therefore, the Commission must conclude that Power Forward costs are not appropriate to be considered for deferral accounting."[10]

While the Commission found arguments for a separate proceeding "compelling," it ultimately directed the Company to utilize existing dockets for grid modernization proposals, of which one (the "Smart Grid Technology Plan" docket) is no longer active. The Commission also directed the Duke Energy Carolinas to "engage and collaborate with stakeholders" to address issues raised in the proceeding.[11] In his testimony in this proceeding, Witness Oliver identifies the

---

[9] Order Accepting Stipulation, Deciding Contested Issues, and Requiring Revenue Reduction, Docket No. E-7, Sub 1146 et al. p. 142-145. Retrieved at https://starw1.ncuc.net/NCUC/ViewFile.aspx?Id=80a5a760-f3e8-4c9a-a7a6-282d791f3f23.
[10] *Ibid.,* p. 146.
[11] *Ibid.,* p. 149.

Commission's Order in the Duke Energy Carolinas Rate Case as relevant guidance for present grid improvement investments.[12]

Q. How did the Company engage and collaborate with stakeholders between the conclusion of the previous rate case and this one?

A. Since the last rate case, the Company held three in-person stakeholder workshops that were facilitated by a third party and conducted a series of webinars. Company Witness Oliver describes the objectives of the first stakeholder workshop as to "[d]evelop understanding of proposed investments; hear and explore stakeholder feedback; and support a collaborative process going forward."[13]

Q. In what capacity did Vote Solar participate in the Grid Improvement Plan stakeholder process?

A. Vote Solar participated in all three of the in-person stakeholder workshops held by the Company and observed several of the Company's webinars.

Q. What is Vote Solar's interest in the grid modernization broadly and the Grid Improvement Plan specifically?

A. As with Dr. Golin's previous testimony, Vote Solar's position is that decisions on how states pursue grid modernization represent critical opportunities for our electric grid. Done correctly, the modernization of the grid can enable a system where customers see economic benefits, distributed energy resources are evaluated fairly, innovative solutions have a chance to compete with traditional investments,

[12] Direct Witness of Company Witness Jay W. Oliver ("Oliver Direct"), p. 41, ll. 20 to p. 42, l. 20.
[13] Oliver Direct, p. 43, ll. 11-13.

the grid's environmental impact is reduced, and energy service is more reliable and resilient to shocks and stressors. An unacceptable grid modernization proposal, on the other hand, could create more costs for customers than benefits, and could fail to deliver on promised benefits. As the onset of climate-related risks affects the risk profile for many grid stakeholders, the need to get grid modernization right is even more urgent. Vote Solar participated in the stakeholder process in pursuit of a grid modernization process in North Carolina that adheres to the best practices cited in Dr. Golin's testimony and ultimately one that works toward a more dynamic, resilient, and distributed grid.

Q. Mr. Fitch, please characterize your experience as a stakeholder in this collaboration process.

A. I will characterize my direct experience as an in-person stakeholder in the third workshop and webinars, and base my review of the first and second workshop on pre-read packets and workshop readout reports provided as exhibits in this proceeding by Witness Oliver. I found the stakeholder workshops valuable insofar as they clarified the Company's justification of its proposal and provided an opportunity for stakeholders to share perspectives and goals for a grid modernization process. I cannot characterize the workshops as "collaborative" in the true definitional sense of a process where stakeholders and the Company work together toward a shared goal.. In general, the prevailing feeling among stakeholders during workshops was unidirectional information-sharing by the Company. Stakeholders did not appear to play a role in choosing which investments

should be selected, or shaping the process by which the Grid Improvement Plan was developed.

Relatedly, I was surprised to find that the Company invited stakeholder input only after the Company had developed the Grid Improvement Plan.[14] This approach leaves stakeholders out of the most important elements of the grid modernization process—defining a shared set of goals and criteria for success, identifying possible solutions, and developing a process for selecting those solutions. In effect, the Plan was "already baked" by the time stakeholders were given a chance to share ideas.

This procedural element may be a reason that management of climate-related risks—an element that several stakeholders called for—was not included in the Plan.[15] The Company in fact explicitly stated that it intended to avoid the term "climate change," and the topic would be addressed only to the extent climate change risks were captured as part of the megatrend identified as "Environmental Trends" and "Impact of Weather Events."[16]

Q. Mr. Fitch, is it clear the extent to which differences between programs proposed in the Power/Forward and the Grid Improvement Plan were driven by stakeholder input?

---

[14] Oliver Direct, p. 29, l. 18 to p. 30, l. 18.
[15] Oliver Direct Ex. 13, p. 12.
[16] Oliver Direct, Ex. 13, p. 29.

A. No. Witness Oliver represents that the stakeholder process led to the Company's creation of the Megatrends,[17] but the excerpt of the Commission's 2018 order cited above shows that several of these Megatrends were previously used to justify the Power/Forward plan. In any case, the Plan's similarity to Power/Forward (further discussed below) suggest that the Megatrends were a *post hoc* justification developed by the Company to justify the path it had already decided to pursue.

Company Witness Oliver cites several other changes to the plan as stakeholder-driven, [18] but a review of the workshop readout demonstrates more nuance at play: Targeted undergrounding was reduced, but the workshop readout report described this project as changing "priority";[19] and the distribution hardening & resiliency program was reduced in size, but the term "distribution hardening" does not appear in the workshop readout report.[20]

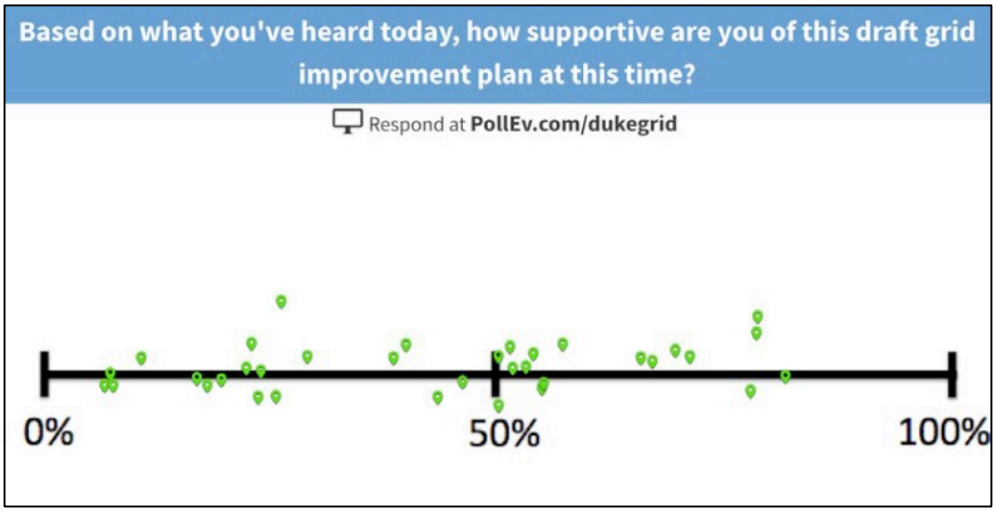
Q. Based on the workshop readout reports, what were other stakeholders' responses to the stakeholder process?

A. The Company rolled out its Grid Improvement Plan proposal at the second stakeholder workshop in November 2018. The readout report registers that stakeholders had a mixed, at best, view of the Plan, as shown in Figure 1. Key takeaways from the workshop included a note that stakeholders asked the Company

[17] Oliver Direct, p. 43, ll. 19-20.
[18] Oliver Direct, p. 43, ll. 20-22.
[19] Oliver Direct, Exhibit 11, p. 12-13.
[20] *Ibid.,* p. 1-44.

to explicitly include climate change as a megatrend and to better understand the DER-enablement implications of its proposal.[21]

Figure 1. Stakeholder Sentiment of Grid Improvement Plan.[22]



The third stakeholder workshop represented more of a "deep dive" into the cost-benefit methodology of several proposed programs, presented in the context of the Company's stated intention to file a rate case application including a Grid Improvement Plan in the next several months.[23] At the last workshop before the Plan's submission to the Commission, the role of stakeholder input was still unclear to stakeholders:

> "Several stakeholders felt unclear about the impact from current stakeholder engagement, and if/how stakeholder input has and will be meaningfully used in the GIP riling. In response, many stakeholders requested to see evidence

[21] Oliver Direct, Ex. 13, p. 12.
[22] Figure is directly taken from Oliver Direct, Ex. 13, p. 22.
[23] Oliver Direct, Ex. 16, p. 6: "Several stakeholders were skeptical about how a "clean slate" for stakeholder engagement could be realized after the filing this year."

and/or explicit explanations demonstrating how stakeholder feedback has thus far been incorporated."[24]

Of course, stakeholders at the Grid Improvement Plan workshops showed a wide range of opinions and interests, and the summary above is not meant to be comprehensive. It does, however, point to a trend of stakeholders (Vote Solar included) finding that the process did not meaningfully incorporate stakeholder input into proposed investments.

Q. Mr. Fitch, did the stakeholder process the Company conducted in advance of this rate case adhere to stakeholder best practices or a reasonable expectation of engagement and collaboration?

A. No. The stakeholder process did not allow stakeholders to set goals for the Plan or work with the Company to identify criteria for evaluating solutions. Especially for the third workshop, stakeholder input was unlikely to alter the Company's proposal to the Commission. Although the Company to my knowledge has not committed to a cyclical, ongoing stakeholder process, the potential for that type of process through the Company's proposed phases is possible. Overall, however, the stakeholder process did not adhere to these best practices.

[24] Oliver Direct, Ex. 16., p. 5-6.

Q. Please compare the Company's proposed Grid Improvement Plan to its previous Power/Forward plan.

A. The Company provided a comparison between the Grid Improvement Plan and Power/Forward during its April 2019 webinar,[25] and provided a more precise comparison between the programs in discovery.[26] Every program that made up Power/Forward is replicated in the Grid Improvement Plan, although the total budgets for targeted undergrounding and "incremental distribution hardening & resilience" have decreased substantially. Several new programs populate the GIP, including security measures, Integrated Volt-Var Control ("IVVC"), integrated systems & operations planning, and support for energy storage and EVs. Even so, over 80 percent of the capital investment that comprises the Grid Investment Plan is derived from projects that were also a part of Power/Forward.[27] The Grid Improvement Plan thus largely incorporates the same projects included in Power/Forward, although the Grid Improvement Plan's scope is much smaller than Power/Forward's (3 years versus 10 years). At the same time, however, it should be noted that the Company has described at least one more "phase" of the Grid Improvement Plan.[28]

---

[25] Oliver Direct, Ex. 14 p. 10.
[26] Company Response to Vote Solar Data Request -1-2.
[27] *Ibid.* Investment in SOG, Incremental Transmission H&R, Transmission Bank Replacement, Oil Breaker Replacement, T&D Communications, Distribution System Automation, Transmission System Intelligence, and T&D Enterprise systems totals $1.952 billion, which is ~84% of the $2.3 billion budget.
[28] Oliver Direct, p. 47, ll. 9 to p. 48, ll. 18.

Q. Mr. Fitch, how did the Company portray its Integrated Systems & Operations Planning ("ISOP") project in Company meetings and webinars?

A. ISOP presentations[29] portrayed ISOP as a way to integrate planning processes across generation, transmission, distribution, and customer services,[30] and identified capabilities of the Advanced Distribution Planning component of ISOP to include "optimized selection of both traditional and non-traditional solutions."[31]

Q. What appears to be the relationship between ISOP and the Grid Improvement Plan?

A. ISOP is an identified component of the Grid Improvement Plan. It is not apparent from the Company's materials how the Grid Improvement Plan projects will be sequenced in their implementation, despite the clear value that the capabilities of ISOP, ADP, and Morecast would bring toward identifying grid needs and placing solutions.

---

[29] Mr. Fitch reviewed Duke Energy's presentation of ISOP to the Commission on August 28, 2019, and observed the ISOP webinar on January 30, 2020.
[30] Duke Energy (2019, August), Integrated Systems & Operations Planning (ISOP) Technical Conference. *North Carolina Utilities Commission*, p. 5. Retrieved at: https://www.duke-energy.com/_/media/pdfs/our-company/isop/isop-ncuc-conference-overview-rev0.pdf?la=en.
[31] Duke Energy Carolinas, LLC and Duke Energy Progress, LLC (2019, August). Response to Commission Questions in July 23, 2019 Order Docket No. E-100, Sub 157. Retrieved at https://www.duke-energy.com/_/media/pdfs/our-company/isop/e100-sub157-decdep-response-to-ncuc-questions.pdf?la=en.

3. ONSET OF CLIMATE-RELATED RISK AND FUNDAMENTAL CHANGES IN THE ELECTRIC UTILITY SECTOR

A. Introducing Climate-Related Risks

Q. Why is climate change relevant to the Company's general rate case application?

A. In its response to Vote Solar's motion to compel responses to discovery in the Duke Energy Carolinas Rate Case, the Duke Energy Carolinas acknowledged that the words climate change or global warming do not appear in its application,[32] and posited that the scope of this proceeding is "limited to the costs, revenues, rates, and regulatory mechanisms reflected in its application."[33] We agree that the focus of this proceeding should not be about climate change, but there is no question that climate-related risks clearly influence the costs, revenues, rates, and regulatory mechanisms in DEC's application. The same statements apply to the Company's application in this proceeding. Whether or not the Company explicitly uses the term "climate-related" or "climate change" in its application, the physical impacts of climate change and the financial, regulatory, and societal responses to it have real, material implications for the Company and the prudency of current proposals in its Application. The following items in the Company's application have climate-related risk implications:

---

[32] Duke Energy Carolinas, LLC's Response to Opposition to Motion to Compel Discovery, Docket No. E-7, Sub 1146, p. 2.
[33] *Ibid.* p. 4.

- The Grid Improvement Plan. The Plan purports to "mitigate the impact of major storm events,"[34] and "support more rooftop solar, battery storage, electric vehicles, and microgrids."[35] Storm and flood risks are likely to change due to climate change,[36] and Executive Order 80[37] and the Clean Energy Plan,[38] both of which cite climate-related risks as a driver, urge adoption of policies that are intended to increase customers' use of rooftop solar, battery storage, electric vehicles and microgrids.

- Storm costs from Hurricanes Florence and Michael and Winter Storm Diego.[39] The frequency and intensity of those storms is increasing, which the Company acknowledges.[40] But if the Company does not update storm preparation to account for this reality there will be implications for the Company's assets[41] and the ability of its customers to cope with the impacts of those storms.[42] Given the Brunswick nuclear plant's exposure to floods as during Hurricane Florence,[43] there is reason to be particularly attentive to this concern.

- Investments to upgrade Company assets to reduce carbon emissions.[44] Switching to lower-carbon fuels reduces regulatory climate-related risk in the future. The application notes this fact when it explains that the

---

[34] Duke Energy Progress, LLC Application to Adjust Retail Rates, Request for an Accounting Order, and to Consolidate Dockets ("DEP Application"). p. 10.
[35] *Ibid*.
[36] Kunkel, K., & Easterling, D., (2020, January). North Carolina Climate Science Report. Presentation given to North Carolina Climate Change Interagency Council, p. 28. Retrieved at https://files.nc.gov/ncdeq/climate-change/interagency-council/Jan-22-2020--Interagency-Climate-Council-presentation-rev.pdf.
[37] State of North Carolina Exec. Order No. 80, (2018, October).
[38] North Carolina Department of Environmental Quality, (2019, October), North Carolina Clean Energy Plan: Transitioning to a 21st Century Electricity System. Retrieved at: https://files.nc.gov/governor/documents/files/NC_Clean_Energy_Plan_OCT_2019_.pdf.
[39] DEP Application, p. 5.
[40] *Ibid.* p. 10.
[41] Morehouse, C., (2020, January), "Ameren, Xcel, Dominion, Duke among most at-risk from changing climate: Moody's." *Utility Dive.* Retrieved at https://www.utilitydive.com/news/ameren-xcel-dominion-duke-among-most-at-risk-from-changing-climate-mood/570789/.
[42] ConEdison (2019, December). Climate Change Vulnerability Study. p. 31. Retrieved at https://www.coned.com/-/media/files/coned/documents/our-energy-future/our-energy-projects/climate-change-resiliency-plan/climate-change-vulnerability-study.pdf.
[43] Murawski, J., (2018, September). "Floods limit access to Duke's Brunswick nuclear plant; crews use porta-potties, cots." *The News & Observer.* Retrieved at: https://www.newsobserver.com/news/local/article218530735.html.
[44] DEP Application, p. 5, #9.

investments will "further reduce carbon emissions across the Carolinas for the benefit of customers."[45]

- Accelerated depreciation for coal assets.[46] Again, this acts as a hedge against potential climate regulation, and the application and Witness DeMay argue that investing in cleaner energy sources is done "for the benefit of [the Company's] customers."[47,48]

- The Company's return on equity.[49] Witness Hevert does not mention that Moody's credit opinions for the Company in 2019 mention its "carbon transition risk,"[50] thereby failing to capture a recent significant pivot in how the financial industry views climate-related risks.

These items show that the Company's decisions today are influenced by climate-related risks and affect the Company's future exposure to those risks. This is not an exhaustive list of climate-related risks to the Company; climate-related risks operate through multiple vectors beyond physical impacts and are complex and inter-related. Avoidance of, or, conversely, engagement with, these risks is very likely to impact the Company's operations and financial position, as we discuss below.

In response to discovery on how it manages climate-related risks, the Company states that "[it], as well as its stakeholders, are unable to say with certainty what the future impacts of climate change may or may not be."[51] This is neither a responsible nor a mainstream approach to risk management. As expressed

---

[45] *Ibid.*
[46] *Ibid.* p. 8.
[47] *Ibid.* p. 9.
[48] Direct Testimony of Company Witness Stephen G. De May ("De May Direct"), p. 14, l. 14
[49] DEP Application. p. 14.
[50] Company Response to Vote Solar Data Request 1-24.
[51] Company Response to Vote Solar Data Request 1-12,.

by State Street CEO Ronald O'Hanley in his recent statement to the *Wall Street Journal* on climate-related risks:

> "Does anyone know with certainty or precision what the scope and pace of climate change might mean for long-term investments? No. But that is the textbook definition of risk: More things can happen than will happen."[52]

As in any business, risk management is fundamental to prudent business practice. As we demonstrate, the Company and Commission are better equipped than ever before to consider the material risks associated with climate change.

Q. What are climate-related risks?

A. Climate-related risks refer to the potential negative impacts of climate change on a firm or organization. Risks may emerge as a result of the physical shocks and stresses of climate change (physical risks), or the social and economic response to those impacts (transition risks). Importantly, the risks discussed here are those borne by the firm alone, not by its customers or society as a whole. As such, the climate-related risks described here are no different than any other business risk that a firm might assess and manage in the course of prudent operation.

Due to the carbon emissions embedded in conventional electricity generation and the nature of transmission and distribution infrastructure, electric

[52] O'Hanley, R., (2020, January). Sustainability Is Part of Good Risk Assessment. *Wall Street Journal*. Retrieved at https://www.wsj.com/articles/sustainability-is-part-of-good-risk-assessment-11580413295#comments_sector.

utilities are among the most vulnerable industries to climate-related risk.[53] Climate-related risks that electric utilities face are categorized below:

- **Physical:** Impacts to assets and operations from physical climate impacts.
- **Financial:** Impacts to cost-of-capital due to climate-related exposure and confidence in risk management.
- **Economic:** Risk of stranded assets or decreased sales due to increased viability of alternatives.
- **Regulatory:** Impacts to operating and capital costs from changing regulations.
- **Reputational:** Potential loss of goodwill due to perceived response to climate change.

Although these categories may be helpful for identifying different types of risk, it should be noted that climate-related risks are complex and interconnected.[54] It is therefore important to understand these risks as related to each other and specifically related to climate change.

For each dimension of risk, we summarize the mechanism by which it impacts utility operations, provide an overview of state-of-the-art efforts to characterize the risk, and describe the Company's potential exposure.

---

[53] The Task Force on Climate-Related Disclosures identified the energy sector, including electric utilities, as one of four non-financial groups with "the highest likelihood of climate-related financial impacts." Task Force on Climate Related Financial Disclosures, (2017, June). Recommendations of the Task Force on Climate-Related Disclosures. P. 16. Retrieved at: https://www.fsb-tcfd.org/wp-content/uploads/2017/06/FINAL-2017-TCFD-Report-11052018.pdf.

[54] *Ibid.,* p. 10.

Q. Does the broader business and financial community consider these risks material? Has the perception or assessment of these risks changed since the Company's last rate case?

A. The answer is "yes" to both questions. While climate change and its attendant business risks may be a lightning rod topic for some, Company witness DeMay observes—and we agree—that "[t]he energy sector is in a period of transformation and profound change," due to technological advancements, environmental mandates, notions of resiliency, and changing customer expectations.[55] Climate-related risks encapsulate these transformative changes, and the industry has reached a tipping point since the Company's last rate case application in 2017. Six key developments are driving this transformation:

First, a common framework for understanding, disclosing, and managing climate-related risks is emerging. At the request of the G20, the Financial Stability Board formed the Task Force on Climate-related Financial Disclosures ("TCFD") in 2015 to develop a universal framework for risk disclosure. The TCFD's final recommendations were published on June 15, 2017—six weeks after the Company submitted its application for the 2017 rate case.[56] Since then, TCFD's

[55] De May Direct, p. 5, ll. 18-21.
[56] Duke Energy Progress, LLC. Application to Adjust Retail Rates and Request for an Accounting Order. Docket No. E-2, Sub 1142. Retrieved at:https://starw1.ncuc.net/NCUC/ViewFile.aspx?Id=7e497cdb-bbfb-491d-ba4c-d52764d37112.

recommendations have become the international standard, adopted by almost 800 organizations representing over $118 trillion in assets.[57]

Second, awareness of the here-and-now risks of climate change to electric utilities—and the urgent need to mitigate those risks—have materialized since 2017. The California wildfires and related PG&E bankruptcy and large-scale public service power shutoffs in response to fire risks have galvanized public conversation about the role of electric utilities in mitigating climate impacts.[58] One Wall Street Journal headline aptly summarizes the new orientation toward climate-related damages: "For the Economy, Climate Risks are No Longer Theoretical."[59]

Public and private institutions have responded to these impacts. Since 2017, seven US states made commitments to 100 percent renewable energy,[60] and eleven of the country's largest utility holding companies, including Duke Energy, have announced deep emissions reduction goals.[61] In section 4, we address the related developments in North Carolina policy, including Executive Order 80 and the

---

[57] Task Force on Climate-related Financial Disclosures, (2019, May). 2019 Status Report. pp. 2. Retrieved at https://www.fsb-tcfd.org/publications/tcfd-2019-status-report/.
[58] Gold, R., (2019, January), PG&E: The First Climate-Change Bankruptcy, Probably Not the Last. *Wall Street Journal.* Retrieved at https://www.wsj.com/articles/pg-e-wildfires-and-the-first-climate-change-bankruptcy-11547820006.
[59] Ip, G., (2019, January), For the Economy Climate Risks Are No Longer Theoretical. *Wall Street Journal.* Retrieved at https://www.wsj.com/articles/for-the-economy-climate-risks-are-no-longer-theoretical-11579174209.
[60] UCLA Luskin Center for Innovation, (2019, November), Progress Toward 100% Clean Energy in Cities & States Across the US. Retrieved at https://innovation.luskin.ucla.edu/wp-content/uploads/2019/11/100-Clean-Energy-Progress-Report-UCLA-2.pdf.
[61] Gearino, D., (2019, October), Utilities Are Promising Net Zero Carbon Emissions, But Don't Expect Big Changes Soon. *InsideClimateNews*. Retrieved at https://insideclimatenews.org/news/15102019/utilities-zero-emissions-plans-urgency-coal-gas-duke-dte-xcel.

Clean Energy Plan, which bring a similar awareness and anticipation of climate change's physical, social, and economic changes into this jurisdiction.

Third, major financial institutions are taking the onset of climate-related risks seriously. The U.S. Commodity Futures Trading Commission, understanding the implications of these risks, created a climate-related financial risk subcommittee to provide insights and recommendations to market regulators and participants.[62] Larry Fink, CEO of the world's largest asset manager BlackRock, recently addressed climate-related risks as the driver of a "fundamental re-shaping of finance" in his annual letter to global CEOs.[63] Fink's letter, and research from BlackRock's Investment Institute,[64] also contend that climate-risks are already present in utility stocks, but they haven't been adequately evaluated by investors. As those risks become clearer, Fink writes that "[i]n the near future—and sooner than most anticipate—there will be a significant re-allocation of capital."[65] BlackRock's position as one of the largest and most influential investors in the world lends credence to these claims. Notably, BlackRock is the 2nd largest individual shareholder in Duke Energy Corporation.

---

[62] Litterman, R., (2019, December), Remarks to the Market Risk Advisory Committee. *U.S. Commodity Futures Trading Commission.* Retrieved at https://www.cftc.gov/media/3181/MRAC_Litterman121119/download.
[63] Fink, L., (2020, January), A Fundamental Reshaping of Finance. *BlackRock*. Retrieved at: https://www.blackrock.com/corporate/investor-relations/larry-fink-ceo-letter
[64] Bertolotti, A., Basu, D., Akallal, K., Deese, B., (2019, March), Climate Risk in the US Electric Utility Sector: A Case Study. *BlackRock Investment Institute*. Retrieved at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3347746.
[65] Fink, 2020.

Institutional investors see managing climate-related risks as part of their fiduciary duty to protect the long-term health of their investments. In February 2019, twenty of the world's largest institutional investors, representing over $1.8 trillion in assets, sent a letter to Duke Energy and other electric utilities indicating that "[a]s long-term investors, we view these [climate-related] risks as significant and material," and calling on firms to set a net-zero by 2050 goal over the next six months.[66] Duke Energy Corporation published its net-zero by 2050 goal seven months later, in September 2019.[67]

Fourth, analytical capability to understand climate risks at a granular level has improved dramatically in the last several years. Analysts are capable of projecting climate-related risks and impacts on a single-county level.[68] One recent study of electric utilities viewed risks on a generating plant-by-plant basis.[69] The credit rating agencies of Moody's and S&P are increasing their in-house analytical capacity on this front, and in January 2020 Moody's released its first comprehensive assessment of climate risk for electric utilities.[70]

---

[66] California Public Employees Retirement System et al., (2019, February). *Institutional Investor Statement Regarding Decarbonization of Electric Utiltiies*. Retrieved at https://www.climatemajority.us/investorstatement-20190228.

[67] Duke Energy (2019, September). Duke Energy aims to achieve net-zero carbon emissions by 2050. Retrieved at https://news.duke-energy.com/releases/duke-energy-aims-to-achieve-net-zero-carbon-emissions-by-2050.

[68] Larsen, K., Larsen, J., Delgado, M., Herndon, W., Mohan, S, (2017, January) Assessing the Effect of Rising Temperatures: The Cost of Climate Change to the U.S. Power Sector. Rhodium Group, p. 10-19. Retrieved at https://rhg.com/wp-content/uploads/2017/01/RHG_PowerSectorImpactsOfClimateChange_Jan2017-1.pdf.

[69] Bertolotti, et al. (2019).

[70] Morehouse, C. (2020, January). Ameren, Xcel, Dominion, Duke among most at-risk from changing climate: Moody's. *Utility Dive.* Retrieved at: https://www.utilitydive.com/news/ameren-xcel-dominion-duke-among-most-at-risk-from-changing-climate-mood/570789/.

Fifth, state regulatory regimes are developing best practices for understanding vulnerability to climate-related risks and crafting specific implementation plans for addressing them. In North Carolina, Governor Roy Cooper's Executive Order 80 initiated a process that includes a comprehensive climate risk assessment, which was released to the public on March 11, 2020.[71] The executive summary of that assessment is provided as Exhibit JMV-TF-3. After Superstorm Sandy, the New York Public Service Commission convened a Grid Hardening & Resiliency Collaborative to reach consensus on risks to the Con Edison system and approaches to managing them—a move that has been hailed as a "nationwide model"[72] and an innovative approach[73] for managing climate-related risks. In partnership with the collaborative, Con Edison released its Climate Change Vulnerability Study in December 2019. This study represents a leap forward in the depth of analysis of climate-related risks, and the utility will develop an

[71] North Carolina Institute for Climate Studies (2020, March). The North Carolina Science Report. Retrieved at: https://ncics.org/cics-news/the-north-carolina-climate-science-report/.

[72] Ralff-Douglas, K., (2016, June). Climate Adaptation in the Electric Sector: Vulnerability Assessments & Resiliency Plans. *California Public Utility Commission*, p. 5. Retrieved at https://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/About_Us/Organization/Divisions/Policy_and_Planning/PPD_Work/PPD_Work_Products_(2014_forward)/PPD%20-%20Climate%20Adaptation%20Plans.pdf.;
Case 13-E-0030 *et al.;* Con Edison's Electric, Gas, and Stream Rates -- Order Approving Electric, Gas, and Steam Rate Plans in Accord with Joint Proposal (2014, February). State of New York Public Service Commission. Retrieved at: https://climate.law.columbia.edu/sites/default/files/content/docs/Final-Order-2014-02-21%20(1).pdf

[73] Columbia Law School, (2014, February). Center for Climate Change Law Helps Secure Novel Pact with Con Edison. Retrieved at: https://www.law.columbia.edu/media_inquiries/news_events/2014/february2014/Con-Ed-climate-change-measures.

implementation plan to address risks throughout 2020. A copy of the Climate Change Vulnerability Study is provided as Exhibit JMV-TF-4.

Sixth, analysts and investors are urging firms to take action in the short-term. The U.S. Global Change Research Project concludes that utilities are already subject to climate-related physical risks.[74] The United Nations Principles for Responsible Investment summarize the point succinctly: "Failure to consider all long-term investment value drivers, including [environmental, social, and governance] issues, is a failure of fiduciary duty."[75]

To recap, there is a common understanding of climate-related risks; investors and the public are taking these risks seriously; new analytical tools render climate risks understandable; a collaborative model for addressing risks exists; and there is value to a proactive approach. Recognition and management of these risks will transform how utilities undertake prudent planning and operations. These developments also mean that firms and regulators now have the tools to act.

Q. What materials have you reviewed in preparation of this testimony?

A. We reviewed literature from the following categories to inform this testimony:

- Duke Energy Progress and Duke Energy Corporation statements on climate change and climate-related risks;

---

[74] Zamuda, C., et al. (2018). Energy Supply, Delivery, and Demand in *Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II*. U.S. Global Change Research Program, pp. 174-201. Doi: 10.7930/NCA4.2018.CH4.

[75] United Nations Principles of Responsible Investment (2019, November). Fiduciary Duty in the 21st Century Final Report. Retrieved at: https://www.unpri.org/fiduciary-duty-in-the-21st-century-final-report/4998.article#.Xc0f5YqtBhQ.twitter.

- Decisions by North Carolina policymakers that might inform future climate-related regulatory risk;
- Financial institution discussion and business decisions on climate-related risks;
- Guidance from financial advisory organizations on prudent business practice around disclosing and managing climate-related risks;
- Research assessing the nature of climate-related risks and best practices on avoiding them from top research organizations;
- Case studies of other electric utilities and utility commissions weighing their own response to climate-related risks.

In total, our review spanned 130 sources from 97 organizations. While the review presented here is not exhaustive or universal, the documents assembled paint a clear picture of the current state of recognizing climate-related risks and the institutional response to them. A list of sources consulted during the literature review is available in Exhibit JMV-TF-5.

B. Physical Risks

Q. Please define climate-related physical risks and describe how they are expected to impact the electric utility industry.

A. Climate-related physical risks are risks to assets or operations due to physical phenomena impacted by climate change. These physical changes can manifest as rising sea levels and flood risk, increasing ambient temperatures and heat waves, changing precipitation patterns, and/or increasing frequency and intensity of extreme weather events. Just as weather and climate have always affected the day-

to-day operations and long-term planning of electric utilities, the industry is already affected by the changing climate at the generation, transmission, and distribution levels.[76]

Climate change impacts that will have the most substantial risk implications for the electric industry are listed below.

- **Extreme Weather Events:** More frequent and severe but less predictable storms (and, in coastal areas, attendant storm surges) will result in damage to infrastructure and increases in storm damages. Ratepayers are likely to see decreased reliability and the potential for long outages.[77]
- **Increased Temperatures:** Increased ambient temperatures will reduce performance and reliability of electricity infrastructure.[78] Customer demand is projected to increase as cooling loads increase, but become less predictable.[79] Longer, more intense heat waves present health risks for utility workers. High temperature and high cooling load will present sustained stress to the grid.[80]
- **Changes in Precipitation:** Although not necessarily applicable to the Company's service territory, projected precipitation patterns as a result of

---

[76] Zamuda, C., et al. (2018).
[77] McKinsey Global Institute (2020, January). Climate risk and response :Physical hazards and socioeconomic impacts. Retrieved at: https://www.mckinsey.com/business-functions/sustainability/our-insights/climate-risk-and-response-physical-hazards-and-socioeconomic-impacts.
[78] Bertolotti et al., p. 5.
[79] ConEdison (2019, December). Climate Change Vulnerability Study. p. 12. Retrieved at https://www.coned.com/-/media/files/coned/documents/our-energy-future/our-energy-projects/climate-change-resiliency-plan/climate-change-vulnerability-study.pdf.
[80] Larsen, K., Larsen, J., Delgado, M., Herndon, W., Mohan, S, (2017, January) Assessing the Effect of Rising Temperatures: The Cost of Climate Change to the U.S. Power Sector. Rhodium Group, p. 10-19. Retrieved at https://rhg.com/wp-content/uploads/2017/01/RHG_PowerSectorImpactsOfClimateChange_Jan2017-1.pdf.

climate change are likely to lead to drier conditions in the southern and western parts of the United States, with intermittent episodes of heavy precipitation.[81] A lack of steady water supply could severely impede the operation of nuclear and conventional thermal plants, which rely on an available stream of water for cooling.[82] Droughts may also increase the risk of wildfire, with clear and present implications for utilities' transmission and distribution.[83]

- **Sea-level Rise and Flooding:** Especially in combination with extreme weather events, higher sea levels increase the risk of inundation for coastal assets.[84]

While electricity infrastructure is designed to withstand a range of conditions, future conditions are projected to exceed historical ranges. Understanding and planning for future conditions, and not just relying on historical benchmarks, is becoming necessary to avoid premature asset replacement and stranded assets.[85]

Analysts estimate that these damages can be material in the case of electric utilities. In a review of the financial materiality of climate-related physical risks to electric utilities, BlackRock Investment Institute placed the increased frequency

---

[81] Nanavati, P., & Gundlach, J., (2016, September), The Electric Grid and its Regulators—FERC and State Public Utility Commissions. Sabin Center for Climate Change Law at Columbia Law School, p. 14.
[82] *Ibid.,* p. 15.
[83] Bertolotti *et al.*, p. 4.
[84] Nanavati & Gundlach, pp. 19.
[85] Chung, J., (2020, January). *Ameren, Xcel, Dominion, Duke among most at-risk from changing climate: Moody's* (interview by Catherine Morehouse for Utility Dive);
Kunkel, K., & Easterling, D., (2020, January). North Carolina Climate Science Report. Presentation given to North Carolina Climate Change Interagency Council, p. 33. Retrieved at https://files.nc.gov/ncdeq/climate-change/interagency-council/Jan-22-2020--Interagency-Climate-Council-presentation-rev.pdf

and severity of hurricanes as a "10" on a 1-10 scale.[86] Another estimate found that storm damages were, on average, likely to increase by 23 percent to $1.7 billion per year by 2050.[87] It is now possible to examine climate risks at the granularity of individual generating plants.[88]

Insurers are increasingly exposed to risks of increasing claims and payouts as the incidence of climate-related events grows.[89] After California's 2018 climate-related[90] wildfire season, which included over 13,000 homes and businesses destroyed and 46,000 insurance claims,[91] analysts were concerned that California utilities might be "uninsurable."[92]

Q. How will climate-related physical risks affect the Company specifically?

A. The Company's location in North Carolina largely determines its exposure to climate-related risks. Although all utilities will be subject to the risks above,

---

[86] BlackRock, (2019, April), Getting Physical: Scenario Analysis for Assessing Climate-Related Risks. p.17. Retrieved at https://www.blackrock.com/us/individual/literature/whitepaper/bii-physical-climate-risks-april-2019.pdf.

[87] Brody, S., Rogers, M., Siccardo, G., (2019, April), Why, and how, utilities should start to manage climate-change risk. McKinsey & Company, p. 3. Retrieved at: https://www.mckinsey.com/industries/electric-power-and-natural-gas/our-insights/why-and-how-utilities-should-start-to-manage-climate-change-risk.

[88] Bertolotti, et al.

[89] Flavelle, C. (2019, August). As Wildfires Get Worse, Insurers Pull Back from Riskiest Areas. *New York Times*. Retrieved at: https://www.nytimes.com/2019/08/20/climate/fire-insurance-renewal.html.

[90] Shrimali, G. (2019, October). In California, More than 340,000 Lose Wildfire Insurance. *High Country News.* Retrieved at https://www.hcn.org/articles/wildfire-in-california-more-than-340000-lose-wildfire-insurance.

[91] Bernstein, S., & Barlyn, S., (2019, January). Insurance losses for California Wildfires top $11.4 Billion. *Reuters.* Retrieved at https://www.reuters.com/article/us-california-fire-claims/insurance-losses-for-california-wildfires-top-114-billion-idUSKCN1PM2CF.

[92] Jaffe, A., Busby, J., Blackburn, J., Copeland, C., Law, S., Ogden, J., & Griffin, P., (2019, September). Impact of Climate Risk on the Energy System. *Council on Foreign Relations.* Retrieved at https://cdn.cfr.org/sites/default/files/report_pdf/Impact%20of%20Climate%20Risk%20on%20the%20Energy%20System_0.pdf.

Southeast utilities are particularly exposed to more frequent and severe storms and hurricanes.[93]

High-quality, in-depth studies of climate impacts focused specifically on North Carolina are in progress. As directed by Section 9 of Governor Roy Cooper's Executive Order 80, leading North Carolina institutions have released a North Carolina Climate Science Report that assesses the state of the science and makes projections for North Carolina-specific impacts.[94] Findings from the report indicate that, "[l]arge changes in North Carolina's climate—much larger than at any time in the state's history—are ***very likely*** by the end of this century under both the lower and higher [emissions] scenarios."[95] Authors of the report presenting to the North Carolina Climate Change Interagency Council found it is "***very likely*** [90-100% probability]" that NC temperatures will increase in all seasons, extreme precipitation frequency and intensity will increase, and that heavy precipitations accompanying hurricanes passing over North Carolina will increase.[96] As a result, climate design standards for North Carolina infrastructure will be outdated by the middle of this century[97]—likely within the design lifetime of investments proposed under the Grid Improvement Plan. The North Carolina Climate Science report was

---

[93] Zamuda, C., et al.
[94] North Carolina Department of Environmental Quality, (2019). NC Climate Science Report Development. Retrieved at https://deq.nc.gov/nc-climate-science-report-development.
[95] Kunkel, K., & Easterling, D., (2020, January), emphasis in original.
[96] *Ibid.,* emphasis in original.
[97] *Ibid.*

released to the public on March 11, 2020,[98] and its executive summary is attached as Exhibit JMV-TF-3. It is a key input into the North Carolina Climate Risk Assessment and Resiliency Plan, which is currently in development.

Financial observers have already been paying careful attention to utilities' climate-related physical risks. When S&P announced a negative outlook for Duke Energy Corporation in 2019, it noted that "[t]he company also operates its utilities in regions of the U.S. that are prone to frequent hurricanes, which could increase the company's risk exposure because climate change is intensifying the severity and frequency of these natural disasters globally."[99] Moody's and S&P mentioned hurricanes or named storms in ratings of the Company in each year 2017-2019.[100]

Beyond broad characterizations, credit rating agencies are using increasingly powerful analytical methods for understanding climate risks, finding that Duke Energy's footprint in the Carolinas in particular is exposed to climate-related risks. Moody's published its first review of climate-related risks for electric utilities in January 2020 and found Duke Energy a top risk for hurricane threats.[101]

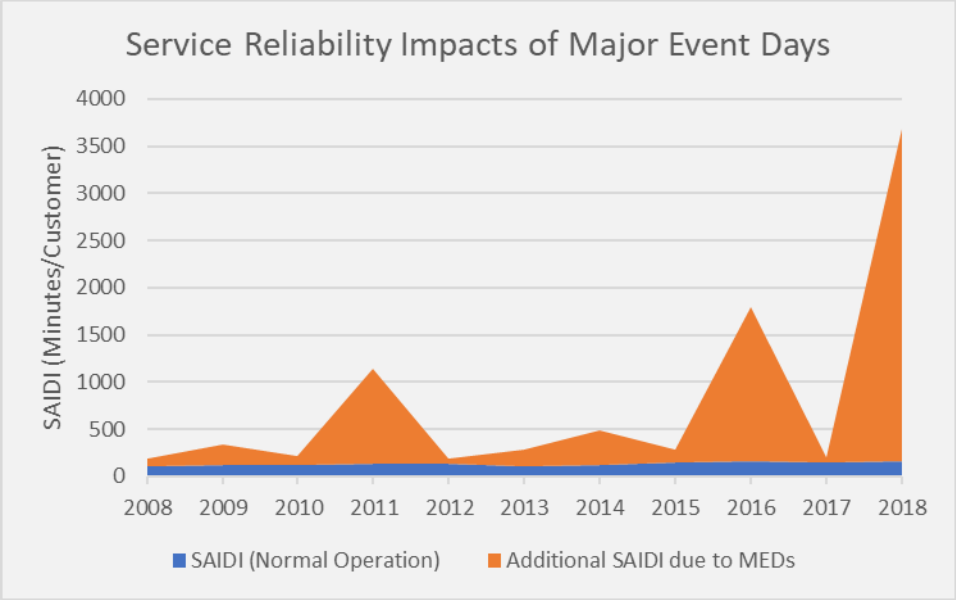
Materials submitted by the Company in this proceeding validate the findings reported by Moody's. Figure 2 below disaggregates system average

---

[98] North Carolina Institute for Climate Studies (2020, March). The North Carolina Science Report. Retrieved at: https://ncics.org/cics-news/the-north-carolina-climate-science-report/.
[99] S&P Global Ratings, (2019, May), Research Update: Duke Energy Corp. and Subs. Outlook Revised To Negative On Coal Ash Risks, Regulatory-Lag, And Project Delays. P. 4. Retrieved at Company Response to Public Staff Data Request 38-5.
[100] Company Response to Vote Solar Data Request 1-24.
[101] Morehouse, 2020.

interruption duration index ("SAIDI") in regular operation and during Major Event Days, which include but are not exclusively related to weather events.

Figure 2: Duke Energy Progress System Average Interruption Duration Index (SAIDI) with and without Major Event Days (MEDs)[102]



The Company's SAIDI trend over the last ten years shows a relatively flat SAIDI during normal operations, but increasing SAIDI impacts from major event days. While the major event days' occurrence is inherently stochastic, experts have found a statistically significant increase in major event days over time.[103] For context, the average customer was without power for 250 minutes in 2018,[104] and

[102] Graph compiled using MED and non-MED SAIDI figures from Company Response to Vote Solar Data Request 1-25.
[103] Larsen, P., Sweeney, P., Hamachi-LaCommare, K., Eto, J., (2014, April). Exploring the Reliability of U.S Electric Utilities. Lawrence Berkeley National Laboratory, p. 29. Retrieved at http://www.usaee.org/usaee2014/submissions/OnlineProceedings/IAEE_ConferencePaper_01Apr2014.pdf.
[104] US Energy Information Administration ("EIA"), (2018, April), "Average frequency and duration of electric distribution outages vary by states." Retrieved at https://www.eia.gov/todayinenergy/detail.php?id=35652.

the cumulative improvement projected for phase one of the Grid Improvement Plan would reduce SAIDI by 49.23 minutes per customer.[105]

C. Financial Risks

Q. Please define climate-related financial risks and summarize how they are expected to impact the electric utilities industry.

A. Climate-related financial risks refer to impacts on the ability of a firm to access reliable and affordable financing due to climate change. Financial risks can be difficult to disaggregate from other risks because financial institutions' climate-related reasons for up- or down-grading a firm will often be linked to other climate-related impacts (e.g. downgrading a California utility due to exposure to wildfire risks). But the unique impacts of financial actions, and specific pathways by which these risks are expressed (e.g. downgrades, disinvestment, votes against board members, changes to stock price), merit treating financial risks as a separate category.

Investors are already paying special attention to electric utilities and their responses to climate-related risks. The Climate Action 100+, a global group of investors with over $35 trillion under management, identified 32 electric utilities as part of the hundred largest greenhouse gas emitters in the world.[106] Duke Energy Corporation is listed as one of the focus companies in the Climate Action 100+.

---

[105] Company response to Vote Solar Data Request 1-26.
[106] Climate Action 100+, (2019). *2019 Progress Report.* Retrieved at https://climateaction100.files.wordpress.com/2019/10/progressreport2019.pdf.

Credit rating agencies have already integrated a review of climate-risk, as a part of environmental, social, and governance ("ESG") review, into their credit ratings. S&P found in its lookback over ratings published 2015-2017 that environment and climate ("E&C") risks played an important role in over 700 cases, and over 100 listed E&C risks as a key factor. Of cases where E&C risks were a key factor, over 40 percent resulted in downgrades.[107] At the same time, S&P demonstrates that prudent management of energy & climate risk represents an opportunity for firms—20 upgrades listed E&C issues as a key factor.[108]

Investors like BlackRock and Morgan Stanley are also building analytical capacity to understand the distribution of climate-related risks. BlackRock and the Rhodium Group are using their plant-level climate risk findings to generate company-level climate-risk indices.[109] Using those indices, they find that climate-resilient utilities trade at a slight premium, while the most risk-exposed utilities trade at a discount.[110] An academic analysis of the relationship between climate risk, risk management, and financial health found similar results:

> "We document a positive correlation between cost of debt and carbon risk for firms [without awareness of climate risks]. Further, this association is economically meaningful, with a one standard deviation increase in carbon risk mapping into between a 38 and 62 basis point increase in the

[107] Williams, J., & Wilkins, M., (2017, November), How Environmental And Climate Risks And Opportunities Factor Into Global Corporate Ratings – An Update. *S&P Global Ratings*. Retrieved at Company Response to Vote Solar Data Request 1-13, Docket No. E-7 Sub 1146.
[108] *Ibid.*
[109] Bertolotti et al.
[110] BlackRock, 2019.

cost of debt. Equally, we find that the penalty is effectively negated for firms exhibiting carbon risk awareness."[111]

Q. How might climate-related financial risks affect the Company specifically?

A. Duke Energy Corporation's largest individual shareholders have taken strong positions on risks related to climate change and their likely response. Table 1 below demonstrates a selection of Duke Energy's creditors and their position on climate risks.

Table 1: Selection of Duke Energy Investors and Positions on Climate Risk

Shareholder	% Share of DUK	Climate-related Risk Position
Vanguard Group	8.19%*	**"**Many companies remain far beyond on their [climate-related risk] journey and have room to improve their disclosure and better educate their board on climate-related risks."[112]
Blackrock Fund Advisors	5.3%*	"In absence of robust disclosures, investors, including BlackRock, will increasingly conclude that companies are not adequately managing risk."[113]
State Street Advisors	5.15%*	"The vast majority of companies are taking a short-term, tactical approach to climate risk; they are failing to identify the long-term threats and opportunities created by a shift to a low-carbon economy and to incorporate this thinking into their boards' strategic planning."[114]

[111] Jung, J., Herbohn, K., Clarkson, P., (2018, July), "Carbon Risk, Carbon Risk Awareness, and the Cost of Debt Financing." *Journal of Business Ethics.*
[112] Vanguard (2019). Investment Stewardship 2019 Annual Report.
[113] Fink, 2020.
[114] State Street Global Advisors, (2019, June), Climate-Related Disclosures in Oil and Gas, Mining, and Utilities: The Current State and Opportunities for Improvement. Retrieved at

		Sent a letter to boards (January 2020) advising they would "take appropriate voting action" against board members of major US firms if they rated poorly on SSGA's ESG score and did not articulate how they would improve it.[115]
New York City Employees' Retirement System	**	Sent a letter to Duke Energy advocating for an ambitious climate goal. "This initiative makes clear that mobilizing for the planet goes hand-in-hand with protecting our pensions, and we need these commitments now."[116]

*: Top three individual investors
**: Investment share outside of top 10 are not published.

Credit rating agencies Moody's and S&P mention climate-related physical, regulatory, and economic risks in their updates on the Company and Duke Energy Corporation.[117] In and of themselves, the risks recorded in these updates may have negative impacts on the Company's business operations. But the financial community's awareness of these risks, and its potential reaction to those risks through stock price movement, shareholder action, and changes to credit ratings, present a unique challenge to the Company's business risks.

D. Economic Risks

https://www.ssga.com/investment-topics/environmental-social-governance/2019/06/climate-disclosure-assesment.pdf.
[115] Wigglesworth, R., (2020, January), "State Street vows to turn up the heat on ESG standards." *Financial Times*. Retrieved at https://www.ft.com/content/cb1e2684-4152-11ea-a047-eae9bd51ceba.
[116] Kerber, R., (2019, February), "Big U.S. pension funds ask electric utilities for de-carbonization plans." *Reuters*. Retrieved at https://www.reuters.com/article/us-usa-utilities-investors/big-u-s-pension-funds-ask-electric-utilities-for-decarbonization-plans-idUSKCN1QH27D.
[117] Company Response to Vote Solar Data Request 1-24.

Q. Please define climate-related economic risks and summarize how they are expected to impact the electric utilities industry.

A. Climate-related economic risks are divided into technology risks and market risk. Technology risks refer to exposure of a firm's assets and operations from disruptive or innovative technologies that develop and mature through societal responses to climate change. In the electric utility sector, the principal technology risk is that of low- or no-carbon generation technologies like wind and solar displacing conventional generation and therefore "stranding" those assets' ability to recover their capital investment. As an example, NIPSCO and Tri-State recently recognized and corrected for climate-related technology risk by committing to shut down legacy coal assets in favor of a shift to renewables.[118] Analyses sponsored by both companies demonstrate the prudency of this decision: it will save money for these companies and ultimately for ratepayers.

Market risk refers generally to risks created by markets adapting to climate change. These risks are subtle and complex, especially in the energy sector, but one illustration might be customers opting out of typical utility service to pursue renewable options. Because of this complexity, this testimony will not analyze or evaluate market risks.

---

[118] McMahon, J., (2019, July), "In Conservative Indiana, Utility Chooses Renewables Over Gas As It Retires Coal Early." *Forbes*. Retrieved at: https://www.forbes.com/sites/jeffmcmahon/2019/07/02/mike-pences-indiana-chooses-renewables-over-gas-as-it-retires-coal-early/#7cb3265243b4;
Best, A., (2020, January), "Tri-State CEO says wholesaler's clean energy transition will pay dividends." *Energy News Network*. Retrieved at: https://energynews.us/2020/01/21/west/tri-state-ceo-says-wholesalers-clean-energy-transition-will-pay-dividends/.

Analysts have focused particular attention on technology risks for utilities operating legacy coal assets. One analysis by Energy Innovation found that by 2025, new wind and solar would be less expensive than running 70percent of all coal assets in the United States.[119] Subsequent studies from Morgan Stanley and Moody's have corroborated those results.[120]

The same principle applies to gas generation. A study from the Rocky Mountain Institute found that a portfolio of clean energy technologies would deliver the same energy at a lower cost than 90 percent of gas-fired power plant capacity. The report ends with a recommendation to state utility regulators: "[a]ccount for the significant risk that uneconomic gas generation will increase customer rates."[121]

Q. How might climate-related economic risks affect the Company specifically?

A. The same national trends regarding coal and gas assets are also relevant in North Carolina. For coal assets, "[t]he trend is so strong that it is hard to imagine Southeastern utilities not relying heavily on solar and complementary load shifting resources to replace the coal and save customers money."[122]

---

[119] Gimon, E., O'Boyle, M., Clack, Ct., McKee, S., (2019, March), The Coal Cost Crossover: Economic Viability of Existing Coal Compared to New Local Wind and Solar Resources. *Energy Innovation* and *Vibrant Clean Energy*. Retrieved at https://energyinnovation.org/wp-content/uploads/2019/03/Coal-Cost-Crossover_Energy-Innovation_VCE_FINAL.pdf.

[120] Smyth, J., (2019, December), "Financial analysts expect decarbonization will benefit utility ratepayers and shareholders." *Energy and Policy Institute.* Retrieved at: https://www.energyandpolicy.org/financial-analysts-expect-decarbonization-will-benefit-utility-ratepayers-and-shareholders/.

[121] Teplin, C., Dyson, M., Engel, A., Glazer, G., (2019), The Growing Market for Clean Energy Portfolios: Economic Opportunities for a Shift from New Gas-Fired Generation to Clean Energy Across the United States Electricity Industry. *Rocky Mountain Institute*, https://rmi.org/cep-reports.

[122] Gimon, et al.

In many cases, multiple climate-related trends can come together to cause an economic shift—a shift that the Duke Energy is already acknowledging. In describing the forces that led to the Company's decision to retire several coal plants, the Duke Energy Carolinas cites the following trends:

- On-going price declines and efficiency improvements of potential replacement including CTs, renewables and energy storage alternatives;
- Potential for increasing regulatory drivers including the release of the NC DEQ Climate Plan, NC Executive Order 80, and NCUC 2018 IRP Order requiring evaluation of accelerated coal plant retirements in future IRPs; and
- Potential for federal or state CO_2 legislation.[123]

Credit rating analysts are paying special attention to the Company's climate-related economic risks. Moody's 2019 credit rating for the Company found that "[DEC] has a moderate carbon transition risk within the regulated utility sector because, as an integrated utility, its generation ownership places it at a higher risk profile than transmission and distribution companies."[124]

Informally, Duke Energy Corporation officials have responded to the threat posed by renewables to gas generation and the inconsistency of gas generation with a carbon goal by proposing shorter depreciation periods for new gas generation—

[123] Duke Energy Carolinas Response to Tech Customers Data Request 3-26, Docket No. E-7, Sub 1214.
[124] Moody's Investor Service, (2019, March), "Duke Energy Progress, LLC." Retrieved at Company's Response to Vote Solar Data Request 1-24.

including periods as short as 15 years.[125] The necessary result of a shorter operating life, of course, is faster recovery of capital investment, driving higher annual costs and a higher average cost per kilowatt-hour. Duke Energy's potential decision to accelerate depreciation and increase ratepayer costs for these plants is, in and of itself, an example of climate-related risks increasing costs for ratepayers. These higher costs also increase the likelihood that renewables might be a more cost-effective option.

The risks of distributed generation referred to in Witness Hevert's testimony are examples of technology risk.[126] Hevert's testimony does not, however, acknowledge the benefits of customer-owned generation, which reduces the Company's exposure to climate-related risks as renewables come onto the grid. It is clear that distributed energy resources offer resilience benefits, and actors at the state and federal level are developing increasingly precise methods for valuing resiliency.[127]

---

[125] Morehouse, C., (2019, October), Duke VP likens gas plant buildout strategy to 15-year home mortgage on path to zero carbon." *Utility Dive*. Retrieved at https://www.utilitydive.com/news/duke-vp-likens-gas-plant-buildout-strategy-to-15-year-home-mortgage-on-path/565328/.
[126] Direct Testimony of Robert B. Hevert ("Hevert Direct"), p. 48, l. 12-18.
[127] National Association of Regulatory Utility Commissioners, (2019, April). The Value of Resilience for Distributed Energy Resources: An Overview of Current Analytical Practices. Retrieved at: https://pubs.naruc.org/pub/531AD059-9CC0-BAF6-127B-99BCB5F02198.

E. Regulatory Risks

Q. Please define climate-related regulatory risks and summarize how they are expected to impact the electric utilities industry.

A. Climate-related regulatory risks refer to negative impacts on a given firm due to policy changes that either seek to constrain actions that would exacerbate climate change, or incentivize actions that would ameliorate its impacts. Greenhouse gas emissions, for example, have until recently been an inextricable part of the electric utility industry, so a clear regulatory risk to electric utilities is constraints on these emissions or requirements to procure energy from renewable sources.

The United Nations Principles for Responsible Investment ("UNPRI") uses a framework called the Inevitable Policy Response ("IPR") to understand regulatory risk. This framework uses a more probabilistic model of climate policy: Instead of using a scenario-based "climate policy" and "no climate policy" approach, IPR asks when such a policy might be put in place. Using this framework, UNPRI found that a two-degree policy scenario (i.e., a scenario assuming an increase of two degrees Celsius in world temperatures) would on average lead to a 4 percent decrease in valuation for electric utilities. It also found electric utilities to have the widest variation in valuation adjustment by firm of any sector analyzed, with some firms decreasing in valuation by over 30 percent, and others increasing by the same margin.[128]

[128] UN Principles for Responsible Investment (2019), Impacts of the Inevitable Policy Response on Equity Markets. Retrieved at https://www.unpri.org/download?ac=9857.

Financial observers are paying close attention to firms' policy, legal, and regulatory risks and their prudent management. S&P's lookback on the role of environment and climate factors in their credit ratings found that physical risks were the most cited type of risk, but policy risks were a close second—and the two of them were drivers of S&P rating decisions more than all other listed climate-related risks and opportunities combined.[129]

Q. How might climate-related regulatory risks affect the Company specifically?

A. Regulation of greenhouse gas emissions at the state or federal level would directly impact the Company's operations and planning. As the single largest owner of coal and gas generation capacity in 2018[130] and largest carbon emitter in the nation among electric power producers in 2019, [131] Duke Energy Corporation would likely face a substantial regulatory burden from passage of an emissions reduction scheme at any level. The share of generation capacity served by conventional generation (coal and gas) for the Company is approximately 50 percent, and according to its integrated resource plan ("IRP") that figure will in fact increase to 60 percent through 2034 (although the share of conventional generation will shift from coal to gas).[132]

---

[129] Williams & Wilkins.
[130] Dholakia, G., (2019, December). Duke Energy tops operating US coal, gas capacity ownership. *S&P Global.* Retrieved at: https://www.spglobal.com/marketintelligence/en/news-insights/trending/w4jueneo16bxoihgp-fhya2.
[131] Van Atten, C., Saha, A., Hellgren, L., Langlois, T, (2019, June), Benchmarking Air Emissions of the 100 Largest Electric Power Producers in the United States. *MJ Bradley.* Retrieved at https://www.mjbradley.com/sites/default/files/Presentation_of_Results_2019.pdf.
[132] Duke Energy Progress (2019, September), Integrated Resource Plan: Update Report. pp. 9, Chart 2-A. Retrieved at: https://starw1.ncuc.net/NCUC/ViewFile.aspx?Id=7f4b3176-95d8-425d-a36b-390e1e57a175.

Speculating on the likelihood of a federal climate policy is outside of the scope of this testimony, but recent developments at the state level, as discussed more in-depth in Section 4, suggest an increasing level of ambition by the states regarding greenhouse gas policy.

Preparation for uncertain outcomes is key to risk management and particularly apt for understanding regulatory risks. The Company, for example, already orients its planning around a tax on emissions beginning in 2025.[133] The level of tax used in the Company's planning starts at one-eighth the level of the tax proposed in September 2019 by the Climate Leadership Council, which counts Exelon, ExxonMobil, BP, Shell, and Vistra as members.[134]

[133] Company Response to Vote Solar Data Request 1-27.
[134] Climate Leadership Council (2019, September). Our Plan. Retrieved at https://clcouncil.org/our-plan/.

F. Reputational Risks

Q. Please define climate-related reputational risks and summarize how they are expected to impact the electric utilities industry.

A. Climate-related reputational risks represent those tied to "changing customer or community perceptions of an organization's contribution to or detraction from the transition to a lower-carbon economy."[135] Electric utilities risk damage to their reputation if their response to climate change is out of line with stakeholders' expectations, from inadequate storm repair to continued investment in conventional electric generation technology without emissions controls.

Increasingly, electric utilities are managing their reputational risk by making commitments or announcements to decrease their greenhouse gas emissions. These announcements may increase goodwill, and potentially decrease the likelihood of new regulatory regimes that might mandate a decrease in emissions. At the same time, announcements in and of themselves may introduce reputational risks if firms do not appear to be honoring their public commitments.

Q. How might climate-related reputational risks affect the Company specifically?

A. A recent poll found North Carolina voters favor action to reduce carbon emissions,[136] and Duke Energy Corporation's recent shareholder resolutions show

---

[135] TCFD Recommendations, p. 6.
[136] Global Strategy Group (2019, October). Regulating North Carolina's Carbon Pollution: Research Findings Prepared by Global Strategy Group for EDF Action. P. 6. Retrieved at https://www.edfaction.org/sites/edactionfund.org/files/u141/nc_carbon_limits_survey_analysis.pdf.

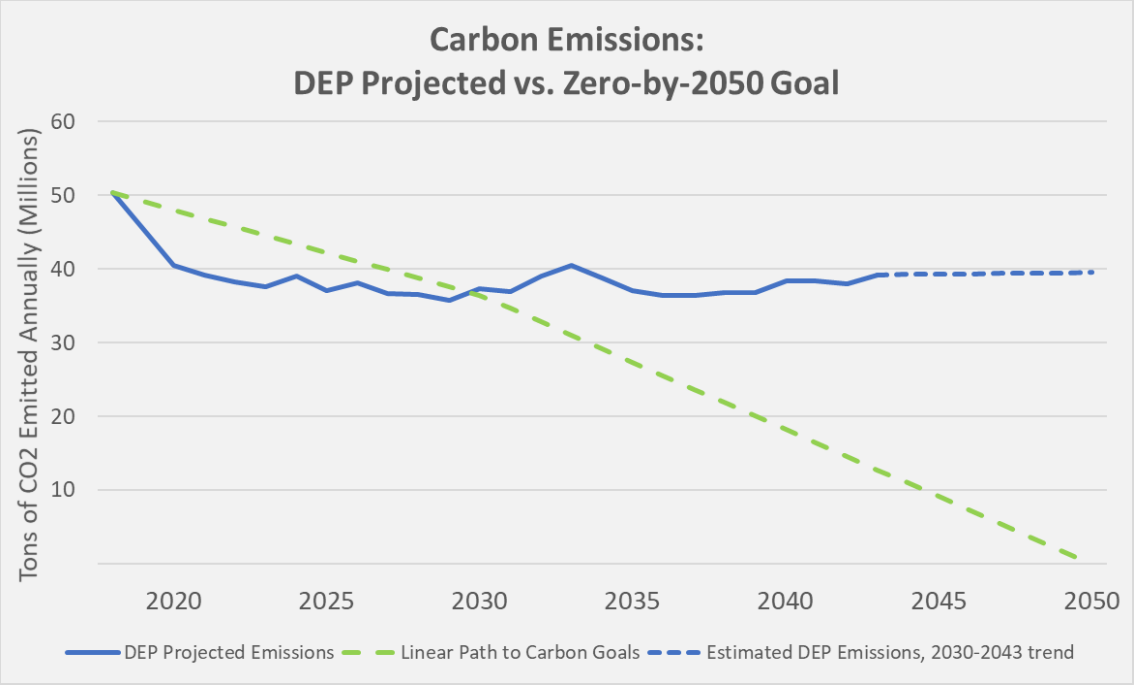
similar sentiment among the Company's shareholders.[137] As long as the Company's operations continue to emit carbon, the Company will likely be exposed to reputational risks. The Company also faces scrutiny due to ongoing coal ash remediation issues.[138]

Duke Energy Corporation announced its non-binding net-zero-by-2050 goal on September 17, 2019, establishing its presence in a growing cohort of large utility holding companies with ambitious carbon goals.[139] As discussed above, carbon announcements such as this one may mitigate some reputational risks but exacerbate others. Although the Corporation's goal is enterprise-wide, the Company would presumably need to follow a similar emissions path for the Corporation to meet its goals. However, the Company's projections in this case do not show that the Company will achieve them. Figure 3 shows the Company's projected carbon emissions as consistent with the higher carbon emissions contemplated in its IRP, in millions of tons of CO_2 emitted annually, compared to the emissions pathway needed to achieve the Corporation's goals for DEC.

---

[137] Duke Energy (2019). Shareholder Proposals. Retrieved at: https://www.duke-energy.com/proxy/_/media/pdfs/our-company/investors/proxy/shareholder-proposal.pdf?la=en.
[138] Sorg, L. (2020, January). DEQ, Duke Energy, community groups strike deal on largest coal ash cleanup in US. *NC Policy Watch.* Retrieved at: http://www.ncpolicywatch.com/2020/01/02/deq-duke-energy-community-groups-strike-deal-on-largest-coal-ash-cleanup-in-us/.
[139] Gearino, D.

Figure 3: DEP Projected Emissions versus Pathway Consistent with Corporate Goals[140]



Thus, the emissions projected for purposes of this case do not comply with stated goals. Even worse, these projected carbon emissions are used to determine the value of carbon reductions created by the Grid Improvement Plan in the Company's cost-benefit analyses.[141] The result of these two decisions is that the Grid Improvement Plan's cost-benefit analysis is "taking credit" for carbon reduction that would not occur if the Company followed a path to achieving its carbon goal. The clear disconnect between the Corporation's public communications and the Company's statements in this proceeding represents a substantial reputational risk.

[140] Graph compiled using projected annual CO2 emissions from Company response to Vote Solar Data Request 1-27 and Duke Energy Corporation's September 17, 2019 net-zero carbon emissions announcement.
[141] Oliver Direct, Ex. 7.

G. Commission Consideration of Climate Risk

Q. Based on your review of the literature and financial statements, are these risks material?

A. Yes. Based on a review of the available literature, the Company's filings, and the findings shown above, we assess climate-related risks are material to any electric utility's investments, costs, and operations, and they are specifically material to the Company in this proceeding.

Q. Does this testimony represent a comprehensive evaluation of the company's vulnerability to climate risks?

A. No. A comprehensive assessment of the Company's climate-related risks and the opportunities available in addressing those risks would require more operational data than is available to the public, consensus from a range of stakeholders, and a substantial analytical burden. As examples, the New York Storm Hardening & Resiliency Collaborative and Con Edison's Climate Change Vulnerability Study represent best practices in field of climate-related physical risks.

Q. How might the Commission view the TCFD climate-related risk framework?

A. As a regulator, the Commission has an important role to play in ensuring emergent risks are managed. (In fact, World Bank case studies on utility climate adaptation find that regulatory support is invaluable in incenting firms to act on long-term

risks.)[142] At a minimum, the Commission may want to ensure that firms it regulates are aware of these risks and that its expectations of management are clear. The Commission could then support firms in meeting those expectations through information sharing and regulatory innovation. The Commission could use the TCFD framework as a tool-kit for categorizing risks and setting expectations for prudent management.

Q. Is the management of climate-related risks a critical component for keeping rates low for customers?

A. Yes. Managing climate-related risks is and will be integral to minimizing the costs imposed on customers associated with the impacts of climate change and ensuring the provision of safe and adequate utility service. Like any other business risk, the prudent management of climate risk will minimize those cost to the Company and, therefore, to customers.

Unlike other business risks, however, customers have their own direct exposure to climate-related risks. Proactive action is necessary to ensure that customers are best protected from climate-related risks and that they get reliable service when they need it most. Managing climate-related risks is in the interest of the Company and the public, a proposition that the Company seems to endorse based on its discovery responses.[143]

---

[142] Audinet, P. (2014). Climate Risk Management Approaches in the Electricity Sector. *World Bank Group*. Retrieved at https://climate-adapt.eea.europa.eu/metadata/publications/climate-risk-management-approaches-in-the-electricity-sector-lessons-from-early-adapters.

[143] Company Response to Vote Solar Data Request 1-20.

Q. If the Commission or the Company adopted the climate-related risk framework, would the Company be expected to undertake major changes in its operations immediately?

A. No. Climate-related risks would represent an additional input to the Company's existing decision-making process. Decision-makers at the Company, and the associated oversight by regulators, would still weigh risks and opportunities across multiple dimensions when making business decisions.

Q. Do climate-related risks warrant considering an increase to the Company's allowed return on equity?

A. No. First, climate-related risks may be described as "asymmetrical" risks—that is, prudent management may avoid a decline in return on equity, but is less likely to result in a higher return on equity. Experts at the Brattle Group have noted that these risks are not suitable for addressing through a simple risk premium.[144] Second, exposure of the Company to these risks is at least partially dependent on the actions it takes in the operation and planning of its enterprise. Therefore, the risk for the Company is present only to the extent that it continues to pursue business decisions that ignore that risk. The same experts at the Brattle group note that "[i]t often may be easier to mitigate a risk directly rather than to measure its marginal effect on the cost of capital."[145] The California Public Utilities

---

[144] Brattle Group, (2017), Compensating Risk in Evolving Utility Business Models. Pp. 14. Retrieved at https://brattlefiles.blob.core.windows.net/files/7264_compensating_risk_in_evolving_utility_business_models_august_2017.pdf.
[145] *Ibid.*, p. 16.

Commission addressed a similar issue with regard to wildfire risk and concluded: "The standard set in *Bluefield* and *Hope** is that investor-owned utilities should not be rewarded with an ROE that is inflated due to imprudent actions."[146]

H. Emerging Best Practices for Managing Climate-Related Risks

Q. Based on your review of the climate-related risk literature, have you identified best practices for managing climate-related risks?

A. Yes. The Task Force for Climate-Related Financial Disclosures recommends that firms exposed to climate-related risks and opportunities embed their climate strategy into the core of their business practices, then disclose to investors how they do so. TCFD recommends that accountability for climate strategy be embedded into the firm's board and management governance structure; that the firm's strategy at all levels be informed by climate risks and scenario-based planning around accelerated transitions; that risk management at all levels integrate climate-related risks; and that the firm's reported metrics and targets include exposure to climate risks and total carbon emissions.[147] As a non-financial sector with special exposure to physical and transition risks, TCFD recommends additional disclosures for

---

* *Bluefield* and *Hope* refers to *Bluefield Water Works and Improvement Co. v. Public Service Commission of West Virginia ("Bluefield")*, 262 U.S. 679 (1923) and *Federal Power Commission et al v. Hope Natural Gas Co. ("Hope")*, 320 U.S. 591, 603 (1944). These two cases set the precedent for a regulated utility's right to earn a reasonable rate of return on investments.

[146] California Public Utilities Commission, (2019, December). Decision on Test Year 2020 Cost of Capital for the Major Energy Companies. Application 19-04-014 et al. p. 36 (italics added). Retrieved at: http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M322/K633/322633896.PDF.

[147] Task Force on Climate-Related Financial Disclosures, (2017). Final Report: Recommendations of the Task Force on Climate-Related Financial Disclosures. Retrieved at: https://www.fsb-tcfd.org/wp-content/uploads/2017/06/FINAL-2017-TCFD-Report-11052018.pdf.

electric utilities, including disclosure of internal carbon prices and capital expenditures on low-carbon generation assets.[148]

Q. Do climate-related risks apply only to the Company's generation assets?

A. No. In fact, climate-related risks span the whole of the Company's operations, from generation to consumer programs. Investments within the Grid Improvement Plan, for instance, are subject to climate-related physical risks (as we describe in Section 5). To the extent that the Grid Improvement Plan enables a transition to a de-carbonized and resilient grid, the investments also have implications for the Company's financial, economic, regulatory, and reputational risks.

Q. How have electric utilities responded to the onset of climate-related physical risks?

A. Even as early as 2014, electric utilities understood the need for guidance and recommendations on resilience to climate-related physical risks.[149] In 2015, the US Department of Energy convened the *Partnership for Energy Sector Climate Resilience*, a collaborative of 19 electric utilities supported by DOE in developing best practices for understanding climate-related vulnerabilities and establishing climate resilience.[150]

---

[148] Task Force on Climate-Related Financial Disclosures, (2017). Implementing the Recommendations of the Task Force on Climate-Related Financial Disclosures. Retrieved at: https://www.fsb-tcfd.org/wp-content/uploads/2017/12/FINAL-TCFD-Annex-Amended-121517.pdf.

[149] Edison Electric Institute, (2014, March). *Before and After the Storm: A compilation of recent studies, programs, and policies related to storm hardening and resiliency.* Retrieved at https://www.eei.org/issuesandpolicy/electricreliability/mutualassistance/Documents/BeforeandAftertheStorm.pdf.

[150] US Department of Energy, (2016, September). *Climate Change and the Electricity Sector: Guide for Climate Change Resilience Planning.* Retrieved at:

The partnership's *Guide for Climate Change Resilience Planning* describes a two-step process for resiliency. First, utilities should conduct a vulnerability assessment to understand their exposure and sensitivity to climate risks. Second, with the vulnerability assessment as an input, utilities can create a resilience plan that responds to those identified vulnerabilities, reviewing a wide range of resilience measures and using a systematic cost-benefit methodology that includes appropriate co-benefits.[151] This two-step process ensures that resiliency measures are designed with granular, up-to-date, high-quality information on vulnerabilities; use of a systematic cost-benefit analysis ensures that all resilience measures are fairly evaluated.

Q. Are there any examples or case studies of that would illustrate the implementation of best practices in climate-informed planning?

A. Yes. The work of the New York Storm Hardening & Resiliency Collaborative (consisting of Con Edison, Department of Public Service Staff, the City of New York, several environmental NGOs, and others) that emerged out of a settlement in Con Edison's 2013 rate case represents a good example of best practice in the industry. In its order approving Con Edison and public staff's settlement in the 2013 rate case, the New York Public Service Commission found that "[t]he Con Edison Resiliency Collaborative has provided a valuable focus for innovative approaches

---

https://toolkit.climate.gov/sites/default/files/Climate%20Change%20and%20the%20Electricity%20Sector%20Guide%20for%20Climate%20Change%20Resilience%20Planning%20September%202016_0.pdf.

[151] *Ibid., p. 71.*

to the 21st century challenges to the utility system, and its work should continue, in public where appropriate."[152] The Collaborative reviewed Con Edison's proposed storm hardening investments, and also created a framework for climate vulnerability assessment, examined the applicability of non-wires resiliency strategies, and developed a robust cost-benefit analysis.[153]

Con Edison's complete climate risk vulnerability study was published in December 2019. The vulnerability study presents a comprehensive, forward-looking assessment of physical risks of climate change (including, for example, risks to workers due to higher frequency and intensity of heat waves) through an integrated framework of physical climate impacts, risks to assets and operations, and potential resilient solutions.[154] The study's use of the best available climate science—analyzed through a transparent, risk-based approach and considering a wide range of resilience solutions over the transmission and distribution system—represents a step forward for the industry.[155] The follow-up Climate Change Resilience Plan is due from Con Edison in December 2020.

---

[152] Case 13-E-0030 *et al.;* Con Edison's Electric, Gas, and Stream Rates -- Order Approving Electric, Gas, and Steam Rate Plans in Accord with Joint Proposal (2014, February). State of New York Public Service Commission. Retrieved at: https://climate.law.columbia.edu/sites/default/files/content/docs/Final-Order-2014-02-21%20(1).pdf.

[153] Case 13-E-0030 *et al,:* Consolidated Edison Company of New York, Storm Hardening and Resiliency Collaborative Phase Three Report. (2015, September).

[154] ConEdison, (2019, December). Climate Change Vulnerability Study. Retrieved at https://www.coned.com/-/media/files/coned/documents/our-energy-future/our-energy-projects/climate-change-resiliency-plan/climate-change-vulnerability-study.pdf.

[155] M.J. Bradley & Associates, (2019, December). Key Considerations for Electric Sector Climate Resilience Policy and Investments. Retrieved at https://www.mjbradley.com/sites/default/files/MJB%26A_KeyConsiderationsforClimateResiliencePolicyandInvestment.pdf.

Q. Based on the material you have reviewed, have you identified best practices for climate resilience?

A. Yes, with one caveat. First and foremost, climate-related risk management in electric utility distribution investments to date has focused exclusively on climate-related physical risks, without integrating financial, economic, regulatory, or reputational risks into risk assessment. Among the many co-benefits that enabling renewable distributed energy resources provides, for example, is that they provide a hedge to a given firm's regulatory and reputational risk.

Based on our review of emerging climate resilience plans, climate resilience plans proceed through two steps:

- **Forward-looking, high-quality vulnerability assessment.** The U.S. Department of Energy's North American Energy Resilience Model urges utilities to "transition from the current reactive state-of-practice to a new energy planning and operations paradigm in which we proactively anticipate [damage], predict associated outages, and recommend optimal mitigation strategies."[156] Utilities need to understand their exposure and vulnerability to climate-related risks before they can cost-effectively address them. Climate resilience plans undergo vulnerability studies that look at a wide variety of risks, integrate the most up-to-date scientific work on the matter, and project potential impacts of these risks

[156] Con Edison (2019, December). Climate Change Vulnerability Study. P. 63.

on specific assets in the future. High-quality vulnerability assessments both identify where the need for intervention is the greatest and provide a value "cost" input into the screen for solutions.

- **Informed, inclusive, and fair solution selection.** The process for identifying and selecting solutions should be robust, to ensure a true "no-regrets" approach. Solutions screens should be informed by the utility's vulnerability assessment, and they should include a stakeholder-informed wide range of traditional and non-traditional solutions. Finally, utilities and stakeholders should work together and agree on a cost-benefit methodology before considering any single intervention.

These steps are supported, in an optimal scenario, by collaboration with stakeholders throughout the process, including while setting a scope and goals for the climate resilience plan. Climate resilience plans are also iterative; as technology develops and vulnerabilities change, resilience plans must be updated.

4. DEVELOPMENTS IN NORTH CAROLINA'S BUSINESS AND POLICY ENVIRONMENT SINCE THE COMPANY'S MOST RECENT RATE CASE

Q. What policy developments, within North Carolina or with Duke Energy Corporation, have occurred since the Company filed its last rate case?

A. Three trends since 2017 are relevant to the Company's climate-related risks. First, state executive and regulatory agencies have announced or commenced new programs with implications for the state's electric utility industry. Second, Duke Energy Corporation made its non-binding carbon reduction goal announcement in September 2019. Third, ongoing, collaborative processes in North Carolina are creating state-of-the-art climate vulnerability data with implications for designing a more resilient electric grid for North Carolina.

Q. Please describe Executive Order 80 ("EO 80").

A. In order to "build resilient communities and develop strategies to mitigate and prepare for climate-related impacts in North Carolina," Governor Cooper's Executive Order 80 pledges the state to, among other things, reduce statewide emissions by 40 percent by 2025.[157] Importantly, the Executive Order directs several executive agencies to develop plans for reducing emissions from the energy and transportation sectors. An Interagency Council convened by the Executive Order may also recommend new and updated goals and actions to meaningfully address climate change. Executive Order 80 is provided as Exhibit JMV-TF-6.

[157] State of North Carolina Exec. Order No. 80, (2018, October).

Q. Please describe the Clean Energy Plan ("CEP").

A. The Clean Energy Plan is a collaborative, stakeholder-driven plan to "foster and encourage the utilization of clean energy resources," developed by the Department of Environmental Quality as directed by Executive Order 80.[158] After a year of conducting workshops and soliciting input from a diverse range of stakeholders, DEQ published its complete CEP in October 2019. The CEP sets ambitious goals for the energy sector, then presents several pathways to work toward those goals alongside short- and long-term actions over the next five years to move along those pathways. While the CEP itself is a complex document with six strategies and over 35 distinct recommendations, the key features of the Plan are summarized in Table 2.

[158] *Ibid.*

Table 2. Key Features of the Clean Energy Plan[159]

Goals	Key Recommendations	Relevant Stakeholders		
Reduce electric power sector emissions by 70% by 2030 and to net-zero by 2050;	Develop carbon reduction policy designs for retiring uneconomic coal; other market-based clean energy policy options	Legislature	NCUC	Governor's Office
Foster long-term energy affordability and price stability for residents and businesses;	Better align utility incentives with public interest, grid needs, and state policy.	State Agencies	Investor-Owned Utilities	Co-ops / Public Utilities
Accelerate clean energy innovation and deployment to create economic opportunities across the state	Modernize the grid to support clean energy resource adoption, resilience, other public interests.	Local Gvmnts	Academia	Business

Q. What are the implications of Executive Order 80 and the Clean Energy Plan on the Company's climate-related risk?

A. EO 80 and the CEP provide a meaningful signal for North Carolina regulatory agencies. They establish the procurement of clean energy and reduction of statewide emissions as a public policy objective and empower regulatory agencies to act in furtherance of that objective.

[159] North Carolina Department of Environmental Quality, (2019, October), North Carolina Clean Energy Plan: Transitioning to a 21st Century Electricity System. Retrieved at: https://files.nc.gov/governor/documents/files/NC_Clean_Energy_Plan_OCT_2019_.pdf.

It is important to note that neither EO 80 nor the CEP has binding, legal enforceability for its goals. Nevertheless, the two actions may be seen as a directional signal for the future of climate policy in North Carolina.

The CEP also invites investor-owned utilities to act as partners in implementation. While it may be reasonable to see incipient carbon regulations as a regulatory risk, the Company's participation may represent a regulatory opportunity. Strategies B and C of the CEP seek to align interests between stakeholders on the 21st century utility business model and the future of utility system planning. By collaborating on innovative new regulatory mechanisms with public stakeholders, the Company could actually reduce regulatory lag and risks of other regulatory impacts to business operations.

DEQ's responsibility to develop a climate risk assessment and support communities in developing resilience also has implications to the Company. To the extent that electric system resiliency is a component of community resiliency, the Company will necessarily be a relevant party in communities' adaptation and resiliency plans.

Finally, EO 80 empowers the interagency council to recommend updated goals to meaningfully address climate change as appropriate. Therefore, while currently ongoing agency work in support of Executive Order 80 may already add climate-related regulatory risk and opportunities, there is potential for on-going long-term policy engagement between the Company and North Carolina executive agencies.

Q. Are there any public statements that the Company or its holding corporation has made that might impact the Commission's view of the Company's application?

A. Duke Energy Corporation published its non-binding net-zero carbon announcement on September 17, 2019.[160] In the announcement, the corporation projects it will decrease carbon emissions by 50 percent by 2030, with a goal of net-zero carbon emissions by 2050.

Q. What are the implications of Duke Energy Corporation's carbon announcement on the Company's climate-related risk?

A. While the Company is not explicitly required to meet Duke Energy Corporation's goals, the goal's ambitious timeline all but requires that the Company follow a similar emissions pathway if Duke Energy Corporation is to achieve its goals. As briefly discussed above, the carbon announcement has an impact on the Company's risk profile; while the urgency and regulatory burden of a regulatory or legislative mandate may be decreased by Duke Energy Corporation's commitment, Duke is also liable to sustain reputational damage and potential regulatory blowback if it is perceived to be missing its goals.

[160] "Duke Energy aims to achieve net-zero carbon emissions by 2050." (2019, September), *Duke Energy News Center.* Retrieved at https://news.duke-energy.com/releases/duke-energy-aims-to-achieve-net-zero-carbon-emissions-by-2050.

Q. Are there ongoing processes to understand climate vulnerability and resiliency to infrastructure in North Carolina?

A. Yes. Work is currently underway within two projects related to both infrastructure and climate change in North Carolina, the results of which will be relevant for the Company's business operations. First, as directed by EO 80, the North Carolina Department of Environmental Quality is currently developing a North Carolina Risk Assessment and Resiliency Plan that will specifically address built infrastructure. As a part of the Risk Assessment and Resiliency Plan, the North Carolina Institute for Climate Research developed a high-quality climate science report that describes the physical impacts of climate change on North Carolina.[161]

Second, in part thanks to a grant from the U.S. Department of Energy, the North Carolina Clean Energy Technology Center, NC Department of Environmental Quality, and UNC Charlotte's Energy Production Infrastructure Center are participating in a two-year joint research project called "Planning an Affordable, Resilient, and Sustainable Grid in North Carolina."[162] Among other things, the project will take stakeholder input, assess new metrics for evaluating grid resiliency, and "enable a more decentralized, resilient grid." Both of these processes represent opportunities for the Company to meaningfully engage with

[161] Kunkel, K., & Easterling, D.
[162] N.C. Clean Energy Technology Center (2020, January). Planning an Affordable, Resilient, and Sustainable Grid in North Carolina. Retrieved at: https://nccleantech.ncsu.edu/2020/01/29/planning-an-affordable-resilient-and-sustainable-grid-in-north-carolina-2/.

stakeholders who are generating meaningful, relevant information for a resilient, 21st century grid in North Carolina.

5. REVIEW OF THE GRID IMPROVEMENT PLAN IN LIGHT OF THESE RISKS

Q. What portions of the Company's application in this case are you addressing in your testimony?

A. As noted earlier, our review of the Company's application focuses on the Company's proposed Grid Improvement Plan ("GIP"). We review the Plan in light of grid modernization best practices, Vote Solar's participation in the stakeholder process, the emergence of climate-related risks, and recent policy development in North Carolina since the Company's last rate case.

Q. Does your testimony present a program-by-program review of the GIP?

A. No. We look to North Carolina Justice Center, North Carolina Housing Coalition, Natural Resources Defense Council, North Carolina Sustainable Energy Association, and Southern Alliance for Clean Energy Witnesses Alvarez and Stephens for a granular review of the individual programs that form the GIP. The review in this testimony will focus more on the process by which the Company selected and scoped these programs and the broader implications for the development of the grid, rather than the technical details of each given program.

Q. What are the criteria that you would apply to a well-designed grid modernization plan in the context of this rate case?

A. While they represent an incomplete justification for any grid investment program, the "Megatrends" described in Witness Oliver's testimony succinctly describe the shifting dynamics of the electric grid. In our view, the Megatrends viewed together, however, do not provide justification for a slate of distribution projects; rather, they

underscore the importance of the Company getting its investments in the grid right. The 21st century grid should be resilient to climate-related physical risks, but at the same time it must enable a more dynamic, communicative, and distributed energy system. And, being critical infrastructure for North Carolina, it must be reactive to ongoing physical, regulatory, and technical developments in the state. It's for this reason that the Department of Environmental Quality combines "grid modernization" and "grid resilience and flexibility" together in its Clean Energy Plan.[163]

The GIP, then, must play multiple roles for the North Carolina electric system. In the previous sections of this testimony, we have explored best practices for grid modernization and climate resilience. We re-produce those best practices, in no specific order, in Table 3 below:

Table 3: Best Practices for Climate Resilience and Grid Modernization

Climate Resilience	Grid Modernization
Forward-looking, high quality vulnerability assessment	Clear, Measurable Goals
	Integrated Distribution Planning
Informed, inclusive, and fair solutions selection	Stakeholder Engagement
	Cost/benefit analysis

[163] North Carolina Department of Environmental Quality (2019, October). North Carolina Clean Energy Plan. P. 82. Retrieved at https://files.nc.gov/ncdeq/climate-change/clean-energy-plan/NC_Clean_Energy_Plan_OCT_2019_.pdf.

A. Grid Modernization

Q. Please review the Grid Improvement Plan against grid modernization best practices.

A. Our review of the GIP against grid modernization best practices is summarized in Table 4, below:

Table 4. Grid Improvement Plan's performance versus Grid Modernization Best Practices

Best Practice	Grid Improvement Plan performance	Implications
Clear, measurable goals	Plan presents "Megatrends" but no measurable goals.	Unclear what 'success' looks like; no way to hold Company accountable; unclear benefits for ratepayers.
Integrated Distribution Planning	Plan will develop capability, but Phase I will not use it.	Plan does not adequately assess potential of NWAs; potential for sub-optimal investment.
Stakeholder Engagement	Company conducted several workshops; use of stakeholder input is not evident from application or stakeholder process.	Plan is less likely to incorporate a wide range of perspectives and value propositions
Cost-benefit analysis	Company does use cost-benefit analysis; no judgment of cost-benefit analysis in this testimony	No implications evaluated in this testimony

Q. Please explain the assessment of the GIP and its implications in Table 4.

A. **Clear, Measurable Goals:** As a $1.3 billion incremental investment in the grid with inevitable ratepayer cost implications, the GIP must demonstrate that the

benefit provided to customers is worth the cost. The best way to do that is through clear, measurable goals and commitment to outcomes that benefit all stakeholders. These keep expectations for all parties aligned, and quantified goals allow stakeholders and regulators to track the Company's progress throughout the plan.

In lieu of stated goals, the Company offers its Megatrends[164] and Implications.[165] The Megatrends represent actual trends that are playing out on the grid, but we find their use alongside the Implications in this case to justify the Grid Improvement Plan to be inappropriate. The Company's analysis of the Megatrends provides no systematic, quantitative understanding of their impacts on the grid—thereby making effective "baselining" impossible. Notwithstanding the lack of an appropriate baseline, the Company does not set any goals for the Plan or metrics by which the Company, regulators, stakeholders, or ratepayers could assess the progress of the GIP or hold the Company accountable. The Company declines to demonstrate how any given project within the Plan relates to the Megatrends.[166] In light of the Plan's similarity to Power/Forward, it is difficult to ascertain how the development of the GIP was affected in any way by the Megatrends concept. In this way, the Megatrends may be characterized as *post hoc* justification for Power/Forward projects, rather than a representation of discrete problems that must be addressed with targeted solutions.

---

[164] Oliver, Ex. 2.
[165] Oliver, Ex. 3.
[166] Company Response to Vote Solar Data Request 1-21.

Integrated Distribution Planning ("IDP"): Simply put, integrated distribution planning is the element that enables utilities to "modernize" their grid. The analytical capability that is a hallmark of IDP processes allows electric utilities to understand grid operations at a more granular level, work with the distribution gird as an integrated system, and as a result precisely take advantage of distributed resources and place grid modernization solutions. The Company has proposed IDP components as a part of the GIP, but these components will be pursued alongside, rather than in advance of, massive capital investment in the grid. Pursuing $1.3 billion in distribution-level investments[167] (just before these IDP capabilities are online) risks premature deployment of these assets and therefore a sub-optimal cost-benefit for all stakeholders, including the Company.

Stakeholder engagement: Stakeholder engagement for the GIP has been reviewed above. The process executed by the Company did not adhere to best practices for an effective process and appears to have minimally incorporated stakeholder input.

Cost-benefit analysis: This review will not cover cost-benefit analysis in depth. Similarly, cost-benefit analysis has not been the focus of this testimony and will not be reviewed.

[167] Oliver Direct, Ex. 10, p. 3.

Q. The Company claims that the projects included as part of the GIP are "no-regrets," "foundational" projects. Do you agree with that characterization?

A. No. First, the "modernize" projects that Witness Oliver describes as "foundational"[168] represent just over a quarter of the total budget of the Plan.[169] Even describing the Plan in the Company's terms, it would be inappropriate to describe the entire plan as "foundational."

Second, many of the projects proposed under the GIP fall into what GridLab calls "geographical" projects—physical infrastructure installed in specific geographical areas to extend some grid capability.[170] GridLab's report points out that the "need" to extend new capabilities to these areas should emerge from a high-quality, risk-based assessment of vulnerability of current operations. "Foundational" investments are those that make such a need assessment possible, or enable the 'capability' that is being extended through geographical investment. ISOP is the paramount example of a "foundational" investment. The Company's proposed Self-Optimizing Grid, for example, would not qualify as "foundational." Some of the projects categorized as "modernize" by the Company, such as distribution system and transmission system automation, would also fall into the "geographical" category.

[168] Oliver Direct, p. 30, l. 7.
[169] Oliver Direct Ex. 12, p. 97.
[170] Alvarez, P., & Stephens, D., p. 16.

Q. Does the Company acknowledge that making investments without all necessary information could lead to sub-optimal or imprudent investment?

A. Yes. In a response to a stakeholder question, the Company responded that it was confident "with 85% certainty" that ISOP would not render GIP investments obsolete.[171] This figure was clearly not intended as a precise estimate, but it provides a helpful estimate for understanding potential losses. To put this number into context, if 15 percent of GIP investment were rendered obsolete by ISOP capabilities, the Grid Improvement Plan as proposed would immediately result in stranded distribution assets worth just under $200 million.[172] The Company must take this risk seriously, and its failure to do so in this proposal represents a major oversight.

Q. Does the GIP's use of Megatrends and implications represent a prudent management of climate-related risks?

A. In short, no. The Company has failed to demonstrate how any specific projects addresses climate-related impacts,[173] and its approach does not acknowledge the interconnectedness of climate-related risks across generation, transmission, and distribution functions. Making new investments in distribution infrastructure without a systematic assessment or climate-specific data gathering is an insufficient response to climate-related risks. The Company's current approach of willful

[171] Oliver Direct Ex. 13, p. 43.
[172] Oliver Direct, Ex. 10, p. 3.
[173] Company Response to Vote Solar DR 1-7 and 1-8.

avoidance of climate analysis is inadequate, if not imprudent, and exposes the currently proposed grid investments to unnecessary and manageable risks.

B. Climate Resilience

Q. Please review the GIP against grid modernization best practices.

A. Our review of the GIP against climate resilience plan best practices is summarized in Table 5, below.

Table 5. Grid Improvement Plan's performance versus Climate Resilience Best Practices

Best Practice	Grid Improvement Plan performance	Implications
Forward-looking, high-quality vulnerability assessment	Plan did not utilize any meaningful climate risk assessment.	Ongoing physical risks to grid assets and reliability; less cost-effective projects.
Informed, Inclusive, and Fair Solutions Selection	Plan uses a solutions-first approach and cost-benefit analysis developed after the fact.	Non-'traditional' alternatives likely excluded from Plan; missing potential co-benefits.

Q. Does the Company explicitly acknowledge the presence of climate-related risks or make any attempt to systematically manage them in its application or in discovery?

A. No. As noted above, the Company has represented that it has incorporated climate-related risk only to the extent that it is included as part of the "Megatrends"

identified by the Company,[174] although it also stated that it is "without knowledge" as to the role of climate change in weather events.[175]

Q. Please explain your assessment of the GIP and the implications of the Plan in Table 5.

A. **High-quality Risk Assessment:** We conducted an in-depth comparison of risk assessment and solution selection between the GIP and Con Edison's Climate Change Vulnerability Study. The results of that comparison are presented in Exhibit JMV-TF-7. Con Edison's climate vulnerability study estimated that climate risks would cost the utility between $1.3 and $4.6 billion by 2050,[176] while the Company, for its part, has presented no quantitative risks of climate-related risks. As an example of a potential risk identified by Con Edison but ignored by the Company, Con Edison estimates that flood risks may exceed design specifications by as early as 2030.[177]

The comparison shows that, compared to the industry standard and even a reasonable understanding of climate-related risks, the Company did not complete any systematic climate risk assessment of its assets or operations. There may be individual examinations of factors that may be impacted by climate change, such as flood risk, but those analyses are backward-looking and do not incorporate likely

---

[174] Company Response to Vote Solar Data Request 1-3.
[175] Company Response to Vote Solar Data Request 1-6.
[176] Consolidated Edison Company of New York Inc. ("ConEd"), (2019, December). Climate Change Vulnerability Study ("ConEd Climate Study"). P. 4. Retrieved at https://www.coned.com/-/media/files/coned/documents/our-energy-future/our-energy-projects/climate-change-resiliency-plan/climate-change-vulnerability-study.pdf.
[177] ConEd Climate Study, p.5.

future climate impacts.[178] The Company's risk assessment is mostly represented by the "Implications" of its Megatrends, which are simply too high-level and qualitative to precisely design a programmatic intervention. In comparison, the Con Edison Vulnerability Study pursued an asset-level risk screen, mirroring the granularity of studies conducted by financial institutions and discussed earlier in this testimony.[179]

Like any other business risk, when climate-related risks are not managed, the Company (and therefore its customers) are more exposed to negative outcomes. And, as we have discussed above, physical risks may spill over into insurance, financial, reputational, or regulatory risks.

Informed, Inclusive, and Fair Solutions Selection: Witness Oliver summarizes the process by which the GIP was developed in his testimony.[180] The process was not conducted in collaboration with stakeholders; beyond identifying the existence of the Megatrends, there are no stated goals; solutions are not informed by high quality vulnerability assessment; selection criteria are not defined, beyond vague programmatic terminology;[181] there is no indication for how the geography or scale of any given intervention was decided; "tools" are a narrow range of traditional solutions; and cost-benefit was performed after the fact, rather

[178] Company Response to Vote Solar Data Request 1-12.
[179] Bertolotti et al.
[180] Oliver Direct, p. 29, l.18 – p. 30, l. 18.
[181] Oliver Direct, Ex. 5.

than designed in advance of the consideration of any particular project and used as a screening tool.

This approach constrains what is possible under the GIP. It leaves very little room for assessment of co-benefits, pre-determines a narrow set of potential solutions, and ignores non-wires or non-standard alternatives.

C. North Carolina Context

Q. Does this process acknowledge the other, ongoing processes to quantify grid vulnerability, modernize the electric system, or increase resilience in North Carolina?

A. No. Witness Oliver's testimony does not mention "Clean Energy Plan" or "Executive Order 80," nor does it refer to either ongoing research project we discuss above.[182] Although one of the identified Megatrends is "Environmental Trends" or "Environmental Commitments," its description of these environmental commitments is exclusively backward-looking.[183] Discussion of environmental commitments in Oliver Exhibit 4 do not mention the Clean Energy Plan or Executive Order 80.

Q. What are the implications of this omission?

A. It's an unfortunate disconnect between a potentially large investment of assets on the grid through the GIP, unfolding at the same time as many simultaneous conversations are developing in the North Carolina policy community. For the

[182] Oliver Direct.
[183] Oliver Direct, Exhibit 4.

Company, not engaging with these processes misses an opportunity to gain working knowledge that could inform the details of the Plan, and increases the potential for obsolescence, stranded assets, or increased costs because of an operations and communication disconnect between Company practice and regulatory policy.

D. Review Overall

Q. Do you see an opportunity for an effective grid modernization and climate resiliency proposal at this time in North Carolina?

A. Yes. We agree that recent trends are changing the way customers use the grid and, as we demonstrate above, climate-related risks and opportunities will shape the electric utility business moving into the future. At the same time, a natural synergy exists between the Company's engagement in integrated planning and circuit-level analysis through ISOP and Advanced Distribution Planning and the vibrant policy conversation in North Carolina discussing the very nature of the grid in the 21st century. And, as we document in Section 2, best practices from other states and proceedings are emerging to light the way toward a clear grid modernization and climate resiliency plan that has benefits for all stakeholders. A truly collaborative grid modernization process that creates goals and accountability in partnership with stakeholders, gathers all of critical information (including climate-risk-related and distribution operations information) needed for grid planning first, then selects projects through an open and transparent process, could deliver substantial, lasting benefits for all stakeholders.

Q. Does the GIP deliver on the potential for a well-designed grid modernization or climate resilience plan?

A. No. As we discussed above, the Company does not have the input from stakeholders (including state executive agencies), climate-related factors, or distribution-level analysis it needs to design a true no-regrets Plan. Partly as a result, the Plan does not contain overall goals or tracking metrics that would allow stakeholders and regulators to maintain reliability. Finally, instead of engaging in an open, transparent assessment of solutions and investments (including non-wires alternatives and distributed energy resources), the majority of the Plan consists of solutions that were proposed under Power/Forward.[184]

As a result, there is a massive potential opportunity cost for proceeding with this plan. At a time when best practices are emerging from a changing national landscape, the Company's own sophisticated distribution planning capabilities are coming online, and stakeholders are proactively pursuing deep, informed engagement, the Company's proposal does not take advantage of those developments. According to the Company's informal assessment, the opportunity costs from declining to inform its Plan with advanced distribution planning could be around $200 million, as described above.[185] Because the Company has not undertaken an assessment of its climate risks, that opportunity cost remains unquantified.

---

[184] Company Response to Vote Solar Data Request 1-2.
[185] Oliver Direct, Ex. 13, p. 43.

Q. Do you believe that a positive benefit-cost ratio is sufficient justification for moving forward with any given project?

A. No. Cost-benefit analyses answer the question, "How does this investment compare to business-as-usual, or no intervention at all?" As stakeholders in the modernization of the grid, the answer we should be more concerned with is "how does this investment compare to a well-executed grid modernization and climate resilience plan in the public interest?" Against this counterfactual, a project with a positive benefit-to-cost ratio might still represent a missed opportunity. Because the Company did not effectively pursue a climate vulnerability study, stakeholder input, or integrated distribution planning, it lacks the information needed to conduct such a comparison.

Q. What role could distributed energy resources (DERs) play in grid modernization and climate resilience?

A. DERs bring unique benefits to both grid modernization and climate resilience program goals. A comprehensive grid modernization or climate resilience plan should ensure that DERs are fully valued versus traditional solutions.

In a climate resiliency context, DERs provide the critical service of generating energy close to load. When distribution or transmission systems are not working at full capacity, such as during extreme weather events, "islandable" DERs can continue to provide power to ratepayers.[186]

[186] ConEd Climate Study, p. 49.

In a grid modernization context, DERs may be able to fulfill distribution system operational needs more cost effectively than traditional investments, or defer the need for incremental investments in distribution assets. In this context, DERs are often referred to as non-wires alternatives ("NWAs") or non-traditional solutions ("NTS"). A recent Duke Energy webinar demonstrating the anticipated functionality of ISOP explained that ISOP analytical capability would be able to weigh benefits of DERs versus traditional solutions and identify where NWAs might be more cost-effective.[187] A typical deferred investment by NWAs is increased line capacity, which is a major component of the Self-Optimizing Grid GIP project.[188]

Q. Do you believe the Grid Improvement Plan appropriately considered DERs and NWAs in the development of potential solutions?

A. No. DERs and NWAs are disruptive solutions, and they require proactive analysis and planning to be fully valued in utility planning. First, the utility needs the data to understand DER benefits. That includes both climate vulnerability, ascertained through a vulnerability study as demonstrated above, and detailed distribution operations data created through an integrated distribution planning process. Then, the utility should use a systematic solutions selection process that incorporates

[187] Duke Energy (2020, January). ISOP Stakeholder Webinar. Retrieved at: https://www.duke-energy.com/_/media/pdfs/our-company/200062/isop-webinar-1-presentation.pdf?la=en.
[188] Oliver, Ex. 10.

climate and distribution data, puts a value on co-benefits, and fairly values DERs against traditional solutions.

The Company did not pursue these steps before developing the GIP. By pursuing its grid modernization planning in this manner, the Company constrained the role of DERs in its Plan and likely lost potential cost-effectiveness benefits for both the Company and its customers.

Q. Are there any programs proposed in the GIP that you approve?

A. Yes. The Integrated Systems & Operations Planning program is a truly innovative program that could enable a more dynamic grid, and its Advanced Distribution Planning and Morecast components both represent major steps forward in analytical capacities for distribution planning. We support this program.

Similarly, IVVC is a program with a high benefit-to-cost ratio and many clear benefits. We support the Company's investment in this program.

6. DISCUSSION OF THE COMPANY'S GRID IMPROVEMENT PLAN AND THE BURDEN OF PROOF

A. Deferral Accounting Request

Q. Describe the Company's request for approval of deferral accounting.

A. The Company is requesting to defer costs related to the Grid Improvement Plan into a regulatory asset for recovery in future rate cases.[189] More specifically, the Company is requesting deferral of the North Carolina retail share of the following types of costs for its GIP: depreciation of capital investments, return on capital investments (net of accumulated depreciation) at the Company's weighted average cost of capital, O&M expense related to the installation of equipment, property tax related to the capital investments, and a return of the balance of costs deferred at the Company's weighted average cost of capital.[190]

Q. Is use of deferral accounting for the types of investments in the GIP in years 2020 through 2022 typical in the utility industry?

A. No. Deferred accounting by its very nature is an extraordinary ratemaking tool, and it would be a departure from customary ratemaking practices to use deferred accounting in these particular circumstances.

---

[189] Direct Testimony of Company Witness Kim H. Smith ("Smith Direct"), p. 37-38.
[190] Smith Direct, p. 38, l. 1-5.

Q. Why is deferral accounting considered extraordinary relief in regulatory practice?

A. The strong presumption is that general rate proceedings are the primary forum for evaluating the prudence of utility investments, updating the utility rate base to reflect the addition of such investments, and capturing in rates the impact on operating expenses, deprecation and return associated with such investments. In the case of large capital investments, the use of an allowance for funds used during construction ("AFUDC") typically provides adequate compensation for a utility's undertaking of significant multi-year investments. Through AFUDC, the utility is allowed to capitalize the financing costs of such investments prior to their completion and inclusion in rate base, with such capitalized costs being added to the original investment upon which the utility is allowed to earn a return and which is amortized over time through depreciation. This is the ordinary and routine ratemaking process for large capital investments.

Q. Why is the Company seeking extraordinary treatment for the GIP investments made in years 2020 through 2022 in this case?

A. The Company contends that costs related to the GIP are "major, non-routine investments, that produce substantial customer benefit," and that this description "meets the Commission's traditional test for deferral." Company Witness Smith also claims that absent deferral the Company will "experience a significant adverse

earnings impact."[191] According to the Company's testimony, in the absence of the requested deferred accounting treatment, the "earnings degradation is expected to grow to over 100 basis points by 2022, the third year of the plan."[192]

Q. Is the relief sought in this case similar to the relief sought in the last case with the Power/Forward grid investment and modernization initiative?

A. No. Although Power/Forward was mentioned in the previous rate case, no extraordinary regulatory treatment was sought.[193] However, relief sought in this case is similar to the relief sought by Duke Energy Carolinas in its most recent rate case. As discussed above, in its previous rate case, DEC sought permission to recover Power/Forward costs through either a bill rider or deferral into a regulatory asset for similar cited reasons.[194]

Q. Why did the Commission deny extraordinary treatment of expenses incurred outside of the test year in the previous rate case?

A. As cited above, the Commission found that "the reasons DEC says underlie the need to Power Forward are not unique or extraordinary… [they] are all issues the Company [has] to confront in the normal course of providing electric service… A

[191] Smith Direct, p. 39, ll. 2-9.
[192] Smith Direct, p. 39, ll. 3-5.
[193] Order Accepting Stipulation, Deciding Contested Issues, and Granting Partial Rate Increase, Docket No. E-2, Sub 1142. Retrieved at: https://starw1.ncuc.net/NCUC/ViewFile.aspx?Id=d2b2a1a0-dae1-45de-af9c-c987d4aeddc8.
[194] Order Accepting Stipulation, Deciding Contested Issues, and Requiring Revenue Reduction, Docket No. E-7, Sub 1146 et al. p. 142-145. Retrieved at https://starw1.ncuc.net/NCUC/ViewFile.aspx?Id=80a5a760-f3e8-4c9a-a7a6-282d791f3f23.

number of the Power Forward programs …are the kinds of activities in which the Company engages or should engage on a routine and continuous basis."[195]

[195] *Ibid,*. p. 146.

Q. Are you aware of Senate Bill 559, which was passed by the North Carolina General Assembly in 2019?

A. Yes. My understanding of Senate Bill 559 is that a major feature eliminated from the bill before it passed would have authorized utilities to request, and the Commission to grant, multi-year rate plans.

Q. Would a multi-year rate plan provide a means for addressing situation for which the Company is seeking extraordinary relief for these GIP expenses incurred outside of the test year?

A. Yes. While the elements of a multi-year rate plan would typically be established through the ratemaking process, a likely element would be the periodic updating of the utility's rate base to reflect anticipated major capital investments, such as the GIP. Allowing the utility to update its rate base to include such investments (and the associated expenses) would go a long way towards eliminating the impact of regulatory lag, which seems to be the primary motivation in the Company's request for deferred accounting in this case. According to the Company, in the absence of deferred accounting, its earned return on equity would erode by 100 basis points by the end of the third year of the GIP. (Of course, that assumes the Company would not file more frequent rate cases as a means of updating its rate base, which is another tool available to a utility to minimize the impact of regulatory lag.)

Q. Based on your knowledge of other states, do multi-year rate plans provide a more appropriate basis for regulatory consideration of forward year investments, such as those sought here?

A. Multi-year rate plans are certainly one means of addressing the issue, assuming there is the statutory authority for entering into such plans. (Even in the absence of express statutory authority, it is sometimes possible for multi-year rate plans to be implemented through agreement by all parties in a proceeding, as is commonly done through settlements in rate cases involving the New York electric utilities.) As part of a multi-year rate plan, I would expect to see a mechanism established that would provide the same level of scrutiny for evaluating the prudence of forward year investments. In other words, the traditional general rate case process provides a good forum for closely scrutinizing the reasonableness of the expenditures and whether the utility has borne its burden of proof in showing that it is undertaking such investments in a manner that minimizes the long-term costs for its customers. Any multi-year rate plan would need to include a process that includes these essential protections for customers. We discuss this in the following section.

Q. Why would a major, comprehensive grid investment scheme like GIP not fit within a utility's ordinary course of seeking cost recovery through rate cases?

A. It typically would, for the reasons stated above, and the Company has the burden to show why the extraordinary remedy of deferred accounting is necessary. As noted above, the Company's position is that the GIP comprises "major, non-routine investments, that produce substantial customer benefit," and that its request "meets

the Commission's traditional test for deferral." Whether or not the Company's proposal is acceptable to the Commission, of course, is entirely up to the Commission; as discussed below, the Commission has substantial discretion in deciding whether or not to allow deferred accounting, and to define the terms under which deferred accounting will be allowed.

Q. When generation and transmission projects are proposed, which are often multiple-year construction projects with long lead times, does the Commission have a process for determining whether the project is necessary?

A. Yes. It is fairly common for utilities to be required to secure a Certificate of Public Convenience and Necessity ("CPCN"), which requires the utility to demonstrate that the generating or transmission project is necessary and that the costs are reasonable. North Carolina has a similar requirement in the case of generating plants (NC GS 110.1) and transmission lines (NC GS 62-105a).

Q. Do major, comprehensive grid investment schemes like the GIP fall within a regulatory gap?

A. I think the Company has made a decent case that the current ratemaking mechanisms available to it do not fit well with the type of projects comprising the GIP. As described in the Company's testimony, most of the projects included within the GIP do not, because of their magnitude and duration, qualify for the AFUDC treatment that was mentioned earlier. There will be some earnings erosion associated with implementing the GIP in the absence of deferred accounting or a multi-year rate plan that includes periodic updating of the Company's rate base. In

addition to the earnings impacts, there is probably a strong basis for providing a regulatory forum for evaluating and approving a comprehensive multi-year program that does not fit neatly within the standard general rate case.

Q. Are major, comprehensive grid investment schemes like the GIP more prevalent around the country in the last decade?

A. Yes, there are several states that are moving towards a more comprehensive grid planning process, given the fundamental changes that are underway in the electric utility industry. For the most part, this process is necessary to accommodate the expanded use of DERs given the failure of traditional planning processes to integrate DERs into long-term planning (which historically was based on one-way power flows from the utility's large, centralized generating stations to end use customers). Both California and New York are well down the path of requiring utilities to engage with stakeholders in distribution system planning which, among other things, identifies the opportunities for strategic deployment of DERs by third parties that can result in lower costs to ratepayers over time. Another driver for comprehensive grid planning is addressing the impacts of climate change, which similarly requires a departure from the traditional planning model that was based largely on historical trends in customer and load growth rather than considering the impact of rising temperatures and sea level, and the increasing frequency of extreme weather events.

Q. Does a deferral accounting request, such as the Company has proposed here for the GIP expenses incurred in the years 2020 through 2022, provide the

Commission the same opportunity to evaluate the reasonableness of the proposed investments before they are built as a CPCN process?

A. No. Deferred accounting, almost by its very nature, does not produce the same level of regulatory scrutiny as is afforded by the traditional ratemaking processes of general rate cases and the CPCN process.

Q. Does the practice of using the extraordinary relief of deferral accounting for the GIP shift risks to ratepayers?

A. Yes. In general, ratepayers' interests are well-served by the reliance on traditional general rate cases for setting rates, and the associated regulatory lag that produces a strong incentive for a utility to manage its costs. Streamlining that process through the use of deferred accounting reduces the regulatory oversight that results from the general rate case process, and largely eliminates the economic incentive from regulatory lag to manage costs.

Q. Going forward, do you have any recommendations for addressing this current regulatory gap to provide better oversight of forward year investment schemes for the Commission and steady revenue recovery for the Company?

A. Yes. As discussed in the next section, we recommend a regulatory scheme that involves (1) a rigorous planning process that, among other things, properly integrates the impacts of climate change, and (2) addresses the Company's legitimate concerns about rate recovery while providing strong incentives for the Company to engage in a planning process that is geared toward minimizing the

costs borne by its customers over time (which necessarily requires the integration of climate change impacts).

B. Need for an Integrated System Planning Process

Q. Please describe the integrated system planning that you are recommending.

A. Future investments in the Company's grid must be subject to a process that thoroughly considers the impacts of such investments in addressing, and minimizing, climate change-related impacts. Given what we know about the impact of past extreme weather events on the Company's system, it is imperative that any future grid investment be evaluated in light of the Company's vulnerability to climate-driven risks, and how such investments address those risks. Such an analysis is essential if the Commission is to fulfill its obligation to minimize the long-term rate impacts to the Company's customers, and to maximize the reliability (at reasonable costs) of the electric service provided to the Company's customers.

Q. Is there any precedent of a utility commission initiating such a process as an outcome of a general rate case proceeding?

A. Yes. The process with which we are most familiar is the Con Edison rate proceeding initiated in New York in early 2013, following the impact of Superstorm Sandy.

Q. How is the Con Edison rate case example similar to the current case?

A. Following Superstorm Sandy in October 2012, Con Edison in January 2013 filed a massive general rate request proposing to "harden the utility's system" in response to Con Edison's experience in coping with Superstorm Sandy. Among other things, Con Edison promised to spend $1 billion over the next four years to harden its

system in response to what it learned during Superstorm Sandy. In response, several environmental organizations filed testimony as the "Clean Energy Parties" to propose a different strategy, based on lessons learned in terms of "where the lights stayed on" during Superstorm Sandy (i.e., areas served by microgrids and DERs). Among other things, the Clean Energy Parties proposed that Con Edison's proposed grid expenditures be subjected to a rigorous examination of their resilience benefits, by subjecting the expenditures to examination by a Storm Hardening and Resiliency Collaborative. In other words, rather than following a "business as usual" approach of spending money to harden the system in light of the most recent extreme weather event, the utility was expected to evaluate its T&D expenditures in a manner that would improve its grid resilience in light of climate change and the increasing frequency of extreme weather events. That process ultimately led to the development of the Climate Change Vulnerability Study, which was released by Con Edison in December 2019 and is attached as Exhibit JMV-TF-4.

Q. In what ways does the climate resilience grid investment strategy outlined in the Con Edison Climate Change Vulnerability Study similar to the GIP?

A. There is very little similarity to the rigorous process followed by Con Edison in its Climate Change Vulnerability Study to the process followed by the Company in developing its GIP. In contrast to the Company's failure to consider the impact of likely trends with respect to temperature, sea level rise or the frequency of extreme weather events, the Climate Change Vulnerability Study performed by Con Edison considered the range of scenarios involving, among other things, anticipated temperature, humidity and sea level increases, as well as the frequency of extreme weather events, and evaluated the value of its grid investments according to the resilience benefits that such investments would provide to the grid.

Q. Compared to the recommended grid investment strategy outlined in the Con Edison report, does the GIP present a comprehensive strategy to approach resiliency on a system-wide basis?

A. No, the Company's Grid Improvement Plan is woefully deficient with respect to the integration of climate change impacts in its long-term planning, for the reasons discussed in the preceding section.

Q. Based on your experience, what process provides the best means to match the state policy goals with the Company's stated investment strategy and objectives?

A. As described in the preceding sections of this testimony, North Carolina has recognized the imminent threat associated with climate change, and has articulated

broad policy objectives that are consistent with minimizing that threat—through mitigation measures such as reduction in GHG emissions—as well as the measures necessary to address adaptation to the "new normal" going forward. The Company's GIP neither addresses the mitigation possibilities nor the adaptation measures that are necessary to cope with climate change-related risks through achieving increased resilience in the Company's network.

C. Prudency and Burden of Proof in Light of Climate-Related Risks

Q. What is the utility's obligation to address the risks associated with climate change in its rate filings?

A. Nothing is different about the utility's obligation to demonstrate that its actions—as incorporated in its rate proposals—reflect the investments and expenditures that result in the lowest costs to customers over time. In order to recover their proposed expenditures in rates, utilities generally must demonstrate that they are prudently managing their expenses, and proceeding down a path of making investments and incurring expenditures that result in reasonable rates to customers over time. The risks associated with climate change now need to be part of that ratemaking equation. If utilities fail to take climate change risks into account, and continue to make investments in T&D infrastructure or incur other expenditures that fail to improve the resilience of the utility grid in the face of climate change, they run the risk of having those investments disallowed as imprudent. As a matter of prudent utility practice, utilities have the obligation to demonstrate that they have integrated

the risks associated with climate change into their long-term planning for T&D investments, and the associated expenditures.

Q. How does the threat of climate change affect the utility's burden of proof in rate proceedings?

A. If a utility fails to demonstrate that it is proceeding down a path that takes climate change-related risks into account and minimizes the costs to customers after taking those associated climate change-related risks into account, their T&D investments (and associated expenditures) are subject to disallowance. It is the "new normal" with respect to prudent utility practice. It is no longer acceptable to expect to recover in rates the investments that are made, if such investments are not mindful of the impacts of climate change and are not designed to improve grid resilience in light of such climate change.

Q. How would you define adequate consideration of climate vulnerabilities?

A. The Con Edison Climate Change Vulnerability Study probably represents the current state of the art in demonstrating how an electric utility should integrate the likely impacts of climate change in its long-term planning process. The extent to which utilities should be expected to integrate the risks associated with climate change in their long-term planning should depend on the circumstances unique to each utility. In that regard, the Company faces an enhanced obligation to integrate climate change into its long-term planning, given the extent to which the financial community has identified the Company as one of the electric utilities in the country with the greatest exposure to climate change impacts. Thus, the Company's failure

to integrate such impacts into its analysis affects not only the level of operating costs it incurs over time, but also the capital costs borne by its customers to the extent that the financial community perceives that the Company is doing a poor job of managing those risks, and accordingly demands a higher cost of capital for the costs of financing the Company's investments.

Q. Are you aware of any processes underway in North Carolina that would enable the Company to use existing climate science and climate analytics to inform its decision making?

A. Yes. As noted above, there is a current proceeding at the North Carolina Department of Environmental Quality—Phase 2 of the climate risk and resilience group—that is relevant to the type of analysis that should be required of the Company going forward. NCICS has performed a high-value granular analysis of likely climate conditions in North Carolina through the remainder of the century (publication pending). Through funding from the US Department of Energy, the North Carolina State Clean Energy Technology Center is hosting a collaborative process that is going to look precisely at this issue.

Q. Would it be reasonable for the Company to use the data and expertise gathered from these various working groups to inform its own system planning process with the best available climate science and scenario analysis techniques?

A. Yes. In fact, it would be unreasonable, and inconsistent with prudent utility practice, for the Company to fail to incorporate these resources to help prioritize strategies and investments to improve the resilience of the Company's network in the face of increasing risks from climate change.

Q. Did the Company perform any forward-looking analysis of climate-related data to inform its recommended GIP investments?

A. No. As described in the preceding section, the Company failed to take into account what we currently know about possible scenarios regarding temperature, humidity, precipitation, and sea level increases over time. It is irresponsible, and contrary to prudent utility practice, to base long-term planning on historical trends that simply do not reflect the new reality of the impacts of climate change going forward. And the consequence of this failure would be to impose unnecessary costs on the Company's customers, which would be disallowed in the typical ratemaking process. The better outcome than relying on the end-loaded disallowance, of course, is to require the Company to engage in a rigorous planning process that integrates the impact of climate change.

Q. Does this mean the Company's GIP fails to carry the burden of proof at this time?

A. There is insufficient data available to determine if the Company made the most prudent prioritization and investments in light of its actual, projected climate risk. However, the failure to even attempt to quantify and identify its climate vulnerabilities, in our view, dramatically increases the risk that these investments could prove more costly to ratepayers over time than investments made under a strategy that diligently considered and mitigates future climate vulnerabilities.

Q. If you are not recommending a current disallowance based on the Company's failure to consider climate risk, why should the Commission consider climate risk as a necessary consideration to justify the prudency of these types of climate-vulnerable infrastructure investments going forward?

A. The risks are intensifying and the impacts are growing. The need to mitigate to be cost-effective is growing. The visibility and confidence level of future climate data are growing. Based on the standard of doing what a reasonable manager would do based on what they know or *should know*, willful blindness to the reality of climate change going forward cannot be a defense. The Company simply must do better if it is to fulfill its fundamental obligation to engage in practices that result in the lowest costs to its customers over time.

D. Incentive Mechanisms to Encourage Integration of Climate-Related Risks

Q. How can the Company be encouraged to integrate climate-related risks into its long-term system planning?

A. As noted above, the Commission has considerable discretion in deciding whether or not to authorize deferred accounting treatment for the Company's GIP. The Commission previously rejected deferred accounting treatment for the Company's proposed Power Forward program, which in many ways is replicated by the Company's proposal in this case with respect to the GIP. Notwithstanding the similarities, the Commission has the authority to address any perceived deficiencies through a properly structured incentive mechanism. We recommend consideration of a performance-based incentive mechanism that would properly penalize or reward the Company for integrating climate change-related risks into its long-term system planning.

Q. What are the elements of this performance-based incentive mechanism?

A. As noted earlier in this testimony, the Company is seeking to defer the investment and costs related to its GIP, and to earn a return equal to its weighted average cost of capital ("WACC") on the unamortized balance. The Commission has the discretion to determine whether or not to grant the Company's deferral request and, correspondingly, has the authority to impose conditions on granting that request. We recommend that the Company's ability to earn its WACC on the unamortized balance of GIP investments be subject to a performance-based incentive

mechanism. In other words, the extent to which the Company is allowed to earn its WACC should be a function of its success in integrating climate change-related risks into its GIP. We propose that the portion of the WACC be weighted according to the Company's success in achieving certain prescribed metrics that reflect the integration of climate change-related risks into long-term system planning.

Q. How would such an incentive mechanism operate?

A. If the Company does a good job of meeting such metrics, it would be allowed to earn its WACC on the unamortized balance. If the Company falls short, the return it is allowed to earn on the unamortized balance would be less than its WACC. To make the incentive mechanism symmetrical, the Company should have an opportunity to earn a return greater than its WACC. In other words, the Company should be rewarded to the extent that it does an exemplary job of integrating climate change-related risks, and could earn a return in excess of its WACC upon exceeding the prescribed metrics.

Q. Is there precedent for such a performance-based mechanism?

A. Yes. Under the Future Energy Jobs Act passed by the Illinois legislature in December 2016, electric utilities in that state have the option of capitalizing the investment they make in energy efficiency measures, and to amortize such investment over the measures' useful lives. The return they earn on the unamortized balance of such investments is subject to performance-based metrics that capture the utilities' respective performance in achieving energy efficiency savings. The performance-based incentives under the Future Energy Jobs Act operate to reward

utilities for exceeding their energy efficiency savings targets and to impose penalties if they fall short.[196] Another example is the use of earnings adjustment mechanisms by the New York Public Service Commission as part of its Reforming the Energy Vision ("REV") programs. Under the "Track Two" Order in the REV proceeding, a utility can be provided with incentives up to the dollar equivalent of 100 basis points of its return on equity based on its ability to implement various measures that are consistent with REV objectives, such as facilitating interconnection of DERs, increasing electric usage intensity (i.e. reducing peak and improving load factor), encouraging customer engagement, and implementing beneficial electrification programs (e.g., heat pumps) geared toward greenhouse gas reductions.[197]

Q. What sort of metrics could be included in such a mechanism to capture the Company's integration of climate change-related risks?

A. There are several measures that would reflect the improvement in the resilience of the Company's network in the face of climate change risks, such as (1) improvements in reliability-related statistics (e.g., SAIDI, SAIFI, or MAIFI), (2) hosting capacity for DERs (measured in kWs), (3) voltage reductions (measured as average annual voltage by circuit), (4) demand response from time-varying rates (measured in kWs), (5) participation in time-varying rates (as a percentage of

[196] The Future Energy Jobs Bill (SB 2814) was enacted into law on December 7, 2016, as Public Act 99-0906, with an effective date of June 1, 2017.
[197] Case 14-M-0101, Proceeding on Motion of the Commission in Regard to Reforming the Energy Vision, Order Adopting a Ratemaking and Utility Revenue Model Policy Framework (May 19, 2016), pp. 53-93.

customers), or (6) operational savings, measured in dollars or dollars per average bill. These metrics would capture the sort of benefits that one should expect from large investments in the Company's grid. These performance targets should be quantifiable, not subjective; should include achievement dates; and be based on outcomes, not processes.

Q. How would this mechanism and these metrics be established?

A. The details regarding the design of such a mechanism are beyond the scope of this proceeding, and should be considered in a subsequent proceeding on comprehensive and integrated grid planning. The record in this case would simply not support a thorough evaluation consideration of these issues, which would benefit from a full examination by all the interested stakeholders.

7. CLIMATE RISK AND CUSTOMERS

Q. How do customers figure into the discussion of utilities and climate risk?

A. Customers are directly affected by the impacts of climate-related physical risks, with respect to both the quality/reliability of their service and the costs of that service. Upon the occurrence of an extreme weather event, customers' electric service is subject to interruption for extended periods. Actions by the utility to improve the resilience of the grid thus should reduce the adverse impacts on service arising from extreme weather events. Similarly, integration of climate change-related risks in the utility's long-term system planning should result in lower costs for customers over time, as the utility will avoid or minimize investments in facilities that are vulnerable to extreme weather events, thereby minimizing the storm damage costs that ultimately are recovered in utility rates. The extent to which utilities engage in resilience-related investments to reduce their climate-related risks thus redound to the benefit of customers.

Q. Are there particular groups that are expected to be more vulnerable to the electric service-related impacts of climate change?

A. Climate adaptation and vulnerability studies show that the most socially vulnerable households today often bear the most exposure to climate-related risks.[198] These

---

[198] Lynn, K., MacKendrick, K., & Donoghue, E., (2011, August). Social Vulnerability and Climate Change: Synthesis of Literature. *US Forest Service.* Retrieved at: https://www.fs.fed.us/pnw/pubs/pnw_gtr838.pdf;
U.S. Global Change Research Program (2016). The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment. *Populations of Concern.* Retrieved at: https://health2016.globalchange.gov/populations-concern.

households often lack access to resources necessary to cope with climate-related shocks and stresses. Specifically, low-income households and communities of color[199]—commonly referred to as "environmental justice communities"—and those at home who are medically dependent on electricity[200] are especially likely to be vulnerable to climate-related risks. Thus, the consequences of a utility's failure to integrate climate change-related risks into its long-term system planning will fall disproportionately on segments of the population least capable of coping with the impacts.

Q. Are there potential customer programs that the Company could pursue through ISOP, or otherwise, that could address the needs of their most vulnerable customers and communities?

A. Yes. As discussed above, DERs have unique resilience benefits in that they can generate energy closest to where it is needed. With the right kind of forward-looking planning, DERs could be deployed through ISOP or other resource planning proceedings to equip these communities with the assets and resources to withstand climate-related risks. Some examples of potential programs could be storage "resilience hubs" in vulnerable neighborhoods, or behind-the-meter solar plus storage programs for medically vulnerable ratepayers.

---

[199] Coffee, J. (2018, February). Climate Disasters Hurt the Poor the Most. Here's What We Can Do About it. *Governing.* Retrieved at: https://www.governing.com/commentary/col-disasters-disadvantaged-climate-justice.html.

[200] Dominianni, C., Ahmed, M., Johnson, S., Blum, M., Ito, K., Lane, K., (2018, July). Power Outage Preparedness and Concern among Vulnerable New York City Residents. *Journal of Urban Health.* Retrieved at https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6181821/.

Q. What are your recommendations to protect customers, and in particular low-income customers, from the rate impacts associated with climate change-related risk and grid resiliency strategies going forward?

A. Ultimately, prudent management of climate-related risks by the utility should produce the desired effect of minimizing rate impacts of climate-related risks and, to the extent such risks are not managed prudently, regulators have a responsibility to ensure that imprudent costs are not passed on to customers, whether low-income or not. The Commission is uniquely situated to exercise its full range of options to minimize rate impacts through, among other things, the period over which grid resilience investments are amortized or how such costs are allocated to customer classes.

Targeted climate resilience investments could also provide relief for low-income customers. Solar plus storage investments, for example, could decrease bills while ensuring resilience against climate impacts. Equitable access to such measures, of course, is a challenge, and the Commission may wish to focus particular attention to developing programs that facilitate access to such investments by environmental justice communities.

8. CONCLUSIONS AND RECOMMENDATIONS

Q. Based on your review of the Company's filing and emerging electric utility trends, what conclusions do you reach in this testimony?

A. We reach the following conclusions:

- Climate-related risks, emerging in many vectors, have a material and substantial bearing on the Company's operations today and will continue to affect operations in the future. Collaborative processes in North Carolina are currently underway to assess these risks and their implications for the electric grid.
- The Company faces demonstrable physical risks from climate change and increasing scrutiny on climate risk management from relevant financial institutions.
- As a potential foundational investment for the 21st century grid, any grid modernization plan should consider best climate resilience practices alongside grid modernization best practices. This includes the fair assessment of DERs as climate resilience and grid modernization solutions.
- The Grid Improvement Plan, as filed, does not assess or respond to climate-related risks, nor does it adhere to grid modernization best practices. As a result, the Company's proposal does not provide enough information to indicate that the Plan is a prudent investment.

Q. Based on your review of the Company's filing and emerging electric utility trends, what recommendations do you make in this testimony?

A. We respectfully ask that the Commission:

- Direct the Company to assess and manage climate-related risks across its operations and assets, in accordance with prudent utility practice.
- Make clear that it will hold the Company accountable for implementing this standard when it evaluates the prudence of proposed GIP investments by the Company.
- Direct the Company to participate in ongoing Department of Environmental Quality stakeholder processes around grid modernization and integrate data, findings, and recommendations, into its grid modernization investments. The Commission should further require that the Company file a report by December 31, 2020 identifying any gaps in knowledge that need to be filled through further collaboration.
- Require the Company to develop large distribution investments such as the GIP through an integrated distribution planning ("IDP") or integrated systems & operations planning ("ISOP") process moving forward.
- To the extent that GIP projects are permitted deferred recovery, impose performance-based conditions on the recovery of such deferred amounts in rates, such as through adjustments to the weighted average cost of capital applied to the unamortized balance of deferred amounts.

Q. Does this conclude your testimony?

A. Yes.