INFORMATION SHEET

PRESIDING: Commissioner McKissick, Jr., Presiding, Commissioners Hughes and Brawley
PLACE: Durham, NC
DATE: 7:06 p. m. to 10:06 p.m., Tuesday, April 30, 2024
DOCKET NO.: E-100 Sub 190
COMPANY: Generic Electric
DESCRIPTION: In the Matter of Biennial Consolidated Carbon Plan and Integrated Resource Plans of Duke Energy Carolinas, LLC , and Duke Energy Progress, LLC Pursuant to N.C.G.S. § 62-110.9 and § 62-110 (c)

VOLUME NUMBER: 5

APPEARANCES
See attached

WITNESSES
See attached

EXHIBITS
See attached

REPORTED BY: Kaylene Clayton	TRANSCRIPT PAGES: 157
TRANSCRIBED BY: Kaylene Clayton	PREFILED PAGES: 0
DATE FILED: June 12, 2024	TOTAL PAGES: 157

PLACE: Durham County Courthouse
Durham, North Carolina
DATE: Tuesday, April 30, 2024
TIME: 7:06 p.m. - 10:06 p.m.
DOCKET: E-100, Sub 190
BEFORE: Commissioner Floyd B. McKissick, Jr.
Commissioner Jeffrey A. Hughes
Commissioner William M. Brawley

IN THE MATTER OF:

Biennial Consolidated Carbon Plan and Integrated Resource Plans of Duke Energy Carolinas, LLC, and Duke Energy Progress, LLC, Pursuant to N.C.G.S. § 62-110.9 and § 62-110(c)

VOLUME 5

NORTH CAROLINA UTILITIES COMMISSION

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NORTH CAROLINA UTILITIES COMMISSION

APPEARANCE SLIP

DATE: 4/30/2024 DOCKET NO.: E-100 Sub 190

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APPEARANCE ON BEHALF OF: Duke Energy Corporation

APPLICANT: ✓ COMPLAINANT: ___ INTERVENOR: ___

PROTESTANT: ___ RESPONDENT: ___ DEFENDANT: ___

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NORTH CAROLINA UTILITIES COMMISSION
PUBLIC STAFF - APPEARANCE SLIP

DATE: April 30, 2024 DOCKET #: E-100, Sub 190

PUBLIC STAFF ATTORNEYS: Thomas J. Felling

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/s/ Thomas J. Felling

North Carolina League of
CONSERVATION VOTERS

April 30th, 2024

North Carolina Utilities Commission
430 North Salisbury Street, Dobbs Building 5th Floor
Raleigh, North Carolina 27603
RE: Docket E-100 Sub 190 / 190CS

To the Utilities Commissioners and the Public Staff:

The North Carolina League of Conservation Voters (NCLCV) appreciates the opportunity to provide extended comments on Duke Energy's proposed Carbon Plan (Docket E-100 Sub 190 /190CS). The North Carolina League of Conservation Voters (NCLCV) is a pragmatic, results-oriented, non-partisan organization whose mission is to protect the health and quality of life for all North Carolinians, with an intentional focus on systematically excluded communities of color. We elect environmental champions, advocate for environmental policies that protect our communities, and hold elected leaders accountable for their decisions. NCLCV is submitting this statement as an organization and as a customer of Duke Energy. Our office is located at 127 W Hargett Street, Raleigh NC 27601 which is within Duke Energy's service area.

These comments were also submitted to the North Carolina Utilities Commission and the Public Staff by Michelle Carter at the Durham public hearing on April 30th, 2024. Michelle Carter is an authorized representative of NCLCV and has obtained explicit permission to share the details of the accounts included in this statement.

NCLCV opposes the proposed Carbon Plan as updated by Duke Energy on January 31st, 2024 and will highlight our organization's concerns on the Carbon Plan itself and the public process surrounding the Carbon Plan. NCLCV believes that this proposed plan for our resource future is too reliant on methane gas and its supporting infrastructure, presents unnecessary risks for carbon neutrality by prematurely betting on immature technology, and does not adequately represent the needs and priorities of North Carolina residents, specifically environmental justice and frontline communities. NCLCV further highlights the arbitrary limits on renewable energy planning and the underestimation of demand side management mechanisms.

Changes to the Carbon Plan Process Reduce Opportunities for Public Participation

As an organization that prioritizes equitable access to public participation under modern democracy, NCLCV presents its concerns about the NC Utilities Commission's changes to

Carter ex. 1

public hearings and public comment on this iteration of the Carbon Plan. During last year's Carbon Plan process, there were six total public hearings: four in person and two virtual. Even though there is evidence that public education and interest in North Carolina's energy future has increased, the NCUC has decreased the amount of opportunities for public comment. There are now four in person public hearings and one virtual hearing, with the number of speakers at the virtual hearing dropping from 30 to 20.

Furthermore, there are no in person hearings available for frontline communities, located where residents are directly bearing the impacts of these proposed projects. All of the in person hearings were also held in urban areas, increasing the burden of travel for rural folks. While a virtual hearing is theoretically available for all residents in North Carolina, folks who cannot drive to a hearing and who do not have strong access to broadband internet are effectively silenced in this process. There is also a developing track record that the Commissioners do not incorporate stakeholder feedback into their decisions. Limiting public participation in the future of our electricity system and failing to listen to feedback that is provided shows complicity with the status quo instead of an active desire to build an energy future that is in the best interest of North Carolinians.

Our organization understands that unlimited speaking time and opportunities for public participation in this process is not pragmatic. However, limiting speaking time to three minutes on a document with hundreds of pages and highly technical information eliminates the nuance that energy issues require. The Commission also requires a spoken public comment to address all the issues covered in a written comment, which is highly challenging to do considering the breadth of information discussed in this Carbon Plan.

To reasonably expand the public process and the opportunity to provide public comment, NCLCV recommends that future Carbon Plan processes prioritize hearings in both urban and rural areas with a specific focus on frontline and environmental justice communities. Next, we recommend the expansion of time per speaker at in person hearings to five minutes or as permitted by the Commission to more accurately capture concerns, questions, and comments on the Carbon Plan. Finally, NCLCV urges the Commission to more heavily weigh the valid and major issues presented by hundreds of Duke Energy customers during these public hearings. If there is no sufficient forum to provide public input and no public confidence that input will be valued and acted on, there is no purpose in holding public hearings.

The Carbon Plan Places Disproportionate Weight on Fossil Fuels to Reduce Emissions

It is incredibly clear that House Bill 951 intends to transition North Carolina to clean, affordable, and reliable energy as opposed to a continued reliance on fossil fuel generation. Affordably transitioning to carbon neutral fuel sources will never include methane gas, which releases

thousands of tons of greenhouse gasses, causes health issues in adjacent and impacted communities, and requires an increasingly expensive supply chain. However, Duke's Supplemental Planning Analysis from January 2024 recommends the addition of nearly 9 GW of new gas fired capacity by 2035,[1] one of the largest methane gas build outs in the United States. From building gas plants on top of former coal plant sites to constructing entirely new units, Duke Energy is cementing our state into decades of gas powered electricity generation.

These gas plants will require miles of pipeline to provide enough fuel to keep them running. There are two currently proposed projects to do just this: Williams' Transco Southeast Supply Enhancement Project (SSEP) and Dominion and Duke's T-15 Reliability Pipeline project. Both of these projects have already received significant local opposition due to worsening property values, increased potential for gas leaks, and higher risks of water contamination. First, the SSEP is estimated to bring 1.4 billion cubic feet of gas into North Carolina per day, making this the largest proposed pipeline in our region in the last ten years.[2] Next, the T-15 Reliability Pipeline plans propose a 45 mile, 30 inch wide pipeline from Eden, North Carolina to Person County.[3] This pipeline is specifically intended to fuel the Roxboro gas plants and will cut across the properties of hundreds of North Carolinians, directly increasing their exposure to fossil fuels and creating risks to their health and safety. All of these projects will have major financial costs and will directly increase costs for ratepayers.

The largest issue with this Carbon Plan is the costs associated with Duke Energy's proposed methane gas buildout and the underlying assumptions Duke has made to support those costs. Large expenses come with the construction of this new infrastructure, from the plants themselves to the pipelines needed to deliver the fuel. Duke underestimates the consistent and ever increasing costs of securing fuel supply even though the Carbon Plan acknowledges prices of gas are projected to steadily increase from now until the 2040s.[4] This steady increase does not account for short term volatility, causing price spikes on monthly bills for ratepayers.

Methane fuel costs are incredibly volatile, and a recent study by EQ Research showed that fuel costs are significant contributors to retail electricity rates. In the Duke Energy Carolinas (DEC) service territory, increases in fuel costs account for roughly 67% of the increase in residential retail rates since 2017, making the portion of the rate increases attributable to fuel costs more

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[1] Anderson, J. (2024, April 16). *Duke Energy sees a need for incremental gas-fired power to meet demand growth: CEO*. S&P Global Commodity Insights. https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/electric-power/041624-duke-energy-sees-a-need-for-incremental-gas-fired-power-to-meet-demand-growth-ceo

[2] Sierra Club. (n.d.). Say No to Duke and Dominion's Dirty, Dangerous Fracked Gas Buildout. https://www.sierraclub.org/sites/default/files/2024-02/2719%20NC-Factsheet%2005_web%20%281%29.pdf

[3] *T15 Reliability Project: Dominion Energy*. T15 Reliability Project | Dominion Energy. (n.d.). https://www.dominionenergy.com/projects-and-facilities/natural-gas-projects/t15-pipeline

[4] See Figure C-3, Appendix C, Duke Energy. (n.d.-a). Carolinas Resource Plan - Duke Energy. https://www.duke-energy.com/our-company/about-us/irp-carolinas

than double the amount from all other rate components.[5] In the Duke Energy Progress (DEP) service territory, where gas currently represents a slightly lower percentage of the generation mix, increases in fuel costs account for roughly 46% of the increase in the residential retail rates since 2017.[6] Transitioning away from methane gas rather than building it out improves energy security by reducing our reliance on fuel supplies and will directly reduce North Carolinians' energy bills. Furthermore, any projects built now that may be forced to wind down due to the carbon neutrality mandate pose the risk of becoming stranded assets.

Even if fuel costs are put aside, there are inherent reliability risks from gas combustion that this Carbon Plan ignores. Duke inflates the reliability contribution assigned to gas plants while ignoring the execution risks around securing firm fuel supply to ensure fuel is available during extreme winter weather. Despite fossil fuel supporters claiming that we need gas to support our grid when the sun doesn't shine and the wind isn't blowing, there is concrete evidence that renewable power supported North Carolina's grid during Winter Storm Elliott. PJM's report on Winter Storm Elliott found that gas generators and fossil fuel plants accounted for 70% of unplanned outages.[7] Furthermore, the Federal Energy Regulatory Commission (FERC) noted that the conditions we faced in Winter Storm Elliott are not an isolated event. In fact, this was the fifth event since 2011 to compromise reliability from cold weather and the third event directly related to the failures of gas generation.[8] This failure of gas plants to perform in cold weather is not adequately accounted for in Duke's proposed Carbon Plan. Even though the propensity of coal and gas plants to fail at higher rates during extreme cold is driving up Duke's assumed reliability need, Duke fails to account for this risk in their assumption of those resources' reliability contribution. Even the premise of further relying on gas under the guise of reliability is opposite to the present state of our grid.

The combination of expensive infrastructure, rising and volatile fuel costs, and the increasing probability of extreme cold weather events all arrive at the same conclusion: methane gas is not the resource we need in North Carolina. Gas has proven to be unreliable and expensive, and recent federal administrative actions (covered at length in the next section) cement our nation's move away from gas towards emissions free, clean energy resources.

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[5] EQ Research LLC. (n.d.). *Issue Brief: The Role of Fuel Costs in Duke Energy's North Carolina's Retail Rates From 2017 Through March 2024*. Environmental Defense Fund. https://www.edf.org/sites/default/files/documents/Issue_Brief_Narrative_4_18_24.pdf

[6] EQ Research LLC. (n.d.). *Issue Brief: The Role of Fuel Costs in Duke Energy's North Carolina's Retail Rates From 2017 Through March 2024*. Environmental Defense Fund. https://www.edf.org/sites/default/files/documents/Issue_Brief_Narrative_4_18_24.pdf

[7] PJM. (n.d.-a). Winter Storm Elliott frequently asked questions. https://www.pjm.com/-/media/markets-ops/winter-storm-elliott/faq-winter-storm-elliott.ashx

[8] Huff, D., & Polzin, E. (2024, February 13). 2022 Winter Storm Elliott inquiry findings ➢ gas-electric ... https://www.energy.gov/sites/default/files/2024-02/Day 1 - FERC 2022 Winter Storm Elliott Inquiry Findings_untagged.pdf

The Carbon Plan Does Not Adequately Consider Federal Legislation and Administrative Actions

Based on NCLCV's direct experience and work with the Inflation Reduction Act (IRA) within communities across North Carolina, we do not believe that Duke Energy has correctly estimated the amount of energy efficiency and demand side management improvements that will come to homes, apartments, and businesses across North Carolina. NCLCV's sister organization, the North Carolina League of Conservation Voters Foundation (NCLCVF), has been involved in tracking funding from the Inflation Reduction Act since its passage in 2022.

NCLCVF has worked in coalition with environmental, social justice, and community based organizations to build a toolkit for Carolinas residents to learn more about and apply for programs in the IRA and BIL (https://energyfundsforall.org). We have presented this toolkit to hundreds of folks and are working with individuals and communities to access loans, rebates, and tax credits to weatherize their homes and lower their energy bills. We also work with the North Carolina Department of Environmental Quality (NCDEQ) and the State Energy Office (SEO) to keep our information current.

Therefore, we know firsthand how much funding is coming to North Carolina and we are confident that money from programs like Solar for All, Climate Pollution Reduction Grants, Greenhouse Gas Reduction Fund, and others will increase distributed energy generation, improve demand side management, and provide relief for Duke Energy's projected demand increases. Much of this funding can also be accessed by small, medium, and large businesses, providing further opportunities to reduce this projected demand. Furthermore, studies have shown that 99% of new gas plants proposed are more expensive than similar amounts of renewable generation if utilities take full advantage of the tax credits available.[9] Both this Carbon Plan and Duke Energy must aggressively leverage these funds for the benefit of North Carolina, even at the risk of a smaller profit margin for their shareholders. As a corporation beholden to the public interest, Duke's obligation is clear and there is no better opportunity than now to leverage the full scope of federal funding to decrease our demand and improve our electricity portfolio. Beyond this, it is the mandate of this Commission and HB 951 to represent the people of NC by identifying the least cost, most reliable plan to meet NC's energy needs. The last iteration of the Carbon Plan explicitly called for maximum usage of IRA benefits, and it is clear to our organization that Duke Energy still has not fulfilled this maximization.

The Inflation Reduction Act is not the only federal action that is inadequately considered in the proposed Carbon Plan. The federal government has made multiple announcements in 2024 that have drastically altered the energy landscape and will subsequently alter Duke Energy's plans for

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[9] Modi, J. (2024, March 18). *Duke Energy's proposal to convert the Roxboro coal plant to gas would be one of many dangerous new fossil fuel investments*. Appalachian Voices. https://appvoices.org/2024/03/18/roxboro-conversion/

our future. In October 2023, The US Department of Energy passed over Duke Energy's application for a Hydrogen Hub, effectively shutting the Southeast off of supply plans and expansion opportunities for hydrogen gas. Duke cited this potential Hydrogen Hub as a key source for hydrogen fuel during their first Carbon Plan filing in August.

While Duke Energy has now said this failure to procure federal funding for hydrogen will not affect their plans, they have failed to provide evidence of other potential sourcing options. Duke has positioned its gas buildout as successful because of the projected hydrogen buildout to extend the life of their proposed infrastructure, but this does not change the underlying issues of reliability of fuel sourcing and supply. NCLCV believes that hydrogen can have a place in the clean energy transition, specifically to decarbonize challenging industrial and technical processes. However, there are cleaner, cheaper, and more efficient energy sources available for our power generation sector to employ much sooner than hydrogen will be available at a utility scale. We have access to more certain and affordable energy generation options now than the current landscape of hydrogen can provide.

The most notable omission of this Carbon Plan is the consideration of EPA's decision concerning new methane gas plant emissions. On April 25th, 2024, the EPA released the final version of their Section 111 rules governing emissions reductions and limits for power plants across the nation. This final ruleset is more aggressive than the previous draft, which was publicly released in 2023. These rules will cut carbon pollution for new gas plants by an estimated 90%, forcing new builds to run at lower capacity or implement carbon capture methods.[10] It is unclear if North Carolina's geography can support carbon capture and underground sequestration. Therefore, it is likely that any new gas plants built will need to majorly shrink their capacity and expected run times to avoid violation of these rules. This directly increases the cost per kilowatt hour of energy generated from gas plants, increasing bills even further. We understand it was not feasible for Duke Energy to evaluate these final rules before the release of their initial draft Carbon Plan, so we call upon the Utilities Commission to evaluate these rules in combination with other federal legislation and actions that have lowered the barriers and cost burdens of renewable energy to economically outcompete methane gas.

To quote Chapter 1 of the August 2023 Carbon Plan, North Carolina is experiencing a "changing energy landscape," and the Utilities Commission must modify this plan to accommodate these rules. If Duke proceeds with new gas plants and they do not comply with EPA's 111 rules, Duke Energy will incur daily fines and bills will increase even more. New gas is simply unaffordable with the release of EPA's final rules and therefore any new gas builds will likely violate the least cost planning principles the Carbon Plan is meant to follow.

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[10] *Fact Sheet: Carbon Pollution Standards For Fossil Fuel-Fired Power Plants Final Rule.* Environmental Protection Agency. (n.d.). https://www.epa.gov/system/files/documents/2024-04/cps-111-fact-sheet-overview.pdf

The Carbon Plan Fails to Meaningfully Involve Environmental Justice (EJ) Communities

In its 2022 Carbon Plan order, the NC Utilities Commission ordered that Duke "[...] continue to develop targeted engagement plans for impacted communities, to enact these plans in the near term and to report to the Commission on these plans and the ensuing engagement with stakeholders in its upcoming CPIRP filing..."[11] Unfortunately, Duke Energy's commitment to environmental justice in the Carbon Plan is clearly lacking, as only one small section of the written plan covered Duke's work. This section did not include information on the number of meetings held, the outcomes of meetings, who attended these meetings, or virtually any concrete details on Duke Energy's plan to engage impacted communities. To date, Duke has only publicly shared the structure of their community engagement plan but did not share any specific information regarding what response or feedback communities had provided to the utility regarding its Carbon Plan proposals. This mirrors the tardy and insufficient EJ outreach during the 2022 Carbon Plan process.

Duke's approach writ large lacks basic environmental justice considerations by limiting their engagement to the infrastructure projects that are already approved in the Carbon Plan, inherently decreasing transparency. By only engaging with communities once a project is sited and decided on, Duke Energy minimizes voices that should be heard and taken into account earlier in the process. Our organization experienced this firsthand when one of our staff members reached out to participate in a regional environmental justice council.

Robin Smith, senior policy director at NCLCV, reached out to Jennifer Bennett, the Duke Energy Government and Community Relations District Manager for Buncombe, Haywood, Madison, Yancey, Mitchell, and Avery Counties on August 8, 2023. Ms. Smith expressed interest in serving on the local EJ council but was told because she did not live in Buncombe county specifically she could not serve on the council. Ms. Bennett explained that while Yancey County was within her region for engagement, Duke was only allowing community members from Buncombe County to serve on the EJ council as that is where Duke currently had projects planned. This not only negates the basic tenets of EJ engagement if all you are doing is mitigating after a decision to build is marked. It also ignores the National Environmental Policy Act (NEPA) that requires federal agencies to assess the environmental effects of their proposed action prior to making decisions. Greenfield construction of transmission lines, solar, and wind is a time consuming process requiring knowledge on where it is feasible to construct to assess the environmental effects of the proposed action prior to making a decision to build.[12] We recommend the Commission order Duke to engage with EJ communities at the greenfield stage

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[11] See Docket No. E-100, SUB 179: "Order Adopting Initial Carbon Plan and Providing Direction for Future Planning".

[12] See Environmental Justice Interagency Working Group. (2019, March). *Community Guide to Environmental Justice and NEPA* ... Environmental Protection Agency. https://www.energy.gov/lm/articles/community-guide-ej-and-nepa-methods-2019

of project development to ensure the process to carbon reduction is not slowed down by long state and local lawsuits.

Duke Energy states in their August 2023 Carbon Plan that they have developed "customized strategies tailored to provide meaningful local engagement to those most impacted by specific projects" but fails to provide detail on these strategies or to define/measure "meaningful local engagement". Because of the overall lack of details on this engagement, NCLCV is skeptical that this work aligns with the Commission's initial recommendation for a robust environmental justice plan. So far, our organization believes this work is performative and arbitrary and lacks accountable measures by which the NCUC can evaluate success.

As one of the oldest environmental organizations in the state with a deep commitment to grassroots organizing in BIPOC and underserved communities, we have significant concerns around the meaningful inclusion of environmental justice communities in this process. From siting resources to public participation for the strong possibility of cumulative impacts, this proposed Carbon Plan comes with huge risks to our vulnerable communities.

An immediate and relevant example is the excessive and rapid development of Person County as the center of fossil fuel generation in our state. Currently, the Roxboro Steam Electric Plant is one of the largest coal fired power plants in North Carolina. While this Carbon Plan schedules it for retirement in the 2030s, it will be immediately replaced with a gas combustion plant. This project will keep pollution in this community for decades, leading to further adverse health impacts and keeping the population reliant on a fossil fuel driven economy. While we understand Duke's desire to use existing transmission lines and infrastructure, this same infrastructure could be retrofitted and modified to support solar development and battery storage on this brownfield site.

Furthermore, other utilities and projects are coming to and through Person County. Dominion Energy has proposed the Moriah Energy Center, a 25 million gallon liquefied natural gas storage facility, which will emit thousands of tons of greenhouse gasses. The T-15 Reliability Pipeline, also proposed by Dominion, crosses through multiple rural counties to supply the Roxboro gas plant with fuel. As the Carbon Plan does not consider the actions and subsequent impacts from different utilities, we believe the Utilities Commission must be a governing body that considers our entire energy landscape to avoid additional harm to Person County residents and residents in other counties with similar future risks. Protecting our residents and communities from the joint impacts of multiple utilities protects all of us from future harms and promotes equity as we continue to build a carbon-neutral power sector.

Duke Energy's Carbon Plan engagement strategy for impacted communities lacks transparency, fails to demonstrate the impact of community engagement and fails to provide the NCUC with

enough detail to evaluate if the 2022 Carbon Plan order requirements are satisfied. Therefore, we recommend the following:

a. **Transparency on Community Engagement.** Going forward, Duke's IRP website should include materials on community engagement subject to the same Chatham House restrictions as it does for other stakeholder engagement-for future CPIRPs. Specifically, this should include:
   i. A publicly accessible, central repository regarding Carbon Plan impacted community outreach
   ii. Widely publicized notice of future community meetings
   iii. Past meetings slides, recording and documents publicly available
   iv. Documents and written information relating to the overall process by which Duke is conducting its engagement and outreach measures
   v. Feedback opportunities for the documents requested in (iv) without restriction to geographic location or identity

b. **Demonstrate Impact of Community Engagement**. The CPIRP rules should require the utility to demonstrate how community feedback was incorporated in Carbon Plan decision-making, if at all, and if not, why not. Furthermore, Duke Energy must make its full plan for public engagement in impacted and environmental justice communities public and open for feedback from North Carolina ratepayers.

c. **Require Additional In-Person and Written Utility Reporting to the Commission on Community Engagement**. During the 2022 CPIRP process, the Commission required Duke to report out and allow time for questions at the Commission's meetings. We recommend that Duke should be required to do the same following its August 2023 CPIRP filings, so that the Commission has the opportunity to direct additional community engagement as appropriate during the remainder of the 2023/4 CPIRP process and occur on an annual basis. This is a departure from the biannual submission of the Carbon Plan but allows the Commission to provide increased oversight over this vital process.

The Carbon Plan is Not Affordable

As stated explicitly in our oral statement made on April 30th to the Utilities Commission and the Public Staff, the proposed Carbon Plan is not affordable for North Carolina consumers due to the extensive amounts of infrastructure required. Duke Energy has estimated that bills will increase by $80 per month on average by 2038.[13] This estimate does not include general rate increases or

[13] *Supplemental Planning Analysis*. Duke Energy. (2024, January 31). https://www.duke-energy.com/-/media/pdfs/our-company/carolinas-resource-plan/supplements/supplemental-planning-analysis.pdf?rev=f134d62ba6d645ccb3de2bc227a0d42d

fuel riders, meaning bills in actuality could skyrocket to hundreds of dollars extra per month. While we in the Southeast have some of the least expensive bills in the nation, this Carbon Plan projects drastic bill impacts that are not truly transitioning us to clean energy.

Duke Energy continually emphasizes profits over the legal requirements by which it is bound and the pragmatism of the energy transition. In the only portfolio presented in Duke's August 2023 plan that meets House Bill 951's carbon reduction requirements, Duke added an arbitrary 20% adder onto all new generation resources.[14] This adder drastically inflates the cost of Duke's plan and implies significant risks for electricity customers while minimizing the benefits of energy efficiency and other demand-side investments in reducing customers' electricity bills. Duke's demand growth is driven by large industrial, manufacturing, and data center loads, but residential customers are exposed to rising costs. While we respect the wishes of large corporations and accounts that want to keep their bills low, it is not equitable to shift costs of one customer onto residents that neither benefit nor know these costs are coming from other customers. NCLCV acknowledges that the use of renewable energy will also come with up front costs and subsequent bill impacts. The transition to any technology from coal will come with economic and systemic costs. However, it is the role of the NC Utilities Commission to ensure a sustainable energy system from now until carbon neutrality is reached in 2050.

The Carbon Plan Relies on Immature Technology to Reach Carbon Neutrality

In Duke Energy's Supplemental Planning Update, three tenets of the plan are emphasized: reliability, least cost, and least risk. Considering this proposed Carbon Plan relies on hydrogen gas and small modular nuclear reactors (SMRs) to achieve North Carolina's mandate of carbon neutral power generation, NCLCV has significant concerns about this plan's risk to North Carolina's consumers.

While Duke Energy says that this plan is the "least risk,"[15] it is actually not the lowest risk plan for consumers due to its future reliance on unproven, inaccessible future technologies. After constructing methane gas plants, Duke plans to gradually transition these plants to blended co-firing of methane and hydrogen with a gradual scale up on fuel. As mentioned previously, Duke did not get a Hydrogen Hub, meaning there is no plainly available source for the fuel intended to get North Carolina to carbon neutrality.[16] There are only 1600 miles of hydrogen fuel pipelines in the country and the federal government has indicated significant retrofits will be

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[14] Duke Energy. (n.d.-a). Carolinas Resource Plan: Chapter 3. https://www.duke-energy.com/our-company/about-us/irp-carolinas

[15] See *Supplemental Planning Analysis*. Duke Energy. (2024, January 31). https://www.duke-energy.com/-/media/pdfs/our-company/carolinas-resource-plan/supplements/supplemental-planning-analysis.pdf?rev=f134d62ba6d645ccb3de2bc227a0d42d

[16] Wagner, A. (2023, October 14). US Energy Department passes on hydrogen 'hub' for southeast | Raleigh News & Observer. https://www.newsobserver.com/news/politics-government/article280513479.html

needed to transition methane pipelines to 100% hydrogen.[17] Because the transition from methane to hydrogen falls outside Duke's window of their Near Term Action Plan, these issues and uncertainties can be conveniently ignored.

Duke's additional plans to employ SMRs are also in question. SMRs are not viable utility scale technology, and projects across the United States that develop SMRs have incurred significant delays and cost increases. Many of these projects have also been canceled, casting doubt upon the viability of this potentially emerging industry. If either hydrogen or small modular nuclear technologies do not materialize, North Carolina ratepayers will be subject to cost overruns and carbon neutrality may not be possible. Any failure of new technology will allow Duke to fall back on expensive and polluting methane gas infrastructure. Cost overruns of nuclear power plants are plaguing the South, and North Carolina is at risk for similar issues if Duke relies on SMRs for their baseload generation capacity.

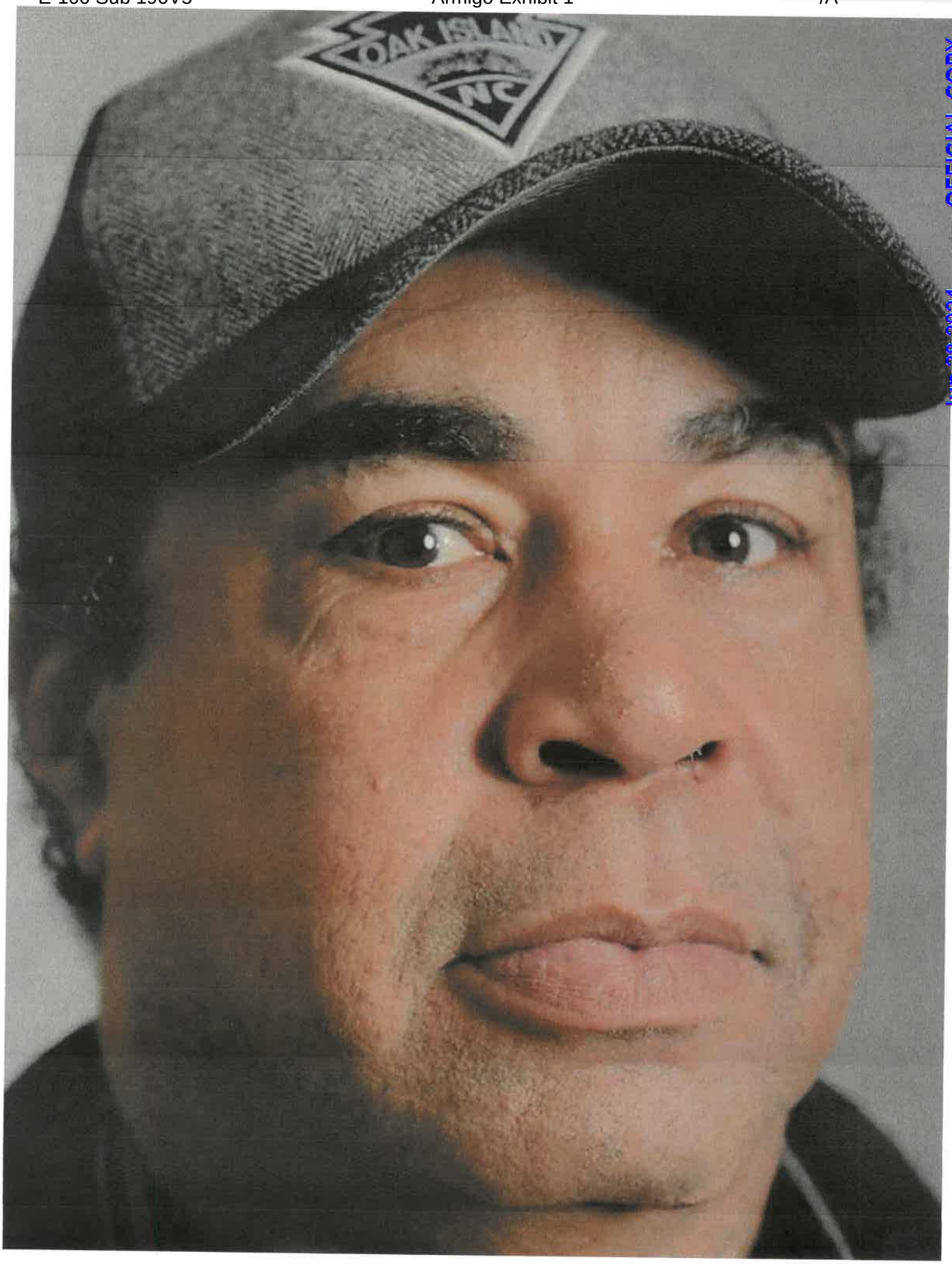
Conclusion

NCLCV as an organization is committed to expanding reliable, affordable, and clean energy and therefore does not support Duke Energy's attempt to cement our state into the legacy of fossil fuels. Specifically, this Carbon Plan also inequitably impacts frontline, environmental justice, and low-income communities: This Carbon Plan overburdens communities already dealing with the legacy of coal, does not provide sustainable transitions to renewable energy for both frontline communities and others across the state, and the Commission did not provide in person opportunities for those communities to share their feedback and experiences. The Commission has an obligation to comply with the law as it is written and must require a stricter transition to clean energy from every utility operating within our state. Duke Energy has never and will never be exempt from our laws and the Companies must begin operating with the best interests of North Carolinians in mind.

Signed on behalf of NCLCV,

Michelle (Meech) Carter
Director of Clean Energy Campaigns

[17] Office of Energy Efficiency and Renewable Energy. (n.d.). *Hydrogen pipelines | Department of Energy*. Department of Energy. https://www.energy.gov/eere/fuelcells/hydrogen-pipelines



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Union of Concerned Scientists

ISSUE BRIEF

Gas Malfunction

Calling into Question the Reliability of Gas Power Plants

Over the last decade, the United States has made significant progress transitioning the electricity sector toward solar, wind, and other clean sources of energy. In 2022, the nation got more than 22 percent of its electricity from renewable resources, nearly twice the amount of 2012 renewable generation (EIA 2023a). Despite this progress, the power grid has simultaneously become even more reliant on natural gas–fired power plants.[1] While the amount varies by region, gas plants provided 40 percent of total US electricity generation in 2022 and accounted for 43 percent of generating capacity (EIA 2023a). This heavy reliance on gas plants, coupled with an assumption that gas plants are more reliable than they actually are, is a vulnerability for the power grid and for consumers.

Historically, utilities and grid operators often have considered gas plants to be "firm" resources that could generate electricity whenever it was needed. However, as recent evidence has shown, the US fleet of gas plants is susceptible to large-scale failures during extreme weather. For example, recent winter storms in Texas and the Southeast knocked unprecedented portions of the fleet offline, ultimately leading to rolling blackouts for millions of people.[2] Other extreme weather events, such as heat waves and droughts, have also significantly interfered with the operation of gas plants, even if winter storms pose the greatest threat.

As the impacts of climate change intensify, extreme weather events are becoming more frequent and more severe (Cohen, Pfeiffer, and Francis 2018; Cohen et al. 2021; UCS 2018; Marvel et al. 2023). This increases the threat to gas plants and, in turn, to the reliability of the power grid. In a world with a rapidly changing climate and increasingly frequent gas plant failures, we must reassess the role of this resource in ensuring grid reliability.

Winter Jeopardizes the Reliability of Gas

In most parts of the United States, regulators, grid operators, and communities are growing increasingly concerned about the impact of severe winter weather on the energy system. In this context, the Federal Energy Regulatory Commission (FERC), the major regulator of the power grid and other energy infrastructure, and the North American Electric Reliability Corporation (NERC), a separate authority that sets reliability standards in the power sector, have identified five major winter storm events since 2011 that have "jeopardized grid reliability" (Table 1) (FERC 2023). Each event caused significant, unplanned losses of generation capacity due to freezing equipment, disrupted fuel supplies, and other system failures (FERC 2011; FERC 2019; FERC 2021; FERC 2023; NERC 2014). Rolling blackouts ensued in all but one of these events, leaving homes and businesses without electricity or heat on some of the coldest days of the year.

Table 1. Generation Failures and Rolling Blackouts During Five Extreme Winter Storms

Winter Storm	Peak Unplanned Generation Outages Due to Cold Weather (MW)	Peak Magnitude of Rolling Blackouts (MW)	Length of Rolling Blackouts (hours)
2011 Southwest Storm	14,702	5,412	7
2014 Polar Vortex	9,800	300	3
2018 South Central Storm	15,600	0	0
2021 Winter Storm Uri	65,622	23,418	70
2022 Winter Storm Elliott	90,500	5,459	7

All five winter storms knocked significant amounts of generation capacity offline. All but the 2018 storm caused rolling blackouts.
Notes: The magnitudes of the 2021 and 2022 rolling blackouts are summed across multiple balancing authorities. For example, during the 2021 storm, ERCOT peaked at 20,000 MW of rolling blackouts, SPP peaked at 2,718 MW, and MISO South peaked at 700 MW, adding up to 23,418 MW. Lengths for the 2021 and 2022 storms are specific to the balancing authorities that implemented the longest rolling blackouts: ERCOT in 2021 and the Tennessee Valley Authority in 2022.
SOURCE: FERC 2023.

The five events varied greatly in their impact on US generation capacity, as well as the magnitude and duration of the resulting rolling blackouts.[3] Also, the magnitude of the generation outages did not always correspond to the severity of the blackouts. For example, Winter Storm Elliott in December 2022 forced the most generation capacity offline at its worst point—peaking at a historic 90,500 megawatts (MW). However, the rolling blackouts and resulting human toll were far less than those of Winter Storm Uri in February 2021, which prompted blackouts for more than 70 hours despite peaking at 65,622 MW of capacity offline. Texas suffered that storm's worst impact by far due to a variety of factors. Among other things, scant transmission capacity connecting the state's independent power grid to other grids severely constrained the amount of electricity Texas could import from its neighbors.

Winter Storm Uri's devastation in Texas was unprecedented in the United States. Total damages have been estimated at $195 billion (City of Austin and Travis County 2021). In freezing temperatures, some households went without electricity for as long as four days (FERC 2021). More than 14 million people either lacked water supplies or were told to boil their drinking water (McNamara 2021). Moreover, follow-up research found an inequitable distribution of the power outages: households in racial minority communities were more likely to have experienced an outage, and those living with disabilities suffered longer and more frequent outages (Shah et al. 2023; Chakraborty, Collins, and Grineski 2023).

Ultimately, the effects of Uri killed 246 people in Texas, about two-thirds of whom died of hypothermia (Svitek 2022). On top of the human toll, the financial costs to communities have persisted long after the disaster and beyond Texas. Utilities significantly raised rates to pass their much higher costs for energy purchased during the storm onto customers, who are now burdened with paying those costs for years to come (Kansas Corporation Commission 2023; Hart 2022).

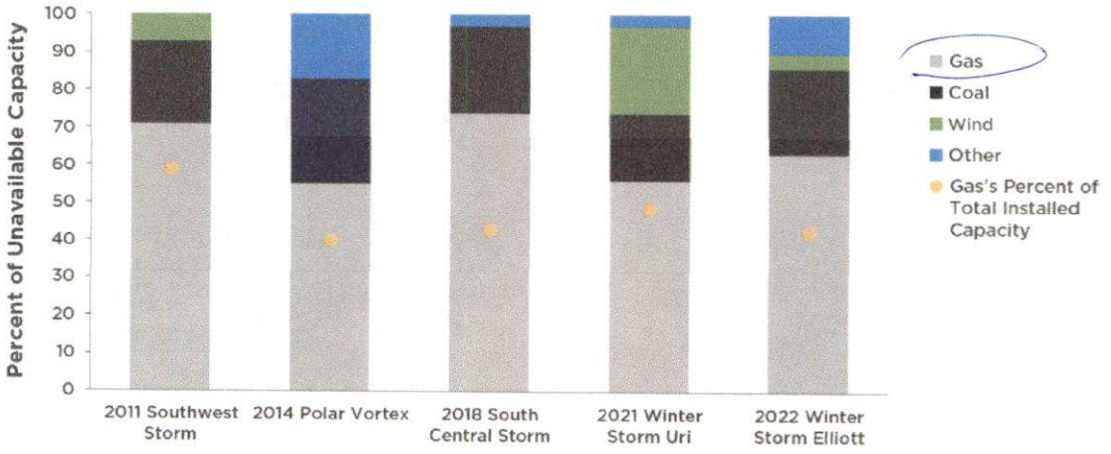
EXTREME WINTER WEATHER CAUSES GAS PLANTS TO FAIL DISPROPORTIONATELY

2011 → 2022

While the scale of the five storms and their impacts varied widely, the energy system failures were very similar across them. A key commonality among all five was that gas plants accounted, by far, for the largest source of generating capacity knocked offline. The cumulative gas plant capacity that failed during each event was more than twice that of the second-most-impacted category of capacity (Figure 1). Each storm exposed vulnerabilities of both the gas plant fleet within affected regions and the gas infrastructure that delivered fuel to those plants.

2x higher failure

Figure 1. Generation Failures by Fuel Type During Five Extreme Winter Storms



Gas plants accounted for most of the failed capacity in all five recent extreme winter weather events. Gas plants failed disproportionately in comparison with gas's percentage of total installed capacity, indicating that they are more susceptible to extreme winter weather than are other resource types. Notes: (1) 2011 data are specific to Texas's main grid operator, ERCOT; it had the most customers experiencing rolling blackouts. (2) 2014 data do not include wind generator outages because NERC had no mandatory reporting protocol for them. (3) 2018 data are specific to failures caused by freezing issues at generators. (4) In its 2011 report, FERC adjusted wind outages downward to account for expected output based on actual wind speed conditions. It did not do so for the 2021 and 2022 storms. This could have made the wind outages in 2021 and 2022 appear more substantial than they actually were, since grid operators rarely expect wind generators to operate at full output. (5) Gas's Percent of Total Installed Capacity is specific to the areas impacted by the storm. SOURCES: FERC 2011; FERC 2019; FERC 2021; FERC 2023; NERC 2014; EIA 2023b; SPP, n.d.

The US gas infrastructure system can be grouped into three primary components: production, transportation and storage, and end use, with power plants being the largest group of end users in terms of gas consumed (EIA 2023c). Extreme winter storms can affect all three components, potentially compounding the strain on gas plants and forcing many of them to fail at the same time. The power and gas systems' mutual dependence on each other has exacerbated these so-called correlated outages, but these plant failures can also be attributed to the sheer amount of area affected by the weather events in question. The events have exposed gas plants and gas infrastructure across large geographic areas to extremely low temperatures. Many facilities were unprepared and ill-designed for the low temperatures (Hilbert and Hallai 2021; FERC 2019). Even facilities that *were* prepared on paper often failed when an extreme storm hit (FERC 2021; FERC 2023).

SEVERE WEATHER DIRECTLY IMPACTS GAS PLANTS

A primary cause of gas plant failures is the direct impact of extreme cold weather on plant operations and equipment. Across all generator types, the top direct causes of plant outages in each of the major winter storm events related to equipment freezing, as well as to a second category labeled "mechanical/electrical" (FERC 2023). Equipment freezing is often caused by the freezing of particular components, including valves, water lines, inlet air systems, and sensing lines. Mechanical/electrical are non-freezing issues that occur when cold temperatures affect certain plant components. These issues include wiring failure, mechanical wear of valves, and embrittlement of flexible seal materials like rubber and silicone.

A troubling pattern in the more recent failures, which were largely of gas plants, is that they generally took place when temperatures were *above* the plants' minimum ambient temperature ratings.[4] Across fuel types, 81 percent of the freeze-related outages during Winter Storm Uri in 2021 occurred when the temperature was above the generating unit's minimum ambient temperature rating; that figure was more than 75 percent for Winter Storm Elliott in 2022 (FERC 2021; FERC 2023).

SEVERE WEATHER JEOPARDIZES FUEL SUPPLIES

Issues related to fuel supply are the second significant cause of lost gas capacity during extremely cold weather. Unlike other thermal power plant types, such as coal or nuclear plants, gas plants generally do not store their fuel on site. Instead, they depend on the real-time delivery of gas via pipeline, burning it upon delivery to produce electricity. This distinct characteristic leaves gas plants vulnerable to running out of fuel, since extreme cold weather can interrupt both the production and the transportation of gas. All five storm events involved gas-supply issues (FERC 2021; FERC 2023).

The significant drops in gas production during the 2011, 2021, and 2022 storms arose largely due to such issues as "freeze-offs" as liquids in the gas wells, wellheads, and ancillary equipment froze up and blocked the flow of gas.[5] During the 2022 event, gas production in the Marcellus and Utica shale formations in the Appalachian Basin dropped by 23 and 54 percent, respectively (FERC 2023). Production dropped even more during Winter Storm Uri in 2021: Texas experienced a 70 percent decrease and the lower 48 states saw an overall 28 percent decrease (FERC 2021).

Gas supply issues can also arise even if production does not decrease. The 2014 and 2018 events did not cause significant drops in production even though fuel supply issues arose. In part, these occurred due to pressure drops and other physical issues affecting gas pipelines, but they also resulted from high coincident gas demand from non-power plant end users, such as homes and businesses trying to keep temperatures up. To save money, many gas plant owners choose to sign only "non-firm" or "interruptible" contracts for at least some of their fuel supply and transportation. The contracts of "firm" or "non-interruptible" customers, such as those in the residential sector, are fulfilled before non-firm customers, leaving less gas available to power plants during cold snaps as demand soars for residential heating.

Even firm contracts to supply or transport fuel do not give a gas plant a guarantee that it can get fuel if a winter storm is severe enough. During Winter Storm Elliott in 2022, failed gas deliveries under firm fuel supply and/or transportation contracts led to 16.5 GW of cumulative losses of gas plant capacity. This was even more than the 14 GW of capacity lost due to failures to fulfill gas deliveries under non-firm transportation contracts (FERC 2023).[6]

The mutual dependence of the power and gas systems also presents a vulnerability with its potential to create a feedback loop of failures. Gas plants need fuel to produce electricity, and the gas system needs electricity to supply the fuel. Rolling blackouts can hit gas production and processing facilities, constraining the amount of fuel supplied to the country's primary source of electricity, causing more rolling blackouts, and so on. FERC estimated that power losses caused 23.5 percent of the gas production drop during Winter Storm Uri (FERC 2021).[7]

Summer Also Threatens Gas Reliability

Extreme summer weather can also pose significant threats to gas plants, even if these are typically less severe than those posed by extreme winter weather. Heat waves, droughts, hurricanes, and floods can all affect gas plants, with heat waves and droughts having the most significant impact.

HEAT CAN FORCE POWER PLANT DERATES AND OUTAGES

High temperatures can reduce both the efficiency and the maximum generating capacity of gas plants. High ambient air temperatures decrease the maximum generating capacity of gas plants by reducing the amount of fuel they can burn. In addition, gas plants require cooling; as the coolant (water or air) gets hotter, plants are less able to dissipate waste heat. As a result, they operate at lower power (Dumas, KC, and Cunliff 2019).

Across all types of generation, extreme heat increases the likelihood of power plant output reductions (or "derates") and forced outages (NERC 2023). In summer, high temperatures and prolonged operations often occur simultaneously as heatwaves lead to higher electricity demand; the combination can cause unexpected plant breakdowns. For example, many California gas plants were forced offline or significantly derated over the course of a 10-day heatwave in September 2022 (Regenerate California 2023).

DROUGHT CAN HAMSTRING WATER-DEPENDENT POWER PLANTS

Because many plants use water for cooling, a shortage of cooling water during extreme summer weather can also affect the gas fleet (EIA 2018). In fact, water shortages can force water-dependent plants to shut down entirely. For example, Texas experienced its second-worst drought in the state's history between 2010 and 2015. As a result, one plant operator took three gas plant units, totaling 403 MW, offline for almost a year until rain replenished the reservoir from which they pulled cooling water (ERCOT 2016). Since then, Texas's grid operator, ERCOT, has published drought risk analyses that have repeatedly classified more than 10,000 MW of gas plant capacity as at risk over the following 18 months (ERCOT 2023).

As the impacts of climate change intensify and lead to more frequent and more severe weather events, the risks that drought poses to the gas fleet may increase significantly. For example, a recent analysis found that under a high-emissions climate scenario, the most severe drought could disrupt 20 percent of ERCOT's thermal generation in Texas. The results were mixed when the same study looked at whether climate change could lead to an increase in thermal-generation disruptions in the state due to drought (Turner et al. 2021).

A Reassessment of Gas Plants' Contributions to Grid Reliability Is Overdue

Extreme weather events, in both winter and summer, illustrate the fragility of gas plants. They also highlight the clear need to reevaluate the assumed contributions of these resources to grid reliability. For far too long, programs to ensure the ability of electricity supplies to meet customer demand (often referred to as "resource adequacy") have overvalued the reliability contributions of gas plants.

The methods used to evaluate resource adequacy can have multiple implications. First, the chosen method directly determines the contribution of existing resources, using the result to inform how much the owner of the resource gets compensated for that contribution. Second, when utilities and regulators make decisions about new resource investments, resource adequacy can be a major factor tipping the scales in favor of certain resource types. Finally, and most important, overestimating the contributions of certain resource types can ultimately lead to power outages. This has been the case especially for gas plants, which failed at an unprecedented scale during recent extreme winter storms.

Currently, grid operators use relatively simple methods to determine the contributions of dispatchable resources, such as gas plants, toward resource adequacy. Most grid operators assume that gas plants will be available to generate electricity at their installed capacity (ICAP) or that gas plants will be available at their unforced capacity (UCAP), which takes into account the probability of some forced outages (Box 1). However, neither method accounts for the possibility of widespread, correlated gas plant outages, such as those experienced during the five extreme winter storms.

Box 1. Three Methods for Measuring Reliability Contributions

ICAP, UCAP, and ELCC are the three most common methods grid operators use to determine the reliability contributions of different resource types.

ICAP—"installed capacity"—is essentially a measure of a power plant's maximum generating capacity. In many cases, ICAP values are determined seasonally (e.g., separate values for summer and winter). Many grid operators require testing to confirm that power plants really can produce energy at their ICAP values.

UCAP—"unforced capacity"—starts with a power plant's ICAP value, adjusting it to account for the probability that the plant will not be able to produce electricity when needed. UCAP values are typically calculated using historical operational data to determine the probability of a power plant being offline.

ELCC—"effective load carrying capability"—is a probabilistic measure of a power plant's ability to produce energy when it is needed most. ELCC uses probabilistic grid-modeling tools to determine the expected reliability contribution of a resource or group of resources under a wide range of scenarios.

To address the shortcomings of current methods, the electricity industry has begun exploring more sophisticated ways to assess the reliability contributions of thermal resources, including gas plants (Stenclik 2023). One alternative method is effective load carrying capability (ELCC). For years, many grid operators have used ELCC to assess the reliability contributions of variable renewable resources such as wind and solar.[8] When applied to gas plants, ELCC can account for the risk of correlated gas plant outages due to, for example, extreme winter weather that directly affects gas plants or disrupts the gas fuel supply (Dison, Dombrowsky, and Carden 2022). Thus, some grid operators are considering applying ELCC not just to renewable resources but to *all* resource types, including gas plants (PJM 2023a). This more accurate quantification of the resource adequacy contribution of gas plants is a critical step toward ensuring that the grid is reliable, especially in the face of increasingly extreme weather events.

Gas Failures in Extreme Weather Events Warrant Action

Gas plants have a reliability problem when it comes to extreme weather, particularly during the peak-demand winter and summer seasons. Scientists have linked climate change to a greater likelihood or severity of extreme weather events like heat waves, droughts, and winter storms (Cohen, Pfeiffer, and Francis 2018; Cohen et al. 2021; UCS 2018; Marvel et al. 2023). If the trajectory of worsening extreme weather events continues, they could increasingly threaten the US electricity system, currently dominated by gas plants. Furthermore, as weather events get more extreme, rolling blackouts will become more dangerous because being without electricity during extreme temperatures can be life threatening.

FURTHER INVESTMENT IN FOSSIL FUELS WILL NOT SOLVE THE PROBLEM

The failures of gas plants and the gas system in extreme weather often involve correlated outages and vulnerabilities that are inherent to gas as a fuel source. Among others, these vulnerabilities include the absence of on-site fuel and a high dependence on water, which makes the resource prone to both freezing and drought issues.

more gas plants = not the solution

Therefore, grid-reliability problems that arise in extreme weather cannot be solved simply by building out more infrastructure, such as gas production wells, pipelines, and power plants. Instead of bolstering grid reliability, the evidence since 2011 suggests that continuing to lean on gas plants will lead to the same types of grid failure in extreme weather. For example, the Mid-Atlantic grid operator, PJM Interconnection, has more generating capacity coming from gas plants than from any other source, and it was set to have a high capacity-reserve margin during 2022's Winter Storm Elliott (PJM 2021). But the dominance of gas plants proved to be a glaring weakness. Gas capacity made up more than 70 percent of the power plant outages and pushed PJM to the brink of rolling blackouts (PJM 2023b).

Nor will the problem be solved by equipping gas plants with the ability to burn diesel or another fossil fuel that can be stored on site. Diesel plants, like gas plants, have also been found to underperform in cold weather, and plant operators have experienced failures in fuel switching during recent winter storms (Murphy, Sowell, and Apt 2019; FERC 2021; FERC 2023).[9] Furthermore, petroleum-based fuels like diesel are heavily polluting and, like gas and coal, they exacerbate global climate change, making their use a misguided, unproductive approach to grid reliability during extreme weather events.

While "weatherizing" or "winterizing" gas plants and other components of the gas system can mitigate near-term reliability risks, these measures are not the ultimate solution to the grid reliability problems the country has experienced in recent years. During Winter Storm Elliott,

for example, the owners of almost all power plants that experienced failures had cold weather–preparedness plans in place, as required by NERC's winterization standards (FERC 2023).[10] Most power plants in colder climates, such as those in PJM and MISO's northern territory, are familiar with cold-weather operations and their enclosed designs shield them from the elements (FERC 2019).[11] Yet large amounts of gas plants in those grid operators' territories still went offline unexpectedly during Winter Storm Elliott (MISO 2023; PJM 2023b).

The extent of the damage due to future extreme weather events is uncertain, and the fact that the gas-fired power system could theoretically be weatherized to withstand today's extreme storms does not mean it will withstand tomorrow's storms. Furthermore, a strategy primarily focused on weatherizing gas plants and other gas infrastructure would be an unsustainable, costly investment in a resource that is a primary contributor to climate change and must be phased out along with all other fossil fuels in coming decades.

REGULATORY CHANGES ARE NEEDED TO ADDRESS GAS FAILURES

Regulators and the industry are exploring ways to at least mitigate near-term reliability risks. Early signs suggest that key stakeholders are beginning to recognize the growing vulnerability of gas-fired power in the context of climate change. For example, after Winter Storm Elliott, PJM proposed to adopt an ELCC method of capacity accreditation across all resources, including thermal generators such as gas plants. That would be a significant step toward a more accurate assessment of a gas plant's reliability contributions and vulnerabilities (PJM 2023a). Beyond PJM, FERC is considering more consistent and accurate methods to accredit capacity nationwide, which could lead to clearer, more uniform guidance from the commission on how to quantify the roles of different resources in keeping the lights on (ACP 2023).

NERC has also begun acknowledging the recent reliability shortcomings of thermal generators (NERC 2023). In the aftermath of Winter Storm Uri in 2021, NERC adopted new reliability standards that include better winter-preparedness planning and transparency from power plant owners. The standards will require owners to identify vulnerable plant components and implement freeze-protection measures as a way of weatherizing their generators (NERC 2021).

To hold the owners of gas plants and gas infrastructure accountable in keeping communities safe during the transition to clean resources, some amount of weatherization investment may be prudent. Under FERC's oversight, NERC creates comprehensive reliability standards for electric transmission and power plants, but no such standards cover the gas system that delivers fuel to thousands of those plants. Stronger oversight and the establishment of reliability rules for the gas system, which may trigger weatherization investments, will be necessary to reduce the risks of more Uri-like catastrophes during the transition to clean energy. Critically, any such rules must be accompanied by that transition as the main goal.

Furthermore, the risks of grid failure will evolve as the energy transition progresses and the climate continues changing. Information about when, where, and why gas plants and other resources fail is currently publicly available only in a limited manner, with varying degrees of transparency from state regulators, regional grid operators, and federal authorities such as FERC and NERC. Making high-quality data on grid reliability available and accessible to policymakers, researchers, and the public would help ensure that the grid is better prepared to withstand the wide array of threats to reliability.

Clean Resources Can Help Ensure Grid Reliability

When deciding about new investments for the purpose of meeting grid reliability requirements, regulators and utilities should prioritize clean alternatives to gas plants. These include solutions on both the supply side and demand side of the nation's energy system.

RENEWABLES, STORAGE, AND TRANSMISSION ARE CRITICAL SUPPLY-SIDE SOLUTIONS

A diverse portfolio of renewable energy resources, coupled with energy storage and additional transmission capacity, can contribute significantly to meeting resource adequacy requirements. For example, diversity in renewable technologies (solar, onshore wind, offshore wind, geothermal, and hydropower) together with geographic diversity of these resources can help ensure that output from renewables is sufficiently consistent across a region. When combined with energy storage, renewable energy can be stored for occasions presenting the greatest challenges to grid reliability. At the same time, significant investments in transmission capacity will make it easier to integrate growing levels of renewable energy into the grid and help ensure that energy can be shared across regions. However, grid operators must conduct detailed studies before integrating new energy projects into the grid, and the list of projects waiting to be studied (often referred to as the "interconnection queue") has increased dramatically over the past decade, leading to significant delays in bringing clean resources online (Rand et al. 2023).

The role of gas plants on a deeply decarbonized grid is murky; in contrast, clean energy technologies clearly will play a pivotal role. Many expert studies have indicated that approximately 90 percent of electricity could come from renewable sources while maintaining grid reliability with today's technologies (Denholm et al. 2022; Clemmer et al. 2023). While such studies show that renewable energy and energy storage resources can meet a significant portion of resource adequacy requirements, many analyses keep a significant amount of gas plant capacity online, operating very infrequently to help ensure reliability on a highly decarbonized grid. However, most studies almost certainly overvalue the reliability contributions of gas plants, failing to account for the very real possibility of widespread, correlated gas plant outages.

In addition to studies showing the reliability benefits of a portfolio of clean energy resources, there are also clear examples of individual renewable resource types making significant contributions toward grid reliability. For example, a recent PJM analysis indicated that the winter ELCC of offshore wind (68 percent) is higher than that of a gas combustion turbine (63 percent) (PJM 2023c). This indicates that, megawatt for megawatt, offshore wind will go further toward ensuring resource adequacy in PJM. On a more tangible level, a different analysis found that, if Texas had had an additional 10 GW of solar during Winter Storm Uri, the rolling blackouts would have been far less widespread for multiple hours every day (Rhodes 2023).

DEMAND-SIDE SOLUTIONS REDUCE AND SHIFT ENERGY CONSUMPTION

Demand-side solutions can also contribute to resource adequacy in lieu of further investments in, and reliance on, gas plants. Energy efficiency, flexible demand, and distributed energy resources can all reduce or shift electricity demand, easing the strain on the power grid (McNamara 2020). For example, a recent analysis found that "virtual power plants"—collections of demand-side resources such as rooftop solar, distributed batteries, electric

vehicles, and smart appliances—could meet resource adequacy needs and significantly reduce utility costs (Hledik and Peters 2023). Other studies have demonstrated that demand-side resources can play a significant role in decarbonizing the power grid and maintaining grid reliability throughout the transition to clean energy (Clack et al. 2021).

THE BENEFITS OF CLEAN ALTERNATIVES EXTEND BEYOND GRID RELIABILITY

Undoubtedly, clean energy alternatives to gas plants can play a major role in ensuring grid reliability. Yet clean energy options offer many additional benefits. First and foremost is the reduction in global warming emissions that comes from transitioning away from fossil-fueled resources. As the impacts of climate change intensify and extreme weather events endanger the power grid and broader energy system, it makes little sense to double down on gas plants: associated methane emissions—from extraction to leakage to combustion—only exacerbate the problem.

Furthermore, reducing the country's reliance on gas plants can improve both air and water quality. Burning gas with air in gas plants produces nitrogen oxides (NO_x), sulfur oxides (SO_x), and particulate matter, all of which are harmful to human health (EPA 2023). NO_x is also a precursor to other air pollutants, such as ground-level ozone, a primary component of smog.

Across the country, gas plants are disproportionately located in communities of color (Cranmer et al. 2023), which subjects these communities to increased health risks from gas plant pollution. Reductions in gas combustion can help reduce the levels of these air pollutants and improve health outcomes for historically oppressed communities. In addition, gas extraction can pollute both groundwater and surface water, so reducing the use of gas at power plants would reduce the pollution of water supplies that people depend on.

Finally, demand-side solutions can decrease the amount of new large-scale infrastructure that would be needed—transmission lines, distribution system infrastructure, and generation resources. Not only do demand-side solutions reduce global warming emissions and pollution, but they also reduce the amount of land required to produce energy along with the materials needed for large-scale energy infrastructure.

Policy Recommendations

The United States should not continue its overreliance on gas plants to meet the country's electricity needs, given their demonstrated reliability challenges during previews of what extreme weather looks like in a warming world. Grid planners, regulators, and policymakers must update the US energy system with solutions that reduce reliance on gas plants, bolster grid reliability, and mitigate the impacts of climate change.

FERC should order all electricity grid operators to use consistent methodologies when valuing the reliability contributions of all resources. The owners of gas plants benefit from capacity accreditation methodologies that overestimate the reliability contributions of those plants. This policy change would help facilitate the transition to clean electricity by putting clean energy technologies on a level playing field with gas plants and other thermal generators.

State regulators should not approve new gas plants except in the extremely limited cases when there are no viable clean energy solutions for grid reliability. In making such a

determination, state regulators should require utilities to use probabilistic modeling tools to quantify the reliability contributions of new gas plants, taking into account the impact of extreme weather on plant performance. No new gas plants should be built in environmental justice communities.

FERC, grid operators, and state utility commissions should continue reducing market and regulatory barriers to clean energy resources. They should expand efforts to address the interconnection queue backlog of renewable and storage projects, increase interregional transmission planning to enable sharing of clean energy across regions, and allow aggregation of distributed energy resources and demand response to reduce peak demand and overall costs.

Grid operators, along with federal and state regulators, should provide the public with detailed, easily accessible information about power plant outages. This includes state public utility commissions and regional grid operators, as well as federal authorities such as FERC and NERC. More transparency will enable the public to better understand the causes of such outages and help in holding power plant owners accountable for preparing for, and responding to, these threats to grid reliability.

Policymakers should increase regulatory scrutiny of the gas system to reduce the risk of failures in extreme weather—and, in the event that failures do occur, ensure that they do not lead to widespread gas plant outages. A new regulatory structure for gas system reliability should focus on managing the transition away from gas, with the clear intention of phasing out the fossil fuel.

Gas plants can be unreliable, especially during extreme weather events, which are growing increasingly frequent and intense as a result of climate impacts from heat-trapping emissions, which come from gas plants themselves. This cycle must end. It is increasingly clear that consumers cannot trust gas when it is needed most, and the transition to clean energy provides an opportunity to build a more reliable power grid while simultaneously addressing climate change.

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ACKNOWLEDGMENTS

This report was made possible by the generous support of the Heising-Simons Foundation, the Joyce Foundation, and UCS members.

The authors would like to thank the following people for their thoughtful review of the issue brief and executive summary: Yvonne Cappel-Vickery, Alliance for Affordable Energy; Ari Eisenstadt, California Environmental Justice Alliance; Priya Sreedharan and Casey Baker, GridLab; and Tom Rutigliano, Natural Resources Defense Council.

The authors are also grateful to colleagues at the Union of Concerned Scientists who were instrumental members of the project team, including Brady Watson, Jeff Deyette, John Rogers, Sanjali De Silva, and Vivian Yang. We also thank many other colleagues for their thoughtful feedback and support, especially Abby Figueroa, Ashley Siefert Nunes, Chris Bliss, Julie McNamara, Juliet Christian-Smith, Mike Jacobs, Steve Clemmer, and Susan Muller.