STATE OF NORTH CAROLINA
UTILITIES COMMISSION
RALEIGH
DOCKET NO. E-100, SUB 157

BEFORE THE NORTH CAROLINA UTILITIES COMMISSION

In the Matter of	)	
2018 Integrated Resource Plans	)	ATTORNEY GENERAL'S OFFICE
And Related 2018 Compliance	)	INITIAL COMMENTS ON DUKE'S
Plans	)	INTEGRATED RESOURCE PLANS

The North Carolina Attorney General's Office ("AGO") respectfully submits these initial comments regarding the 2018 Integrated Resource Plans ("IRPs") for Duke Energy Carolinas and Duke Energy Progress (referenced together as "Duke"). This proceeding investigates utility plans for meeting electric power requirements in North Carolina over the next 15 years using "the least cost mix of generation and demand-reduction measures" that will provide adequate, reliable electric service.[1]

Duke's plans propose using new supply, primarily fueled by natural gas combustion turbines, to meet energy requirements over the planning period. Deficiencies in Duke's current modeling and analytic methods, however, mean that this supply-side, natural-gas strategy may not be the least cost mix. The AGO sees three areas where further analysis is warranted. Specifically:

- Duke's modeling should test a wider range of storage technologies paired with renewable energy generation.

- Planning should take into account the costs to ratepayers from climate change caused by natural gas power generation.

[1] N.C. Gen. Stat. §§ 62-2(3a) (establishing, in quoted text, this policy of the State); 62-110.1(c) (calling for this proceeding).

- Duke's modeling should consider demand-side management, using energy efficiency resources, on a level playing field alongside supply-side alternatives.

I. STANDARD OF REVIEW

Commission Rules require that public utilities forecast their 15-year load requirements, the supply-side and demand-side resources expected to satisfy those loads, the reserve margin that would be produced, and provide a comprehensive analysis of all resource options (supply- and demand-side) for satisfaction of those requirements.[2] Biennial[3] plans and other required information are submitted by the utilities, and in response, other interested parties may file alternative resource plans or submit an evaluation of or comments on the utility reports and/or seek an evidentiary hearing.[4] From the reports, comments and other evidence in the proceeding, the Commission determines the sufficiency of the information provided as well as the reasonableness of the utility plans and may direct further action based on conclusions drawn in the proceeding.[5]

An example of such further action directed by the Commission is found in the 2016 IRP Order, where the Commission recognized the potential role that battery storage could play in regards to resources such as solar and wind:

> The Commission is of the opinion that evaluations of this technology, as documented in the IRPs, have not been fully developed to a level sufficient to provide guidance as to the role this technology should play going forward. As such, the utilities should provide in future IRPs or IRP updates a more complete and thorough assessment of battery

[2] NCUC Rule R8-60(c).
[3] Update reports are required for review in each year when the biennial reports are not filed. NCUC Rule R8-60.
[4] NCUC Rule R8- 60(h), (k).
[5] See, e.g., Order Accepting Integrated Resource Plans and Accepting REPS Compliance Plans In the Matter of 2016 Biennial Integrated Resource Plans and Related 2016 REPS Compliance Plans issued 27 June 2017 In Docket No. E-100, Sub 147.

storage techniques including the "full value" as discussed in the NCSEA comments.[6]

II. AREAS WHERE FURTHER ASSESSMENT IS NEEDED

A. To ensure a least cost mix, the State needs more thorough valuation of storage technologies paired with renewable energy generation.

The recent and upcoming additions of solar resources to Duke's generation portfolio in North Carolina represent a movement towards how electricity requirements could be met over the next 15 years. North Carolina ranks second in the country in solar capacity added in 2017, and remains second in total solar capacity on line.[7] Duke Carolinas projects that its renewables portfolio will grow over the next five years from 1,337 Megawatts (MW) to 2,615 MW, and Duke Progress projects that its renewables portfolio will grow from 3024 MW to 4199 MW over that same time frame.[8] The queue of solar projects in various stages of development amounts to 12,000 MW.[9] Duke has stated publicly that this growth in renewable resources provides an impetus for individuals and businesses to move to North Carolina to live and do business.[10]

An even broader opportunity is presented by solar resource development with the addition of storage technologies. Duke attributes only limited value to solar resources for planning purposes beyond the output that is needed to comply

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[6] Id.

[7] Duke Energy Carolinas, North Carolina Integrated Resource Plan 2018 ("DEC") at 22; Duke Energy Progress, North Carolina Integrated Resource Plan 2018 ("DEP") at 22; U.S. Energy Information Administration, North Carolina State Energy Profile Quick Facts (updated Sept. 20, 2018), www.eia.gov/state/print.php?sid=NC.

[8] DEC at 75; DEP at 73.

[9] DEC at 26.

[10] See Duke Energy, 2017 Sustainability Report (Apr. 4, 2018) at 24, sustainabilityreport.duke-energy.com/downloads/2017-DukeSR.pdf.

with state mandates, finding additional solar capacity would make only a negligible contribution to meeting peak load needs.[11] Duke's basis for attributing the low value to solar capacity is that peak demand hours in winter occur in early morning or evening hours when the sun is not shining.[12]

Duke's assessment may undervalue the peak load contribution from solar technologies. Not all studies support Duke's conclusion that solar projects make only a *de minimis* contribution toward meeting peak load. The capacity values for solar identified in the Astrapé study relied on by Duke are much lower than the results found in a similar study performed by the National Renewable Energy Lab in California, where solar resources have a higher penetration rate.[13]

Even if Duke's peak load analysis is correct, pairing these solar additions with energy storage offers a way to preserve their capacity value. This would eliminate the need for other capacity resources, and therefore take better advantage of the solar resources that would ultimately benefit ratepayers. A strategy that combines storage and solar expands the contribution profile,[14] increasing the value of renewable energy generation for meeting peaking requirements. Moreover, pairing storage with solar can potentially yield cost advantages by reducing inverter and interconnection costs and allowing the storage component to benefit from federal investment tax credits.

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[11] DEC at 37, 43; DEP at 37, 44.
[12] Id.
[13] J. Jorgenson, P. Denholm, and M. Mehos, National Renewable Energy Laboratory, Estimating the Value of Utility-Scale Solar Technologies in California Under a 40% Renewable Portfolio Standard, (May 2014), www.nrel.gov/docs/fy14osti/61685.pdf.
[14] For example, by storing electricity and dispatching it after dark, the resource has a more flexible profile for when it is available to meet demand.

The cost of storage technologies is trending downward,[15] and renewable resources are increasingly competitive on a cost basis with conventional power plants as the cost per KW of installed utility-scale solar and wind technologies fall.[16] More specifically, Lazard's Levelized Cost of Energy Analysis indicates that costs for utility-scale photovoltaics have fallen 88% over the last nine years, while lithium-ion battery prices have fallen 28% over the last five years.[17] Research from the National Renewable Laboratories has found similar trends – utility scale photovoltaics have fallen from over $5.50/watt in 2010 to $1.13/watt in 2018.[18] Duke notes these trends, but does not thoroughly evaluate them.[19]

Solar-plus-storage resource options are not addressed in Duke's modeling in a systematic way. Duke's plans indicate that its development of energy storage thus far has been for use primarily as a tool to support grid stability through frequency regulation, solar smoothing, and energy shifting related to renewable

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[15] "Lazard's latest annual Levelized Cost of Storage Analysis (LCOS 4.0) shows significant cost declines across most use cases and technologies, especially for shorter duration applications." Lazard, Levelized Cost of Energy and Levelized Cost of Storage 2018 (Nov. 8, 2018), www.lazard.com/perspective/levelized-cost-of-energy-and-levelized-cost-of-storage-2018/.

[16] Lazard's Levelized Cost of Energy Analysis – Version 12.0 at 7 (Nov. 2018), www.lazard.com/media/450784/lazards-levelized-cost-of-energy-version-120-vfinal.pdf; The Companies noted, "Lazard's latest annual Levelized Cost of Energy Analysis…shows a continued decline in the cost of generating electricity from alternative energy technologies, especially utility-scale solar and wind. In some scenarios, alternative energy costs have decreased to the point that they are now at or below the marginal cost of conventional generation" Lazard, Levelized Cost of Energy and Levelized Cost of Storage 2018, supra note 15. See also, U.S. Energy Information Association, "Average U.S. construction costs for solar and wind continued to fall in 2016," Today in Energy (Aug. 8, 2018), www.eia.gov/todayinenergy/detail.php?id=36813.

[17] Id.

[18] Ran Fu, David Feldman, and Robert Margolis, National Renewable Energy Laboratory, U.S. Solar Photovoltaic System Cost Benchmark: Q1 2018, NREL/TP-6A20-72399 (Nov. 2018), www.nrel.gov/docs/fy19osti/72399.pdf.

[19] DEC at 9; DEP at 9.

resources, and that Duke has not considered storage in combination with solar resources as a way to expand contribution to peak hours of demand.[20] Only one solar-plus-storage technology configuration was included in the initial screen of the model used to evaluate resource options.[21] By comparison, Duke's initial modeling screen included nine natural gas-burning technologies, two coal technologies, two nuclear technologies, and two stand-alone storage technologies.[22]

Given the broad array of storage technologies with different sizes and operating characteristics,[23] additional information and more modeling should be required including robust treatment of solar combined with storage. For example, other utilities have recently contracted for solar plus storage technologies that were not included in Duke's model. NV Energy will build solar-plus-storage with a much different battery size, relative to the solar resource, than what Duke has considered.[24] The NV Energy plan will add battery capacity equal to 25% of the solar capacity.[25] In the economic screening, Duke only considers a 2MW battery with 8 MWh of duration paired with a 2 MW solar facility.[26] Batteries recently procured by utilities in other states have been much larger in order to benefit from

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[20] DEC at 33, 179; DEP at 33, 175.
[21] DEC at 184-185; DEP at 180-181.
[22] Id.
[23] Duke describes a number of storage technologies in Appendix F to the plans. DEC at 173-74, 180-82; DEP at 168-70, 176-79. See also, Ran Fu, David Feldman, and Robert Margolis, National Renewable Energy Laboratory, 2018 U.S. Utility-Scale Photavaltaics-Plus-Energy Storage System Costs Benchmark, NREL/TP-6A20-71714 (Nov. 2018), www.nrel.gov/docs/fy19osti/71714.pdf.
[23] DEC at 9; DEP at 9.
[24] NV Energy, Press Release: NV Energy Announces Largest Clean Energy Investment in Nevada's History (May 31, 2018), www.nvenergy.com/about-nvenergy/news/news-releases/nv-energy-announces-largest-clean-energy-investment-in-nevadas-history.
[25] Id.
[26] DEC at 184.

economies of scale and lower siting and interconnection costs (installing one 100MW battery is cheaper than fifty 2MW batteries).[27]

In sum, the IRP should analyze and model costs for a broader range of solar plus storage technologies, including solar plus storage resources utilized in other states.

B. Planning should consider additional costs associated with natural gas production, including the costs of climate change.

An Integrated Resource Plan must take "into account the sensitivity of its analysis to . . . risks associated with . . . fuel costs, . . . transmission and distribution costs, and costs of complying with environmental regulation," as well as taking into account other factors such as "environmental impacts."[28] Duke's plan does not yet adequately perform that analysis.

The use of solar plus storage technologies, rather than natural gas, would avoid environmental costs associated with burning fossil fuels. Natural gas power production produces significant carbon dioxide and methane emissions, which both contribute to climate change.[29] Climate change has real costs that are

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[27] For Hawaii, see Hawaiian Electric, Press Release: New Solar-Plus-Storage Projects Set Low-Price Benchmark for Renewable Energy in Hawaii (Jan. 3, 2019), www.hawaiianelectric.com/new-solar-plus-storage-projects-set-low-price-benchmark-for-renewable-energy-in-hawaii. For Arizona, see Gavin Bade, "APS to Install 850 MW of Storage, 100 MW of Solar in Major Clean Energy Buy," Utility Dive (Feb. 21, 2019), www.utilitydive.com/news/aps-to-install-850-mw-of-storage-100-mw-of-solar-in-major-clean-energy-buy/548886/. For Nevada, see Robert Walton, "NV Energy Plan to Add 100 MW Storage, 1 GW Renewables Gets PUC Approval," Utility Dive, (Dec. 21, 2018), www.utilitydive.com/news/nevada-regulators-near-vote-on-nv-energy-plan-to-double-solar-capacity/544923/. For Colorado, see also Jason Deign, "Xcel Attracts 'Unprecedented' Low Prices for Solar and Wind Paired with Storage," GTM (Jan. 8, 2018), www.greentechmedia.com/articles/read/record-low-solar-plus-storage-price-in-xcel-solicitation#gs.0hswuq.

[28] NCUC Rule R8-60(g).

[29] Environmental Protection Administration, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2014 (Apr. 15, 2016), www.epa.gov/sites/production/files/2017-

ultimately borne by ratepayers. As the Commission is aware, extreme weather in 2018 was costly for Duke. Duke Progress seeks to defer over $350 million for recovery in future rates due to extensive storm damage from Hurricanes Florence and Michael and Winter Storm Diego.[30] Likewise, Duke Carolinas seeks to defer over $120 million due to damage caused by the extreme storms.[31]

Thoroughly analyzing the costs of climate change and the benefits of renewables would follow North Carolina's stated policy and the rules of this Commission. Governor Cooper issued Executive Order No. 80 last October, which highlights a North Carolina commitment to fight climate change and transition to a clean energy economy, setting a goal of reducing statewide greenhouse gas emissions to 40% below 2005 levels by 2025.[32] Economic costs associated with frequent and intense hurricanes such as those experienced in the past year, as well as extreme temperatures, flooding, and drought, were cited as

04/documents/us-ghg-inventory-2016-main-text.pdf. An important recent study, published in Science during June 2018, found that the natural gas industry emitted 60% more methane than previously estimated. Ramon A. Alvarez, et al., "Assessment of Methane Emissions from the U.S. Oil and Gas Supply Chain," Science, Vol. 361, Issue 6398, pp. 186-188 (July 13, 2018). A useful summary of this study is found in an article by Steven Mufson, "Methane leaks offset much of the climate change benefits of natural gas, study says," Washington Post (June 24, 2018), www.washingtonpost.com/business/economy/methane-leaks-offset-much-of-the-benefits-of-natural-gas-new-study-says/2018/06/21/e381654a-7590-11e8-b4b7-308400242c2e_story.html

[30] See Application of Duke Energy Progress, LLC for an Accounting Order to Defer Incremental Storm Damage Expenses Incurred as a Result of Hurricanes Florence and Michael and Winter Storm Diego, filed 21 December 2018 in Docket No. E-2, Sub 1193.

[31] See Application of Duke Energy Carolinas, LLC for an Accounting Order to Defer Incremental Storm Damage Expenses Incurred as a Result of Hurricanes Florence and Michael and Winter Storm Diego, filed 21 December 2018 in Docket No. E-7, Sub 1187.

[32] Executive Order No. 80, "North Carolina's Commitment to Address Climate Change and Transition to a Clean Energy Economy" (Oct. 29, 2018), files.nc.gov/governor/documents/files/EO80-%20NC%27s%20Commitment%20to%20Address%20Climate%20Change%20%26%20Transition%20to%20a%20Clean%20Energy%20Economy.pdf.

key factors motivating Executive Order No. 80.[33] State law requires that the Renewable Energy and Energy Efficiency Portfolio Standard (REPS) must provide greater energy security and diversify the resources used to meet consumers' energy needs.[34] Renewable resources provide greater energy security because they are indigenous and available within the State, without risks associated with transportation limitations. Further, renewables increase the diversity of resources, mitigating the impact of Duke's increased reliance on natural gas power generation. The Commission Rules regarding Integrated Resource Plans require that the utilities "shall appropriately consider and incorporate the utility's obligation to comply with the Renewable Energy and Energy Efficiency Portfolio Standard," as well as assess the "potential benefits of reasonably available alternative supply-side energy resource options," which include but are not limited to wind, solar thermal, solar photovoltaic, and fuel cells.[35]

Reliance on natural gas power generation also raises the potential for future anticipated costs due to government-imposed limitations on greenhouse gas emissions. For example, the state of California has a cap and trade program to reduce greenhouse gas emissions, and a consortium of Northeastern states (Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont) has a similar mandatory market-based program.[36] Furthermore, incorporating environmental considerations into

[33] Id.
[34] N.C. Gen. Stat. § 62-2(10)(a),(b).
[35] NCUC Rule R8-60(c),(e).
[36] See California Air Resources Board, Cap-and-Trade Program (Feb. 27, 2019),

resource planning is critical even if specific standards are not yet defined in environmental regulations. Indeed, there are costs associated with *not* addressing environmental concerns.

Finally, Duke's reliance on natural gas raises a risk that ratepayers will face unanticipated, unmodeled costs from natural gas price volatility. Although natural gas supply has been available at low cost for a number of years now,[37] historically there have been periods of price volatility, and the average prices a decade ago were about twice what they are today.[38] The risk of volatility and the impact associated with increased natural gas prices are amplified for electric power customers as reliance on natural gas increases. Prices may be driven upward due to the significant increased reliance on natural gas for electric power across the country,[39] as well as the recent opening up of export opportunities for liquefied natural gas.[40]

In sum, Duke's IRP should more thoroughly evaluate (1) the costs to ratepayers of climate change associated with Duke's proposed power generation from natural gas; (2) the benefits that renewables provide under state policy, which stresses the need for energy security and diversification of resources; (3) potential

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www.arb.ca.gov/cc/capandtrade/capandtrade.htm. See also, the website of the Regional Greenhouse Gas Initiative, https://www.rggi.org/.

[37] DEC at 74; DEP at 77.

[38] See U.S. Energy Information Administration, Natural Gas Annual Citygate Price (Feb. 28, 2019), www.eia.gov/dnav/ng/hist/n3050us3a.htm; U.S. Energy Information Administration, Natural Gas Monthly Citygate Price (Feb. 28, 2019), www.eia.gov/dnav/ng/hist/n3050us3M.htm.

[39] U.S. Energy Information Administration, Annual Energy Outlook 2019 (Jan. 24, 2019), www.eia.gov/outlooks/aeo/.

[40] Id.; U.S. Department of Energy, Office of Fossil Energy, Liquefied Natural Gas (LNG) (visited Mar. 7, 2019), www.energy.gov/fe/science-innovation/oil-gas/liquefied-natural-gas.

future costs from government-imposed limitations on greenhouse gas emissions; and (4) potential future costs from natural gas price volatility.

C. Demand-side management should be considered on a level playing field alongside supply-side alternatives.

Demand-side resources can often be the most cost-effective option for meeting utility resource needs, and managing demand is frequently cheaper than adding supply-side generation on a $/MWh Levelized Cost of Electricity (LCOE) basis. As such, the AGO is encouraged that Duke has included a serious treatment of energy efficiency and other demand-side resources. However, the AGO believes there may be areas for further improvement in the exact approach Duke has taken to evaluating these options in its plan.

Under Duke's plan, the load forecast is modified to incorporate the effects of both "naturally occurring" and energy efficiency measures implemented in response to government mandates.[41] For example, for the planning years 2018-2027 Duke includes levels of energy efficiency that are based in whole or in part on its five year program plan for 2018-2022.[42] However, there may be additional cost-effective energy efficiency resources, beyond the program plan, that could be implemented. It is not clear to what extent Duke considered these additional resources in making its resource portfolio selection.

The AGO believes it would better to evaluate energy efficiency resources on a level playing field with other resources. For example, rather than specifying a predetermined amount of energy efficiency resources equal to the 5-year base

[41] DEC at 122.
[42] DEC at 21.

plan, Duke's System Optimizer model could be configured to allow for incremental energy efficiency measures to be selected if they are more cost-effective than supply-side alternatives. In general, Duke's modeling should allow all cost-effective energy efficiency resources to be selected during years 2019-2027.

III. CONCLUSION.

The AGO respectfully recommends that the Commission ask Duke to submit a revised Plan that:

1) Provides a more robust evaluation of storage-plus-renewables, including but not limited to modeling that explores a wide array of solar-plus-storage configurations;
2) More thoroughly assesses:
    a. The costs to ratepayers of climate change associated with Duke's proposed power generation from natural gas;
    b. The benefits that renewables provide under state policy, including the need for energy security and diversification of resources;
    c. Potential future costs from government-imposed limitations on greenhouse gas emissions; and
    d. Potential future costs from natural gas price volatility; and
3) More thoroughly assess demand-side management and energy efficiency measures, including configuring Duke's System Optimizer model to allow for incremental energy efficiency measures to be selected if they are more cost-effective than supply-side alternatives.

Respectfully submitted this the 7th day of March, 2019.

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CERTIFICATE OF SERVICE

The undersigned certifies that she has served a copy of the foregoing ATTORNEY GENERAL'S OFFICE INITIAL COMMENTS ON DUKE'S INTEGRATED RESOURCE PLANS upon the parties of record in this proceeding by email or by depositing a copy of the same in the United States Mail, postage prepaid, this the 7th day of March, 2019.

/s/
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