STATE OF SOUTH CAROLINA

BEFORE THE PUBLIC SERVICE COMMISSION

In the Matters of South Carolina	**)**	
Energy Freedom Act (House Bill 3659)	**)**	
Proceeding Related to S.C. Code Ann.	**)**	**Docket Nos.**
Section 58-37-40 and Integrated	**)**	**2019-224-E**
Resource Plans for Duke Energy	**)**	**2019-225-E**
Carolinas, LLC and Duke Energy	**)**	
Progress, LLC	**)**	

SURREBUTTAL TESTIMONY OF RACHEL S. WILSON

ON BEHALF OF

CAROLINAS CLEAN ENERGY BUSINESS ASSOCIATION, NATURAL RESOURCES DEFENSE COUNCIL, SIERRA CLUB, SOUTHERN ALLIANCE FOR CLEAN ENERGY, SOUTH CAROLINA COASTAL CONSERVATION LEAGUE, AND UPSTATE FOREVER

APRIL 15, 2021

Table of Contents

I. INTRODUCTION AND QUALIFICATIONS

Q. Please state your name, business address, and position.

A. My name is Rachel Wilson and I am a Principal Associate with Synapse Energy Economics, Incorporated (Synapse). My business address is 485 Massachusetts Avenue, Suite 3, Cambridge, Massachusetts 02139.

Q. Please describe Synapse Energy Economics.

A. Synapse is a research and consulting firm specializing in energy and environmental issues, including electric generation, transmission and distribution system reliability, ratemaking and rate design, electric industry restructuring and market power, electricity market prices, stranded costs, efficiency, renewable energy, environmental quality, and nuclear power.

Synapse's clients include state consumer advocates, public utilities commission staff, attorneys general, environmental organizations, federal government agencies, and utilities.

Q. Please summarize your work experience and educational background.

A. At Synapse, I conduct analysis and write testimony and publications that focus on a variety of issues relating to electric utilities, including: integrated resource planning; power plant economics; federal and state clean air policies; emissions from electricity generation; environmental compliance technologies, strategies, and costs; electrical system dispatch; and valuation of environmental externalities from power plants.

I also perform modeling analyses of electric power systems. I am proficient in the use of spreadsheet analysis tools, as well as optimization and electricity dispatch models to conduct analyses of utility service territories and regional energy markets. I have direct experience running the Strategist, PROMOD IV, PROSYM/Market Analytics, PLEXOS, EnCompass, and PCI Gentrader models, and have reviewed input and output data for several other industry models.

Prior to joining Synapse in 2008, I worked for the Analysis Group, Inc., an economic and business consulting firm, where I provided litigation support in the form of research and quantitative analyses on a variety of issues relating to the electric industry.

I hold a Master of Environmental Management from Yale University and a Bachelor of Arts in Environment, Economics, and Politics from Claremont McKenna College in Claremont, California.

A copy of my current resume is attached as Exhibit RW-1.

Q. On whose behalf are you testifying in this case?

A. I am testifying on behalf of Carolinas Clean Energy Business Association, Natural Resources Defense Council, Sierra Club, Southern Alliance for Clean Energy, South Carolina Coastal Conservation League, and Upstate Forever.

Q. Have you testified previously before the Public Service Commission of South Carolina?

A. No, but I have testified as an expert witness in a number of prior proceedings in different states, including proceedings related to Duke Energy in North Carolina. My experience as a witness is summarized in my resume, which is provided in Exhibit RW-1.

Q. What is the purpose of your surrebuttal testimony in this proceeding?

A. The purpose of my surrebuttal testimony is to respond to the rebuttal testimony of Duke Energy witness Glen A. Snider, who attempts to defend Duke's assumptions, methodology and results against intervenor critiques. According to Witness Snider, the intervenors' agendas "do not include pursuing least cost planning and ensuring power supply reliability to meet load."[1] Witness Snider also asserts that the direct testimony submitted on behalf of the parties whom he calls "the Advocacy Groups" ignores the important metrics of system reliability and affordably while promoting the deployment of solar, battery storage, and demand side management (DSM) and energy efficiency (EE).

To the contrary, my surrebuttal testimony demonstrates that increased deployment of solar, battery storage, and DSM/EE are in fact essential to a cost-effective and reliable resource portfolio that meets Act 62's "most reasonable and prudent" standard. I present an alternative resource portfolio in my testimony and in the

[1] Rebuttal Testimony of Glen A. Snider (hereinafter "Snider Rebuttal) at 17.

attached report, *Clean, Affordable, Reliable: A Plan for Duke Energy's Future in the Carolinas*, which was also submitted in the North Carolina Utilities Commission's current Integrated Resource Plan (IRP) docket. This alternative portfolio, developed with an industry-standard capacity expansion and production cost model and employing reasonable assumptions, shows that accelerated retirement of aging coal plants, deployment of clean energy resources, and avoiding investment in new gas plants that will become obsolete before the end of their useful lives result in a clean, low-cost, low-risk resource plan.

Q. Please identify the documents and filings on which you base your opinions.

A. My findings are based on the information presented by Duke Energy Carolinas and Duke Energy Progress (collectively "Duke Energy" or "the Companies") in their 2020 Integrated Resource Plans and from independent modeling analysis of Duke Energy's service territory in the Carolinas that examined the cost and reliability impacts of increased quantities of energy efficiency, renewables, and storage. Synapse's analysis used Duke's own data produced through discovery, as well as publicly available data from government laboratories and other sources.

Q. Are you sponsoring any exhibits?

A. Yes. I am sponsoring the following exhibits:

Exhibit Number	**Description of Exhibit**
Exhibit RW-1	Resume of Rachel S. Wilson
Exhibit RW-2	Synapse Report: *Clean, Affordable, Reliable: A Plan for Duke Energy's Future in the Carolinas*

II. OVERVIEW OF TESTIMONY AND CONCLUSIONS

Q. Please summarize your primary conclusions.

A. Synapse's modeling, which employed utility-grade software and evaluated least-cost generation plans on Duke's system, selected a clean energy portfolio that retires Duke Energy's existing coal units and adds 16 gigawatts (GW) of new utility-scale solar, 2.5 GW of new onshore wind, and 10 GW of new battery storage by 2035. The model selected this as the optimal, least-cost capacity mix to meet Duke's peak and annual energy requirements at the lowest cost over time. The selected portfolio also reduces total system cost by $7.2 billion relative to a scenario that relies primarily on new gas-fired resources to meet Duke's identified energy and capacity needs.

The most reasonable and prudent resource plan for Duke's service territory in the Carolinas includes substantial growth in energy efficiency and demand response, as well as the addition of renewables like wind and solar photovoltaics (PV) and new battery storage resources. This clean resource plan meets the modeled reliability metrics and is least-cost compared to a resource portfolio that relies heavily on the addition of new gas-fired capacity.

Q. Please summarize your primary recommendations.

A. I recommend that the Commission reject Duke Energy's 2020 Integrated Resource Plans and require the Companies to 1) update their modeling using capital costs for wind and battery resources, as well as operations and maintenance (O&M) costs for solar, that come from the National Renewable Laboratory's (NREL) 2020

Advanced Technology Baseline and also include any appropriate tax credits; and 2) file modified IRPs within 60 days of the Commission's order.

I also recommend that the Commission require Duke to complete a new coal retirement analysis that adheres to industry best practices and optimizes for both retirement dates and replacement resources as part of the next IRP filing in 2022.

III. CRITIQUE OF DUKE'S COAL RETIREMENT ANALYSIS

Q. Please briefly describe the retirement analysis that Duke conducted as part of its IRP process.

A. The methodology that underlies Duke's retirement analysis has three steps: (1) Ranking plants for retirement analysis; (2) Sequential Peaker Method (SPM); and (3) Portfolio Optimization.

The first step in Duke's process was to develop a rank order in which the coal retirements would occur. That rank order was based on the capacity of the units, retiring the smallest units first.

The second step in Companies' coal unit retirement approach is the SPM, developed by Duke to determine the most economic retirement dates for coal plants. The SPM method is based on what Duke calls a Net Cost of New Entry (Net CONE) method, which compares the capital and fixed costs, as well as the net production value of a generic combustion turbine peaking unit (a "peaker"), to the costs of the existing coal unit being retired.[2] The SPM, according to Witness Snider, selects the retirement date for the coal unit in that year when the replacement peaker was determined to be more economic.

Having determined the "economic" retirement dates using the SPM, Duke performed capacity optimization and production cost modeling as part of step 3 in order to determine the set of resources that replaced the retiring coal, forming the basis for the Companies' two Base Case scenarios.

Q. Witness Snider claims that the Companies' economic analysis of coal retirements "accurately captures the economic retirement dates of the coal units."[3] How do you respond?

A. I disagree. The internally developed methodology employed by Duke does not comport with industry practice, and the Commission cannot have confidence that Duke has arrived at an optimal set of retirement dates for its coal-fired units.

Q. Please explain why you believe Duke's analysis was flawed.

A. There were flaws in all three steps of Duke's analysis, which are detailed more fully in Exhibit RW-2. With respect to step 1, ranking the unit retirements based on capacity is a flawed methodology, as it ignores the costs associated with the operation of those units. Capacity and energy value both have a part to play in the overall economics of individual coal units. A rigorous retirement analysis would

---

[2] DEP 2020 IRP. Page 83.

[3] Snider Rebuttal at 85.

identify and retire the worst performing and most costly units first to provide the most benefit for customers. Simply ranking the units from lowest to highest in terms of capacity does not accomplish that goal.

In Step 2, each of the existing coal units is compared to a replacement combustion turbine, which could overstate the cost of replacement capacity. Capital costs for wind, solar, and battery storage are expected to decline in the coming decades, and these low variable cost resources already provide a better energy value than a fossil-fueled peaker. A combination of solar, wind, batteries, and DSM measures would likely be a more cost effective replacement portfolio than a combustion turbine; however, Duke did not evaluate such a portfolio until step 3, when the "economic" retirement dates had already been selected.

Finally, the outcome seems to indicates that Duke's analysis was flawed, as it produces a result that is no different than the estimated depreciable lives that resulted from Duke's 2018 depreciation study. A comparison of the depreciable life dates, the economic retirement dates, and the earliest practicable retirement dates is shown in Table 1. [4,5] Except for the Allen Units 2-4, which are taken at the plant

[4] Direct Testimony of John J. Spanos for Duke Energy Progress, LLC. *In the Matter of: Application of Duke Energy Progress, LLC For Adjustment of Rates and Charges Applicable to Electric Service in North Carolina.* Before the North Carolina Utilities Commission Docket No. E-2, SUB 1219. Available at: https://starw1.ncuc.net/NCUC/ViewFile.aspx?Id=22094489-2fd5-46de-a228-571757f06434.

[5] Direct Testimony of John J. Spanos for Duke Energy Carolinas, LLC. *In the Matter of: Application of Duke Energy Carolinas, LLC For Adjustment of Rates and Charges Applicable to Electric Service in North Carolina.* Before the North Carolina Utilities Commission Docket No.

level in the depreciation study, none of the economic retirement dates identified in Duke's retirement analysis occur any earlier than the end of the units' depreciable lives.

Data from the United States Environmental Protection Agency's Air Markets Program show that Allen Unit 1 operated for only nine days in all of 2020 and Allen Unit 2 operated for only eight days, notably in the summer months of July and August. These units, which were intended for baseload operation, are in fact operating like peaking units, indicating extremely poor economics. Yet Duke's analysis of "economic" retirement dates keeps them operating until 2022 (Unit 2) and 2024 (Unit 1). Allen Unit 3, which is shown in Table 1 to have both an "economic" and "earliest practicable" retirement date of January 1, 2022, was in fact announced to be retired on March 31, 2021.[6]

E-7, SUB 1214. Available at: https://starw1.ncuc.net/NCUC/ViewFile.aspx?Id=46f3ba8e-b73a-4555-9d99-688087ed70b6.

[6] Duke Energy Carolinas, LLC Update to Allen Unit 3 Retirement Date, Docket No. E-100, Sub 165. Available at: https://starw1.ncuc.net/NCUC/ViewFile.aspx?Id=c089e35f-4a36-46aa-b175-768670ff48a6

Table 1. Comparison of retirement dates for existing coal units

Plant Name	Depreciable Life Date	Economic Retirement Dates (Jan 1)	Earliest Practicable Retirement Dates (Jan 1)
Allen 2	2024	2022	2022
Allen 3	2024	2022	2022
Allen 4	2024	2022	2022
Allen 1	2024	2024	2024
Allen 5	2024	2024	2024
Cliffside 5	2026	2026	2026
Roxboro 3	2028	2028	2028
Roxboro 4	2028	2028	2028
Roxboro 1	2029	2029	2029
Roxboro 2	2029	2029	2029
Mayo 1	2029	2029	2029
Marshall 1	2034	2035	2028
Marshall 2	2034	2035	2028
Marshall 3	2034	2035	2028
Marshall 4	2034	2035	2028
Belews Creek 1	2037	2039	2029
Belews Creek 2	2037	2039	2029
Cliffside 6	2048	2049	2049

Lastly, it is possible, though not a certainty, that one or more of the "economic" retirement dates could be earlier than the "earliest practicable" retirement dates. This would occur in situations where an economic analysis finds that there is a benefit to retiring a unit, but transmission constraints or other reliability concerns indicated that the unit was unable to be removed from service any earlier. This never occurs in Duke's analysis.

Q. Witness Snider also commits that "[t]o the extent the new Encompass software is capable of fully optimizing retirement dates and replacement options, the Company will agree to perform that analysis in the comprehensive IRP filing in 2022." Is this commitment sufficient?

A. Waiting until the 2022 IRP filing to revise the unit retirement analysis means that Duke could be missing opportunities for earlier retirements, particularly at the Allen units. It harms ratepayers when Duke continues to operate units that are uneconomic and foregoes opportunities to procure low-cost, carbon-free replacement resources. However, I recognize that unit retirement analyses are complex and take time to do correctly, such that it would be very challenging to produce an updated analysis in 60 days if Duke were required to revise its IRP as part of this docket. Absent a standalone docket specifically for the unit retirement study, including an updated analysis in the 2022 IRP filings is sufficient.

IV. SYNAPSE MODELING METHODOLOGY

Q. Have you done any analysis that examines alternate resource portfolios that differ from what Duke Energy has put forth in its 2020 Integrated Resource Plans?

A. Yes. As noted, I was the principal author of the study entitled *Clean, Affordable, Reliable: A Plan for Duke Energy's Future in the Carolinas*, which has been filed with the North Carolina Utilities Commission in the current IRP docket in that state.

Q. Which modeling software did you use to perform your analysis?

A. The Synapse analysis uses the EnCompass capacity optimization and detailed production cost model, developed by Anchor Power Solutions, to simulate resource choice impacts in Duke Energy's service territory. Capacity optimization models are used to determine the optimal capacity mix over time that will meet peak and annual energy requirements at the lowest cost. In short, these models select the least-cost future resource build. Production cost models, by contrast, simulate hourly system operation and dispatch for a specified generation fleet. Previous versions of these models could only execute one of these operations – either optimization or detailed dispatch – but not both.

Q. Why did Synapse use EnCompass?

A. EnCompass is a widely accepted industry model with the capabilities to do both capacity optimization and detailed production cost modeling. EnCompass was released in 2016 and several major utilities have transitioned to the model since that time. For example, the three investor-owned utilities in Minnesota (Minnesota Power, Otter Tail Power, and Xcel Energy) adopted the EnCompass model in 2019, along with Great River Energy, the largest of the state's electric cooperatives.[7] Public Service New Mexico and Public Service Company of Colorado are two other IOUs that have adopted EnCompass in recent years. Duke Energy announced in

[7] Anchor Power Solutions. December 2019. Available at: https://anchor-power.com/news/minnesota-plans-for-its-energy-future-with-encompass/

2020 that it had chosen EnCompass to expand its capabilities in resource planning,[8] and Witness Snider's rebuttal confirms this.[9] Duke did not, however, use EnCompass for this IRP filing, but instead continued using the combination of System Optimizer capacity expansion model and the PROSYM production cost model.

Q. Is EnCompass a more sophisticated model than Duke's combination of System Optimizer and PROSYM?

A. Yes. Previous capacity optimization models did not have chronological unit commitment, but instead relied upon a simplified dispatch methodology (typically a load duration curve) to simulate the operation of resources. Witness Snider points out in his rebuttal that this is true of the System Optimizer model, which uses a simplified subset of representative hours throughout the year.[10] This method was well-suited for electric systems that relied on the traditional hierarchy of "baseload, intermediate, and peaking" resource options that consisted primarily of nuclear, coal, and hydro resources (baseload), gas combined cycle units (intermediate), and gas- and oil-fired combustion turbines (peaking). It is not well-suited to optimize around resource options that turn on and off daily, or even hourly, like wind, solar, and battery storage. In his rebuttal testimony, Witness Snider notes that the System

[8] Anchor Power Solutions. May 2020. Available at: https://anchor-power.com/news/duke-energy-implemented-encompass-software/

[9] Snider Rebuttal at 82.

[10] Snider Rebuttal at 89.

Optimizer model cannot fully optimize batteries due to its inability to model on an hourly basis.[11]

Q. What did Synapse model in its analysis?

A. Synapse used the EnCompass model to develop two scenarios. In the first, called "Mimic Duke," Synapse used Duke's own assumptions, with two exceptions, to create a resource portfolio that results in a similar, but not identical, portfolio to that put forth in Duke's Base Case With Carbon Policy. The first deviation from Duke's modeling was to merge the DEC and DEP territories, optimizing the resource build and dispatching resources in the combined area. This was done primarily as a means to simplify the modeling such that we could reasonably construct and analyze Duke's service territory in the time allotted to meet regulatory filing deadlines in the Carolinas in the applicable dockets.

Second, unlike Duke's preferred plan, which manually builds solar resources, the Mimic Duke scenario was allowed in the EnCompass modeling runs to fully optimize the resource build, resulting in a resource portfolio that is slightly different than the one in the Duke IRP. We modeled the Mimic Duke scenario to produce a baseline resource portfolio that could then be compared to an alternative scenario on various metrics related to cost, emissions, and reliability. A comparison of the input assumptions used in the Synapse modeling analysis is shown in Table 2, below. In the cases where the input assumption is labeled "From IRP," this means

[11] Snider rebuttal, page 93, lines 2-4.

that the data were taken directly from the Duke IRPs as filed or from the Companies responses to discovery.

Table 2. Comparison of input assumptions in Synapse modeled scenarios

Input	Mimic Duke	Reasonable Assumptions
Carbon Constraint	None	None
DEC/DEP BA's	Merged	Merged
Imports/Exports	Not Allowed	Not Allowed
Load Forecast	From IRP	From IRP
EE/DSM	From IRP	Synapse Forecast
Solar Costs	Duke IRP Costs	Duke IRP Costs
Battery Costs	Duke IRP Costs	ATB 2020 Low
Onshore Wind Costs	Duke IRP Costs	ATB Low: Class 7
Offshore Wind Costs	Duke IRP Costs	ATB Low: Class 6
Coal Retirement	Duke Economic	Earliest Practicable
Coal Operations Costs	Duke IRP Costs	Duke IRP Costs
Coal Prices	Duke IRP Costs	Duke IRP Costs
Gas Prices	EnCompass defaults	EnCompass defaults
Planning Reserve Margin	17% (from IRP)	17% (from IRP)
Wind/Solar Capacity Credit	ELCC from Duke	ELCC from Duke
ITC Assumptions	From COVID relief bill	From COVID relief bill
New Gas Builds Allowed	Yes	No

In our alternative scenario, "Reasonable Assumptions," Synapse used a different set of more robust and defensible assumptions to model an alternate scenario. First, we increase the forecasted energy efficiency in Duke's service territories such that first year program savings starts to increase from 2022 by 0.15 percent of retail sales per year until they reach 1.5 percent, and then stay at this level through the study period. Second, the Reasonable Assumptions scenario speeds the pace of coal retirements using Duke's "Earliest Practicable" retirement timeline and pathway. Third, we correct the costs for the wind and battery storage resource options offered to the model for replacement capacity and energy, utilizing values from the NREL's 2020 ATB.[12] Next, the costs of wind and solar resources were levelized using Duke's financing assumptions on weighted average cost of capital and construction schedule for the different resources and offered to the EnCompass model on a $/MWh basis. This was done to allow for the model to choose resources based primarily on their energy benefit to the system rather than on the capacity need each year. Finally, the Reasonable Assumptions scenario restricts new gas additions, to account for the likelihood that gas resources would need to be retired before they are fully depreciated, exposing ratepayers to the risk of being saddled with costs of plants that are no longer used and useful.[13]

V. RESULTS OF SYNAPSE MODELING ANALYSIS

Q. What were the results of the EnCompass modeling analysis?

A. The model selected new generating capacity during the analysis period to meet the 17 percent planning reserve margin in both the Mimic Duke and Reasonable

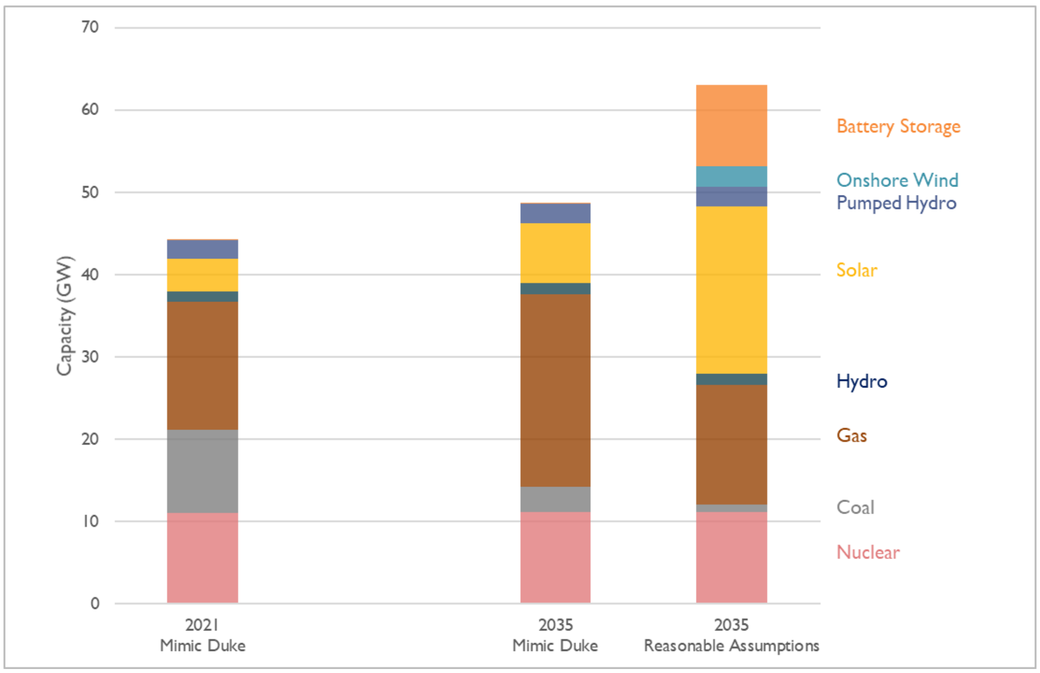
[12] NREL's 2020 ATB is available at: https://atb.nrel.gov/electricity/2020/data.php

[13] EnCompass's optimization algorithm attempts to minimize the carrying charge associated with the addition of new resources but calculates the capital component of the revenue requirement as the sum of book depreciation, property taxes, other costs, and allowed return. This can result in a scenario in which gas capacity is added to the system, but the total revenue requirement associated with this gas scenario is higher in that scenario than in one that does not add new gas-fired resources. Synapse ran a scenario in which new gas builds were allowed with other updated inputs. The result was the addition of 1,185 MW of new gas-fired capacity and an increased revenue requirement above the Reasonable Assumptions scenario of approximately $400 million.

Assumptions scenarios. Thus, both scenarios would provide reliable power to the Duke service areas. However, the type of capacity selected by the model differed substantially between the scenarios as a result of the use of more reasonable assumptions regarding the costs of replacement resources.

The Mimic Duke scenario includes heavy additions of new gas-fired combined cycle and combustion turbine units, adding 8.8 GW of new capacity, with solar PV additions of 3.4 GW. The Reasonable Assumptions scenario, on the other hand, selects a slate of clean energy resources to meet its energy and capacity requirements, adding 16 GW of new solar, 2.5 GW of onshore wind, and almost 10 GW of battery storage. Total capacity in each scenario is shown in Figure 1, below.

Figure 1. Duke Energy modeled nameplate capacity by scenario, 2021 and 2035



Q. How do you respond to Witness Snider's assertion in his rebuttal testimony that the Advocacy Groups do not give proper consideration to costs when advocating for increased amounts of efficiency, renewables, and storage?

A. Witness Snider's assertion is simply not accurate. EnCompass optimizes for cost, and the Synapse modeling shows that the Reasonable Assumptions scenario, with its additions of energy efficiency, renewables, and storage, is less expensive than the Mimic Duke scenario. A comparison of the net present value of revenue requirements (NPVRR) is shown in Table 3, below.

Table 3. Comparison of revenue requirements

Scenario	NPVRR (Billion $)
Mimic Duke	$75.6
Reasonable Assumptions	$68.5
Delta	($7.2)

The cost of the Reasonable Assumptions scenario is $68.5 billion in net present value terms, and represents a savings to ratepayers of $7.2 billion over the planning horizon when compared to the Mimic Duke scenario. There are several reasons for the cost savings that occur under the Reasonable Assumptions scenario. First, additional energy efficiency avoids the construction of some of the new capacity that is present in the Mimic Duke scenario. Second, renewable and battery storage resources are growing comparatively less expensive as their capital costs fall over time. Lastly, in contrast to resources that rely on fossil fuels to operate, renewable resources have no fuel costs. Displacement of energy from fossil-fueled generating sources with zero-variable cost resources results in savings to ratepayers from reduced operating costs.

Q. How do these results relate to the coal retirement analysis you discussed previously in your testimony?

A. They show that retiring coal and replacing it with clean energy resources results in a lower NPVRR that likely benefits ratepayers. Witness Snider states in his rebuttal testimony that the question of coal retirements in advance of the "economic" dates identified using Duke's SPM boils down to whether the replacement resource options, with their higher capital costs, provide enough production cost benefit to overcome those higher capital costs and still warrant coal retirement acceleration.[14] The Synapse modeling demonstrates that costs for replacement renewable and storage resources that are in line with industry forecasts lead to the selection of those resources in a capacity optimization modeling exercise. It also demonstrates that these resources, with their low variable operating costs, do indeed provide enough production cost benefit to overcome the expense of the additional capital.

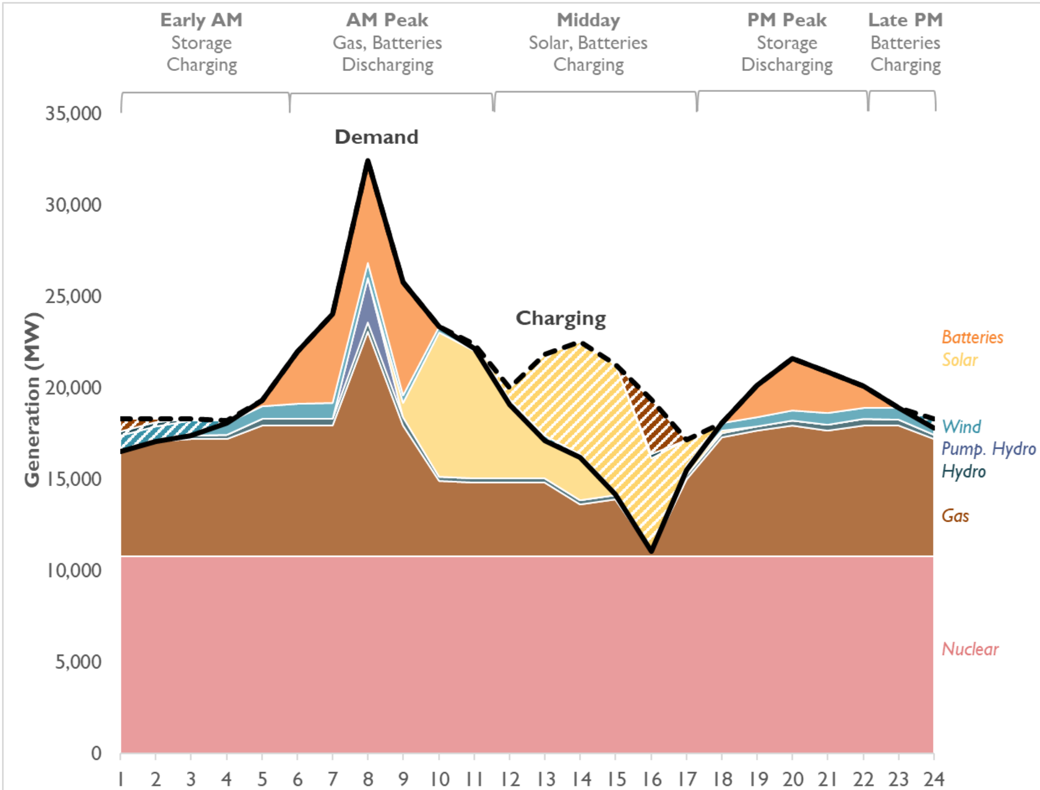
[14] Snider rebuttal, page 96, lines 4-7.

Q. How do you respond to Witness Snider's assertion in his rebuttal testimony that the Advocacy Groups do not give proper consideration to system reliability when advocating for increased amounts of efficiency, renewables, and storage?

A. Synapse's analysis did properly consider system reliability. The Synapse modeling uses Duke's 17 percent planning reserve margin in both scenarios. We give firm capacity credit to new resources using Duke's assumptions around Effective Load Carrying Capability (ELCC), in which the firm capacity of renewables and storage decline as their penetrations increase. These values were seasonal, and thus solar is given only a 1 percent firm capacity credit during the winter months.

Figure 2, below, shows energy generation on a representative winter peak day in January 2030 for the Reasonable Assumptions scenario. Duke Energy's hourly load requirements are shown by the solid line. The area between the dashed line and the solid line represents the time in which battery resources are being charged by solar or other resources within Duke's service territory. The dark orange section under the solid line represents battery discharge to meet the morning and evening peaks. In 2030, all of Duke's existing coal has been retired according to the "earliest practicable" retirement schedule, with the exception of Cliffside 6, which operates solely on gas.

Figure 2. Sample winter peak generation by fuel type, January 2030



We see in this example that the capacity and energy mix in the Reasonable Assumptions scenario meets hourly demand requirements on a peak winter day. This is true over the duration of the analysis period, as EnCompass projects no loss-of-load hours and sees zero hours with unserved energy. System reliability is therefore preserved under the Synapse Reasonable Assumptions approach.

VI. CONCLUSIONS AND RECOMMENDATIONS

Q. What should the Commission take away from your modeling analysis?

A. The important take away from the Synapse modeling analysis is that Duke can reliably and cost-effectively retire coal according to its "earliest practicable" schedule and add increased quantities of efficiency, renewables, and storage well above what it has modeled in its 2020 IRPs. As Witness Snider points out in his rebuttal testimony, Duke Energy is "…in the midst of an unprecedented, long-term transition from a legacy fleet that included coal generation towards a new mix of cleaner generation…"[15] and he says that this transition is a marathon, not a sprint.[16] While it is true that the energy transition will take time, it is essential to get moving early in the right direction – in order to accomplish its own corporate carbon emissions goals and to comply with state laws, Duke needs to start running.

Witness Snider states that the Companies "have a unique challenge in transitioning the over 10,000 MW of coal capacity in the Carolinas to equally reliable capacity and energy production."[17] If Duke were to rely on new gas capacity for replacement capacity, it practically guarantees that at some point in the near future, the Companies will find themselves facing the a similar challenge in transitioning that same gas capacity to carbon-free generating sources. Duke Energy should instead embrace this unique opportunity to transition directly to clean sources of capacity and energy in the form of renewables and storage.

Q. Does this conclude your testimony?

A. Yes.

[15] Snider Rebuttal at 7.

[16] Id.

[17] Snider Rebuttal at 88.