STATE OF NORTH CAROLINA
UTILITIES COMMISSION
RALEIGH

DOCKET NO. E-7, SUB 1282

BEFORE THE NORTH CAROLINA UTILITIES COMMISSION

In the Matter of	)	
Application of Duke Energy Carolinas, LLC	)	**DIRECT TESTIMONY OF**
Pursuant to G.S. 62-133.2 and NCUC Rule	)	**JEFFREY FLANAGAN FOR**
R8-55 Relating to Fuel and Fuel-Related	)	**DUKE ENERGY CAROLINAS, LLC**
Charge Adjustments for Electric Utilities	)	

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Jeffrey Flanagan and my business address is 8320 East Highway 150, Terrell, North Carolina.

Q. BY WHOM ARE YOU EMPLOYED AND IN WHAT CAPACITY?

A. I am employed by Duke Energy and am the General Manager III of the Carolinas Dispatchable Generation - West Zone including Marshall, Allen, Asheville, WS Lee stations.

Q. PLEASE DESCRIBE YOUR EDUCATIONAL AND PROFESSIONAL BACKGROUND.

A. I graduated from NC State University with a Bachelor's Degree in Paper Science & Engineering and a Bachelor's Degree in Chemistry. I also graduated from The University of South Carolina with a Master's Degree in Business Administration. I am a registered Professional Engineer in the state of South Carolina. My career began with Duke Energy as an FGD Scrubber Engineer at Progress Energy. Since that time, I have held various roles of increasing responsibility in generation projects, engineering and operations areas, including Operations and Maintenance Superintendent at Marshall Station and Station Manager at Smith Energy Complex. I was named General Manager of Marshall and Allen Stations in July of 2021. I assumed my current role in February of 2023.

Q. WHAT ARE YOUR CURRENT DUTIES AS GENERAL MANAGER III OF THE CAROLINAS DISPATCHABLE GENERATION?

A. I am responsible for the overall direction and management for over 4,000 megawatts of Carolina's Dispatchable Generation coal, combined cycle and peaking generation,

providing strategic direction and leadership to station general managers including day to day operations, business analysis, process development, O&M and capital budget allocation and implementation and outage performance. I am also responsible for operational excellence at all levels of the organization including continuous improvement and competitive benchmarking. I interact with the public and private sector to manage the overall business to maintain profitable and publicly positive stations.

Q. HAVE YOU TESTIFIED BEFORE THIS COMMISSION IN ANY PRIOR PROCEEDINGS?

A. No. I have not.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY IN THIS PROCEEDING?

A. The purpose of my testimony is to (1) describe DEC's Traditional/Renewable (formerly described as Fossil/Hydro/Solar) generation portfolio and changes made since the 2022 fuel and fuel-related cost recovery proceeding, as well as those expected in the near term, (2) discuss the performance of DEC's Traditional/Renewable facilities during the test period of January 1, 2022 through December 31, 2022 (the "test period"), (3) provide information on significant Traditional/Renewable outages that occurred during the test period, and (4) provide information concerning environmental compliance efforts.

Q. PLEASE DESCRIBE DEC'S TRADITIONAL/RENEWABLE GENERATION PORTFOLIO.

A. The Company's Traditional/Renewable generation portfolio consists of

approximately 14,332 megawatts ("MWs") of generating capacity, made up as follows:

Coal-fired -	6,087 MWs
Hydro -	3,357 MWs
Combustion Turbines ("CT") -	2,646 MWs
Combined Cycle Turbines ("CC")-	2,110 MWs
Solar -	119 MWs
Combined Heat and Power ("CHP") -	13 MWs

The coal-fired assets consist of four generating stations with a total of 10 units. These units are equipped with emissions control equipment, including selective catalytic or selective non-catalytic reduction ("SCR" or "SNCR") equipment for removing nitrogen oxides ("NO_x"), and flue gas desulfurization ("FGD" or "scrubber") equipment for removing sulfur dioxide ("SO_2"). In addition, all 10 coal-fired units are equipped with low NO_x burners.

The Company has a total of 31 simple cycle CT units, of which 29 are considered the larger group providing approximately 2,549 MWs of capacity. These 29 units are located at Lincoln, Mill Creek, and Rockingham Stations, and are equipped with water injection systems that reduce NO_x and/or have low NO_x burner equipment in use. The Lee CT facility includes two units with a total capacity of 84 MWs equipped with fast-start ability in support of DEC's Oconee Nuclear Station. The Company has 2,110 MWs of CC turbines, comprised of the Buck CC, Dan River CC and W.S. Lee CC facilities. These facilities are equipped with technology for emissions control, including SCRs, low NO_x burners, and carbon monoxide/volatile

organic compounds catalysts. The Company's hydro fleet includes two pumped storage facilities with four units each that provide a total capacity of 2,300 MWs, along with conventional hydro assets consisting of 59 units providing approximately 1,057 MWs of capacity. The 178 MWs of solar capacity are made up of 17 rooftop solar sites providing 119 MWs of relative summer dependable capacity, the Mocksville solar facility providing 10 MWs of relative summer dependable capacity, the Monroe solar facility providing 37 MWs of relative summer dependable capacity, Woodleaf solar facility providing 4 MWs of relative summer dependable capacity, Gaston solar facility providing 17 MW of relative summer dependable capacity and Maiden Creek solar facility providing 46 MW of relative summer dependable capacity. Finally, the Company has the Clemson CHP that provides 13 MW of capacity.

Q. WHAT CHANGES HAVE OCCURRED WITHIN THE TRADITIONAL/RENEWABLE PORTFOLIO SINCE DEC'S 2022 FUEL AND FUEL-RELATED COST RECOVERY PROCEEDING?

A. The solar Contribution to Peak percentages increased from 40% to 67% for DEC, resulting in a 48MW increase in capacity. The increase was based on the updated ELCC ("Effective Load Carrying Capability") results.

Q. WHAT ARE DEC'S OBJECTIVES IN THE OPERATION OF ITS TRADITIONAL/RENEWABLES FACILITIES?

A. The primary objective of DEC's Traditional/Renewable generation department is to provide safe, reliable and cost-effective electricity to DEC's customers. Operations personnel and other station employees are well-trained and execute their responsibilities to the highest standards in accordance with procedures, guidelines,

and a standard operating model.

The Company complies with all applicable environmental regulations and maintains station equipment and systems in a cost-effective manner to ensure reliability for customers. The Company also takes action in a timely manner to implement work plans and projects that enhance the safety and performance of systems, equipment, and personnel, consistent with providing low-cost power options for DEC's customers. Equipment inspection and maintenance outages are generally scheduled during the spring and fall months when customer demand is reduced due to milder temperatures. These outages are well-planned and executed in order to prepare the units for reliable operation until the next planned outage in order to maximize value for customers.

Q. WHAT IS HEAT RATE, AND WHAT WAS THE HEAT RATE FOR DEC'S COAL-FIRED AND COMBINED CYCLE UNITS DURING THE REVIEW PERIOD?

A. Heat rate is a measure of the amount of thermal energy needed to generate a given amount of electric energy and is expressed as British thermal units ("Btu") per kilowatt-hour ("kWh"). A low heat rate indicates an efficient fleet that uses less heat energy from fuel to generate electrical energy. Over the review period, the Company's ten coal units produced 56% of the Traditional/Renewable generation, with the average heat rate for the coal-fired units being 9,778 Btu/kWh. The most active station during this period was Belews Creek, providing 43% of the coal generation for the DEC fleet with a heat rate of 9,333 Btu/kWh. During the review period, the

Company's three combined cycle power blocks produced 35% of the Traditional/Renewable generation, with an average heat rate of 7,110 Btu/kWh.

Q. HOW MUCH GENERATION DID EACH TYPE OF TRADITIONAL/RENEWABLE GENERATING FACILITY PROVIDE FOR THE TEST PERIOD?

A. The Company's system generation was approximately 98 million MW hours ("MWhs") for the test period. The Traditional/Renewable fleet provided 39 million MWhs, or approximately 39% of the total generation. As a percentage of the total system generation, 22% was produced from coal-fired stations and approximately 14% from CC operations, 2% from CTs, 1% from hydro facilities, and 0.5% from solar.

Q. HOW DID DEC COST EFFECTIVELY DISPATCH ITS DIVERSE MIX OF GENERATING UNITS DURING THE TEST PERIOD?

A. The Company's portfolio includes a diverse mix of units that, along with additional nuclear capacity, allows DEC to meet the dynamics of customer load requirements in a cost-effective manner. Additionally, DEC has utilized the Joint Dispatch Agreement, which allows generating resources for DEC and DEP to be dispatched as a single system to enhance dispatching by allowing DEC customers to benefit from the lowest cost resources available. The cost and operational characteristics of each unit generally determine the type of customer load situation (*e.g.,* base and peak load requirements) that a unit would be called upon, or dispatched, to support.

At Belews Creek, Cliffside, and Marshall, dual fuel capabilities also promote efficiency, fuel flexibility and reduced cost. The units equipped with dual fuel

capability can be economically dispatched based on need and cost, and the ability to switch fuels can allow the units to avoid forced outages if there is an issue with a fuel system or supply.

Q. PLEASE DISCUSS THE OPERATIONAL RESULTS FOR DEC'S TRADITIONAL/RENEWABLES FLEET DURING THE TEST PERIOD.

A. The Company's generating units operated efficiently and reliably during the test period. The following key measures are used to evaluate the operational performance depending on the generator type: (1) equivalent availability factor ("EAF"), which refers to the percent of a given time period a facility was available to operate at full power, if needed (EAF is not affected by the manner in which the unit is dispatched or by the system demands; it is impacted, however, by planned and unplanned (*i.e.*, forced) outage time); (2) net capacity factor ("NCF"), which measures the generation that a facility actually produces against the amount of generation that theoretically could be produced in a given time period, based upon its maximum dependable capacity (NCF *is* affected by the dispatch of the unit to serve customer needs); (3) equivalent forced outage rate ("EFOR"), which represents the percentage of unit failure (unplanned outage hours and equivalent unplanned derated[1] hours); a low EFOR represents fewer unplanned outages and derated hours, which equates to a higher reliability measure; (4) starting reliability ("SR"), which represents the percentage of successful starts; and (5) equivalent forced outage factor ("EFOF")—which quantifies the number of period hours in a year during which the unit is unavailable because of forced outages and forced deratings.

[1] Derated hours are hours the unit operation was less than full capacity.

Q. PLEASE DISCUSS SIGNIFICANT OUTAGES OCCURRING AT DEC'S TRADITIONAL/RENEWABLE FACILITIES DURING THE TEST PERIOD.

A. In general, planned maintenance outages for all fossil and larger hydro units are scheduled for the spring and fall to maximize unit availability during periods of peak demand. Most of these units had at least one small planned outage during this test period to inspect and maintain plant equipment.

In the spring of 2022, Marshall 4 completed an outage to rebuild major turbine valves, repair condenser valves and steam piping, and replace step up transformer oil coolers and pumps. Cliffside 6 completed an outage to inspect and test the generator, rebuild turbine valves, and replace the A Induced Fan rotor and six boiler coal burners. Buck CC performed an outage to conduct a turbine inspection and balance of plant maintenance, hotwell cleaning and condenser inspection. Dan River CC completed an outage to inspect the steam turbine, generator, and high energy piping and replace the cooling tower fill and natural gas valve. Lincoln CT 3 and 4 performed an outage to replace Generator Step Up relays. W.S. Lee CC completed an outage to perform pressure wave cleaning and do general inspection and maintenance activities. In the fall of 2022, outages included an outage at Mill Creek CT-1 and Mill Creek CT-2 to inspect CT Combustion hardware and stacks, and outages at Mill Creek CT-3 and Mill Creek CT-4 to inspect CT combustion hardware and replace compressor blades. Rockingham CT-3 performed an outage to complete a CT Hot Gas Path Inspection and parts replacement. Marshall 1 completed an outage to replace lower slope boiler tubes, inspect and test CT & Aux transformers, replace the main stop valve and booster

fan rotor, and perform BOP maintenance. W.S. Lee CC1-10 completed an outage to inspect the generator and replace the turbine valve. W.S. Lee CC1-11 completed an outage to perform a GT11 medium generator inspection. W.S. Lee CC1-12 completed an outage to perform CT Hot Gas Path Inspection and parts replacement, DCS Evergreen, SCR Catalyst replacement, HEP Inspection, and GT12 medium inspection.

Major forced outages during the test period included Belews Creek U2, which experienced an unexpected failure of the main turbine side crossover piping balance-end expansion joint tie rods, Marshall U2, which was forced offline due to the failure of a wall bushing which supplies auxiliary power to the unit. The failed bushing caused damage to the auxiliary buss and switchgear.

During startup at Cliffside U5 the station was investigating issues related to elevated mercury readings, and when testing the 'A' forced draft, (FD) fan developed a significant vibration requiring the unit to be shutdown for repairs to the fan housing foundation. WS Lee CT11 was forced offline due to a combustion turbine failure. The root cause was found to be a failure of the thermal barrier coating on the Row 1 vanes.

Q. HOW DOES DEC ENSURE EMISSIONS REDUCTIONS FOR ENVIRONMENTAL COMPLIANCE?

A. The Company has installed pollution control equipment in order to meet various current federal, state, and local reduction requirements for NO_x and SO_2 emissions. The SCR technology that DEC currently operates on the coal-fired units uses ammonia or urea for NO_x removal. The SNCR technology employed at Allen Station and Marshall Units 1, 2 and 4 injects urea into the boiler for NO_x removal. All DEC

coal units have wet scrubbers installed that use crushed limestone for SO_2 removal. Cliffside Unit 6 has a state-of-the-art SO_2 reduction system that couples a wet scrubber (*e.g.*, limestone) and dry scrubber (*e.g.*, quicklime). SCR equipment is also an integral part of the design of the Buck, Dan River and Lee CC Stations in which aqueous ammonia is introduced for NO_x removal.

Overall, the type and quantity of chemicals used to reduce emissions at the plants varies depending on the generation output of the unit, the chemical constituents in the fuel burned, and/or the level of emissions reduction required. The Company is managing the impacts, favorable or unfavorable, as a result of changes to the fuel mix and/or changes in coal burn due to competing fuels and utilization of non-traditional coals. Overall, the goal is to effectively comply with emissions regulations and provide the optimal total-cost solution for the operation of the unit. The Company will continue to leverage new technologies and chemicals to meet both present and future state and federal emission requirements including the MATS rule. MATS chemicals that DEC uses when required to reduce emissions include, but may not be limited to, activated carbon, mercury oxidation chemicals, and mercury re-emission prevention chemicals. Company witness Clark provides the cost information for DEC's chemical use and forecast.

Q. DOES THIS CONCLUDE YOUR PRE-FILED DIRECT TESTIMONY?

A. Yes, it does.