STATE OF NORTH CAROLINA
UTILITIES COMMISSION
RALEIGH

DOCKET NO. E-7, SUB 1304

BEFORE THE NORTH CAROLINA UTILITIES COMMISSION

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

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Jeffrey Flanagan and my business address is 8320 East NC 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. Yes. I testified before this Commission in support of DEC's 2023 fuel and fuel-related cost recovery application in Docket No. E-7, Sub 1282 and in DEP's 2023 fuel and fuel-related cost recovery application in Docket No. E-2, Sub 1321.

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 2023 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, 2023 through December 31, 2023 (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 14,360 megawatts ("MWs") of generating capacity, made up as follows:

Coal-fired/dual fuel -	6,045 MWs
Hydro -	3,440 MWs
Combustion Turbines ("CT") -	2,633 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, 8 of which are dual fueled 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 2,380 MWs, along with conventional hydro assets consisting of 59 units providing approximately 1,060 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 facility that provides 13 MW of capacity.

Q. WHAT CHANGES HAVE OCCURRED WITHIN THE TRADITIONAL/RENEWABLE PORTFOLIO SINCE DEC'S 2023 FUEL AND FUEL-RELATED COST RECOVERY PROCEEDING?

A. The Bad Creek Unit 3 upgrade was completed, adding 80 MW to the system. Allen Unit 1 was derated 42 MW due to condenser degradation. It is in the best interest of the customer to derate the unit and continue to operate in the current state until its scheduled retirement at the end of 2024.

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 acts 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. 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. 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 test period, the Company's two coal units and eight dual fuel units produced 57% of the Traditional/Renewable generation, with the average heat rate for the dual fuel units being 9,803 Btu/kWh. The most active station during this period was Belews Creek, providing 41% of the dual fuel unit generation for the DEC fleet with a heat rate of 9,479 Btu/kWh. During the review period, the Company's three combined cycle power blocks produced 37% of the Traditional/Renewable generation, with an average heat rate of 7,161 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 95.9 million MW hours ("MWhs") for the test period. The Traditional/Renewable fleet provided 36.4 million MWhs, or approximately 38% of the total generation. As a percentage of the total system generation, 22% was produced from coal/dual fuel-fired stations (10% coal, 12% gas), and approximately 14% of generation was produced from CC operations, 1% from CTs, 1% from hydro facilities, and 0.3% from solar.

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 CC fleet produced approximately 13.5 million MWh of power for the benefit of the customers during the test year. The CT fleet produced approximately 960,000 MWh of power during the test year with a starting reliability rate above 99%. The dual fuel steam fleet produced approximately 20.7 million MWh of power in 2023, supporting the Company's position that these units are still critically important to the reliability of the non-nuclear fleet. The dual fuel steam stations provided 57% of the non-nuclear power generated for DEC in 2023, of which 9.1M MWh were produced using coal and 11.6M MWh were produced using natural gas. The Company produced approximately 1.2M MWh of renewable power during the test period. The Hydro fleet produced approximately 918,000 MWh of power for our customers in the test period, let by Wateree Hydro at over 200,000 MWh of generation. Rounding out the portfolio, the Solar fleet produced approximately 326,000 MWh of generation.

Q. DID THE COMMISSION ORDER ANY OUTAGES FROM THE 2023 FUEL AND FUEL-RELATED CHARGE ADJUSTMENT PROCEEDING TO BE CONSIDERED IN THE 2024 FUEL PROCEEDING?

A. Yes. The W.S. Lee outage that began on December 11, 2022. This outage was not completed during the prior test period and the Commission ordered the outage over for consideration in the 2024 fuel and fuel-related charge adjustment proceeding[1]. As such, we have included a brief discussion of the outage in current testimony.

Q. PLEASE PROVIDE A BRIEF OVERVIEW OF THE W.S. LEE OUTAGE THAT BEGAN ON DECEMBER 11, 2022.

A. The fire that occurred at W.S. Lee CC Unit ST 10 was caused by a failed hydraulic turning gear unit There were no indications of a problem with the turning gear unit prior to the outage and no work was performed on the turning gear unit as part of the outage. The failure occurred due to a malfunction causing the turning gear not to disengage properly during turbine startup.

Q. PLEASE DISCUSS SIGNIFICANT PLANNED AND FORCED 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. Forced outages are immediate unplanned conditions that require the unit to be removed from service.

[1] North Carolina Utilities Commission *Order Approving Fuel Charge Adjustment* at 37, Docket No. E-7, Sub 1282 (August 23, 2023)

Planned outages over the test period included the following significant work. Cliffside Unit 6 had an outage to replace the air preheater baskets and do a layer 3 and 4 catalyst replacement; Marshall Unit 3 had an outage to replace the air preheater baskets and work on the backpass baffles. Marshall Unit 4 performed an outage to correct a boiler acoustic leak, do FGD inspections and cleaning. Buck Units ST10, GT11 and GT12 did a hot gas path inspection outage. Rockingham CT4 performed a rotor replacement outage. Lincoln CTs 5, 6, 7 and 8 all had relay upgrade outages. Marshall Unit 2 conducted a preheater basket replacement outage. Belews Creek Unit 1 performed a routine fall outage. A hot gas path inspection was performed on Dan River Units CC1-7, 8 and 9. A winterization project was performed at Buck CC1 - S ,1 and 2, replacing several freeze protection systems and adding enhanced heat trace monitoring capability throughout the plant. In the Hydro fleet, Mountain Island Units 3 and 4 had an outage to do Accumulator and GSU relay upgrades. Cedar Cliff Hydro did a turbine inspection and cavitation repair outage. Mountain Island Unit 1 performed a turbine upgrade. Rhodhiss performed a Trash Rack/Stop Log project. Oxford performed an outage to repair/reinforce the bypass liner. Wateree did a controls upgrade on Units 1, 3 and 4. Bear Creek performed an outage to reinforce the penstock isolation valve. Bad Creek Units 1-3 did an outage to do water column separation unit load center work.

In addition to the forced outage at W.S. Lee CC Unit 10 which began December 11, 2022 and concluded January 11, 2023, major forced outages during the test period included a circuit switcher failure affecting Lincoln CT Units 11 and 12, a

boiler recirculation pump motor failure at Marshall Unit 1, and a boiler external fire at Cliffside Unit 5.

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 Mercury and Air Toxics

Standards ("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.