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** **STEVEN D. CAPPS FOR** **DUKE ENERGY CAROLINAS, LLC**

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Steven D. Capps and my business address is 13225 Hagers Ferry Road, Huntersville, North Carolina.

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

A. I am Senior Vice President of Nuclear Operations for Duke Energy Corporation ("Duke Energy") with direct executive accountability for Duke Energy's South Carolina nuclear plants, including Duke Energy Carolinas, LLC's ("DEC" or the "Company") Catawba Nuclear Station ("Catawba") in York County, South Carolina, the Oconee Nuclear Station ("Oconee") in Oconee County, South Carolina, and Duke Energy Progress, LLC's ("DEP") Robinson Nuclear Plant, located in Darlington County, South Carolina.

Q. WHAT ARE YOUR PRESENT RESPONSIBILITIES AS SENIOR VICE PRESIDENT OF NUCLEAR OPERATIONS?

A. As Senior Vice President of Nuclear Operations, I am responsible for providing executive oversight for the safe and reliable operation of Duke Energy's three South Carolina operating nuclear stations. I am also involved in the operations of Duke Energy's other nuclear stations, including DEC's McGuire Nuclear Station ("McGuire") located in Mecklenburg County, North Carolina.

Q. PLEASE SUMMARIZE YOUR EDUCATIONAL BACKGROUND AND PROFESSIONAL EXPERIENCE.

A. I hold a B.S. in Mechanical Engineering from Clemson University and have over 36 years of experience in the nuclear field in various roles with increasing responsibilities. I joined Duke Energy in 1987 as a field engineer at Oconee. During my time at Oconee, I served in a variety of leadership positions at the

station, including Senior Reactor Operator, Shift Technical Advisor, and Mechanical and Civil Engineering Manager. In 2008, I transitioned to McGuire as the Engineering Manager. I later became plant manager and was named Vice President of McGuire in 2012. In December 2017, I was named Senior Vice President of Nuclear Corporate with direct executive accountability for Duke Energy's nuclear corporate functions, including nuclear corporate engineering, nuclear major projects, corporate governance and operation support and organizational effectiveness. I assumed my current role in October 2018.

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

A. Yes. I provided testimony and appeared before the Commission in DEC's fuel and fuel related cost recovery proceeding in Docket No. E-7, Sub 1163 and provided testimony in DEC's fuel and fuel related cost recovery proceedings in Docket No. E-7, Sub 1190, Docket No. E-7, Sub 1228, Docket No. E-7, Sub 1250, Docket No. E-7, Sub 1263, and Docket No. E-7, Sub 1282.

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

A. The purpose of my testimony is to describe and discuss the performance of DEC's nuclear fleet during the period of January 1, 2023 through December 31, 2023 ("test period"). I provide information about refueling outages completed during the period and also discuss the nuclear capacity factor being proposed by DEC for use in this proceeding in determining the fuel factor to be reflected in rates during the billing period of September 1, 2024 through August 31, 2025 ("billing period").

Q. PLEASE DESCRIBE EXHIBIT 1 INCLUDED WITH YOUR TESTIMONY.

A. Exhibit 1 is a confidential exhibit outlining the planned schedule for refueling outages for DEC's nuclear units through the billing period. This exhibit represents DEC's current plan, which is subject to adjustment due to changes in operational and maintenance requirements.

Q. PLEASE DESCRIBE DEC'S NUCLEAR GENERATION PORTFOLIO.

A. The Company's nuclear generation portfolio consists of approximately 5,389[1] megawatts ("MWs") of generating capacity, made up as follows:

Oconee - 2,554 MWs

McGuire - 2,316 MWs

Catawba - 519 MWs[2]

The three generating stations summarized above are comprised of a total of seven units. Oconee began commercial operation in 1973 and was the first nuclear station designed, built, and operated by DEC. It has the distinction of being the second nuclear station in the country to have its license, originally issued for 40 years, renewed for up to an additional 20 years by the Nuclear Regulatory Commission ("NRC"). The license renewal, which was obtained in 2000, extends operations to 2033, 2033, and 2034 for Oconee Units 1, 2, and 3, respectively. The Company submitted a subsequent license renewal ("SLR") application for the Oconee units in June 2021, and the application is currently under review by the NRC. If approved, the Oconee units would be licensed to operate for an additional

[1] Based on Net Maximum Dependable Capacity as of January 1, 2024.
[2] Reflects DEC's 19.2 percent ownership of the Catawba Nuclear Station.

20 years. In 2019, the Company publicly announced intention to seek SLR for all 11 units operated by Duke Energy.

McGuire began commercial operation in 1981, and Catawba began commercial operation in 1985. In 2003, the NRC renewed the licenses for McGuire and Catawba for up to an additional 20 years each. This renewal extends operations until 2041 for McGuire Unit 1, and 2043 for McGuire Unit 2 and Catawba Units 1 and 2. The Company jointly owns Catawba with North Carolina Municipal Power Agency Number One, North Carolina Electric Membership Corporation, and Piedmont Municipal Power Agency.

Q. WHAT ARE DEC'S OBJECTIVES IN THE OPERATION OF ITS NUCLEAR GENERATION ASSETS?

A. The primary objective of DEC's nuclear generation department is to safely provide reliable and cost-effective electricity to DEC's customers in North and South Carolina. The Company achieves this objective by focusing on a number of key areas. Operations personnel and other station employees receive extensive, comprehensive training and execute their responsibilities to the highest standards in accordance with detailed procedures that are continually updated to ensure best practices. The Company maintains station equipment and systems reliably, and ensures timely implementation of work plans and projects that enhance the performance of systems, equipment, and personnel. Station refueling and maintenance outages are conducted through the execution of well-planned, well-executed, and high-quality work activities, which ensure that the plant is prepared for operation until the next planned outage.

Q. PLEASE DISCUSS THE PERFORMANCE OF DEC'S NUCLEAR FLEET DURING THE TEST PERIOD.

A. The Company operated its nuclear stations in a reasonable and prudent manner during the test period, providing approximately 62% of the total power generated by DEC. During 2023, DEC's seven nuclear units collectively achieved a fleet capacity factor of 94.57%, marking the 24th consecutive year in which DEC's nuclear fleet exceeded a system capacity factor of 90%. Oconee Unit 1 established new annual net generation and capacity factor records during the year, and both Catawba Unit 1 and McGuire Unit 1 entered their 2023 refueling outages after completing breaker-to-breaker continuous cycle runs.

Q. HOW DOES DEC'S NUCLEAR FLEET COMPARE TO INDUSTRY AVERAGES?

A. The Company's nuclear fleet has a history of performance that consistently exceeds industry averages. The most recently published North American Electric Reliability Council's ("NERC") Generating Unit Statistical Brochure ("NERC Brochure") indicates an average capacity factor of 91.90% for the period 2018 through 2022 for comparable units. The Company's 2023 capacity factor of 94.57% and 2-year average[3] of 94.62% both exceed the NERC average of 91.90%.

Industry benchmarking efforts are a principal technique used by the Company to ensure best practices and cost performance. For 2023, Catawba, McGuire, and Oconee nuclear plants ranked in the top quartile in total operating

[3] This represents the simple average for the current and prior 12-month test periods.

cost per kWh among the 54 U.S. operating nuclear plants[4]. By continually assessing the Company's performance as compared with industry benchmarks, the Company continues to ensure the overall safety, reliability and cost-effectiveness of DEC's nuclear units.

The superior performance of DEC's nuclear fleet has resulted in substantial benefits to customers. DEC's nuclear fleet has produced approximately 56.7 million MWhs of additional, emissions-free generation over the past 24 years (as compared with production at a capacity factor of 90%), which is equivalent to an additional 11.7 months of output from DEC's nuclear fleet (based on DEC's average annual generation for the same 24-year period). These performance results demonstrate DEC's continuing success in achieving high performance without compromising safety and reliability.

Q. WHAT IMPACTS A UNIT'S AVAILABILITY AND WHAT IS DEC'S PHILOSOPHY FOR SCHEDULING REFUELING AND MAINTENANCE OUTAGES?

A. In general, refueling, maintenance, and NRC required testing and inspections impact the availability of DEC's nuclear system.

Prior to a planned outage, DEC develops a detailed schedule for the outage and for major tasks to be performed, including sub-schedules for particular activities. The Company's scheduling philosophy is to strive for the best possible outcome for each outage activity within the outage plan. For example, if the "best ever" time an outage task was performed is 12 hours, then 12 hours becomes the goal for that task in each subsequent outage. Those individual aspirational goals

[4] Based on benchmarking data from the Electric Utility Cost Group ("EUCG").

are incorporated into an overall outage schedule. The Company then aggressively works to meet, and measures itself against, that aspirational schedule. To minimize potential impacts to outage schedules due to unforeseen maintenance requirements, "discovery items" (walk-downs, inspections, etc.) are scheduled at the earliest opportunities so that any maintenance or repairs identified through those activities can be promptly incorporated into the outage plan.

As noted, the schedule is utilized for measuring outage preparation and execution and driving continuous improvement. However, for planning purposes, particularly with the dispatch and system operating center functions, DEC also develops an allocation of outage time that incorporates reasonable schedule losses. The development of each outage allocation is dependent on maintenance and repair activities included in the outage, as well as major projects to be implemented during the outage. Both schedule and allocation are set aggressively to drive continuous improvement in outage planning and execution.

Q. HOW OFTEN DO NUCLEAR REFUELING OUTAGES OCCUR?

A. Refueling outages for the Company's nuclear stations occur every 18 to 24 months. The two Catawba and two McGuire units operate on an 18-month refueling cycle, and the three Oconee units operate on a 24-month refueling cycle. During refueling outages a nuclear unit replaces approximately one-third of the used fuel assemblies and performs maintenance, inspections, and testing that cannot be done while online.

Q. HOW DOES DEC HANDLE OUTAGE EXTENSIONS AND FORCED OUTAGES?

A. If an unanticipated issue that has the potential to become an on-line reliability challenge is discovered while a unit is off-line for a scheduled outage and repair cannot be completed within the planned work window, the outage is extended when in the best interest of customers to perform necessary maintenance or repairs prior to returning the unit to service. The decision to extend an outage is based on numerous factors, including reliability risk assessments, system power demands, and the availability of resources to address the emergent challenge. In general, if an issue poses a credible risk to reliable operations until the next scheduled outage, the issue is repaired prior to returning the unit to service. This approach enhances reliability and results in longer continuous run times and fewer forced outages, thereby reducing fuel costs for customers in the long run. In the event that a unit is forced off-line, every effort is made to safely perform the repair and return the unit to service as quickly as possible.

Q. DOES DEC PERFORM POST OUTAGE CRITIQUES AND CAUSE ANALYSES FOR INTERNAL IMPROVEMENT EFFORTS?

A. Yes. DEC applies self-critical analysis to each outage and, using the benefit of hindsight, identifies every potential cause of an outage delay or event resulting in a forced or extended outage, and applies lessons learned to drive continuous improvement. The Company also evaluates the performance of each function and discipline involved in outage planning and execution to identify areas in which it can utilize self-critical observation for improvement efforts.

Q. IS SUCH ANALYSES INTENDED TO ASSESS OR MAKE A DETERMINATION REGARDING THE PRUDENCE OR REASONABLENESS OF A PARTICULAR ACTION OR DECISION?

A. No. Given this focus on identifying opportunities for improvement, these critiques and cause analyses are not intended to document the broader context of the outage nor do they make any attempt to assess whether the actions taken were reasonable in light of what was known at the time of the events in question. Instead, the reports utilize hindsight (*e.g.,* subsequent developments or information not known at the time) to identify every potential cause of the incident in question. However, such a review is quite different from evaluating whether the actions or decisions in question were reasonable given the circumstances that existed at that time.

Q. WHAT OUTAGES WERE REQUIRED FOR REFUELING AT DEC'S NUCLEAR FACILITIES DURING THE TEST PERIOD?

A. There were four refueling outages completed during the test period: McGuire Unit 2 and Catawba Unit 1 in the spring of 2023, followed by McGuire Unit 1 and Oconee Unit 2 in the fall. The Catawba Unit 1, McGuire Unit 1, and Oconee Unit 2 refueling outages were completed under the scheduled allocation. The McGuire Unit 2 refueling outage extended beyond the scheduled allocation due to emergent challenges associated with valves in the safety injection and feedwater systems.

McGuire Unit 2 was removed from service on February 18, 2023, for refueling. In addition to refueling, safety and reliability enhancing maintenance, inspections, and testing was completed. The reactor vessel closure head ("RVCH") peening work was the primary driver for this outage's duration. This work was done to improve the RVCH condition and extend the life of the

penetration welds and tubes that are subject to primary water stress corrosion cracking ("PWSCC"). The unit also replaced the '2D' reactor coolant pump seal, the '2B' solid state protection system circuit boards, and multiple components on the lower containment air handling units including the '2B' and '2C' motors and the '2A' cooling coils to ensure continued reliability of the equipment. Tests and inspections completed during the outage included containment integrated leak rate testing and inspection of the high pressure turbine. Challenges with valves in the safety injection system and vibrations in the main feedwater system piping resulted in an extension of 1.2 days beyond the scheduled allocation. After refueling, maintenance, inspections, and testing were completed, the unit returned to service on April 4, 2023, for a total outage duration of 45.2 days.

Following a 531-day continuous cycle run, Catawba Unit 1 was removed from service on April 19, 2023 for refueling. In addition to refueling, safety and reliability enhancing maintenance, inspections, and testing was completed. The RVCH peening work executed to improve the RVCH condition and extend the life of the penetration welds and tubes that are subject to PWSCC was the primary driver for this outage's duration. The unit also replaced the '1B' main step-up transformer as part of the fleet's strategy to replace large oil-filled transformers to ensure continued reliability. Additionally, the unit replaced the '1B' main power relaying to ensure continued equipment reliability and compliance with NERC requirements for protective relays, and replaced the '1B', '1C', and '1D' reactor coolant pump seals. The unit also performed steam generator Eddy Current testing during the outage. After refueling, maintenance, inspections, and testing were

completed, the unit returned to service on May 28, 2023, for a total outage duration of 39.2 days, which was 2.8 days under the 42-day outage allocation.

Following a continuous run of over 494 days, McGuire Unit 1 was removed from service on September 16, 2023 for refueling. In addition to refueling, safety and reliability enhancing maintenance, inspections, and testing was completed. The RVCH peening work executed to improve the RVCH condition and extend the life of the penetration welds and tubes that are subject to PWSCC was the primary driver for this outage's duration. Reliability enhancements included the replacement of the '1B' reactor coolant pump seal, replacement of motors on the '1A2' component cooling water and '1A' nuclear service water pumps, and replacement of the '1B' and '1C' lower containment air handling unit cooling coils. Additionally, the site replaced the '1A' main generator circuit breaker and the '1A' solid state protection system circuit boards. Tests and inspections completed during the outage included containment integrated leak rate testing and inspection of the high pressure turbine. After refueling, maintenance, inspections, and testing were completed, the unit returned to service on October 25, 2023 for a total outage duration of 38.9 days, which was 5.1 days under the 44-day outage allocation.

Oconee Unit 2 was removed from service on October 28, 2023 for refueling. In addition to refueling, safety and reliability enhancing maintenance, inspections, and testing was completed. Reliability enhancements included the replacement of the '2B1' reactor coolant pump seal, and replacement of multiple pump motors including those for a reactor coolant pump, a high pressure injection pump, a heater drain pump, and a condensate booster pump. In addition the unit

replaced the isolated phase bus cooling fans, the stator coolant rectifier, and completed an upgrade to the unit's standby shutdown facility instrumentation infrastructure. The unit also performed a reactor vessel in-service inspection and performed steam generator Eddy current testing. After refueling, maintenance, inspections, and testing were completed, the unit returned to service on November 22, 2023, for a total outage duration of 25 days, which was four days under the 29-day outage allocation.

Q. WHAT OTHER OUTAGES OCCURRED DURING THE TEST PERIOD?

A. Oconee Unit 3 was offline in June 2023 when a leak was detected in a low-pressure service water system piping connection located in the reactor building. Since the location of the leak was in an area subject to increased dose rates while the unit is online, the decision was made to take Oconee Unit 3 offline to make the necessary repairs. The repairs were safely completed and the unit was returned to service after an outage of 2.1 days.

Q. WHAT CAPACITY FACTOR DOES DEC PROPOSE TO USE IN DETERMINING THE FUEL FACTOR FOR THE BILLING PERIOD?

A. The Company proposes to use a 95.73% capacity factor, which is a reasonable value for use in this proceeding based upon the operational history of DEC's nuclear units and the number of planned outage days scheduled during the billing period. This proposed percentage is reflected in the testimony and exhibits of Company witness Clark and exceeds the five-year industry weighted average capacity factor of 91.9% for comparable units as reported in the NERC Brochure during the period of 2018 to 2022.

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

A. Yes, it does.