BEFORE THE UTILITIES COMMISSION OF NORTH CAROLINA

DOCKET NO. E-2, SUB 1300

In the Matter of: Application of Duke Energy Progress, LLC For Adjustment of Rates and Charges Applicable to Electric Service in North Carolina and Performance-Based Regulation	)	**DIRECT TESTIMONY OF TOM RAY FOR DUKE ENERGY PROGRESS, LLC**

I. INTRODUCTION AND OVERVIEW

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Tom Ray, and my business address is 12700 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 North Carolina nuclear stations, including Duke Energy Progress, LLC's ("DEP" or the "Company") Brunswick Nuclear Station ("Brunswick") in Brunswick County, North Carolina and Harris Nuclear Station ("Harris") in Wake County, North Carolina, and Duke Energy Carolinas, LLC's ("DEC") McGuire Nuclear Station, located in Mecklenburg County, North Carolina.

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

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

Q. PLEASE SUMMARIZE YOUR EDUCATIONAL BACKGROUND AND PROFESSIONAL EXPERIENCE.

A. I have a Bachelor of Science degree in nuclear engineering from North Carolina State University and received a senior reactor operator certification from Duke Energy's McGuire Nuclear Station. My career in the nuclear power industry spans over 30 years. I began my nuclear career as an engineer with the Bechtel Power Corporation where I was a field engineer assigned to projects at various nuclear plants. In 1989 I joined Duke Energy as a nuclear engineer in the corporate headquarters. I transferred to reactor engineering at the McGuire Nuclear Station in 1994, and progressed through leadership roles at McGuire in engineering, maintenance, and outage management. In 2004, I joined the Catawba Nuclear Station team as safety assurance manager and was named maintenance manager in 2005 and engineering manager in 2009. I was transferred to the Oconee Nuclear Station as engineering manager in 2010 and was promoted to plant manager in 2012 and vice president of the Oconee Station in 2016. I was named site vice president for McGuire in 2017 and held that position until February 2022 when I assumed my current role.

Q. HAVE YOU PREVIOUSLY TESTIFIED BEFORE OR FILED TESTIMONY WITH THIS COMMISSION?

A. Yes. I filed testimony with this Commission on June 14, 2022, in DEP's fuel and fuel-related cost proceeding in Docket No. E-2, Sub 1292.

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

A. The purpose of my testimony is to provide information in support of the Company's request for a base rate adjustment. To this end, I describe DEP's nuclear generation assets; update the Commission on capital additions since the Company's last rate case filed in 2019, Docket No. E-2, Sub 1219 (the "2019 Rate Case"); explain key drivers impacting nuclear operations and maintenance ("O&M") costs; provide operational performance results for calendar year 2021 (the "Test Period"); and support the nuclear capital investments included in the Company's Multi-Year Rate Plan ("MYRP").

Q. WAS RAY EXHIBIT 1 PREPARED OR PROVIDED HEREIN BY YOU, UNDER YOUR DIRECTION AND SUPERVISION?

A. Yes. It was.

Q. WHAT ARE THE PRIMARY DRIVERS WITHIN THE NUCLEAR FLEET DRIVING THIS REQUEST?

A. Since the 2019 Rate Case, capital investments have been made to enhance safety, comply with new or revised regulatory requirements, enhance reliability and efficiency, and manage aging and obsolescent equipment. In addition, while the Company has effectively managed O&M challenges, it also continues to face O&M pressures.

Q. HOW IS THE REMAINDER OF YOUR TESTIMONY ORGANIZED?

A. The remainder of my testimony is organized as follows:

II. NUCLEAR FLEET: Generation Capacity and Asset Descriptions

III. CAPITAL ADDITIONS: In-Service for This Proceeding

IV. O&M EXPENSES

V. ADDITIONAL NUCLEAR FLEET CONSIDERATIONS

VI. NUCLEAR OPERATIONAL PERFORMANCE: Metrics and Industry Benchmarking

VII. PROPOSED MULTI-YEAR RATE PLAN CAPITAL INVESTMENTS

VIII. CONCLUSION

II. NUCLEAR FLEET

Q. PLEASE LIST DEP'S NUCLEAR FLEET.

A. DEP's nuclear generation portfolio consists of 3,593[1] megawatts ("MWs") of power capacity made up as follows:

Brunswick - 1,870 MWs

Harris - 964 MWs

Robinson - 759 MWs

[1] As of January 2022.

Q. PLEASE GENERALLY DESCRIBE DEP'S NUCLEAR GENERATION ASSETS.

A. DEP's nuclear fleet consists of three generating stations and a total of four units. Brunswick is a boiling water reactor facility with two units and was the first nuclear plant built in North Carolina. Unit 2 began commercial operation in 1975, followed by Unit 1 in 1977. The operating licenses for Brunswick were renewed in June 2006 by the Nuclear Regulatory Commission ("NRC"), extending operations up to 2036 and 2034 for Units 1 and 2, respectively. Harris is a single unit pressurized water reactor that began commercial operation in 1987. The NRC issued a renewed license for Harris in 2008, extending operations up to 2046. Robinson, also a single unit pressurized water reactor, began commercial operation in 1971. The license renewal for Robinson Unit 2 was issued by the NRC in 2004, extending operation for Robinson up to 2030.

Q. WERE THERE ANY RECENT POWER CAPACITY CHANGES WITHIN DEP'S NUCLEAR PORTFOLIO?

A. Yes. As of January 2020, the Robinson Unit 2 capacity increased from 741 MWs to 759 MWs from replacing the low-pressure turbine, which was included in rates in the 2019 Rate Case.

Q. WHAT ARE DUKE ENERGY'S PLANS RELATED TO SUBSEQUENT LICENSE RENEWAL FOR THE EXISTING NUCLEAR FLEET?

A. In 2019, Duke Energy announced intentions to seek subsequent license renewal ("SLR") for all six nuclear plants, including DEP's Brunswick, Harris, and

Robinson plants. The license application for DEC's Oconee station was submitted to the NRC in June 2021. The remaining plant SLR submittals are scheduled to follow approximately three years after the Oconee plant's SLR application submittal. The SLR application process is detailed and thorough, and each application review is expected to take approximately 18 months or longer.

Q. WHY IS THE COMPANY SEEKING SLR FOR ITS NUCLEAR FLEET?

A. The Company's nuclear fleet is a critical component of DEP's strategy for maintaining safe, reliable, and affordable electric service for its customers in both North Carolina and South Carolina as part of DEP's dual state system. These units have contributed to the Company's ability to provide such service for decades and are projected to be needed for decades more. In addition, due to its zero carbon emissions, the nuclear fleet also represents a crucial piece of achieving a successful energy transition in the Carolinas. Put simply, the transition to a lower carbon energy landscape in the Carolinas will not occur without nuclear energy as a key component of the Company's energy portfolio. Seeking SLR for the fleet is therefore in the best interest of customers continuing to benefit from affordable and reliable electric energy as well as from reduced carbon emissions. The Company's long-term maintenance of its nuclear plants, including investments made for major modifications and upgrades to each plant and adherence to an aging management program

pursuant to the stations' previous license extensions, make these stations good candidates for SLR.

III. CAPITAL ADDITIONS

Q. PLEASE PROVIDE ADDITIONAL DETAILS REGARDING MAJOR CAPITAL PROJECTS FOR NUCLEAR BEING INCLUDED IN THIS CASE.

A. Since the 2019 Rate Case, DEP has, or will have by April 30, 2023, invested approximately $625 million in beneficial capital projects for the nuclear fleet. These capital improvements were and are required to enhance safety and efficiency, preserve performance and reliability of the plants throughout their extended life operations, and address regulatory requirements.

For example, all three DEP stations made advancements in the area of innovation by the installation of equipment associated with the intelligent monitoring and remote analytics center ("IMAC") at each site. IMAC enables remote online monitoring of certain plant equipment for vibration, motor current signature analysis, turbine monitoring, and transformer monitoring. This capability drives increased equipment reliability by allowing engineers to assess equipment performance and determine when maintenance is required, shifting many time-based preventive maintenance activities to condition-based maintenance. It is anticipated that remote online monitoring will reduce O&M expenses by eliminating unnecessary preventive maintenance when equipment is performing as designed and reducing dose exposure to workers.

Additionally, the fleet has completed the projects to optimize the sites' physical security via the execution of the secure owner-controlled area ("SOCA"), early warning and assessment system ("EWAS"), and defensive position upgrade ("DFP") projects. These projects enhanced the security posture at each nuclear plant in the most cost-effective manner. The final SOCA and EWAS projects were completed at Brunswick in 2020 and the Brunswick DFP effort was completed in 2021.

At Brunswick, capital investments to remediate and replace portions of the saltwater containing systems, including replacements of both service water and circulating water pumps, are continuing. To date, six service water pumps and seven circulating water pumps have been replaced. The new pumps are designed to better withstand the corrosive effects of the saltwater environment, improving equipment reliability and reducing long-term operating and maintenance costs. Brunswick also began addressing the buried service water ("SW") piping degradation via the installation of a carbon fiber reinforced polymer ("CFRP") lining. This project will be executed over the course of multiple refueling outages and will help ensure reliable operations through the end-of-life.

Brunswick also completed a project to improve the groundwater monitoring program and the groundwater monitoring wells' reliability. Additionally, Brunswick will complete the retirement of the site's storm drain stabilization pond, place it in a safe condition, reroute flows into a new lined pond, and construct additional groundwater extraction wells to strengthen the

site's environmental stewardship and ensure the site continues to protect groundwater.

Brunswick has completed multiple projects to ensure continued reliable operations of electrical equipment at the site. Both Brunswick Units 1 and 2 have replaced the main generator's no-load disconnect switches ("NLDS") with generator circuit breakers. The installation of the generator circuit breakers eliminates an NLDS vulnerability that has resulted in unplanned generation losses. Additionally, Brunswick Units 1 and 2 replaced the start-up auxiliary transformers that reached end-of-life and were at risk of experiencing an age-related failure, which would result in an unplanned outage.

At Harris, projects have been executed to ensure continued safe and reliable operations including the replacement of the reactor auxiliary building ("RAB") fire detection equipment and the completion of the first of several projects to repair buried circulating water system prestressed concrete cylinder pipe ("PCCP"). The RAB fire detection equipment was original plant equipment that had operated beyond its anticipated service life and placed a burden on site personnel to maintain. The replacement system allows site personnel to have more accurate information regarding the location of fire alarms, upgrades the smoke detectors with modern technology, and aligns the RAB fire detection system with other systems in the Duke Energy nuclear fleet. The Harris station is also installing a CFRP lining in the circulating water system's buried PCCP based on 2019 inspection results. Lining this pipe will ensure continued reliability while mitigating the risk of an unplanned outage

and emergent repair. The first CFRP lining was installed during the 2021 refueling outage and the remaining pipe will be addressed during future refueling outages.

Robinson has completed multiple projects since 2019 to address the station's seismic probabilistic risk assessment that provides the station with additional protection from seismic hazards based on the requirements stemming from Fukushima. Replacement of the station's feedwater isolation valves mitigated a single point vulnerability for the site and resolved a non-conforming condition.

Additionally, Robinson will complete several projects by April 30, 2023 to ensure continued reliable operations. Robinson will complete the replacement of the site's digital protective relays, which will allow the site to operate in compliance with the latest industry standards and upgrade obsolete equipment that is becoming subject to age-related failure. Robinson will also complete the replacement of its distributed information control systems platform ("DICSP") hardware and software due to equipment obsolescence. This upgrade will allow Robinson to maintain cyber security compliance of the DICSP, which houses the controls for multiple plant systems including the turbine controls, emergency preparedness, and the emergency response facility information systems.

Q. MR. RAY, ARE THE CAPITAL ADDITIONS AND ENHANCEMENTS YOU HAVE DESCRIBED IN YOUR TESTIMONY USED AND USEFUL, OR WILL THEY BE USED AND USEFUL BY APRIL 30, 2023, IN PROVIDING ELECTRIC SERVICE TO DEP'S ELECTRIC CUSTOMERS IN NORTH CAROLINA?

A. Yes. These capital additions are, or by April 30, 2023, will be, used and useful in safely and efficiently providing reliable electric service to the Company's customers. The Company recognizes the value to customers of well-maintained and high-performing nuclear plants. DEP's nuclear plants have been maintained to a standard that allowed all four units to be relicensed for an additional 20-years via the initial license renewal process, and these efforts support the subsequent license renewal process that can extend the life of the plants out through 80 years. The Company's successful efforts to maintain and, when required, replace obsolete equipment and systems, enhance safety margins in compliance with new NRC requirements, and increase output and capacity, ensure customers will continue to benefit from the power provided by this reliable, efficient, cost-effective and greenhouse gas emissions-free, 24/7 power source of energy for many years to come. These investments have positioned the Company to maintain high levels of operational safety, efficiency, reliability, and performance that is reflected in the nuclear performance results I discuss later in my testimony.

IV. O&M EXPENSES

Q. PLEASE DESCRIBE SIGNIFICANT COST DRIVERS IMPACTING O&M EXPENSES FOR DEP'S NUCLEAR FLEET.

A. During the Test Period, approximately 29% of the required O&M expenditures for DEP's nuclear fleet were fuel related. A complete discussion of nuclear fuel costs can be found in Witness Matthew L. Cameron's testimony filed with this Commission on June 14, 2022 in the Company's annual fuel proceeding in Docket No. E-2, Sub 1292. In his testimony, Witness Cameron noted that the Company anticipates a modest increase in nuclear fuel costs on a cents per kilowatt hour ("kWh") basis through the next several years. Customers will continue to benefit from the Company's diverse energy mix and the strong performance of its nuclear fleet through lower fuel costs than would otherwise result absent the significant contribution of nuclear power to meeting customer demand.

Non-fuel items compose the remainder of O&M expenditures for the nuclear fleet. Nuclear power plant operations are very labor intensive and, therefore, a significant portion of O&M expenses are related to internal and contracted labor. The Company continues to face upward pressure on these ongoing labor costs and other challenges have occurred with rising costs for materials and supplies.

Q. WHAT EXAMPLES CAN YOU PROVIDE RELATED TO THE COMPANY'S EFFORTS TO CONTROL O&M COSTS?

A. The Company has many efforts in place for controlling and/or saving costs. An area of focus in recent years has been outage optimization, focusing on duration, budget, dose, and production. This approach applies strict controls on reducing outage durations, aligning typical maintenance work within duration templates, allocating costs based on duration templates, improving alignment of bulk work to minimize schedule impacts, and targeting dose to the five-year ALARA[2] plan. Continuing efforts to reduce refueling outage durations are yielding results. The Brunswick Unit 2 and Harris refueling outages completed during the Test Period represented the shortest refueling outage durations ever achieved for those two units. Shorter refueling outages result in reduced O&M expense and directly benefit customers by allowing increased output from the lower fuel cost nuclear units.

Innovation is another key area of focus to help control costs. I mentioned IMAC earlier in my testimony. The remote monitoring capability enabled by IMAC is expected to reduce O&M costs as more maintenance activities are initiated by equipment performance-based maintenance versus time-based preventive maintenance, thereby reducing both labor and material requirements. The Company has expanded the use of robotics and drones for inspection activities in high dose areas or areas that are difficult or impossible

[2] Code of Federal Regulations (10 C.F.R. § 20.1003) acronym for "as low as (is) reasonably achievable."

to access during plant operations. Expanded use of these type technologies reduce radiation exposure and enhance personnel safety for workers. As indicated by these examples, the Company is aggressively pursuing innovation and technology.

Q. CAN YOU COMMENT ON THE COMPANY'S EFFORTS TO MAINTAIN AND IMPROVE CYBER SECURITY?

A. Yes. DEP operates under a Cyber Security Plan approved by the NRC. The activities outlined by the Company within its Cyber Security Plan included examining current practices, developing cyber security program processes, reviewing critical digital assets, performing validation testing, and implementing new controls. The DEP nuclear plants continue to assess current cyber threats and improve defenses. The Nuclear Generation organization maintains dedicated resources to these key protective actions and works with enterprise cyber security experts, the NRC, Department of Homeland Security, and other law enforcement agencies. We also partner with nuclear organizations such as the Nuclear Energy Institute and the Institute of Nuclear Power Operations and maintain open communications with our industry peers. The combination of these actions provides a robust defense.

V. ADDITIONAL NUCLEAR FLEET CONSIDERATIONS

Q. HAS THE COMPANY ATTEMPTED TO LIMIT COST INCREASES FOR CAPITAL ADDITIONS AND O&M EXPENSES?

A. Yes. The Company controls costs for capital projects and O&M utilizing a rigorous cost management program. The Company sustainably controls costs through routine executive oversight of project budget and activity reporting, with new projects requiring approval by progressively higher levels of management depending on total project cost. The Company also controls ongoing capital and O&M costs through strategic planning and procurement, efficient oversight of contractors by a trained and experienced workforce, rigorous monitoring of work quality, thorough critiques to drive out process improvement, and industry benchmarking to ensure best practices are being utilized.

Q. HAS THE COMPANY INCURRED ADDITIONAL O&M OR CAPITAL COSTS DUE TO ANY OTHER REGULATORY OBLIGATIONS SINCE THE 2019 RATE CASE?

A. No. In the 2019 Rate Case, the Company indicated that additional Fukushima and Environmental Protection Agency regulations related to water intake and cooling functions could potentially result in additional O&M and capital expense. Those potential increases have not materialized.

There were no new Fukushima regulatory actions announced since the 2019 Rate Case. All Fukushima related actions at Brunswick, Harris, and Robinson have been completed.

Harris and Robinson have submitted reports related to the EPA water intake and cooling water regulations, and no plant modifications are required. Brunswick will submit its report during 2022, and no required modifications are anticipated.

Q. ARE THERE CURRENT ISSUES IN THE NUCLEAR INDUSTRY THAT MAY FURTHER IMPACT COSTS FOR CAPITAL AND/OR O&M?

A. Yes. For example, as a result of the Russian invasion of Ukraine, supply challenges and increased cost pressures on the procurement of uranium and uranium fuel process services are expected over the next several years. Duke Energy has always valued diversity of supply and is working with urgency to mitigate these potential impacts.

As I discussed earlier in my testimony, cyber security requires an ongoing effort to maintain defenses against ever increasing technical capabilities of adversaries. The current geopolitical unrest associated with Russian aggression in Ukraine has heightened the threat assessment for critical infrastructure including power generation. Continued diligence is required to ensure reliable operations are not impacted by malicious cyber actors. As cyber risks continue to increase, Company efforts must match these threats. Continued diligence could require deployment of additional resources. As I noted earlier, despite the success of the Company's efficiency initiatives to mitigate cost increases, DEP continues to face upward pressure on O&M costs. The Company is also experiencing supply chain challenges resulting in longer

lead times and increased costs for some materials. These challenges have increased as the world begins to exit the pandemic. Efforts to mitigate these challenges include relying on the size of Duke Energy's combined purchasing and contracting scale, partnering with community colleges and universities to ensure availability of a pool of well-trained candidates in our service territories, and developing our existing workforce with training.

Finally, a significant challenge facing the nuclear industry is the cost and technological requirements for modernizing systems and equipment within nuclear stations across the country to ensure safe, reliable, and economical power that emits zero greenhouse gases. Therefore, maintaining the Company's nuclear assets is critical to achieving significant reductions to current and future levels of greenhouse gas emissions.

VI. NUCLEAR OPERATIONAL PERFORMANCE

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

A. The primary objective of DEP's nuclear generation department is to safely provide reliable and cost-effective energy to the Company's customers. The Company achieves this objective by focusing on several key areas. Operations personnel and other station employees are well-trained and execute their responsibilities to the highest standards in accordance with detailed procedures. The Company maintains station equipment and systems reliably, and endeavors to ensure 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 effectively ready the plant for operation until the next planned outage.

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

A. As in years past, DEP's nuclear fleet continued to perform well during the Test Period, providing approximately 50% of DEP's generation needs. During 2021, DEP's nuclear plants achieved an annual capacity factor of 94.94% and established a new DEP annual generation record. The Brunswick plant achieved record annual generation during 2021, and the Harris plant established a new annual generation record during 2020. As I mentioned earlier in my testimony, the two refueling outages conducted during the review period established new refueling outage durations for each unit.

These performance results support DEP's continued commitment for achieving high performance without compromising safety and reliability.

Q. WHAT INITIATIVES HAS THE COMPANY TAKEN TO INCREASE EFFICIENCIES IN NUCLEAR OPERATIONS?

A. The Company uses benchmarking, long-range planning, work prioritization tools, and other processes to continuously improve operational and cost performance. Over the years, the Company has gained efficiencies from the implementation of common policies, practices, and procedures across the Duke Energy nuclear fleet. In addition, efficiencies are sought through incorporation of industry best practices. Since the merger, a focused effort remains on

improving fleet performance in various areas, and a focus on organizational effectiveness continues identifying and addressing work improvements. The goal is aligning operations at a fleet level, taking advantage of shared experiences and process improvement opportunities. Overall, improvement efforts result in enhanced fleet reliability and efficiency on a cost per kWh basis.

Q. HOW DOES THE DUKE ENERGY NUCLEAR FLEET COMPARE TO OTHERS IN THE INDUSTRY?

A. The Company's nuclear fleet has a history of top performance. The most recently published North American Electric Reliability Council's ("NERC") Generating Unit Statistical Brochure ("NERC Brochure") indicates an average capacity factor of 93.92% for comparable units representing the period 2017 through 2021. The Company's Test Period capacity factor of 94.94% exceeds the NERC average of 93.92%.

Duke Energy's nuclear fleet continues to rank among the top performers when compared to the seven other large domestic nuclear fleets using Key Performance Indicators ("KPIs") in the areas of personal safety, radiological dose, manual and automatic shutdowns, capacity factor, forced loss rate, industry performance index, and total operating cost. Industry benchmarking efforts are a principal technique used by the Company to ensure best practices. These efforts further ensure overall prudence, safety and reliability of DEP's nuclear units.

VII. PROPOSED MULTI-YEAR RATE PLAN CAPITAL ADDITIONS

Q. DOES THE COMPANY'S PROPOSED MYRP INCLUDE NUCLEAR PROJECTS?

A. Yes. Twenty-six nuclear projects are included in the Company's proposed MYRP.

Q. WHAT PROCESS AND CRITERIA DID THE COMPANY USE TO SELECT THESE PROJECTS FOR INCLUSION IN THE PROPOSED MYRP?

A. The Company selected the projects for inclusion in the proposed MYRP based on the value of the projects in maintaining safe and reliable operation of the nuclear stations in combination with having a high level of confidence in both the cost estimates and schedule for the projects.

Q. HOW WERE THE PROJECTED COSTS FOR THE PROJECTS CALCULATED?

A. The projected costs for the nuclear projects included in the proposed MYRP were obtained from the Company's long-range nuclear planning tool, which is updated regularly to reflect the most accurate total project costs (including AFUDC and contingency), cash flows, and schedule, as required by Commission Rule R1-17B(d)(2)j.

Q. WERE ANY OF THESE PROJECTS PRESENTED AT THE JULY 25, 2022 TECHNICAL CONFERENCE HELD IN THIS PROCEEDING?

A. No. The technical conference addressed only the transmission and distribution ("T&D") projects in the proposed MYRP, and none of the nuclear projects are T&D.

Q. WILL ANY OF THE NUCLEAR MYRP PROJECTS REQUIRE A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY FROM THE COMMISSION?

A. No.

Q. DO ANY OF THE PROJECTS OFFER PROJECTED OPERATING BENEFITS?

A. No quantified projected operating benefits were identified for the proposed projects. The qualitative benefits of completing the projects are that they will enable DEP to maintain safe and reliable operation of the nuclear stations, including aging systems and equipment. The specific benefits of each project are presented in further detail in Ray Exhibit 1.

Q. IN YOUR VIEW, IS THE COMPANY'S DECISION TO INVEST IN THESE PROJECTS PRUDENT, JUST, AND REASONABLE FOR THE PROVISION OF SAFE AND RELIABLE ELECTRIC SERVICE TO CUSTOMERS AND IN THE PUBLIC INTEREST?

A. Yes. The Company has prudently and reasonably selected these projects for investment as they will enable DEP to maintain the nuclear fleet in reliable and efficient condition for the benefit of customers.

Q. WILL YOU PLEASE PROVIDE ADDITIONAL DETAIL REGARDING THE NUCLEAR MYRP PROJECTS?

A. Yes. In this section of my testimony I will present additional details regarding these projects. I will first discuss the DEP projects applicable to all stations, and then will discuss remaining projects organized by station. Ray Exhibit 1 provides additional details regarding projected cost, schedule, and scope for each project, as well as the reason for each project, as required by Commission Rule R1-17B(d)(2)j.

Q. WHAT MYRP CAPITAL INVESTMENTS IS THE COMPANY PROPOSING TO MAKE ACROSS THE NUCLEAR FLEET?

A. The Company is proposing to execute two fleet-wide projects: 1) operational data process book replacement, and 2) fleet firewall replacement. The operational data process book replacement project will upgrade the fleet's existing system used to track and analyze station system and equipment performance using real-time data. This upgrade will replace the currently used obsolete software with a version that can receive vendor technical support and continue to receive the latest cyber security patches. This upgrade will also be applied to the Duke Energy nuclear stations in the DEC fleet. The fleet firewall replacement project will upgrade the existing firewall used for all Duke Energy nuclear stations in both the DEP and DEC fleets with a new firewall that meets the Company's cyber security requirements and allows the Company to maintain cyber security for its digital assets.

Q. WHAT MYRP CAPITAL INVESTMENTS IS THE COMPANY PROPOSING TO MAKE AT BRUNSWICK STATION?

A. The Brunswick station is executing multiple projects that will allow both operating units to maintain reliability of various station systems and equipment.

For example, Brunswick will be replacing the Unit 1 plant process computer ("PPC"). The existing PPC equipment is obsolete and spare parts availability is limited, which will not allow for long-term maintenance of the system. These issues place additional burden on plant personnel and pose a risk of station process data not being available in an accurate and timely manner. A failure of the PPC system has the potential to result in unplanned unit power reductions or the inability to restart after a unit outage.

Additionally, both Brunswick operating units will be replacing feedwater heaters (the Unit 1 '4B' and the Unit 2 '5A/5B'). These feedwater heaters are at end-of-life and a loss of this equipment for either operating unit would result in a substantial unplanned reduction in generation capacity until the feedwater heaters can be replaced.

Q. WHAT MYRP CAPITAL INVESTMENTS IS THE COMPANY PROPOSING TO MAKE AT ROBINSON STATION?

A. The Robinson station is executing multiple projects that will allow the site to maintain safe and reliable operation. The station's combined emergency response facility information system ("ERFIS") and PPC gathers, processes, stores, and displays operational data. The ERFIS system has become obsolete and replacement parts availability is severely limited, which will not allow

Robinson to execute long-term maintenance of the ERFIS equipment. Replacing ERFIS will allow the station to continue to display station operational data in a clear and concise manner during emergencies to the following locations: 1) control room, 2) technical support center, 3) operational support center, and 4) emergency operations facility. The PPC portion of the project will allow the station to reliably support plant operations, perform station performance analysis, and better monitor station performance.

In addition, the Robinson main generator automatic voltage regulator ("AVR") has become obsolete, manufacturer support is unavailable, and spare parts cannot be readily obtained. Additionally, the existing AVR lacks redundancy and is considered by the station to be a single point vulnerability where a failure could result in an unplanned outage and potential damage to both the main generator and exciter. Robinson will replace the existing Unit 1 AVR with a new design that eliminates the single point vulnerability risk and will be aligned with the design of other AVRs replaced at both DEP and DEC nuclear stations.

Q. WHAT MYRP CAPITAL INVESTMENTS IS THE COMPANY PROPOSING TO MAKE AT HARRIS STATION?

A. The Harris station is executing multiple projects that will allow the site to maintain safe and reliable operation. The station's combined ERFIS and PPC gathers, processes, stores, and displays operational data. The ERFIS system has become obsolete and replacement parts availability is severely limited, which will not allow Harris to execute long-term maintenance of the ERFIS

equipment. Replacing ERFIS will allow the station to continue to display station operational data in a clear and concise manner during emergencies to the following locations: 1) control room; 2) technical support center; 3) operational support center; and 4) emergency operations facility. The PPC portion of the project will allow the station to reliably support plant operations, perform station performance analysis, and better monitor station performance.

The Harris station will also be replacing the unit's start-up transformer ("SUT") to address equipment obsolescence and convert the SUT to a new design that will support grid voltage requirements after the retirement of the Roxboro and Mayo stations.

VIII. CONCLUSION

Q. IS THERE ANYTHING YOU WOULD LIKE TO SAY IN CLOSING?

A. Yes. The Company has a proven history of cost competitive operation of its nuclear assets concurrent with maintaining safety, quality, and reliability. DEP is positioned to continue as a leader in the industry with a solid base of knowledge and experience, and with a nuclear fleet that is highly efficient and reliable. This base rate increase will allow the Company to continue the tradition of operational excellence and focus on safe operations, reliable generation, and strong performance that ultimately benefits our customers. The MYRP projects that the Company is seeking approval of in this case will do the same over the next several years as DEP continues to transition toward a cleaner energy future.

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

A. Yes.

DUKE ENERGY PROGRESS
MYRP PROJECTS

Line No.	MYRP Project Name	FERC Function	Project Forecasted In-Service Date	MYRP Project Description & Scope	Reason for the MYRP Project	Total Project Amount (System) Projected In-Service Costs	Projected Annual Net O&M	Projected Installation O&M
1	Brunswick Nuclear Plant Containment Atmosphere Control Tank	Nuclear Plant In Service	Dec-23	Replace components in the Brunswick Containment Atmosphere Control (CAC) tank area including the vaporizer, piping, and CAC tank.	The Brunswick station's CAC tank area contains equipment used to support each of the operating units during start-up after an outage. The equipment in this area is nearing the end of its service life and needs to be addressed to mitigate the risk of equipment failures due to age-related degradation. This project will address age-related degradation issues with the CAC area piping, vaporizer, and tank.	$ 2,059,973	$ -	$ -
2	Brunswick Nuclear Plant Distributed Information Control Systems Platform Replacement	Nuclear Plant In Service	Dec-25	Replace the Brunswick Distributed Information Control Systems Platform (DICSP) hardware and software that has reached end-of-life.	The Brunswick DICSP hardware and software require upgrades to maintain manufacturer support and the ability to install the latest cyber security patches. Control systems for various pieces of station equipment including the turbine controls system, emergency response facility information system (ERFIS), and plant process computer (PPC) are housed on, or interface with, the DICSP. A failure of the DICSP could lead to unplanned generation losses for both Brunswick operating units.	$ 9,890,241	$ -	$ -
3	Brunswick Nuclear Plant Lighting Transformers Replacement	Nuclear Plant In Service	Dec-25	Replace the 480V '1L' and '2L' lighting transformers at the Brunswick station	Brunswick has identified multiple 480V transformers requiring replacement due to age-related degradation. The '1L' and '2L' lighting transformers are the final two transformers that require replacement to ensure continued reliability of the lighting system at the station.	$ 2,319,623	$ -	$ -
4	Brunswick Nuclear Plant Radio System & Console Replacement	Nuclear Plant In Service	Dec-23	Replace the Brunswick security radio system and console with a new system that is aligned with the nuclear fleet's standard radio system requirements.	Brunswick is replacing the security radio system and console with a system that has been adopted by the nuclear fleet as the standard security radio system. The current Brunswick system has reached end-of-life and a failure of the system could impact communications for multiple plant organizations including security, maintenance, operations, emergency planning, and the fire brigade.	$ 9,455,767	$ -	$ -
5	Brunswick Nuclear Plant Security Door Controllers and Turnstiles Replacement	Nuclear Plant In Service	Nov-23	Replace the Brunswick station's obsolete vital area door controllers and turnstiles.	Brunswick will replace the obsolete vital area door controllers and turnstiles, which will mitigate the risk of the station needing to have an increased amount of security personnel present to monitor and control access to the plant if the controllers and turnstiles fail.	$ 1,173,537	$ -	$ -
6	Brunswick Nuclear Plant Unit 1 Circulating Water Ocean Discharge Pump Replacement	Nuclear Plant In Service	May-25	Replace the Brunswick Unit 1 '1A' Circulating Water Ocean Discharge (CWOD) Pump	The Brunswick CWOD pumps operate in a harsh saltwater environment and are critical to maintaining water levels in the Brunswick station's discharge canal. This pump is being replaced with an upgraded material specifically designed for use in sea water environments that will allow the pump to operate with a lower risk of failure from material degradation.	$ 3,692,992	$ -	$ -
7	Brunswick Nuclear Plant Unit 1 Emergency Response Facility Information System Replacement	Nuclear Plant In Service	Jun-24	Replace the Brunswick Unit 1 Emergency Response Facility Information System (ERFIS)	The BNP ERFIS system is in a degraded condition and the equipment is obsolete and needs to be replaced to ensure proper functionality. The system gathers, processes, stores, and displays data from plant parameters. During an emergency ERFIS displays plant data at various locations (e.g., Control Room, Technical Support Center, Operational Support Center, Emergency Operations Facility).	$ 13,354,778	$ -	$ -
8	Brunswick Nuclear Plant Unit 1 Feedwater Heater Replacement	Nuclear Plant In Service	Mar-24	Replace the Brunswick Unit 1 '4B' Feedwater Heater (FWH)	All of the Brunswick Unit 1 high-pressure feedwater heaters have been replaced except the '4B' feedwater heater. This feedwater heater is operating beyond its original design life of 40 years and needs to be replaced in order to ensure continued reliability of Brunswick Unit 1.	$ 12,981,212	$ -	$ -
9	Brunswick Nuclear Plant Unit 1 Main Generator Automatic Voltage Regulator Replacement	Nuclear Plant In Service	Apr-24	Replace the Brunswick Unit 1 main generator's automatic voltage regulator (AVR).	The Brunswick Unit 1 main generator automatic voltage regulator (AVR) has become obsolete, manufacturer support is unavailable, and spare parts cannot be readily obtained. Additionally, the existing AVR lacks redundancy and is considered by the station to be a single point vulnerability (SPV). The new AVR is designed to eliminate the SPV risk where a failure could result in an unplanned outage and potential damage to both the main generator and exciter.	$ 7,654,615	$ -	$ 258,454

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10	Brunswick Nuclear Plant Unit 1 Plant Process Computer	Nuclear Plant In Service	Apr-24	Replace the Brunswick Unit 1 Plant Process Computer (PPC)	The Brunswick Plant Process Computer (PPC) is obsolete and spare parts are increasingly difficult to obtain. The parts obsolescence places an additional burden on plant personnel and poses a risk of the PPC system not being available to provide accurate data in a timely manner. Additionally, a failure of this system has the potential to result in a unit derate or unplanned outage extension. The PPC needs to be replaced to ensure continued reliable operations of Brunswick Unit 1.	$ 11,626,916	$ -	$ -
11	Brunswick Nuclear Plant Unit 2 Circulating Water Ocean Discharge Pump Replacement	Nuclear Plant In Service	Dec-23	Replace the Brunswick Unit 2 '2A' Circulating Water Ocean Discharge (CWOD) Pump	The Brunswick CWOD pumps operate in a harsh saltwater environment and are critical to maintaining water levels in the Brunswick station's discharge canal. This pump is being replaced with an upgraded material specifically designed for use in sea water environments that will allow the pump to operate with a lower risk of failure from material degradation.	$ 4,098,022	$ -	$ -
12	Brunswick Nuclear Plant Unit 2 Emergency Response Facility Information System Replacement	Nuclear Plant In Service	Dec-23	Replace the Brunswick Unit 2 Emergency Response Facility Information System (ERFIS)	The BNP ERFIS system is in a degraded condition and the equipment is obsolete and needs to be replaced to ensure proper functionality. The system gathers, processes, stores, and displays data from plant parameters. During an emergency ERFIS displays plant data at various locations (e.g., Control Room, Technical Support Center, Operational Support Center, Emergency Operations Facility).	$ 23,230,324	$ -	$ -
13	Brunswick Nuclear Plant Unit 2 Feedwater Heater Replacement	Nuclear Plant In Service	Apr-25	Replace the Brunswick Unit 2 '5A/5B' Feedwater Heater (FWH)	Several of the Brunswick Unit 2 high-pressure feedwater heaters have been replaced due to meeting the end of their design life. The Brunswick Unit 2 '5A' and '5B' feedwater heaters are operating beyond their original design life of 40 years and need to be replaced in order to ensure continued reliability of Brunswick Unit 2.	$ 17,703,289	$ -	$ -
14	Fleet Firewall Replacement	Nuclear Plant In Service	Dec-25	Replace the Adaptive Security Appliance (ASA) 5555-X firewalls at each of the Duke Energy Progress (DEP) sites (Brunswick, Harris, and Robinson).	This project will upgrade the existing firewall used for all Duke Energy nuclear stations in both the DEP and DEC fleets with a new firewall meeting the latest cyber security requirements. The new firewall maintains cyber security of digital assets and allows for continued compliance with cyber security regulations.	$ 12,846,954	$ -	$ -
15	Fleet Operational Data Process Book Replacement	Nuclear Plant In Service	Dec-24	Replace the Operational Data Process Book software at each of the Duke Energy Progress (DEP) nuclear sites (Brunswick, Harris, and Robinson).	The Process Book application is used by all nuclear departments (e g., engineering, operations, maintenance, etc.) to track and analyze station system and equipment performance using real-time data. The existing software is obsolete, and the vendor no longer provides technical support. This upgrade will replace the software that is currently in use with a version that can receive vendor technical support and be updated with the latest cyber security patches. Note, this upgrade will also be applied to the Duke Energy Carolinas (DEC) nuclear stations (Catawba, McGuire, and Oconee).	$ 11,601,385	$ -	$ -
16	Harris Nuclear Plant Circulating Water Pipe Liner Installation	Nuclear Plant In Service	May-24	Install a carbon fiber reinforced polymer (CFRP) lining inside the buried pre-stressed concrete cylinder pipe (PCCP) used in the Harris Circulating Water (CW) System during the H1R25 refueling outage in 2024.	In 2019 the Harris station identified and repaired sections of the circulating water system's buried PCCP with a CFRP wrap. Inspections of the pipe identified other areas of this pipe where degradation was present, and the Harris station developed a plan to address the degraded pipe over the course of several future refueling outages. This project will install a CFRP wrap along a portion of the PCCP during the 2024 Spring refueling outage (H1R25). Additional sections of the PCCP will have a CFRP wrap installed during each refueling outage until all of the degraded sections have been addressed. If the pipe degradation is not addressed and a portion of the PCCP becomes inoperable the station would have to go into an unplanned outage to repair the piping.	$ 8,163,182	$ -	$ -

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17	Harris Nuclear Plant Circulating Water Pump Cable Replacement	Nuclear Plant In Service	Dec-23	Replace the Harris 'A' Circulating Water Pump (CWP) power cables.	The power cable insulation for the Harris station's 'A' CWP has degraded, indicating that the power cables have reached the end-of-life. These cables support the station's circulating water pumps by carrying power to the pump motors. The inability to operate the station's CWPs will not impact plant safety but will result in an unplanned power reduction. This project will replace the 'A' CWP power cables to ensure continued reliable operation of the circulating water system.	$ 1,747,847	$ -	$ -
18	Harris Nuclear Plant Distributed Information Control Systems Platform Upgrade	Nuclear Plant In Service	Nov-24	Replace the Harris Distributed Information Control Systems Platform (DICSP) hardware and software that has reached end-of-life.	The Harris DICSP hardware and software require upgrades to maintain manufacturer support and the ability to install the latest cyber security patches. Control systems for various pieces of station equipment including the turbine controls system, radiation monitoring system, reactor auxiliary building normal ventilation system controls application, containment pre-entry purge exhaust system, and flow rate monitor controls for the plant vent stack and the waste processing building stacks are housed on the DICSP. A failure of the DICSP could lead to unplanned generation losses for the Harris station.	$ 13,428,612	$ -	$ -
19	Harris Nuclear Plant Emergency Response Facility Information System and Plant Process Computer Replacement	Nuclear Plant In Service	Jun-24	Replace the Harris station's combined Emergency Response Facility Information System (ERFIS)/Plant Process Computer (PPC)	The Harris station's combined emergency response facility information system (ERFIS) and plant process computer (PPC) gathers, processes, stores, and displays operational data. Both the ERFIS and PPC equipment are in a degraded condition and require replacement to ensure continued reliable operations. The ERFIS equipment is obsolete and replacement parts availability is severely limited, which will not allow Harris to execute long-term maintenance of the system. Replacing ERFIS will allow the station to continue to display station operational data in a clear and concise manner during emergencies to the following locations: 1) control room, 2) technical support center, 3) operational support center, and 4) emergency operations facility. The PPC equipment is also facing obsolescence and difficulty obtaining spare parts. Replacing the PPC allows the station to reliably support plant operations, perform station performance analysis, and better monitor station performance.	$ 22,859,911	$ -	$ -
20	Harris Nuclear Plant Transformers Replacement	Nuclear Plant In Service	May-24	Replace the two Harris station Unit Auxiliary Transformers (UATs) and the two Start-Up Transformers (SUTs) with new transformers utilizing a load-tap changing design.	The Harris UATs and SUTs have reached the end of their service life and need to be replaced to support continued safe and reliable operations of the Harris station. Additionally, the new UAT and SUT design will align the Harris transformers with the design of the UATs and SUTs across the other Duke Energy Progress stations (Brunswick and Robinson). Additionally, the Roxboro and Mayo coal-fired stations support the Harris station's switchyard voltage requirements during an emergency loss of coolant accident. Replacement of the existing Harris station UATs and SUTs with a new load-tap changing design will allow the Roxboro and Mayo stations to be retired in support of Duke Energy's carbon reduction goals without negatively impacting the switchyard voltage during a potential emergency situation for the Harris station.	$ 30,915,144	$ -	$ -

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21	Robinson Nuclear Plant - Lake Robinson Dam Spillway Electrical Upgrade	Nuclear Plant In Service	Oct-23	Replace the Robinson site's buried power cable and power panel supporting equipment at the Lake Robinson Dam spillway.	The Lake Robinson Dam spillway must remain operable as long as Lake Robinson is maintained. Additionally, the spillway must remain available to ensure proper lake levels for operation of the Robinson Nuclear Plant and to prevent plant flooding during a design basis rain event. The buried power feed cable and power panels supporting the Lake Robinson Dam Spillway are originally installed equipment that have been supporting the station since the 1950s and are experiencing age-related degradation. This project will replace buried power cables and power panel components to ensure continued operability of the spillway electrical components. Additionally, this project will install a backup power generator based on the upgrades made to other spillways at Duke Energy hydroelectric stations.	$ 9,373,010	$ -	$ -
22	Robinson Nuclear Plant Emergency Response Facility Information System and Plant Process Computer Replacement	Nuclear Plant In Service	Nov-24	Replace the Robinson station's combined Emergency Response Facility Information System (ERFIS)/Plant Process Computer (PPC)	The Robinson station's combined emergency response facility information system (ERFIS) and plant process computer (PPC) gathers, processes, stores, and displays operational data. Both the ERFIS and PPC equipment are in a degraded condition and require replacement to ensure continued reliable operations. The ERFIS equipment is obsolete and replacement parts availability is severely limited, which will not allow Robinson to execute long-term maintenance of the system. Replacing ERFIS will allow the station to continue to display station operational data in a clear and concise manner during emergencies to the following locations: 1) control room, 2) technical support center, 3) operational support center, and 4) emergency operations facility. The PPC equipment is also facing obsolescence and difficulty obtaining spare parts. Replacing the PPC allows the station to reliably support plant operations, perform station performance analysis, and better monitor station performance.	$ 22,782,194	$ -	$ -
23	Robinson Nuclear Plant Intrusion Detection System	Nuclear Plant In Service	Dec-25	Replace the Robinson site's Intrusion Detection System (IDS) equipment.	Robinson is executing a project to replace the physical security equipment used to detect unauthorized intrusion into the plant area. Many of these components are obsolete and have become unreliable, which has led to the Robinson security organization having to place more security personnel on duty while the equipment is repaired. Replacement of the equipment will increase the intrusion detection system's reliability and effectively maintain compliance with federal regulatory requirements related to plant security in accordance with 10 CFR Part 73, "Physical Protection of Plants and Materials."	$ 18,323,529	$ -	$ -
24	Robinson Nuclear Plant Main Control Room Annunciator Replacement	Nuclear Plant In Service	Dec-25	Replace the existing Robinson main control room annunciator system.	The control room annunciator system was originally installed in 1986 and has become obsolete and spare parts are difficult to obtain. This system is used to alert control room personnel via alarms when various station equipment/systems are operating outside of expected parameters. The operation of these alarms is needed to ensure the station is operated reliably and in compliance with the station's technical specifications.	$ 8,568,423	$ -	$ -
25	Robinson Nuclear Plant Main Generator Automatic Voltage Regulator Replacement	Nuclear Plant In Service	Dec-24	Replace the Robinson main generator's automatic voltage regulator (AVR).	The Robinson main generator AVR has become obsolete, manufacturer support is unavailable, and spare parts cannot be readily obtained. Additionally, the existing AVR lacks redundancy and is considered by the station to be a single point vulnerability (SPV). The new AVR is designed to eliminate the SPV risk where a failure could result in an unplanned outage and potential damage to both the main generator and exciter.	$ 11,569,440	$ -	$ -

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26	Robinson Nuclear Plant Programmable Logic Controllers Replacement	Nuclear Plant In Service	Dec-24	Design and install replacements for the Robinson programmable logic controllers (PLCs) for the Condensate Polishing System, Makeup Water Treatment (MWT) System, and the Steam Generator Blowdown (SGBD) System.	The Robinson station systems where PLCs are being replaced are condensate polishing, makeup water treatment, and steam generator blowdown. A failure of the PLCs in these systems results in increased operational burden on station employees to support continued operation of the unit. Additionally, the existing PLCs are obsolete and manufacturer support is no longer available. The replacement of the PLCs will allow the station to continue to operate these systems reliably and efficiently.	$ 20,208,367	$ -	$ -
	TOTALS					**$ 311,629,286**	**$ -**	**$ 258,454**