STATE OF NORTH CAROLINA
UTILITIES COMMISSION
RALEIGH

DOCKET NO. E-2, SUB 1318
DOCKET NO. EC-67, SUB 55

BEFORE THE NORTH CAROLINA UTILITIES COMMISSION

In the Matter of: Joint Application of Duke Energy Progress, LLC and North Carolina Electric Membership Corporation for a Certificate of Public Convenience and Necessity to Construct a 1,360 MW Natural Gas-Fueled Combined Cycle Electric Generating Facility in Person County, North Carolina	)	**DIRECT TESTIMONY OF WILLIAM B. MCALEB ON BEHALF OF ENVIRONMENTAL DEFENSE FUND**

REDACTED

TABLE OF CONTENTS

I. Introduction. Background, Findings, and Recommendations

Q: PLEASE INTRODUCE YOURSELF, YOUR CURRENT POSITION AND BUSINESS LOCATION.

A: My name is William B. ("Bill") McAleb, and I am employed as the Chief Executive Officer and President of Rod Walker & Associates ("RWA"), a Management Consultancy and Technical Advisory firm based near Atlanta, GA.

Q: PLEASE SUMMARIZE YOUR EXPERIENCE, PROFESSIONAL AND EDUCATIONAL BACKGROUND.

A: I possess over forty years of Oil, Gas, Power and Utility industry experience and business operational knowledge, engineering, and technical expertise. Having a well-seasoned range of career executive, management, strategic and operational experience, I offer leadership, guidance, vision, corporate and board counsel, interim executive, and expert witness services. The focus of my practice is the provision of technical, financial, policy and managerial advisory and forensics services to clients engaged in the nexus between hydrocarbon fuels, electric power, transmission & distribution, energy and fuels storage, petroleum midstream, inter- and intrastate pipelines and utilities. Further, I deliver deep experience and hands-on leadership, implementation, and management relative to operations, financial and operational performance and optimization, utility and energy policy practices, process and profitability strategy and innovation. In addition, I have expertise with respect to M&A/Transactional/Transitional advisory services to financial and

private equity clients as well as strategic advisory services to utility, energy, and related clients.

I have MBA and Master of Petroleum Engineering degrees from Tulane University and a Bachelor of Chemical Process Metallurgical Engineering from the University of Texas at El Paso.

I have provided expert testimony related to natural gas procurement and prudency, energy asset property tax issues, RCN analysis, operational joint-interest agreements and performance, energy market performance and forecasting, regulatory policy and practices, utility prudency determinations and economic forensics in state, federal, and regulatory venues.

Q: ON WHOSE BEHALF ARE YOU APPEARING?

A: I am submitting this testimony on behalf of the Environmental Defense Fund.

Q: HAVE YOU EVER TESTIFIED BEFORE A STATE PUBLIC UTILITIES COMMISSION?

A: Yes, I have submitted and/or supported testimony before various state commissions including The New Orleans City Council's Utility Regulatory Office (one of the regulatory agencies having oversight and jurisdiction over Entergy), the Regulatory Commission of Alaska, the state of Alaska Petroleum Tax Review and Assessment Board, and the Illinois Commerce Commission. I have previously submitted testimony before the North Carolina Utilities Commission in Docket No. E-100, Sub 190 and Docket No. E-7, Sub 1297.

Q: HAVE YOU PREPARED ANY ATTACHMENTS IN SUPPORT OF YOUR TESTIMONY?

A: Yes. I have included various supporting documents contained in EDF Exhibit A.01 through EDF Exhibit E.01 as identified below.

Exhibit No.	Description
EDF Exhibit A.01	General Electric 7HA Heavy Duty Turbine Specification Sheet
EDF Exhibit B.01	Siemens Energy HL-Class Gas Turbine Specification Sheet
EDF Exhibit C.01	EIA Cost and Performance Characteristics of New Generating Technologies, Annual Energy Outlook 2022
EDF Exhibit D.01	EIA Annual Energy Outlook 2023 Table 55 Overnight Capital Costs for New Generating Plants
EDF Exhibit E.01	Direct Testimony of William McAleb NCUC Docket 100, Sub 190

Table 1: List of Exhibits

Q: WHAT IS THE PURPOSE OF YOUR TESTIMONY?

A: The purpose of my testimony is to review and provide commentary and analysis regarding the Application of Duke Energy Progress, LLC ("DEP" or "Duke"; DEP and North Carolina Electric Membership Corporation ("NCEMC") collectively referred to as "Applicants") for a Certificate of Public Convenience and Necessity to construct a 1,360 MW Natural Gas-Fired Combustion Turbine Generating Facility ("Proposed Facility") in Person County, North Carolina ("Application"). DEP is proposing to construct the Proposed Facility utilizing two, advanced-class, hydrogen-capable natural gas combustion turbines ("CT"), two heat recovery steam generators ("HRSG") with Selective Catalytic Reduction ("SCR") technology emissions control, and one steam turbine generator ("STG") in a 2 x 1 CC

configuration on the site of the existing Roxboro Generation Facility. The Roxboro Generation Facility is an existing, four-unit, coal-fired 2,462 megawatt ("MW") generating facility located in Person County, North Carolina. The Proposed Facility is intended to replace and retire coal Units 1 and 4. The Proposed Facility, configured as a 2X1 CC will have a winter capacity of 1,360 MW.

Specifically, my testimony will:

- Review and offer comments relative to the pertinent portions of the Application,
- Review, highlight, and compare cost and performance data within the Application against publicly available information and datasets to confirm reasonableness,
- Cite to any concerns related to cost, emissions, reliability, definition, potential ratepayer impacts, or other areas of concern related to foundational issue omissions related to the Application,
- Explain the foundation of any such concerns, and an overview level discussion related to the Application.

Q: PLEASE SUMMARIZE YOUR FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS.

A: My review and analysis of the Plan has resulted in the following broad conclusions:

- The Application is supported by and was developed based in substantive part on analytic investigations performed within the Duke Energy Carolinas, LLC

("DEC") and DEP's (DEC and DEP, collectively, "Duke") 2023-2024 Carbon Plan and Integrated Resource Plan ("CPIRP" or "Plan").

- The exit from coal generation appears to be of primary concern during reshaping of Duke's power resource transition to reduced emissions through changing fuels and a greater reliance on renewable resources – the instant Application focuses on that objective.
- However, Duke's presumption that it will be able to convert new natural gas-fired assets into low or zero carbon emission, hydrogen-fired assets is not based on substantive evidence presented in this docket proceeding.
- The issues surrounding hydrogen co-firing, 100% hydrogen fueling, and infrastructure is not inconsequential. OEM ("original equipment manufacturers") for combustion turbines have not demonstrated a firm commitment as to when, or even if, 100% hydrogen fueling of combustion turbines ("CTs") is technically and economically feasible.
- Two of the leading CT manufacturing firms currently have equipment capable of a 50% hydrogen/natural gas blended fuel, but the delivery of CT equipment with 100% hydrogen fuel capabilities stands as currently unavailable and only potentially capable sometime in or after 2030.
- A clear commitment and guidance from the OEMs are currently lacking with respect to the timing of a fully compatible 100% hydrogen fired utility scale ("General Electric model 7HA" and/or "Siemens Energy model SGT6-9000HL" or other Duke-acceptable OEM equipment offering) turbine.

- Even if the equipment manufacturers can introduce hydrogen-capable turbines sometime in or after 2030, 100% hydrogen equipment retrofits for the then in-service turbines will require additional, and currently unknown, costs associated with the fuel technology implementation.
- Due to regional pipeline congestion,[1] TRANSCO Zone 5 area is planned for a supply enhancement project that Duke have subscribed to on the order of 1,000,000 Dth per day that assures natural gas deliveries for projects like the Proposed Facility into the future.
- There exists two additional supply enhancement project that will provide natural gas supply support to the Proposed Facility, as well as other Duke proposed projects. The Mountain Valley Pipeline ("MVP") and the MVP Southgate project will provide additional volumes for regional Duke project generation needs. Both the MVP and the MVP Southgate projects will bring gas supplies from north to south that will connect to TRANSCO, as well as to other intrastate pipelines, to support ongoing natural gas generation supply needs. The Companies has similarly contracted for 250,000 Dth per day with the MVP Southgate project.[2]
- Whether the new Proposed Facility is a reasonable and necessary investment made on behalf of ratepayers depends largely on whether the Proposed Facility will be able to continue to provide generation when North Carolina law

[1] *Direct Testimony of Lee Mitchell*, Docket No. E-2, Sub 1318 & Docket No. EC-67, Sub 55 ("Direct Testimony of Lee Mitchell"), p. 5.
[2] *Direct Testimony of Lee Mitchell*, p. 11.

requires low or zero emissions by Duke's in-state generation resources. As it stands today, presuming a hydrogen-fired, carbon emissions-free Proposed Facility within the time frame required by law is not only speculative but unlikely.

- While NCEMC is not subject to the same carbon emissions reduction requirements as Duke, the underlying project's viability basis is based, in large part, on DEP's portion of the investment and, accordingly, the need for the facility to run within a reduced emissions generation portfolio by the 2030 interim reduction mandate and a zero carbon emissions portfolio by 2050. Accordingly, my analysis, while focused on DEP's ambitious hydrogen conversion plan, would necessarily apply to the entire facility's viability based on plan feasibility under future statutory restrictions.

Recommendations:

As a result of the above findings and conclusions, The Commission should not approve the Application unless it also directs Applicants to comply with each of the following pointed recommendations and in doing so, apply a clear, transparent, and rigorous, statistical, and logic-based analysis protocol.

Recommendation 1: 100% Hydrogen Reasonable Demonstration Study

- The Commission should require Applicants to present:
  - The commitments made to DEP by the manufacturers of the proposed CT units relative to when the units will be 100% hydrogen capable.

- A detailed timeline explaining when DEP anticipates, based on substantial evidence, to convert the Proposed Facility to 100% hydrogen firing.
- A detailed and evidence-based analysis showing the basis for the DEP perceived likelihood of a viable hydrogen pipeline supply to the Proposed Facility.
- Detail DEP's estimate of retrofit and/or modification costs to convert the Proposed Facility and ancillary "inside the fence" plant infrastructure and controls to achieve 100% hydrogen capable generation status.
- Sourcing and/or generation plus storage costs anticipated for the Proposed Facility.
- An alternatives analysis for how DEP will supply hydrogen to the Proposed Facility if hydrogen blending utilizing existing methane pipelines is unavailable or infeasible.
- An evidence-based analysis determining the relative costs and obstacles to:
  - Co-located renewable energy and PEM technology, as at the DeBary hydrogen co-firing pilot.
  - Import of hydrogen via non-pipeline means such as train or truck.

Recommendation 2: Hydrogen Blending Study

- The Commission should require Applicants to detail what representations and/or commitments from its current gas suppliers it relies upon in assuming the availability of hydrogen blended into the existing methane pipeline network and addressing safety and feasibility concerns.

II. Category 1: Discussion of the Roxboro Coal Unit Replacement and Energy Combustion Turbine Construction Projects, Need Determination, Project Components, and Fuels

Q: PLEASE PROVIDE A DISCUSSION OF THE FUTURE OF COAL GENERATION RESOURCES AND HOW THAT FUTURE IS BEING ADDRESSED BY DEP WITH RESPECT TO THE PROPOSED FACILITY.

A: In a 2019 article that appeared in Energy News[3] entitled "*Coal has always been king in the South. Now that's changing*", the increasing difficulties in achieving a positive economic outlook for coal generation resources are discussed. The article cites that Duke Energy's "coal fleet is running less and less." And that "nine of the company's 13 coal plants ran less than half the year in 2018." The article continues to describe that lower priced natural gas has rendered some of the older, less efficient coal units less competitive – including those that the Proposed Facility will replace. Lower gas costs, coupled with the dispatching of more efficient units,

[3] www.energynews.us/2019/10/03/coal-has-always-been-king-in-the-south-now-thats-changing/ (last checked May 24, 2024).

results in the displacement of inefficient coal units from the dispatch merit stack leading to disappointing operational factors and metrics.

Duke frames natural gas as a bridge fuel capable of reducing carbon emissions. The point of the use of natural gas in the near term is essentially to "buy time" until less emission-emitting generation technologies and fuels can be proven and constructed at a scale that can be relied upon for the energy needs of DEP's service area.

The economic and emission review performed by DEP comparing the proposed natural gas units to the existing coal generation resources appears to have been the primary driver of the new generation units to replace two of the old coal units at the Roxboro Facility to the extent that DEP is in the process of obtaining an approval to replace Units 1 and 4.

Q: ON WHAT BASIS DO APPLICANTS PROPOSE THE DEVELOPMENT OF THE PROPOSED FACILITY?

A: The Roxboro Proposed Facility currently consists of four coal-fired generation units, wherein two of the four units will be replaced with a 2X1 CC. The Application is a result of Duke's modeling efforts within the CPIRP and consistent with Duke's plans to replace inefficient coal generation resources prior to forced retirement in an effort directed toward transitioning to a progressively cleaner generation emissions future. The CPIRP is an overarching proposal, not yet approved by the Commission, focused on the provision of reliable electric service as required under law, which shapes DEP's transition to a carbon emission free generation stack. The CPIRP claims as a fundamental tenet an "Orderly Energy

Transition" that has four main objectives - Resource Diversity, a Clean Resource Mix, Least Cost Planning, and the ability to Execute the Plan, with Foreseeable Conditions with an overriding focus on reliability and the meeting of and compliance with laws and regulations. The State of North Carolina has a statutory requirement for a 70% reduction in emissions from 2005 levels in Duke's generation portfolio with an additional carbon neutrality requirement by 2050. Moreover, according to the CPIRP document, Duke is focused on a "most reasonable, least cost" approach to the North Carolina emissions reduction requirements.

These goals and statutory framework are the basis for the proposed facility.

Q: PLEASE BRIEFLY DISCUSS THE CPIRP MODELING EFFORT THAT APPLICANTS ALLEGE DEMONSTRATES THE NEED REQUIRED IN THE APPLICATION.

A: The CPIRP modeling effort identified a need for 2,125 MW of new capacity of which 1,135 MW[4] of resource capacity is intended to be provided by the Proposed Facility.

Q: PROVIDE A DESCRIPTION OF THE PROPOSED FACILITY PROJECT THAT IS SCHEDULED TO BE ONLINE IN 2029.

[4] The complete proposed Roxboro facility is projected to provide approximately 1,360 MW capacity, with NCEMC owning 225 MW of that output capacity and DEP owning the remaining 1,135 MW capacity. *Application*, p. 1.

A: The Proposed Facility project Applicants are proposing to have constructed is a 2X1 CC, advanced-class, hydrogen-capable baseload[5] natural gas turbine generation facility with the CTs components equipped with bypass stacks to allow for simple-cycle operation for during extended periods should DEP have to take the STG or HRSGs out of service on a site within the existing[6] Roxboro Facility site that will replace and retire coal units 1 and 4. In addition, the CTs have dual fuel capabilities that will allow approximately 72 hours of continuous operation utilizing ultra-low sulfur diesel backup fuel.[7] The CT portion of the 2X1 CC facility is being offered by the OEM manufacturers are 50% "hydrogen capable" with the potential of being 100% capable by or after 2030. Further, the CTs are "advanced-class" potentially pointing to enhanced performance specifications and lower emissions, lower heat rates, and exceptional ramp rates. The proposed CC facility have a winter capacity of 1,360 MW.

Q: WHAT CONCERNS DO YOU HAVE WITH THE PROPOSED COMBUSTION TURBINE COMPONENTS?

A: In general, there are only two or three OEM companies that manufacture utility scale CTs that are "advanced class" and 50% hydrogen fuel capable. This fact is confirmed by DEP who state: "The Company received bids to supply the CT units to be installed at the Proposed Facility from all three major CT manufacturers (General

[5] *Application*, Exhibit 3, p. 6.
[6] *Application*, Exhibit 4, p. 3.
[7] *Application*, Exhibit 4, p. 7.

Electric Vernova ("GE"), Siemens Energy ("Siemens"), and Mitsubishi Power Americas, Inc. ("Mitsubishi"))[.]"[8]

Q. HAS DEP IDENTIFIED THE CT EQUIPMENT THEY PLAN TO INSTALL?

A. No firm selection and negotiated purchase order/contract has been confected, however two of the OEM companies, Siemens Energy and General Electric, specification sheets are included as Exhibits EDF-A.01 and EDF-B.01. Because both simple- and combined-cycle CT configurations are presented in these Exhibits and because Duke has recent experience with a new Siemens SGT-9000HL facility at Lincoln County, North Carolina, there is a reasonable potential that one of the two OEMs presented here is likely to be selected to supply the CT equipment for the Proposed Facility.

While no public apparent CT selection has provided some of the features it plans for the selected CTs. The planned CTs will be "advanced-class, hydrogen-capable" utility scale CTs. These features appear to support the conclusion that one of the two OEMs above will be the equipment vendor for the Proposed Facility.

Q: WHAT IS MEANT BY "HYDROGEN CAPABLE" AND WHAT ARE YOUR CONCERNS WITH THE ROUTINE USE OF HYDROGEN AS A CT FUEL?

A: The focus of the OEMs of the CTs is to respond to market wants for a CT that can utilize, initially, a 50% blend of hydrogen and natural gas as fuel, with an aspiration of 100% hydrogen. The CTs being offered by the OEM manufacturers claim to be 50% hydrogen capable with potential of being 100% capable by or after 2030.

[8] *Application*, Exhibit 4, p. 3.

Further, the CTs are described as being "advanced-class", potentially pointing to enhanced performance specifications and lower emissions (2 ppm NOx – 10ppm CO2), and lower heat rates (5,331 Btu/kWh in a 2X1 CC configuration).

The use of hydrogen as a routine fuel, however, is burdened with uncertainties. Many of which will require new technological advancements with respect to the handling, storage, and transportation of hydrogen fuel and whether a robust hydrogen marketplace will develop to provide those services.

Moreover, technological strides are also necessary within hydrogen production wherein the production of hydrogen will need to utilize as much emission-free energy as possible to address and be compliant with the State of North Carolina's statutory requirement for a 70% reduction in emissions from 2005 levels with an additional carbon neutrality requirement of 2050. Simply using grid power to produce hydrogen does not automatically mean that the facilities are now inherently low-emissions and the lifecycle emissions of the hydrogen burned must be considered – not just the combustion emissions.

Q: WHAT IS MEANT BY ADVANCED-CLASS AND WHAT ARE THE POTENTIAL IMPLICATIONS FOR IMPROVED PERFORMANCE?

A: The term "advanced class" with respect to CTs is not defined in the Application or industry in general. After a review of publicly available specification documents from the probable OEMs, the likely performance improvements that could support this idea of "advanced class" designation are fairly clear. For example, the Siemens

Energy HL-class gas turbine specification sheet displays several significant changes and/or upgrades to the HL-class CT.[9]

The improvements include:

- Higher efficiency turbine blades
- Advanced combustion system (higher firing temperatures and operation flexibility)
- Improved blade cooling characteristics and features
- Improved air leakage sealing
- Larger turbine blades that enhance power output

In addition, improved performance metrics also may contribute to an "advanced class" designation:

- Enhanced Ramp-up – 150 MW per Minute
- Improved Heat Rate - 5,331 Btu/kWh
- NOx emission – 2-25 ppm (with/without SCR)
- CO emission – 10 ppm

However, it is not clear if there is an additional cost for the 50% hydrogen current capability or whether there will be a retrofitting cost if the CTs potentially become 100% hydrogen capable in the future. The "advanced class" designation appears to be solely tied to the improvements to current technology and not newly developed technology as it relates to blended or full hydrogen combustion. Therefore, DEP

[9] EDF Exhibit B.01.

use of the "advanced class" refers to improvements to a natural gas CT and not hydrogen combustion.

Q: HOW WILL DUKE SOURCE THE NECESSARY FT GAS SUPPLIES TO SUPPORT THE FUEL SECURITY OF THE PROPOSED FACILITY?

A: With respect to sourcing natural gas supplies from the interstate market, there are three major interstate pipeline expansion projects that will provide necessary gas supplies and interstate FT ("Firm Transportation") to the Proposed Facility (1.) the Transcontinental Pipeline ("TRANSCO") Southeast Supply Enhancement ("SSE") expansion project, (2.) the Mountain Valley Pipeline ("MVP"), and (3.) the MVP Southgate ("Southgate").

Q. IS THE ISSUE OF FUEL DELIVERY AND AVAILABILITY FURTHER DISCUSSED WITHIN THE CPIRP OR THE APPLICATION?

A. Yes, the Application discusses that natural gas supplies are currently delivered to the existing CC fleet and will prospectively be delivered to the Proposed Facility once interstate pipeline expansion projects are completed and additional intrastate expansion plans are completed by Public Service of North Carolina ("PSNC"), an affiliate of DEP and an intrastate pipeline that will provide redelivery services to the Proposed Facility. Natural gas to be delivered is currently and will be in the future sourced from PSNC's interconnection with TRANSCO[10] in Zone 5, the final completion of the MVP mainline pipeline, and the interconnection with Southgate.

[10] *Direct Testimony of Lee Mitchell*, p. 11.

All three of these interstate pipelines fall under Federal Energy Regulatory Commission ("FERC") jurisdiction and regulatory oversight.

Q: DO SUFFICIENT AND AVAILABLE NATURAL GAS VOLUMES EXIST WITHIN TRANSCO'S ZONE 5 TO ENSURE THE DELIVERY OF RELIABLE FIRM QUANTITIES OF NATURAL GAS SUPPLIES TO THE PROPOSED FACILITY INTO THE FUTURE?

A: Natural gas supplies within the TRANSCO Zone 5 are currently constricted[11] at Station 160 in Rockingham County, North Carolina, that limits gas supply flowing southward from Virginia into the Carolinas.[12] TRANSCO has recognized this constrained situation and, on February 1, 2024, filed with the FERC a request[13] for approval of a southeast supply enhancement project to expand its ability to supply additional volumes of natural gas to shippers within the TRANSCO Zone 5 area.[14] Duke has already subscribed to 1,000,000 Dth per day of transportation capacity to the new TRANSCO Southeast Supply Enhancement Project. Participation in both the TRANSCO and MVP pipeline project unlocks north-to-south capacity on TRANSCO and ends the denial of additional natural gas firm service volume requests on TRANSCO. The proposed in-service date of the TRANSCO Southeast Supply Enhancement Project is November 1, 2027

[11] EDF Exhibit E.01 Transcontinental Pipe Line Company Southeast Supply Enhancement
[12] *Direct Testimony of Lee Mitchell*, p. 7.
[13] EDF Exhibit E.01 Transcontinental Pipe Line Company Southeast Supply Enhancement
[14] *Id*.

Southgate represents an additional flow path into North Carolina. The Southgate pipeline path is currently planned to be roughly thirty-one miles of high capacity 30-inch diameter pipeline that would extend from the termination of the MVP mainline in Pittsylvania County, Virginia for delivery into Rockingham County, North Carolina.[15]

With the projects' completion and in-service dates between 2027 and 2028, both the TRANSCO Supply Enhancement Project and the Southgate Project allow ample time to be in service prior to the firm gas volume need for the Proposed Facility.

Q: PLEASE HIGHLIGHT SOME OF THE POTENTIAL TECHNOLOGICAL CONTINGENCIES THAT ARE OF CONCERN.

A: Some of the long-lead and/or nascent technology concerns that I have identified include:

1. OEM manufacturers of CTs have not demonstrated a firm commitment as to when, or even if, hydrogen fueling of CTs is technically and economically feasible to deliver on the promise of 100% hydrogen capable equipment. According to two of the leading OEM CT manufacturing firms (i.e., Siemens and GE), utility scale CTs are currently capable of a 50% hydrogen/natural gas blended fuel, but the delivery of CT equipment with 100% hydrogen fuel capabilities stands as currently unavailable and only potentially capable

[15] *Direct Testimony of Lee Mitchell*, p. 7.

sometime in or after 2030.[16] Moreover, there are a myriad of other technical hurdles related to the use of hydrogen as a primary CT fuel, coupled with hydrogen production, storage, transport, and infrastructure issues are discussed further as a separate set of topics later in this testimony.

2. There is no clear commitment as to timing of a fully compatible 100% hydrogen fired utility scale (General Electric model 7HA and/or Seimens Energy model SGT6-9000HL) turbine at this time. Both equipment manufacturers discussed earlier have indicated a target date for this technology sometime during 2030 or beyond.

3. Even if the OEMs introduce hydrogen-capable turbines sometime in or after 2030 and ultimately introduce 100% hydrogen equipment retrofits for the then in-service turbines, there will be additional, currently unknown costs associated with the technology implementation. The installation of the retrofit equipment and additional labor and likely ancillary equipment and controls costs which will impact ratepayers above and beyond the current generator replacements, in the future. This unknown ratepayer cost impact would be based on decisions made today that have future, unknown rate consequences due to their reliance on this emerging technology. DEP apparently did not account for this in their Plan.

[16] Exhibits EDF-A.01 and EDF-B.01

III. Category 2: Reasonableness of Costs, Potential Shortfalls and Recommendations

Q: WITH RESPECT TO PROJECT COST, HAVE YOU HAD THE OPPORTUNITY TO REVIEW THE CONFIDENTIAL COST INFORMATION IN EXHIBIT 3 TO THE APPLICATION?

A: Yes, I have reviewed and compared the data included in Exhibit 3 to publicly available similar Energy Information Administration data.

Q: WHAT METHOD DID YOU USE TO DETERMINE REASONABLENESS RELATED TO THE PROPOSED FACILITY AS PROVIDED IN EXHIBIT 3 TO THE APPLICATION?

A: My review of the cost information provided in Exhibit 3 consisted of a comparison of the costs presented with publicly available information from the U.S. Energy Information Administration ("EIA"). The information utilized is contained within the attached exhibits EDF Exhibit C.01 and EDF Exhibit D.01. Both of these exhibits utilize data that is collected by the EIA from a variety of sources and is then published in the EIA Annual Energy Outlook ("AEO") documents as "our assessment of the cost to develop and install various generating technologies used in the electric power sector." The data include within these documents are not absolute. According to the EIA documents "All technologies demonstrate some degree of variability in cost, based on project size, location, and access to key infrastructure…" Thus, the data is useful in a general determination of reasonableness.

The CTs, as a component of the 2X1 CC configuration, are characterized as advanced-class and "hydrogen capable", they represent the next generation in CTs. Since they are the latest next generation, the CTs planned for the Proposed Facility Application are not a perfect match for the historic data included within EIA AOE documents that could be used to support a finding of reasonableness.

The technology selected for comparison to the proposed 2X1 CC project CTs was selected based on the general size, cycle performance, and the likelihood of similar operational performance. The selected technology for comparison was both that of a Combined Cycle Single-Shaft Turbines and a Combined Cycle Multi-Shaft Turbine. The Combined Cycle Single- and Multi-Shaft Turbines represent a reasonable range limit because the average size of the turbines in the EIA data are similar in size to that of the instant Application project.

Q: WHAT ARE YOUR CONCLUSIONS RELATED TO THE COST OF THE PROPOSED FACILITY AS PROVIDED IN EXHIBIT 3 TO THE APPLICATION?

A: **[BEGIN CONFIDENTIAL]** [redacted]

[redacted]

[redacted]

[END CONFIDENTIAL]

The costs associated with the instant Proposed Facility because of the above comparison, are reasonable. However, the costs assumptions do not solve the bridge to a hydrogen-firing facility required to meet the carbon emissions reductions requirements.

Q: IN YOUR VIEW, ARE THERE ANY FURTHER AREAS OF CONCERN, QUESTIONS, OR RECOMMENDATIONS TO THE COMMISSION THAT SHOULD BE HIGHLIGHTED?

A: Yes, there are a few areas to highlight and discuss, as follows:

The Commission should direct Applicants to apply a clear, transparent, and rigorous analysis and commentary to each of the following pointed recommendations.

- Applicants state in the Application that: "The Proposed Facility will operate as a baseload electric generating facility"[18] and is also "equipped with bypass stacks to allow for simple-cycle operation for extended periods"[19] but fails to address the following issues and concerns related to efficiencies, capabilities, retrofitting costs, and operations/capacity factors for both 2X1 CC and CT operations:

[redacted]

[18] *Application*, Exhibit 3, p 6
[19] *Application*, Exhibit 4, p 3

- The efficiencies and other benefits associated with the term "advanced-class";
- Whether the cost of the proposed CTs is enhanced as a result of them being "hydrogen-capable";
- What are the CT component and ancillary equipment requirements, costs, and potential timing associated with the retrofitting of the CTs to 100% hydrogen capable;
- The anticipation of capacity factor level in both the 2X1 CC and CT modes of operation; and
- Discussion of ramp rates and turndown rates, coupled with the implication on both 2X1 CC and CT operations.

- What is the level of necessary reserve margin that the Proposed Facility will contribute to maintaining and has the reserve margin been influenced by the increased reliance on renewable energy resources?
  - Is the necessary reserve margin level, at least in part, a result of operational impacts from an increase in variable renewable generation that necessitates additional dispatchable generation resources?

Q: DOES THIS CONCLUDE YOUR TESTIMONY?

A: Yes, it does.