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STATE CORPORATION COMMISSION

May 12, 2022

BY ELECTRONIC DELIVERY

Mr. Bernard Logan, Clerk
State Corporation Commission
Document Control Center
Tyler Building, First Floor
1300 E. Main Street
Richmond, Virginia 23219

Re: *Application of Virginia Electric and Power Company, For approval and certification of the Coastal Virginia Offshore Wind Commercial Project and Rider Offshore Wind, pursuant to § 56-585.1:11, § 56-46.1, § 56-265.1 et seq., and § 56-585.1 A 6 of the Code of Virginia*, Case No. PUR-2021-00142

Dear Mr. Logan,

Pursuant to the Hearing Examiner's May 12, 2022 Ruling, please file the attached in the above referenced proceeding. These documents consist of updated public and extraordinarily sensitive versions of the testimonies of Commission Staff ("Staff") witnesses Katya Kuleshova, Sean M. Welsh, and Phillip M. Gereaux to update certain information, which was originally identified by the Virginia Electric and Power Company ("Company") as being extraordinarily sensitive but that the Company has since agreed, and the Hearing Examiner has since ruled, does not require confidential treatment and can therefore be made public.

Further, since the time Staff filed its direct testimony on April 8, 2022, Staff has identified several corrections needed to the testimonies of Staff witnesses Welsh and Kuleshova. These corrections are attached here in redlined versions and have been incorporated into both the public and extraordinarily sensitive versions of the updated testimonies described above.

Sincerely,

/s/ William H. Harrison, IV
William H Harrison, IV

WHH:abh

Attachment

cc: Service List

COMMONWEALTH OF VIRGINIA

STATE CORPORATION COMMISSION

STAFF TESTIMONY REFILED

VIRGINIA ELECTRIC AND POWER COMPANY

For approval and certification of the Coastal Virginia Offshore Wind Commercial Project and Rider Offshore Wind, pursuant to § 56-585.1:11, § 56-46.1, § 56-265.1 *et seq.*, and § 56-585.1 A 6 of the Code of Virginia

Public Version

PUR-2021-00142

May 13, 2022

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Division of Public Utility Regulation

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Division of Utility Accounting and Finance

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Division of Utility Accounting and Finance

PART A

Summary of the Testimony of Katya Kuleshova

My testimony provides the following findings and recommendations for Commission consideration:

1. The record may or may not support granting Virginia Electric and Power Company ("Company") the presumption of reasonableness and prudence for the CVOW Commercial Project ("Project") under the statute. After running levelized cost of energy ("LCOE") sensitivity analyses, Staff finds that there are certain scenarios in which the Project's projected total LCOE[1] exceeds 1.4 times the comparable cost of a conventional simple cycle combustion turbine ("Conventional CT") generating facility ("1.4x LCOE"). On advice of counsel, if projected total LCOE is above 1.4 times the comparable cost of a CC, the Project would lose the presumption of reasonableness and prudence.

2. According to Staff's analysis, a 1.4x LCOE would result in a $12.4 billion total cost of the Project incurred prior to the commercial operations date.[2]

3. In the absence of the statutory presumption of prudence, Staff does not take a position on the prudence of the Project. Staff does not contest that the Project would contribute to meeting the Company's Renewable Portfolio Standard Program requirements and capacity and energy needs resulting from the retirement of fossil-fueled generation under the VCEA. Staff does have concerns, however, including: (i) the Company's LCOE projection; (ii) the results of the net present value ("NPV") analysis; (iii) the fact that the Project's energy production is expected to be at its highest during shoulder months and at its lowest during summer afternoons, when it is needed the most; and (iv) certain construction, operational, and market risks of the Project.

4. If the Commission approves the Project, Staff proposes a performance guarantee for the Commission's consideration to mitigate the Project's risks to ratepayers. As discussed further in my testimony, the Commission may also wish to impose similar protections for ratepayers as it directed in Case No. PUE-2007-00066, to address potential cost overruns.

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[1] Per the statute, the Project's LCOE includes any tax credit, on a cost per megawatt hour basis, inclusive of the costs of transmission and distribution facilities associated with the facility's interconnection.

[2] Staff calculates the Project's LCOE by: (i) including the ITC tax basis reduction, (ii) including decommissioning expenses, and (iii) excluding any REC value.

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PREFILED TESTIMONY
OF
KATYA KULESHOVA

VIRGINIA ELECTRIC AND POWER COMPANY

CASE NO. PUR-2021-00142

I. INTRODUCTION

Q. PLEASE STATE YOUR NAME AND POSITION WITH THE STATE CORPORATION COMMISSION ("COMMISSION").

A. My name is Katya Kuleshova. I am a Strategic Planning Specialist with the Commission's Division of Public Utility Regulation.

Q. WHAT ARE YOUR PRESENT RESPONSIBILITIES?

A. My duties as a Strategic Planning Specialist include reviewing utility rate adjustment applications, integrated resource plans, renewable portfolio standard filings, and generation certificate filings, as well as analyzing public utility rate increase applications regarding cost of service, rate design, and terms and conditions of service. I am also responsible for presenting testimony as a Staff witness and making alternative proposals to the Commission when appropriate.

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

A. My testimony addresses Virginia Electric and Power Company's d/b/a Dominion Energy Virginia's ("Company" or "Dominion") Application for approval and certification of the Coastal Virginia Offshore Wind Commercial Project ("CVOW Commercial Project,"

"CVOW," "CVOW Project," or the "Project") and for approval of a rate adjustment clause, designated Rider Offshore Wind ("Rider OSW"), pursuant to §§ 56-585.1:11; 56-46.1, 56-265.1 *et seq.*, and 56-585.1 A 6 of the Code of Virginia[3] ("Application"). Among other things, Dominion seeks approval, as required, of the CVOW Project, to be located in a federal lease area beginning approximately 27 statute miles (approximately 24 nautical miles) off the coast of Virginia Beach, Virginia ("Lease Area"), and related power export facilities.[4]

My testimony includes the following sections: Presumption of Reasonableness and Prudence of Costs; Costs and Risks Analysis and Proposed Ratepayers' Protections; Net Present Value ("NPV") Analysis; and Need.

The Presumption of Reasonableness and Prudence of Costs section includes a discussion of:

- The Company's compliance with the competitive solicitation and procurement requirements pursuant to subsection E of § 56-585.1:11 ("Prong 1");
- Levelized cost of energy ("LCOE") of the Projects, including a review of assumptions underlying the Project's LCOE calculation, as well as sensitivity analyses of the Project's LCOE ("Prong 2");
- The Company's compliance with the commencement of construction of the Project for U.S. income taxation purposes or a plan for the Project to be in service, pursuant to subsection C (iii) of § 56-585.1:11 ("Prong 3").

The Costs and Risks Analysis and Proposed Ratepayers' Protections section includes a discussion of:

- The Project's prudence;

[3] Referred to hereafter as "Code."

[4] Application at 1.

- The total plant expenditures of the CVOW Project;
- The Company's assessment of the Project's risks;
- Construction and operational risks of the Project, and mitigation measures;
- Market risks of the Project;
- Risk management of offshore wind projects;
- Protection against cost overruns;
- Proposed performance guarantee for the CVOW Commercial Project.

The NPV Analysis section includes a discussion of:

- The Project's NPV analysis based on the information presented in the Direct testimony of Company witness Kelly, or the "low solar, high battery saturation base case;"
- The Project's NPV analysis based on the additional PLEXOS model runs performed by the Company in the course of the discovery process, or the "high solar, low battery saturation revised base case;" and
- The comparison of the CVOW Project's NPV in the "low solar, high battery saturation base case" and the "high solar, low battery saturation revised base case."

The Need section includes a discussion of the need for the Project and potential effects of its approval on construction of future solar facilities by the Company.

Q. PLEASE PROVIDE AN OVERVIEW OF THE COMPANY'S APPLICATION.

A. On November 5, 2021, Dominion filed an application for approval and certification of the CVOW Project and for approval of Rider OSW, pursuant to §§ 56-585.1:11; 56-46.1, 56-265.1 *et seq.*, and 56-585.1 A 6 of the Code. The Application requests the Commission grant:

(i) Approval, as required, of the CVOW Project, to be located in the Lease Area, and related power export facilities;[5]

(ii) Approval and certification of electric interconnection and transmission facilities, comprising transmission facilities required to interconnect CVOW reliably with the existing transmission system ("Virginia Facilities");[6]

(iii) Approval of a rate adjustment clause, Rider OSW, for the recovery of costs incurred to construct, own, and operate the offshore wind generation facilities and related interconnection and transmission facilities that compose the CVOW Project; and

(iv) Approval of a Foreign Currency Risk Mitigation Plan.

The Application states that the CVOW Project encompasses offshore wind generation facilities consisting of 176 14.7 megawatt ("MW") wind turbine generators located in the Lease Area, as well as related offshore export facilities that will transport the generated electricity onshore to the Cable Landing Location at the State Military Reservation ("SMR") in the City of Virginia Beach, Virginia, then to the Harpers Switching Station at Naval Air Station Oceana, which will become the point of interconnection to the PJM[7] transmission system after construction, and finally terminating at the Company's existing Fentress Substation.[8] With a combined nominal capacity of 2,587 MW (alternating current ("AC")), Dominion asserts that the CVOW Project is expected to provide approximately 9,500 gigawatt-hours of carbon-free energy per year.[9] According to Dominion, the total cost of the CVOW Project is expected to be approximately $9.8

[5] Application at 1.

[6] *Id.*

[7] PJM Interconnection, LLC, regional transmission organization.

[8] Application at 7.

[9] *Id.*

billion, including the estimated conceptual cost of $1,148.5 million for the onshore Virginia Facilities; the latter cost includes approximately $774.3 million for transmission-related work and approximately $374.2 million for substation-related work in 2021 dollars.[10]

Q. PLEASE PROVIDE A SUMMARY OF YOUR FINDINGS AND RECOMMENDATIONS BY SECTION.

A. A summary of my findings and recommendations by section is provided below.

Presumption of Reasonableness and Prudence

- The record may or may not support granting the presumption of reasonableness and prudence under the statute, based on the three "prongs" set forth in the VCEA for the Project (previously referred to as Prong 1, Prong 2, and Prong 3 in my testimony).
- Staff does not assert that the Company failed to meet competitive solicitation and procurement requirements set forth in the statute (Prong 1), but Staff presents information about (i) services and equipment that the Company considered and did not consider associated with the Project's construction; (ii) qualifying proposals received in response to the Company's competitive solicitation, selected proposals, and the resulting contract prices; (iii) equipment and work that the Company considered and did not consider to be interconnection costs; and (iv) firms hired by the Company as experienced developers.
- After running LCOE sensitivity analyses, Staff finds that there are certain scenarios in which the Project's projected LCOE exceeds 1.4 times the comparable cost of a conventional CT generating facility ("1.4x LCOE," or Prong 2). On advice of counsel, if projected total LCOE is above 1.4 times the comparable cost of a conventional CT, the Project would lose the presumption of reasonableness and prudence.
- Staff does not take issue with the Company meeting the VCEA requirement for the commencement of the Project's construction prior to January 1, 2024, or the

[10] *Id.* at 16, 18.

Company having a plan for the facility being in service prior to January 1, 2028 (Prong 3).

Prong 1: Competitive solicitation and procurement

- § 56-585.1:11. E. of the VCEA states,

> Any project constructed or purchased pursuant to subsection B shall (i) be subject to competitive procurement or solicitation for a substantial majority of the services and equipment, exclusive of interconnection costs, associated with the facility's construction; (ii) involve at least one experienced developer; and (iii) demonstrate the economic development benefits within the Commonwealth, including capital investments and job creation. A utility may give appropriate consideration to suppliers and developers that have demonstrated successful experience in offshore wind.

- According to the Company, $7.6 billion in competitively bid contracts' costs constitute 86% of the approximately $8.9 billion of total Project costs, excluding interconnection costs.

- The Company engaged Ramboll, an engineering consulting firm, as the Owner's Engineer for the Project. The Company also engaged Merkur Offshore, which was originally financed in 2016 and developed a 400 MW offshore wind farm that became operational in 2019,[11] as a strategic consultant.

- Staff witness Carsley addresses the Company's estimates of economic development benefits of the Project.

Prong 2: 1.4x LCOE

- The presumption of reasonableness and prudence contained in the VCEA for the Project includes the requirement for the Project's LCOE to not exceed 1.4 times the comparable cost of a conventional CT.

- The estimated unweighted average LCOE for a new conventional CT entering service in 2023 is $89.3 per megawatt hour ("MWh") in 2018 dollars. Therefore, the cost per MWh of a facility that is 1.4 times this $89.3/MWh value would be $125/MWh.

[11] https://www.merkur-offshore.com/company-2/ and https://www.merkur-offshore.com/progress-3/.

- The Company calculated LCOE values on a stand-alone basis,[12] including transmission and distribution investments and the investment tax credit ("ITC") benefit.[13] The Company assumed a 42% net capacity factor. Decommissioning expenses are not included. Operations and Maintenance ("O&M") expenses to be incurred prior to the CVOW Project's commercial operations date and O&M expenses for the Harpers to Fentress transmission assets upon their energization are not included either. Future battery storage investments are not accounted for. Finally, the Company adjusted the LCOE values for the value of renewable energy certificates ("RECs"). The resulting LCOE values are $73/MWh in 2018 dollars and $87/MWh in 2027 dollars.

- In Staff's view, at a minimum, the Project's LCOE calculation should account for the ITC benefit differently and incorporate decommissioning expenses, and LCOE should not be adjusted for REC value. With these assumptions, the Project's LCOE would be $88/MWh in 2018 dollars and $105/MWh in 2027 dollars.

- Staff tested the CVOW Project's LCOE sensitivities to seven of the LCOE input components, independently. The Project's LCOE is most sensitive to capacity factor and potential capital expenditure ("CAPEX") overruns.

- Staff also tested 21 LCOE scenarios in which multiple LCOE input components change simultaneously, and the correct tax basis reduction for ITC and decommissioning expenses are incorporated. In many of these scenarios, the Project's LCOE exceeds $125/MWh in 2027 dollars if the Project's capacity factor is 38% before adjustments for availability factor,[14] and if various cost overruns materialize.

- System or incremental LCOE of the CVOW Project, calculated based on the Project's net energy addition to the system and accounting for dispatch cost savings of the fossil-fueled generation units, would exceed $125/MWh in 2027 dollars in all scenarios tested by Staff.

[12] The Company's LCOE model does not account for synergies stemming from the CVOW Project's addition to its system or cannibalization of other Company-owned units' generation.

[13] Staff disagrees with the way the ITC benefit flows through the Company's LCOE model, as discussed later in my testimony.

[14] Capacity factor of 38% before adjustments for availability factor is the lower boundary of the capacity factor range tested by the Company for LCOE sensitivity analysis purposes.

Conclusions

- After running LCOE sensitivity analyses, Staff cannot conclude that LCOE will necessarily remain under $125 per MWh over the lifetime of the Project.

- According to Staff's analysis, if costs incurred prior to the Project's commercial operations date do not exceed approximately $12.4 billion, LCOE may remain under $125 per MWh.[15]

Recommendations

- If the CVOW Project is approved, the Commission may consider directing the Company to present strategic analyses (described in the "Prong 2: 1.4x LCOE" subsection of my testimony) with each annual Rider OSW filing to ensure that the Company operates the Project in a way that optimizes economics of its whole system to the extent possible.

Prong 3. The Commencement of construction or a plan to be in service

- In Staff's opinion, the Company met the VCEA requirement for the commencement of Project's construction prior to January 1, 2024, or the Company having a plan for the facility to be in service prior to January 1, 2028.

Cost and Risks Analysis and Proposed Ratepayers' Protections

- In the absence of the statutory presumption of prudence, Staff does not take a position on the prudence of the Project.

The Company's assessment of the Project's risks

- **[BEGIN EXTRAORDINARILY SENSITIVE]** [redacted] **[END EXTRAORDINARILY SENSITIVE]**

[15] Provided that the Company's assumptions on the Project's energy output and its costs during the operational phase are accurate and that the Company's cost of capital and capital structure do not change significantly since the 2021 triennial review.

Construction, operational, and market risks of the Project

- The Company's major construction contracts include protective provisions consistent with those suggested by Moody's Investor Service for offshore wind projects.[16]

- The Company addressed mitigation measures for operational risks proposed in the Moody's report. Among other measures, the Company entered into a Long-Term Service Agreement ("LTSA") with Siemens Gamesa Renewable Energy.

- **[BEGIN EXTRAORDINARILY SENSITIVE]** [redacted] **[END EXTRAORDINARILY SENSITIVE]**

- Staff reviewed a study of 917 wind facilities in the U.S., prepared by the Lawrence Berkeley National Laboratory ("Berkeley Lab"), which concluded that "[t]he tax-credit sensitivity shows that performance decline is not only a physical process, but is also influenced by maintenance cost-benefit tradeoffs. Thus, performance decline can be partially managed and influenced by policy."[18] In Staff's view, such influence could be exerted through a performance guarantee.

- The CVOW Project's capacity factor is expected to be at its lowest value during the PJM system peak in late afternoon summer hours, which may create a need for expensive off-system energy purchases by the Company during these peak hours.

- According to an ICF International, Inc. ("ICF") forecast, energy prices are expected to be lower during shoulder months and higher in the winter and summer. The CVOW Commercial Project is expected to generate more energy during the shoulder months of lower energy prices and less energy during the months of higher energy prices in summer. Therefore, winter is the only season in which higher expected energy production of the CVOW Commercial Project coincides will higher energy prices.

[16] *Strategic owners and robust contractual protections offset US offshore wind power's increased risks*, published by the credit rating company Moody's Investor Service on November 18, 2019 ("Moody's report").

[17] *See* Filing Schedule 46.b.1.v, Statement 1, at 22 (Slide 21).

[18] *How Does Wind Project Performance Change with Age in the United States?* This study is available for download at https://www.cell.com/joule/pdfExtended/S2542-4351(20)30174-4.

Proposed Ratepayers' Protections

- The Commission may wish to impose similar protections for ratepayers as it directed in Case No. PUE-2007-00066, to address potential cost overruns.

- The Commission may wish to consider a performance guarantee tied to the CVOW's actual capacity factor to mitigate the Project's risks to ratepayers. Staff recommends that the capacity factor be set at 38% (before adjustments for the 97% availability factor) for the purposes of performance guarantee for the Project.

Additional Recommendation

- The Commission may wish to consider directing the Company to provide a detailed analysis of the "duck curve" effect for the proposed additions of renewable resources, including but not limited to the future RPS filings and the potential second tranche of offshore wind. The Commission may also wish to consider directing the Company to provide a consolidated "duck curve" analysis for the Company's existing and planned renewable resources portfolio in future RPS plans and Integrated Resource Plan ("IRP") cases.

NPV Analysis

Base case – Low solar and high battery saturation

- According to the Company, the NPV of the CVOW Commercial Project is $2.5 billion. Staff notes that this amount includes a negative $5.6 billion change in system NPV as a result of the CVOW Commercial Project's addition ("PLEXOS NPV"), $4.9 billion avoided cost of RECs with proxy values based on statutory deficiency payments starting at $45/MWh, and $3.2 billion social cost of carbon benefit.

- Total customer benefits of the CVOW Commercial Project are lower than the Project's cost if the social cost of carbon benefit is considered a separate societal benefit. Further, if the ICF REC price forecast is used as a source for REC proxy values, total customer benefits calculated by Staff are approximately half of the Project's cost, and the Project's NPV becomes approximately negative $1.6 billion.

- Staff has several concerns with assumptions that went into the PLEXOS modeling of the base cases with and without the CVOW Project, including (1) adding the "shadow price"[19] to the dispatch cost of the Company's fossil-fueled units in PLEXOS in this case results in higher avoided cost of energy and therefore higher

[19] A "shadow price" is an estimated price for something that is not normally sold in the market.

NPV of the CVOW Commercial Project; (2) the NPV of PJM energy revenues and avoided costs of energy is likely higher than it would have been without battery storage added by the Company in both the base case without CVOW and the base case with CVOW; (3) the PLEXOS model runs that support the original filing in the instant case were not optimized on an economic (least-cost) basis and do not include solar facilities directed by the VCEA to be proposed for Commission approval. As a result, the CVOW Commercial Project's potential impact on the Company's system was not modeled comprehensively, in Staff's view.

- Staff believes that the Company's calculation methodology for the Social Cost of Carbon ("SCOC") benefit should be refined, such that displacement of the Company's own generation by the CVOW Commercial Project and net change in PJM power purchases is analyzed separately.

Revised Base case – High solar and low battery saturation

- According to the Company, the Revised NPV of the CVOW Commercial Project is $1.1 billion. Staff notes that this amount includes a negative $3.3 billion change in system NPV as a result of the CVOW Commercial Project's addition ("revised PLEXOS NPV"), $1.2 billion avoided cost of 3,760 gigawatt-hours ("GWh") of RECs and 97,060 GWh of deficiency payments, and $3.2 billion SCOC benefit.

- If the ICF REC price forecast is used as a source for REC proxy values, the NPV of the avoided cost of RECs would have been approximately $0.3 billion.

- If the SCOC benefit was calculated based on approximately 101,000 GWh out of the 286,035 total lifetime generation of the CVOW Project (i.e., net of 185,025 GWh of displaced solar generation), then the NPV of the SCOC benefit would have been approximately $1.3 billion, and the resulting Revised NPV of the CVOW Commercial Project would have been negative.

Need

- Staff concludes that the need for the proposed CVOW Commercial Project is driven primarily by the policy goals of the VCEA to (1) construct an offshore wind facility with an aggregate rated capacity of not less than 2,500 MW; (2) replace capacity from the required retirement of the Company's fossil-fueled generation fleet; and (3) comply with the mandatory RPS goals for retiring RECs.

- The addition of the CVOW Project would partially alleviate the projected capacity and energy gaps arising from the planned retirements of the Company's fossil-fueled units. However, the Company has not performed an analysis to identify the

sources and cost of replacement energy that is expected to be incurred due to the increasing levels of intermittent renewable energy resources in its generating fleet.

- The CVOW Project would help the Company meet its RPS goals but it may also displace and postpone construction of new solar facilities. Based on Staff's estimate, if the CVOW Project is approved, approximately 8,200 MW of new solar capacity would be needed in 2038[20] to meet the need for RECs originating in Virginia. Conversely, if the CVOW Project is not approved, the Company may be able to comply with RPS requirements for RECs originating in Virginia through the building of only solar resources, up until 2036.

Recommendation

- To facilitate the determination of need and economic competitiveness of future renewable resources, the Commission may wish to consider directing the Company to provide a detailed energy and asset displacement analysis and a calculation of levelized avoided cost of energy for the Company's proposed future additions of renewable resources, including but not limited to, the future RPS filings and the potential second tranche of offshore wind .

Q. PLEASE IDENTIFY THE OTHER STAFF WITNESSES FILING TESTIMONY IN THIS PROCEEDING.

A. Staff witness Neil Joshipura will be providing testimony on reliability analysis and certification of electric interconnection and transmission facilities required to interconnect the Project with the existing transmission system (the Virginia Facilities).

Staff witness Mark K. Carsley will be providing testimony on the analysis of the economic development benefits of the CVOW Commercial Project.

Staff witness Sean M. Welsh will be providing testimony on the proposed revenue requirement for Rider OSW and the accounting and recovery of Rider OSW eligible costs.

[20] Based on Staff's analysis of the solar projects' timelines in Case No. PUR-2021-00146, Staff concludes that 2038 is the first fully operational year for solar resources that would be proposed by the Company in 2035 to comply with the VCEA.

Staff witness Phillip M. Gereaux will be providing testimony on the appropriate capital structures and costs of capital for the Company, as well its Foreign Currency Risk Mitigation Plan.

Staff witness Kelli B. Gravely will be providing testimony on the proposed cost allocation and rate design of Rider OSW.

II. PRESUMPTION OF REASONABLENESS AND PRUDENCE OF COSTS

Q. WHAT GUIDANCE DOES THE VCEA PROVIDE CONCERNING THE PRESUMPTION OF REASONABLENESS AND PRUDENCE OF THE CVOW PROJECT'S COSTS?

A. § 56-585.1:11. C 1 of the VCEA states, in part (emphasis added),

> [C]onstruction by a Phase II Utility of one or more new utility-owned and utility-operated generating facilities utilizing energy derived from offshore wind and located off the Commonwealth's Atlantic shoreline, with an aggregate rated capacity of not less than 2,500 megawatts and not more than 3,000 megawatts, along with electrical transmission or distribution facilities associated therewith for interconnection is in the public interest. In acting upon any request for cost recovery by a Phase II Utility for costs associated with such a facility, the Commission shall determine the reasonableness and prudence of any such costs, *provided that such costs shall be presumed to be reasonably and prudently incurred if the Commission determines that (i) the utility has complied with the competitive solicitation and procurement requirements pursuant to subsection E [(Prong 1)]; (ii) the project's projected total levelized cost of energy, including any tax credit, on a cost per megawatt hour basis, inclusive of the costs of transmission and distribution facilities associated with the facility's interconnection, does not exceed 1.4 times the comparable cost, on an unweighted average basis, of a conventional simple cycle combustion turbine generating facility as estimated by the U.S. Energy Information Administration in its Annual Energy Outlook 2019 [(Prong 2)]; and (iii) the utility has commenced construction of such facilities for U.S. income taxation purposes prior to January 1, 2024, or has a plan for such facility or facilities to be in service prior to January 1, 2028 [(Prong 3)]. The Commission shall disallow costs, or any portion thereof, only if they are otherwise unreasonably and imprudently incurred.*[21]

On advice of counsel, the Code states the Commission shall determine the reasonableness and prudence of the costs of CVOW. However, the Code requires that these costs be presumed to be reasonable and prudent if the Company establishes Prong 1,

[21] Emphasis added.

Prong 2, and Prong 3. If the Company fails to meet any of these three tests, the Project will not be *presumed* to be reasonable and prudent.

Q. DID THE COMPANY MEET EACH OF THE THREE PRONGS NEEDED TO MEET THE PRESUMPTION OF REASONABLENESS AND PRUDENCE?

A. The record may or may not support granting the presumption of reasonableness and prudence under the statute. Staff will discuss the Company's compliance with each prong separately.

Staff does not assert that the Company failed to meet the competitive solicitation and procurement requirements set forth in Prong 1, but Staff presents information about (i) services and equipment that the Company considered and did not consider associated with the Project's construction; (ii) qualifying proposals received in response to the Company's competitive solicitation, selected proposals, and the resulting contract prices; (iii) equipment and work that the Company considered and did not consider to be interconnection costs; and (iv) firms hired by the Company as experienced developers.

Concerning Prong 2, after running LCOE sensitivity analyses, Staff finds that there are certain scenarios in which the Project's projected LCOE exceeds 1.4 times the comparable cost of a conventional CT generating facility ("1.4x LCOE"). On advice of counsel, if projected total LCOE is above 1.4 times the comparable cost of a conventional CT, the Project would lose the presumption of reasonableness and prudence.

In Staff's opinion, the Company met requirements set forth in Prong 3.

Prong 1: Competitive Solicitation and Procurement

Q. PLEASE DESCRIBE PRONG 1 OF THE PRESUMPTION OF REASONABLENESS AND PRUDENCE FOR THE PROJECT.

A. The presumption of reasonableness and prudence contained in the VCEA for the Project requires for the Project to meet certain solicitation and procurement standards, as stated in § 56-585.1:11. E. of the VCEA. As previously noted, Staff refers to this requirement as Prong 1. For convenience, Staff copied the relevant provisions of § 56-585.1:11. E. of the VCEA below.

> Any project constructed or purchased pursuant to subsection B shall (i) be subject to competitive procurement or solicitation for a substantial majority of the services and equipment, exclusive of interconnection costs, associated with the facility's construction; (ii) involve at least one experienced developer; and (iii) demonstrate the economic development benefits within the Commonwealth, including capital investments and job creation. A utility may give appropriate consideration to suppliers and developers that have demonstrated successful experience in offshore wind.

Q. DID THE COMPANY MEET COMPETITIVE SOLICITATION AND PROCUREMENT REQUIREMENTS SET FORTH IN PRONG 1?

A. As previously stated, Staff does not assert that the Company failed to meet competitive solicitation and procurement requirements set forth in Prong 1.

Q. WHAT PROPORTION OF SERVICES AND EQUIPMENT, EXCLUSIVE OF INTERCONNECTION COSTS, ASSOCIATED WITH THE CVOW PROJECT'S CONSTRUCTION WAS COMPETITIVELY PROCURED, ACCORDING TO THE COMPANY?

A. According to Company witness Bennett, **[BEGIN EXTRAORDINARILY SENSITIVE]** [redacted] **[END EXTRAORDINARILY SENSITIVE]**

Q. WHAT SERVICES AND EQUIPMENT ARE ASSOCIATED WITH THE CVOW PROJECT'S CONSTRUCTION, ACCORDING TO THE COMPANY?

A. The Company considered **[BEGIN EXTRAORDINARILY SENSITIVE]** [redacted] **[END EXTRAORDINARILY SENSITIVE]** to be costs of services and equipment associated with the Project's construction.

Listed below are costs and adjustments that the Company did not include in its analysis to support the Company's proof of compliance with § 56-585.1:11. E. of the VCEA. Although Staff does not assert that such costs and adjustments should have been included in the Company's analysis, Staff describes them below for informational purposes, as their potential inclusion would have resulted in a higher total Project cost, excluding interconnection cost.

[22] Direct testimony of Company witness Joshua Bennett ("Bennett Direct"), at 19.

[23] Generation Appendix, at 50.

[BEGIN EXTRAORDINARILY SENSITIVE] [redacted]

[redacted]

[24] *See* Attachment KK-1 for a copy of the Company's response to Staff Interrogatory No. 09-116.

[25] Filing Schedule 46.b.1.vi Statement 3, tab "Inputs_Total."

[26] *See* Attachment KK-2 for a copy of the Company's response to Staff Interrogatory No. 06-71.

[27] Filing Schedule 46.b.1.i Statement 2 pt. 1, tab "O&M Master."

[28] *See* Attachment KK-3 for a copy of the Company's response to Staff Interrogatory No. 04-58.

[29] *See* Attachment KK-4 for a copy of the LTSA contract summary provided by the Company as Attachment Staff Set 07-85(c)6, slide 4.

[redacted] [END EXTRAORDNARILY SENSITIVE]

Q. WHAT CONTRACTS FOR THE CVOW PROJECT'S CONSTRUCTION RESULT FROM COMPETITIVE SOLICITATIONS AND PROCUREMENTS?

A. Major competitively procured contracts are listed and briefly described on pages 20-21 of Company witness Bennett's testimony. A complementary breakdown of miscellaneous competitively procured contracts is provided on page 50 of the Generation Appendix. Further, at the request of Staff, the Company provided a detailed table that lists the underlying contracts for each construction CAPEX cost component and indicates their contractual amounts and execution status, as well as whether they were competitively bid, separately for each contract as of February 23, 2022.[31] The Company also provided management materials that summarize the received bids and support the winners' selection,[32] as well as bid evaluation results (scoring sheets).[33] Staff has summarized these materials in the table below, confirmed with the Company.[34]

[30] Filing Schedule 46.b.1.vi Statement 3, tab "Inputs_Total."

[31] *See* Attachment KK-5 for a copy of Attachment Staff Set 06-69 (a).

[32] *See* Attachment KK-6 for a copy of Attachments Staff Set 07-85 (c) (1) through (5).

[33] *See* Attachment KK-7 for a copy of Attachments Staff Set 07-85 (d) (1) through (6).

[34] See Attachment KK-8 for a copy of Attachment Staff Set 14-137

[BEGIN EXTRAORDINARILY SENSITIVE]

[redacted]

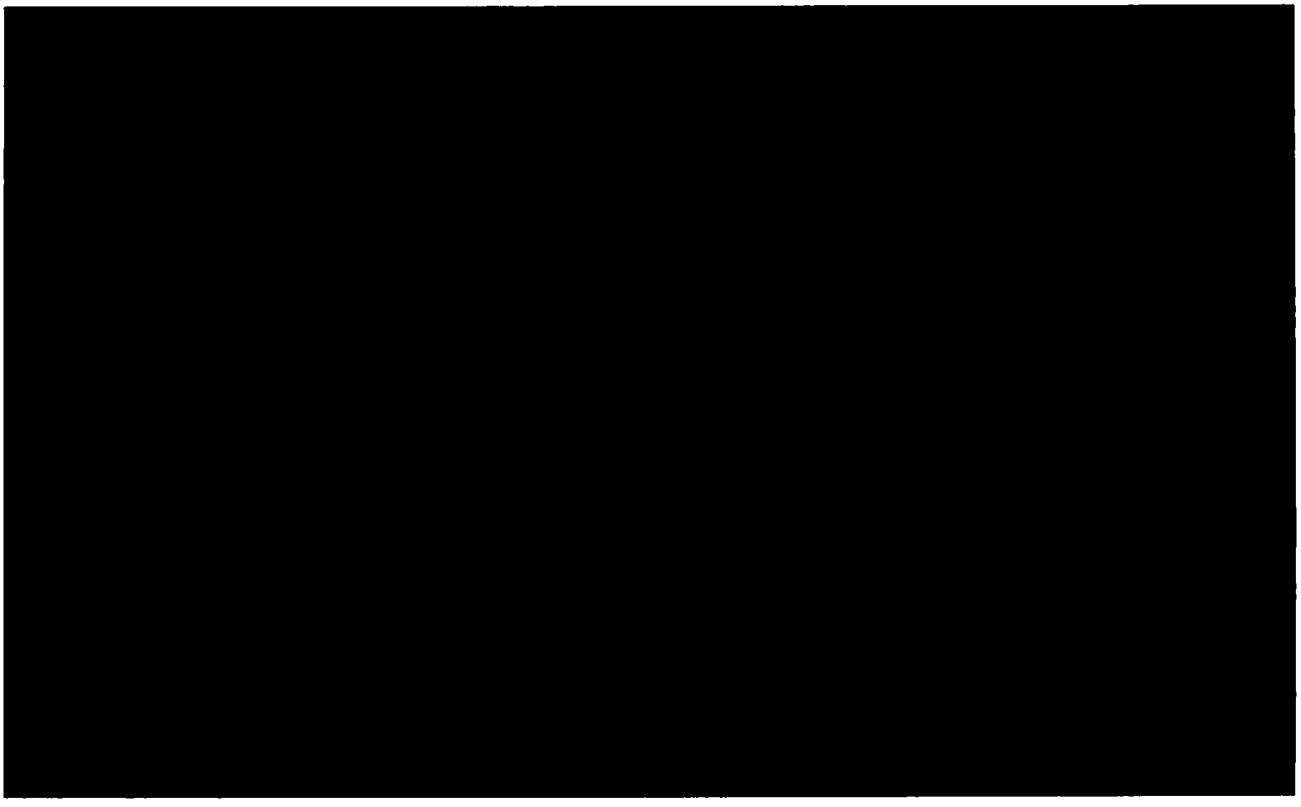
[END EXTRAORDINARILY SENSITIVE]

Q. WHAT IS INCLUDED IN THE INTERCONNECTION COSTS OF THE PROJECT?

A. Staff copied the image below from page 2 of the Generation Appendix and added boxes that indicate whether each key segment of various cables that comprise the CVOW Project

were sourced through an RFP, and whether the Company considered them to be interconnection costs. Harpers to Fentress overhead onshore interconnection costs and PJM Network Upgrade costs (the latter not shown below) were not sourced through an RFP and are considered by the Company as interconnection costs.

The offshore (underwater) cables and the related work were sourced through various RFPs and are not considered interconnection costs by the Company. Hence, the Company included the respective amounts in the **[BEGIN EXTRAORDINARILY SENSITIVE]** [redacted]



[END EXTRAORDINARILY SENSITIVE]

The table below demonstrates that even if the costs of offshore cables (beginning from the offshore substation) and the related transportation and installation work are

reclassified as interconnection costs,[35] the proportion of the remaining construction CAPEX costs of the CVOW Project procured through an RFP would still be above **[BEGIN EXTRAORDINARILY SENSITIVE]** [redacted].

[redacted]

[END EXTRAORDINARILY SENSITIVE]

Q. HOW DID THE COMPANY ADDRESS THE VCEA REQUIREMENT TO INVOLVE AN EXPERIENCED DEVELOPER?

A. The Company engaged Ramboll, an engineering consulting firm with more than 30 years of experience in the global wind industry, as the Owner's Engineer for the Project.[36]

The Company also engaged Merkur Offshore as a Strategic Consultant. This company, which was originally financed in 2016,[37] has developed and operated a 400 MW

[35] According to Schedule 2 of Staff witness Joshipura's testimony, PJM considers the Harpers Switching Station to be the point of interconnection, which is consistent with the Company's classification. However, cable segments from the offshore substation to the Fentress Substation could also be considered interconnection facilities.

[36] According to Ramboll's website, Ramboll's project development services include layout and micrositing, feasibility studies, project engineering, cost optimization, procurement and contracting, permit management, serving as an owner's and lender's engineer, and repowering.

[37] https://www.merkur-offshore.com/company-2/

offshore wind farm that was fully commissioned in 2019 and which could generate up to 1,750 gigawatt-hours annually.[38]

[38] According to Merkur Offshore's website, Merkur Offshore GmbH is a Hamburg-based company which has been responsible for the planning and construction of the Merkur offshore wind farm located some 45 kilometers north of the Borkum Island. Merkur comprises 66 General Electric Haliade-150 6 MW offshore wind turbines which were fully commissioned in June 2019. https://www.merkur-offshore.com/progress-3/

Prong 2: 1.4x LCOE

Q. PLEASE DESCRIBE PRONG 2 OF THE PRESUMPTION OF REASONABLENESS AND PRUDENCE FOR THE PROJECT. WHAT ARE THE LCOE REQUIREMENTS FOR THE CVOW PROJECT?

A. The presumption of reasonableness and prudence contained in the VCEA for the Project requires that the Project's LCOE not exceed 1.4 times the comparable cost of a Conventional CT. As mentioned previously, Staff refers to this requirement as Prong 2. For convenience, Staff copied the relevant provision of § 56-585.1:11. C 1 of the VCEA below.

> [T]he project's projected total levelized cost of energy, including any tax credit, on a cost per megawatt hour basis, inclusive of the costs of transmission and distribution facilities associated with the facility's interconnection, does not exceed 1.4 times the comparable cost, on an unweighted average basis, of a conventional simple cycle combustion turbine generating facility as estimated by the U.S. Energy Information Administration in its Annual Energy Outlook 2019 [("AEO 2019")].

As can be seen above, in Prong 2 the Code only specifies that interconnection costs and tax credits should be included in LCOE. The VCEA, however, does not otherwise define LCOE, which normally includes many input components.

The section of the Code that states, "[T]he comparable cost, on an unweighted average basis, of a [conventional CT]" is a reference to LCOE values in Table 1b of the AEO 2019, included as Company witness Kelly's Schedule 1 for convenience.[39] Table 1b includes the estimated unweighted average LCOE for a new conventional CT entering

[39] The AEO 2019 also includes another table with LCOE calculated on capacity-weighted average basis.

service in 2023, which is $89.3 per MWh in 2018 dollars. Therefore, cost per MWh of a facility that is 1.4 times this $89.3/MWh would be $125/MWh. On advice of counsel, the $125/MWh figure is significant in that above this amount, the Company would not meet the requirements of Prong 2.

Q. DID THE COMPANY MEET THE LCOE REQUIREMENTS SET FORTH IN PRONG 2?

A. After running LCOE sensitivity analyses, Staff finds that there are certain scenarios in which the Project's projected LCOE exceeds $125/MWh, i.e., 1.4 times the comparable cost of a conventional CT. On advice of counsel, if the Commission were to adopt these assumptions, the Company would no longer receive the benefit of the presumption of reasonableness and prudence.

Q. WHAT IS LCOE?

A. LCOE stands for Levelized Cost of Energy, which is the generation-weighted average cost per MWh of total projected energy output over the operating life of a project.

Multiple input components impact the LCOE calculation, all of them projections, available at this time and subject to change in the future. As such, LCOE can only be known, rather than estimated, upon the end of a project's useful life, when both its costs and energy output are certain in hindsight. This is especially the case for new technologies, particularly offshore wind, which has the highest technological optimism factor (1.25)

across all generating technologies analyzed by Sargent & Lundy for the U.S. Energy Information Administration ("EIA").[40]

Q. WHAT IS EIA'S DEFINITION AND GENERAL GUIDANCE ON LCOE?

A. EIA's paper *Levelized Cost and Levelized Avoided Cost of New Generation Resources in the Annual Energy Outlook 2019* provides the following guidance,

> Levelized cost of electricity (LCOE) represents the average revenue per unit of electricity generated that would be required to recover the costs of building and operating a generating plant during an assumed financial life...
>
> Key inputs to calculating LCOE include capital costs, fuel costs, fixed and variable operations and maintenance (O&M) costs, financing costs, and an assumed utilization rate for each plant type.... The availability of various incentives, including state or federal tax credits ... can also affect the calculation of LCOE. As with any projection, these factors are uncertain because their values can vary regionally and temporally as technologies evolve and as fuel prices change.
>
> Actual plant investment decisions are affected by the specific technological and regional characteristics of a project, which involve many other factors not reflected in LCOE values. ... For example, a wind resource that would primarily displace existing natural gas-fired generation will usually have a different economic value than one that would displace existing coal-fired generation.[41]

Q. PLEASE LIST LCOE INPUT COMPONENTS INCLUDED IN THE COMPANY'S LCOE CALCULATION.

A. Company witness Bennett provides a list of nine LCOE input components on page 15 of his testimony. They include capital expenditures, gross capacity factor, availability factor, RECs, nominal capacity, book life, annual O&M expense, investment tax credits, and ROE

[40] https://www.eia.gov/outlooks/aeo/assumptions/pdf/table_8.2.pdf at 2. The technological optimism factor is applied to the first four units of a new, unproven design; it reflects the demonstrated tendency to underestimate actual costs for a first of-a-kind unit.

[41] https://www.eia.gov/outlooks/archive/aeo19/pdf/electricity_generation.pdf at 1-2.

percentage. Each LCOE input component is then discussed individually in pages 15-19 of Company witness Bennett's testimony.

Q. ARE THERE OTHER POTENTIAL LCOE INPUT COMPONENTS?

A. Yes. In Staff's view, the following LCOE input components require additional consideration:

- The inclusion of RECs;
- The inclusion of decommissioning expenses;
- The potential for inclusion of energy storage investments;
- Stand-alone or system LCOE; and
- A baseline year for the CVOW's LCOE calculation.

Q. PLEASE DISCUSS THE POTENTIAL INCLUSION OF RECS IN LCOE.

A. The Company's position is that the value of RECs generated by the CVOW Commercial Project should offset its LCOE.[42] Therefore, the Company included a REC value of $9.41 in its LCOE calculation.[43] To support this position, the Company states that "for example, the New Jersey solicitation instructions clearly identify the Levelized Net Offshore Cost ("LNOC") as exclusive of the avoided REC value."[44]

Staff notes that LNOC and LCOE are two different metrics and that the VCEA refers to the EIA's estimate of LCOE values, specifically contained in *the AEO 2019*, as a

[42] *See* Attachment KK-9 for a copy of the Company's response to Staff Interrogatory No. 04-55.

[43] *See* Corrected Attachment III.A of the Generation Appendix, at 47, filed as a part of the Company's errata filing on March 2, 2022.

[44] *See* Attachment KK-9 for a copy of the Company's response to Staff Interrogatory No. 04-55.

basis for comparison. Neither potential revenues from REC sales nor avoided REC costs are mentioned as one of the LCOE input components. Further, as mentioned in the Total CVOW Plant Expenditures subsection of my testimony, for AEO 2020, EIA commissioned an engineering consultant firm Sargent & Lundy to evaluate the overnight capital cost and performance characteristics for various electric generator types, including offshore wind. In the EIA Case 22,[45] Sargent & Lundy did not assume that RECs offset variable O&M costs of a generic offshore wind facility.

Staff does not support the inclusion of RECs in LCOE, as it is not the practice by EIA, or energy sectors experts such as LAZARD or the Berkeley Lab.

Q. PLEASE DISCUSS THE POTENTIAL INCLUSION OF DECOMMISSIONING EXPENSES IN THE LCOE OF THE CVOW PROJECT.

A. The Company did not include approximately $1.7 billion decommissioning expenses in its LCOE calculation for the CVOW Commercial Project,[46] even though the Company plans to begin recovering such costs through Asset Retirement Obligation ("ARO") accretion and Asset Retirement Cost ("ARC") depreciation as of the commercial operations date of the Project.[47] Staff has not found decommissioning expenses being explicitly mentioned in the EIA's LCOE calculation guidelines. However, the World Nuclear Association

[45] 2020 Annual Energy Outlook in the EIA report *Capital Cost and Performance Characteristic Estimates for Utility-Scale Electric Power Generating Technologies* prepared by Sargent & Lundy, released on February 5, 2020 and available at: https://www.eia.gov/analysis/studies/powerplants/capitalcost/pdf/capital_cost_AEO2020.pdf. This cost estimate was prepared for a generic 400 MW fixed-bottom Offshore Wind facility.

[46] See Attachment KK-10 for a copy of the Company's response to Staff Interrogatory No. 10-115.

[47] *See* Extraordinarily Sensitive Filing Schedule 46.b.1.vi, Statement 3.

includes decommissioning expenses of nuclear plants in operating costs.[48] Therefore, Staff believes that decommissioning expenses should be included in the CVOW Project's LCOE as an add-on to its annual Fixed O&M, equivalent to the sum of ARO accretion and ARC depreciation. Based on Staff's estimate, this would result in an approximately $7 increase in the Project's LCOE calculated in 2027 dollars or an approximately $6 increase calculated in 2018 dollars, as discussed later in my testimony.

Q. PLEASE DISCUSS THE POTENTIAL INCLUSION OF ENERGY STORAGE INVESTMENTS IN LCOE.

A. The Company did not include its potential future energy storage investments in its LCOE calculation. However, the Company forced the full generic battery storage buildout[49] into the PLEXOS model for the purposes of the CVOW Commercial Project's NPV calculation, in both the base case without CVOW and the case with the CVOW Project added.[50]

Staff notes that the base case with CVOW in the PLEXOS model includes noticeable increases in generation of the Company's new battery storage and existing pumped storage units, as compared to the base case without CVOW. Specifically, the new generic battery storage units' cumulative generation is 8,132 GWh (approximately 18%)

[48] Specifically, its website states that "Plant operating costs ... include the costs of fuel, operation and maintenance (O&M), and a provision for funding the costs of decommissioning the plant and treating and disposing of used fuel and wastes." https://world-nuclear.org/information-library/economic-aspects/economics-of-nuclear-power.aspx

[49] Consistent with the storage capacity directed by the VCEA to be proposed for Commission approval.

[50] *See* Attachment KK-11 for a copy of the Company's response to Consumer Counsel's Interrogatory No. 02-17.

higher[51] and the Bath County Pumped Storage facility's cumulative generation is 12,462 GWh (approximately 28%) higher for the base case with CVOW between 2027 and 2056,[52] which are the operating years of the CVOW Project.

The Company explained the increases in energy storage units' utilization *over time* by (1) the gradual addition of the "shadow price" of the SCOC to the dispatch cost of the Company's fossil-fueled units, such that their dispatch appears to become less economic over time,[53] and (2) load growth leading to the need for additional generation.[54] Staff concludes that such additional generation would then come from the Company's renewable or energy storage resources. Energy storage units can rely either on power purchases from the PJM market (which would appear more economic over time in comparison with the Company's fossil-fueled units), or on the Company's generation units.[55]

The Company's responses pertaining to the increases in the storage units' utilization did not distinguish between the base cases with and without CVOW. Staff interprets the increase in storage capacity utilization as an indication that the Company may need energy storage capacity complementary to the CVOW Project for two reasons – to preserve energy generated in excess of demand at the time of its generation, and to align the timing of

[51] Staff's analysis of the information on battery storage generation provided by the Company in Attachment Staff Set 09-103 (a). The change in the CE-2 Projects' storage generation is immaterial (6 GWh) in 2027 – 2056.

[52] Staff's analysis of the information on pump storage generation provided by the Company in Attachment Staff Set 09-103 (c).

[53] The implications of the addition of such "shadow price" will be discussed in detail in the NPV section in my testimony.

[54] *See* Attachment KK-12 for a copy of the Company's responses to Staff Interrogatory Nos. 09-103 (a) and (c), 8-99. This will be discussed further in detail in the NPV section of my testimony.

[55] During Staff's informal discussion with the Company on February 9, 2022, the Company stated that the Bath County Pumped Storage facility would charge from the market, i.e., not necessarily from the Company's generating fleet.

energy sales with periods of higher prices in the DOM Zone. For example, Massachusetts recognized the potential necessity for energy storage in its Request for Proposals for Long-term contracts for offshore wind energy projects issued on May 7, 2021.[56]

It is Staff's position, therefore, that the future energy storage investments should be included in the LCOE calculation of the CVOW Commercial Project, to the extent they are necessary to preserve the facility's energy output and sell it at commercially optimal times.[57] Based on Staff's high-level estimate, this would result in an approximately $5 increase in the Project's LCOE calculated in 2027 dollars or an approximately $4 increase calculated in 2018 dollars, as discussed later in my testimony.

Q. PLEASE DISCUSS THE DIFFERENCE BETWEEN A STAND-ALONE LCOE AND LCOE CALCULATED ON A SYSTEM BASIS.

A. A stand-alone LCOE estimates the cost of energy that will be generated by an asset, without regard to any potential impacts of its addition on the output of other Company-owned generation assets (i.e., cannibalization) or a potential change in the cost of generation and emissions for the Company's fleet as a whole (i.e., synergies). It also ignores the potential

[56] That RFP stated, in part, "[p]ricing must be designed to recover all costs associated with the proposal, including but not limited to the cost of Offshore Wind Energy Generation, cost of Offshore Delivery Facilities, cost of network upgrades, and, if applicable, Energy Storage Systems." https://macleanenergy files.wordpress.com/2021/05/83c3-rfp-and-appendices-final.pdf at 15.

[57] Lack of adequate energy storage could potentially result in energy from the CVOW Commercial Project being dumped during hours of excess production relative to energy consumption. As discussed in the NPV Analysis section of my testimony, Staff requested two additional PLEXOS model runs without instructing (forcing) the model to select battery storage facilities, in order to determine whether the model will select battery storage facilities on a least-cost optimization (economic) basis. The PLEXOS model selected modest amounts of battery storage PPAs and only after 2049, close to the time of the modeled Surry nuclear plant license extensions expiration in 2051 and 2052.

need for energy storage over the lifetime of a project, whereas such energy storage facilities are particularly important for reliability of a system that includes a high proportion of intermittent resources such as renewable generation assets. As such, stand-alone LCOE is most appropriate for merchant plants and relatively small generation facilities that don't cause substantial ripple effects in the Company's system.[58] The Company calculated only a stand-alone LCOE for the CVOW Commercial Project.

In Staff's view, a stand-alone LCOE for the CVOW Commercial Project may be an informative financial metric, when used in conjunction with an LCOE calculated on a system basis. This would allow the Commission to consider cannibalization of other Company-owned units' generation by the Project, and the Project's synergies with the rest of the Company's system. Such comparison will demonstrate a possible range of LCOE values that may be achieved once the CVOW Commercial Project is in operation, thus highlighting both its benefits and risks to the Company's system.

Q. PLEASE DISCUSS BASELINE YEARS FOR THE LCOE CALCULATION.

A. The Company included LCOE values in 2018 dollars and in 2027 dollars in its Application.[59] Staff agrees that, in the absence of specific VCEA guidance, both 2018 and 2027 could be considered baseline years. This is because the former is the year for which the AEO 2019 provides LCOE values for various generating assets, and the latter is the first full calendar year of commercial operation for the CVOW Commercial Project. Staff

[58] For example, if a merchant offshore wind facility causes a merchant natural gas-fired unit to dispatch less, then the cost of the lost energy sales are borne by the shareholders of the natural gas-fired merchant unit. That is not the case for a vertically integrated utility, such as the Company, that owns both the offshore wind facility and the fossil-fueled units likely to be impacted by the offshore wind unit's energy production.

[59] Direct testimony of Company witness Glenn A. Kelly ("Kelly Direct"), Summary page.

also calculated the Project's LCOE in 2022 dollars, as it is the year in which the Commission's decision will be rendered in the instant case. Staff has included the respective values in the LCOE summary tables found later in this testimony.

Q. PLEASE DESCRIBE THE COMPANY'S LCOE CALCULATION FOR CVOW.

A. To summarize the information on the LCOE input components, the Company calculated LCOE values on a stand-alone basis,[60] including transmission and distribution investments and the ITC benefit.[61] The Company assumed a 42% net capacity factor.[62] Decommissioning expenses were not included. O&M expenses to be incurred prior to the CVOW Project's commercial operations date[63] and O&M expenses for the Harpers to Fentress transmission assets upon their energization were not included either.[64] Future battery storage investments were not accounted for. Finally, the Company adjusted the LCOE values to include the price of RECs. The resulting LCOE values are $73/MWh in 2018 dollars and $87/MWh in 2027 dollars.[65]

Q. PLEASE LIST THE FACTORS THAT CREATE UNCERTAINTY FOR LCOE ESTIMATES FOR THE CVOW COMMERCIAL PROJECT.

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[60] The Company's LCOE model does not account for synergies stemming from the CVOW Project's addition to its system or cannibalization of other Company-owned units' generation.

[61] As previously mentioned, Staff disagrees with the way the ITC benefit flows through the Company's LCOE model, as discussed by Staff witness Welsh.

[62] Staff witness Joshipura discusses the CVOW Project's capacity factor in his testimony.

[63] See Attachment KK-13 for a copy of the Company's response to Staff Interrogatory No. 15-140 (b).

[64] See Attachment KK-14 for a copy of the Company's response to Staff Interrogatory No. 04-60.

[65] Kelly Direct, Summary page.

A. Multiple factors influence the LCOE of the CVOW Commercial Project, and they are different for its construction and operational phases.

Considering the relatively long timeline of the construction phase and the large size of the CVOW Commercial Project, its construction CAPEX may be at risk of a higher contingency, despite fixed price protections in the executed contracts. In Staff's view, risk factors that may lead to cost overruns include:

- Unhedged commodity risk. The Company estimates the value of commodities to be **[BEGIN EXTRAORDINARILY SENSITIVE]** [redacted] **[END EXTRAORDINARILY SENSITIVE]**.[66]
- Transmission costs attributable to the Company depend on other transmission projects' timely execution, as described by Staff witness Joshipura.
- Schedule coordination across several counterparties, each supplying different components that are subject to a unique set of supply chain conditions, may lead to delays, which may be further exacerbated by the necessity to avoid installation of foundations during the Right Whale exclusion period. **[BEGIN EXTRAORDINARILY SENSITIVE]** [redacted] **[END EXTRAORDINARILY SENSITIVE]** However, such a delay might also be caused by potential supply chain and supplier coordination challenges. For instance, Siemens Gamesa recently reported that supply chain disruption challenged its performance and that there was no expectation for the supply chain conditions to normalize in the remainder of the year.[68]

During the operational phase, LCOE uncertainty drivers are:

[66] Generation Appendix at 48-49. See also Attachment KK-15 for a copy of the Company's response to Staff Interrogatory No. 06-70 and Attachment Staff Set 06-70.

[67] Filing Schedule 46.b.1.v, Statement 1, page 8 of 32.

[68] https://www.siemensgamesa.com/en-int/newsroom/2022/02/220203-siemens-gamesa-press-release-results-q1-2022

- Potential maintenance CAPEX overruns due to equipment degradation in the marine environment leading to the necessity to replace certain components. **[BEGIN EXTRAORDINARILY SENSITIVE]** [redacted] **[END EXTRAORDINARILY SENSITIVE]** Further, the Company provided an estimate for the number and cost of such events, which is embedded in its capital maintenance cost budget.[70]

- Potential operational expense overruns stemming from the learning curve inherent to running a new type of generating facility that is not yet proven on the Atlantic shoreline, **[BEGIN EXTRAORDINARILY SENSITIVE]** [redacted] **[END EXTRAORDINARILY SENSITIVE]**

- Weather impacts on the capacity factor.

Q. HAS THE COMPANY ANALYZED LCOE VALUE SENSITIVITIES?

A. Yes. The Company included its analysis of key LCOE drivers in its presentation to the Board of Directors.[72] These drivers include **[BEGIN EXTRAORDINARILY SENSITIVE]** [redacted].

[69] Filing Schedule 46.b.1.v, Statement 1, pages 9 and 15 of 32.

[70] See Attachment KK-16 for a copy of the Extraordinarily Sensitive Attachment Staff Set No. 04-59.

[71] See Attachment KK-17 for a copy of the Extraordinarily Sensitive Attachment Staff Set No. 07-85(c)(6), slide 5.

[72] Filing Schedule 46.b.1.v, Statement 1, page 31 of 32.

[redacted]

[73] See Attachment KK-18 for a copy of the Company's response to Staff Interrogatory No. 06-69 (b).

[74] As per Attachment Staff Set 01-16(2).

[redacted]

[75] Both LCOE values are adjusted for the value of a REC, an assumption that Staff does not support, and which is not the practice of either the EIA or energy sectors experts such as LAZARD or the Berkeley Lab.

[76] The Company's changes in the LCOE model between the preparation of the presentation for the Board of Directors and the instant filing are listed in the Company's response to Staff Interrogatory No. 08-97 (b), attached hereto as Attachment KK-19.

[77] *See* Attachment KK-20 for a copy of the Company's response to Staff Interrogatory No. 06-73.

[redacted] [END EXTRAORDINARILY SENSITIVE]

Q. HAS STAFF ANALYZED CVOW'S STAND-ALONE LCOE SENSITIVITIES?

A. Yes. Staff analyzed multiple sensitivities to test their potential impact on the CVOW Commercial Project's LCOE, first on a stand-alone basis, as if the Project were a merchant plant. The purpose of this analysis was to estimate the impact of changes in various factors on LCOE, individually or collectively. It should not be understood as being Staff's opinion on what could or may happen in the future. Rather, it was an attempt to quantify potential consequences of various scenarios without estimating their respective probabilities.

First, as discussed by Staff witness Gereaux, changes in the capital structure or cost of capital would have an impact on the Project's final cost. Therefore, Staff created four scenarios for financing inputs, including:

- The capital structure and cost of capital based on the 2021 triennial review, with the discount rate updated based on inputs from Staff witness Gereaux;
- An increase in the proportion of equity in the Company's capital structure to 55% based on its recent historic maximum,[79] in order to test CVOW's LCOE sensitivity to potential future capital structure changes;
- A subsequent addition of 1% to the baseline ROE of 9.35% in order to test CVOW's LCOE sensitivity to potential future increases in the rate of return on shareholder equity; and
- A combination of a 1% increase in the baseline ROE and an increase in a proportion of equity in the Company's capital structure to 55%.

[78] [BEGIN CONFIDENTIAL] [redacted] [END CONFIDENTIAL]

[79] *See* Attachment KK-21 for a copy of Schedule 3 in Case PUE-2013-00020, 2013 Biennial Review.

As shown in the table below, these changes would have a moderate impact on CVOW's LCOE, unless they are combined with other changes in the LCOE model.

Next, Staff performed an analysis of how each LCOE factor may impact the CVOW Commercial Project's LCOE, independently from change in other factors. For the purposes of this analysis, Staff adjusted only one factor at a time in the Company's LCOE model (albeit its underlying cost of capital inputs were updated based on the 2021 triennial review[80]), then arranged the factors in the order of their impact on LCOE. The assumptions and justifications for each change in individual factors are listed below:

- A 10% Fixed O&M increase is a proxy for the tax basis reduction portion of the ITC in the amount of $420 million, as calculated by Staff witness Welsh;
- A 25-year useful life for the Project, which is the Company's original assumption, which would also lead to a corresponding reduction in cumulative on-going CAPEX in the LCOE model;
- Future investments of approximately $1 billion for 500 MW of battery storage facilities became a 60% add-on to On-going CAPEX in the CVOW's LCOE model. This is a high-level estimate based on the following assumptions:
    - The maximum increase in battery storage generation over the operating life of the CVOW Project due to its addition to the Company's system is 668 GWh in 2045,[81] which corresponds to 508 MW of battery storage capacity at 15% capacity factor;[82]

[80] *Application of Virginia Electric and Power Company, For a 2021 triennial review of the rates, terms and conditions for the provision of generation, distribution and transmission services pursuant to § 56-585.1 A of the Code of Virginia,* Case No. PUR-2021-00058, Doc. Con. Cen. No. 211160097, Final Order (Nov. 18, 2021).

[81] Staff's calculation based on battery storage generation information provided in Attachment Staff Set 09-103 (a).

[82] Conversely, if energy storage investments are not economic and some level of energy production from the CVOW Commercial Project is expected to be dumped rather than stored or injected into the grid, then this amount of lost energy production should be removed from the LCOE calculation.

- [BEGIN CONFIDENTIAL] [redacted] [END CONFIDENTIAL]

- A 10% construction CAPEX contingency is based on the EIA's Case 22 contingency;

- Decommissioning expenses became a **[BEGIN EXTRAORDINARILY SENSITIVE]** [redacted] **[BEGIN EXTRAORDINARILY SENSITIVE]**

- 38% capacity factor is the lower boundary of the Project's capacity factor range tested by the Company for the purposes of LCOE sensitivity analysis;[85] and

- 25% construction CAPEX contingency is based on EIA's technological optimism index for offshore wind facilities.

This analysis demonstrated that changing any factor in the Company's LCOE model independently from other factors did not push CVOW's LCOE beyond $125, at least with the levels of factors' change tested by Staff. **[BEGIN CONFIDENTIAL]** [redacted] **[END CONFIDENTIAL]**

Finally, Staff created three groups of consolidated scenarios—Staff's conservative, moderate, and aggressive scenarios in the table below—in which multiple assumptions

[83] Direct Testimony of Emil Avram in Case PUR-2021-00146, at 24.

[84] Filing Schedule 46.b.1.vi, Statement 3, tab "Input_Total." This LCOE modeling input was agreed with Staff witness Welsh.

[85] *See* Attachment KK-22 for a copy of the Company's response to Consumer Counsel's Interrogatory No. 04-84.

change at the same time, with decommissioning expenses and the tax basis reduction portion of the ITC underlying all scenarios, because it is Staff's position that both changes should be incorporated in the CVOW's Project LCOE calculation. Staff's conservative scenarios assume baseline cost of capital from the 2021 triennial review; moderate scenarios assume 55% proportion of equity and 38% capacity factor; and aggressive scenarios assume 55% proportion of equity, 10.35% ROE, and 38% capacity factor.

Each group of Staff's scenarios includes the following sub-scenarios: (i) Future investments of approximately $1 billion for 500 MW of battery storage; (ii) 10% Construction CAPEX contingency, (iii) 10% Construction CAPEX contingency and addition of future battery storage investments; (iv) 10% Construction CAPEX contingency, addition of future battery storage investments, useful life is reverted to 25 years; (v) Construction CAPEX overrun by 25%, (vi) Construction CAPEX overrun by 25%, useful life reverted to 25 years.

The table below shows that simultaneous changes in multiple assumptions push the Project's LCOE close to or above $125/MWh as highlighted, especially if LCOE is not adjusted for REC value and incorporates future investments in battery storage or CAPEX overruns. Several moderate and aggressive scenarios in which 38% capacity factor is combined with higher cost of capital result in the CVOW's LCOE exceeding $125/MWh.

Impact of each scenario on CVOW's LCOE, $/MWh	LCOE not adjusted for REC			LCOE adjusted for REC		
	2027	2022	2018	2027	2022	2018
The Company's analysis as filed	$ 96	$ 88	$ 81	$ 87	$ 79	$ 73
Cost of capital changes - effect on LCOE						
The 2021 triennial review (baseline)	$ 98	$ 89	$ 82	$ 88	$ 80	$ 74
The 2021 triennial review, 55% equity (medium - high equity)	$ 99	$ 90	$ 83	$ 90	$ 82	$ 76
The 2021 triennial review, 10.35% ROE (medium - high ROE)	$ 103	$ 94	$ 87	$ 94	$ 85	$ 79
The 2021 triennial review, 10.35% ROE, 55% equity (maximum)	$ 106	$ 96	$ 89	$ 96	$ 87	$ 81
Separate change in each LCOE factor, with underlying baseline cost of capital from the 2021 triennial review						
Correct tax basis reduction for ITC	$ 99	$ 90	$ 83	$ 90	$ 81	$ 75
Useful life reverted to 25 years	$ 101	$ 91	$ 84	$ 92	$ 83	$ 77
Add battery storage investments	$ 101	$ 92	$ 85	$ 92	$ 83	$ 77
10% construction CAPEX contingency	$ 103	$ 93	$ 86	$ 93	$ 85	$ 78
Add decommissioning costs	$ 103	$ 94	$ 87	$ 94	$ 85	$ 79
Capacity factor (before adjustments for availability) changed to 38%	$ 111	$ 101	$ 93	$ 102	$ 92	$ 85
EIA's technological optimism factor = > Add 25% to the Company's construction CAPEX estimate	$ 117	$ 106	$ 98	$ 107	$ 97	$ 90
Staff's conservative LCOE scenarios - correct tax basis reduction for ITC, add decommissioning costs, baseline cost of capital						
Staff's conservative scenario - baseline	$ 105	$ 95	$ 88	$ 95	$ 87	$ 80
Add battery storage investments	$ 109	$ 99	$ 91	$ 99	$ 90	$ 83
10% construction CAPEX contingency	$ 110	$ 100	$ 92	$ 101	$ 91	$ 84
10% construction CAPEX contingency + battery storage investments	$ 114	$ 103	$ 96	$ 105	$ 95	$ 88
10% construction CAPEX contingency + battery storage investments, revert to 25 years useful life	$ 117	$ 106	$ 98	$ 108	$ 98	$ 91
Add 25% to the Company's construction CAPEX estimate	$ 124	$ 113	$ 104	$ 115	$ 104	$ 96
Add 25% to the Company's construction CAPEX estimate, revert to 25 years useful life	$ 128	$ 116	$ 107	$ 119	$ 108	$ 100
Staff's moderate LCOE scenarios - correct tax basis reduction for ITC, add decommissioning costs Assume 38% capacity factor (before adjustments for availability) and medium cost of capital (55% equity)						
Staff's moderate scenario - baseline	$ 122	$ 110	$ 102	$ 112	$ 102	$ 94
Add battery storage investments	$ 126	$ 114	$ 106	$ 117	$ 106	$ 98
10% construction CAPEX contingency	$ 128	$ 116	$ 107	$ 118	$ 107	$ 99
10% construction CAPEX contingency + battery storage investments	$ 132	$ 120	$ 111	$ 123	$ 111	$ 103
10% construction CAPEX contingency + battery storage investments, revert to 25 years useful life	$ 136	$ 123	$ 114	$ 127	$ 115	$ 106
Add 25% to the Company's construction CAPEX estimate	$ 144	$ 131	$ 121	$ 135	$ 122	$ 113
Add 25% to the Company's construction CAPEX estimate, revert to 25 years useful life	$ 148	$ 134	$ 124	$ 139	$ 126	$ 117
Staff's aggressive LCOE scenarios - correct tax basis reduction for ITC, add decommissioning costs Assume 38% capacity factor (before adjustments for availability), maximum cost of capital (55% equity, 10.35% ROE)						
Staff's aggressive scenario - baseline	$ 129	$ 117	$ 108	$ 119	$ 108	$ 100
Add battery storage investments	$ 133	$ 121	$ 112	$ 124	$ 113	$ 104
10% construction CAPEX contingency	$ 135	$ 123	$ 113	$ 126	$ 114	$ 106
10% construction CAPEX contingency + battery storage investments	$ 140	$ 127	$ 117	$ 131	$ 118	$ 110
10% construction CAPEX contingency + battery storage investments, revert to 25 years useful life	$ 143	$ 130	$ 120	$ 134	$ 122	$ 113
Add 25% to the Company's construction CAPEX estimate	$ 153	$ 138	$ 128	$ 143	$ 130	$ 120
Add 25% to the Company's construction CAPEX estimate, revert to 25 years useful life	$ 156	$ 142	$ 131	$ 148	$ 134	$ 124

The table below shows an incremental increase in LCOE triggered by each scenario.

Impact of each scenario on CVOW's LCOE, $/MWh	LCOE not adjusted for REC			LCOE adjusted for REC		
	2027	2022	2018	2027	2022	2018
The Company's analysis as filed						
Cost of capital changes - effect on LCOE						
The 2021 triennial review (baseline)	$ 1	$ 1	$ 1	$ 1	$ 1	$ 1
The 2021 triennial review, 55% equity (medium - high equity)	$ 3	$ 3	$ 2	$ 3	$ 3	$ 2
The 2021 triennial review, 10.35% ROE (medium - high ROE)	$ 7	$ 6	$ 6	$ 7	$ 6	$ 6
The 2021 triennial review, 10.35% ROE, 55% equity (maximum)	$ 9	$ 8	$ 8	$ 9	$ 8	$ 8
Separate change in each LCOE factor, with underlying baseline cost of capital from the 2021 triennial review						
Correct tax basis reduction for ITC	$ 3	$ 2	$ 2	$ 3	$ 2	$ 2
Useful life reverted to 25 years	$ 4	$ 4	$ 3	$ 5	$ 4	$ 4
Add battery storage investments	$ 5	$ 4	$ 4	$ 5	$ 4	$ 4
10% construction CAPEX contingency	$ 6	$ 6	$ 5	$ 6	$ 6	$ 5
Add decommissioning costs	$ 7	$ 6	$ 6	$ 7	$ 6	$ 6
Capacity factor (before adjustments for availability) changed to 38%	$ 15	$ 13	$ 12	$ 15	$ 13	$ 12
EIA's technological optimism factor = > Add 25% to the Company's construction CAPEX estimate	$ 20	$ 18	$ 17	$ 20	$ 18	$ 17
Staff's conservative LCOE scenarios - correct tax basis reduction for ITC, add decommissioning costs, baseline cost of capital						
Staff's conservative scenario - baseline	$ 8	$ 8	$ 7	$ 8	$ 8	$ 7
Add battery storage investments	$ 12	$ 11	$ 10	$ 12	$ 11	$ 10
10% construction CAPEX contingency	$ 14	$ 12	$ 11	$ 14	$ 12	$ 11
10% construction CAPEX contingency + battery storage investments	$ 17	$ 16	$ 15	$ 17	$ 16	$ 15
10% construction CAPEX contingency + battery storage investments, revert to 25 years useful life	$ 21	$ 19	$ 17	$ 21	$ 19	$ 18
Add 25% to the Company's construction CAPEX estimate	$ 28	$ 25	$ 23	$ 28	$ 25	$ 23
Add 25% to the Company's construction CAPEX estimate, revert to 25 years useful life	$ 31	$ 28	$ 26	$ 32	$ 29	$ 27
Staff's moderate LCOE scenarios - correct tax basis reduction for ITC, add decommissioning costs Assume 38% capacity factor (before adjustments for availability) and medium cost of capital (55% equity)						
Staff's moderate scenario - baseline	$ 25	$ 23	$ 21	$ 25	$ 23	$ 21
Add battery storage investments	$ 30	$ 27	$ 25	$ 30	$ 27	$ 25
10% construction CAPEX contingency	$ 31	$ 28	$ 26	$ 31	$ 28	$ 26
10% construction CAPEX contingency + battery storage investments	$ 36	$ 32	$ 30	$ 36	$ 32	$ 30
10% construction CAPEX contingency + battery storage investments, revert to 25 years useful life	$ 39	$ 36	$ 33	$ 40	$ 36	$ 33
Add 25% to the Company's construction CAPEX estimate	$ 47	$ 43	$ 40	$ 47	$ 43	$ 40
Add 25% to the Company's construction CAPEX estimate, revert to 25 years useful life	$ 52	$ 47	$ 43	$ 52	$ 47	$ 44
Staff's aggressive LCOE scenarios - correct tax basis reduction for ITC, add decommissioning costs Assume 38% capacity factor (before adjustments for availability), maximum cost of capital (55% equity, 10.35% ROE)						
Staff's aggressive scenario - baseline	$ 32	$ 29	$ 27	$ 32	$ 29	$ 27
Add battery storage investments	$ 37	$ 33	$ 31	$ 37	$ 34	$ 31
10% construction CAPEX contingency	$ 39	$ 35	$ 32	$ 39	$ 35	$ 33
10% construction CAPEX contingency + battery storage investments	$ 43	$ 39	$ 36	$ 43	$ 39	$ 36
10% construction CAPEX contingency + battery storage investments, revert to 25 years useful life	$ 47	$ 42	$ 39	$ 47	$ 43	$ 40
Add 25% to the Company's construction CAPEX estimate	$ 56	$ 51	$ 47	$ 56	$ 51	$ 47
Add 25% to the Company's construction CAPEX estimate, revert to 25 years useful life	$ 60	$ 54	$ 50	$ 60	$ 55	$ 51

Q. DID THE COMPANY ANALYZE LCOE OF THE CVOW COMMERCIAL PROJECT ON A SYSTEM LEVEL, AS A PART OF ITS GENERATION FLEET?

A. No. Such analysis was not included in the Company's presentation to the Board of Directors, nor was it submitted with the instant filing before the Commission.

Q. DID STAFF ANALYZE LCOE OF THE CVOW COMMERCIAL PROJECT ON A SYSTEM LEVEL?

A. Yes. As will be discussed in detail in the NPV section of my testimony, Staff compared generation output of each unit in the base case with the case with the CVOW project added. The reduction in the output of the existing generating units was approximately 112,000 GWh over the lifetime of the CVOW Commercial Project. In other words, the addition of the CVOW Commercial Project is expected to displace or cannibalize generation of the Company's stranded fossil-fueled units, such that *the net addition of energy* by CVOW is approximately 174,000 GWh, which translates to approximately 25.6% average net capacity factor over the lifetime of the CVOW Project. At the same time, the displacement of fossil-fueled units' generation would lead to *dispatch costs savings*, such as fuel, variable O&M, and emissions costs. In Staff's view, this warrants an analysis of a modified or incremental LCOE, in which only the net increase in system costs resulting from CVOW's addition and the net change in system generation are inserted into the Company's LCOE model.

Staff, therefore, adjusted the net capacity factor and Fixed O&M[86] in the model to calculate the base system level LCOE of the CVOW Project. Staff also added five additional system LCOE scenarios to account for potential CAPEX contingency, decommissioning expenses, and to test the impact of a higher cost of capital, based on the same assumptions as those used for such adjustments in the stand-alone LCOE calculation. The resulting table below shows that system LCOE of the CVOW Project would exceed $125/MWh in 2027 dollars in all scenarios.

CVOW Commercial Project's LCOE scenarios, $/MWh	LCOE adjusted for REC			LCOE not adjusted for REC		
	2027	2022	2018	2027	2022	2018
The Company's analysis as filed (Stand-alone LCOE)	$ 87	$ 79	$ 73	$ 96	$ 88	$ 81
System LCOE scenarios (25.6% net capacity factor, dispatch cost savings, baseline cost of capital)						
Base system LCOE => 25.6% net capacity factor, dispatch cost savings	$ 127	$ 115	$ 106	$ 136	$ 123	$ 114
10% construction CAPEX contingency	$ 135	$ 123	$ 113	$ 145	$ 131	$ 121
Add decommissioning cost and correct tax basis reduction for ITC	$ 139	$ 126	$ 116	$ 148	$ 134	$ 124
Maximum cost of capital (+1% ROE, 55% equity)	$ 140	$ 127	$ 117	$ 149	$ 135	$ 125
10% construction CAPEX contingency, add decommissionning cost and correct tax basis reduction for ITC	$ 147	$ 134	$ 124	$ 157	$ 142	$ 131
10% construction CAPEX contingency, add decommissionning cost and correct tax basis reduction for ITC, assume maximum cost of capital	$ 161	$ 146	$ 135	$ 171	$ 155	$ 143

Q. HOW CAN THE COMPANY'S STRATEGIC DECISIONS IMPACT CVOW'S LCOE?

A. Decisions made by the Company during the course of the CVOW Commercial Project's operations may impact the LCOE. The list below includes a few examples, but it may not be comprehensive.

- Performing a detailed economic and operational analysis for each of its fossil-fueled generation units to justify decisions on their generation displacement by CVOW.

[86] According to Staff's analysis of the PLEXOS model output, dispatch cost savings amount to **[BEGIN EXTRAORDINARILY SENSITIVE]** [redacted] **[END EXTRAORDINARILY SENSITIVE]**

Outputs of such an analysis may lead the Company to update its unit retirement analysis, to the extent the CVOW addition changes the economics of each unit.

- Balancing maintenance CAPEX and its impact on CVOW's capacity factor, including equipment degradation, which may eventually impact the decision on CVOW's decommissioning timeline.
- Potential extension of the LTSA based on CVOW's operational performance and the economics of the LTSA itself.
- Strategic approach to running or not running the CVOW Commercial Project if energy prices fall below zero, balancing economic considerations with system reliability impacts. This is especially salient if the Company chooses PTC over ITC.

If the CVOW Commercial Project is approved, the Commission may consider directing the Company to present the analyses described above with each annual Rider OSW filing to ensure that the Company operates the Project in the way that optimizes economics of its whole system to the extent possible.

Q. HAS THE COMPANY CALCULATED THE CVOW'S PRE-COMMERCIAL OPERATIONS DATE ("COD") COSTS CORRESPONDING TO THE LCOE OF $125/MWH?

A. Yes. At Staff's request, the Company provided an estimate of the CVOW Commercial Project's pre-COD costs in nominal dollars that would correspond to the Project's LCOE of $125/MWh in 2018 dollars and in 2027 dollars. These costs amount to $17.8 billion if the LCOE threshold is $125/MWh in 2018 dollars,[87] and $14.7 billion if the LCOE threshold is $125/MWh in 2027 dollars.[88] Both of these cost estimates incorporate LCOE

[87] As per Attachment Staff Set 10-114 (a).

[88] As per Attachment Staff Set 10-114 (b).

adjustments for a REC value of $9.41; without such adjustment, LCOE threshold would have been $134/MWh, that is, $125/MWh plus $9.41.

Q. HAS STAFF CALCULATED CVOW'S PRE-COD COSTS CORRESPONDING TO THE LCOE OF $125/MWH IN 2027 DOLLARS?

A. Yes. Staff updated the cost of capital in the Company's LCOE model based on the 2021 triennial review, added decommissioning expenses, and adjusted Fixed O&M to incorporate the tax basis reduction portion of the ITC. Staff also removed the LCOE's adjustment for REC value. These changes resulted in an estimate of the CVOW Project's pre-COD costs—including construction CAPEX and O&M—of approximately $12.4 billion in nominal dollars. This amount is approximately 26% higher than the Company's construction CAPEX estimate and **[BEGIN EXTRAORDINARILY SENSITIVE]** [redacted] **[END EXTRAORDINARILY SENSITIVE]** Staff's estimate is also very close to the Project's pre-COD construction CAPEX adjusted for the EIA's 25% technological optimism factor for offshore wind facilities.

Prong 3. The commencement of construction or a plan to be in service

Q. PLEASE DESCRIBE PRONG 3 OF THE PRESUMPTION OF REASONABLENESS AND PRUDENCE FOR THE PROJECT.

A. The presumption of reasonableness and prudence contained in the VCEA for the Project includes the requires the Company to commence construction of the Project prior to January 1, 2024 or to have a plan for a Project to be in service prior to January 1, 2028. As mentioned previously, Staff refers to this requirement as Prong 3. For convenience, Staff copied the relevant provision of § 56-585.1:11. C 1 of the VCEA below.

> [T]he utility has commenced construction of such facilities for U.S. income taxation purposes prior to January 1, 2024, or has a plan for such facility or facilities to be in service prior to January 1, 2028.

Q. DID THE COMPANY MEET THE REQUIREMENTS SET FORTH IN PRONG 3?

A. In Staff's opinion, the Company met requirements set forth in Prong 3.

Q. HOW DID THE COMPANY COMPLY WITH THE VCEA'S REQUIREMENT TO COMMENCE CONSTRUCTION OF AN OFFSHORE WIND FACILITY FOR U.S. INCOME TAXATION PURPOSES PRIOR TO JANUARY 1, 2024?

A. Company witness Bennett states on page 5 of his testimony that "[t]he Company began constructing the facility in 2020, for U.S. income tax purposes, beginning with fabrication of inter-array cables to secure certain tax credits." At Staff's request, the Company provided competitively bid contacts, purchase orders, and production schedules supporting the fabrication of inter-array cables.

The Company further clarified that "Notice 2018-59, 2018-28 I.R.B. 196 (6/22/2018) provides guidance for determining when construction has begun for qualified facilities and energy property projects under the Internal Revenue Code." However, it goes on to say "[a]t this time, the Company has not determined what documentation will be used to support the beginning of construction [of] the project."[89]

Q. DOES THE COMPANY HAVE A PLAN FOR THE CVOW PROJECT TO BE IN SERVICE PRIOR TO JANUARY 1, 2028?

A. Yes. Attachment IV.B on page 84 of the Application's Generation Appendix provides a construction schedule for the CVOW Commercial Project, to support Prong 3 of the presumption of the Project's reasonableness and prudence under § 56-585.1:11. C 1 (iii) of the Virginia Code. The Company states on page 83 of the Generation Appendix that offshore construction is scheduled to commence in 2023 and that the wind turbine generators will be installed and commissioned in 2025 and 2026.

[89] See Attachment KK-23 for a copy of the Company's response to Staff Interrogatory No. 07-84.

III. COSTS AND RISKS ANALYSIS AND PROPOSED RATEPAYERS' PROTECTIONS

Q. WHY DID STAFF PERFORM A DETAILED ANALYSIS OF THE PROJECT'S COSTS, AND DO YOU HAVE ASSOCIATED RECOMMENDATIONS FOR THE COMMISSION'S CONSIDERATION?

A. Staff performed the detailed cost analysis, because on advice of counsel, if projected total LCOE is above 1.4 times the comparable cost of a Conventional CT, the Project would lose the presumption of reasonableness and prudence.

To determine reasonableness and prudence of proposed projects, the Commission has routinely reviewed an array of financial metrics. Therefore, Staff suggests that the Commission consider the following financial metrics of the CVOW Commercial Project, in addition to LCOE:

- The total CVOW plant expenditures, including its construction CAPEX, maintenance CAPEX, O&M, and decommissioning expenses; and
- The project's NPV, both stand-alone and on a system basis, the latter incorporating a project's synergies with the Company's system or fleet;

In addition, due to the size of capital investments needed to build the CVOW Commercial Project, Staff believes that its potential impact on other Riders and the system as a whole should be carefully considered.[90]

Q. WHAT POSITION DOES STAFF TAKE ON THE PRUDENCE OF THE PROJECT'S COST?

[90] The Project's potential impact on other Riders stems from its **[BEGIN CONFIDENTIAL]** [redacted] **[END CONFIDENTIAL]**

A. In the absence of the statutory presumption of prudence, Staff does not take a position on the prudence of the Project. Staff does not contest that the Project would contribute to meeting the Company's RPS Program requirements and capacity and energy needs resulting from the retirement of fossil-fueled generation under the VCEA. Staff does have concerns, however, including: (i) the Company's LCOE projection; (ii) the results of the NPV analysis; (iii) the fact that the Project's energy production is expected to be at its highest during shoulder months and at its lowest during summer afternoons, when it is needed the most; and (iv) certain construction, operational, and market risks of the Project.

Q. DOES STAFF PROPOSE ANY RISK MITIGATION MEASURES?

A. Yes. If the Commission approves the Project, Staff suggests a performance guarantee for the Commission's consideration to mitigate the Project's risks to ratepayers. The Commission may also wish to impose similar protections for ratepayers as it directed in Case No. PUE-2007-00066, to address potential cost overruns.

Total CVOW plant expenditures

Q. WHAT IS THE EXPECTED COST OF THE CVOW PROJECT AS STATED IN THE APPLICATION?

A. According to the Company, the total cost of the CVOW Commercial Project is expected to be approximately $9.8 billion, including approximately $1.1 billion for the onshore Virginia Facilities.[91] These amounts exclude financing costs. The Project's nominal capacity is 2,587 MW AC[92], and its approximate construction CAPEX per kW AC is $3,788 in 2021 dollars.[93]

For comparison, a capital cost estimate prepared by an engineering consultant firm Sargent & Lundy for EIA for a smaller generic fixed-bottom offshore wind facility is $4,375 per kW AC in 2019 dollars ("EIA Case 22").[94]

Both estimates include construction CAPEX up to a facility's COD but no capital or operating expenditures incurred after a facility's COD. Notably, the EIA Case 22 estimation assumes contingency to be 10% of project costs, while the Company assumes contingency to be **[BEGIN EXTRAORDINARILY SENSITIVE]** [redacted], [redacted] **[END EXTRAORDINARILY SENSITIVE]**

[91] Application at 18.

[92] *Id.* at 7.

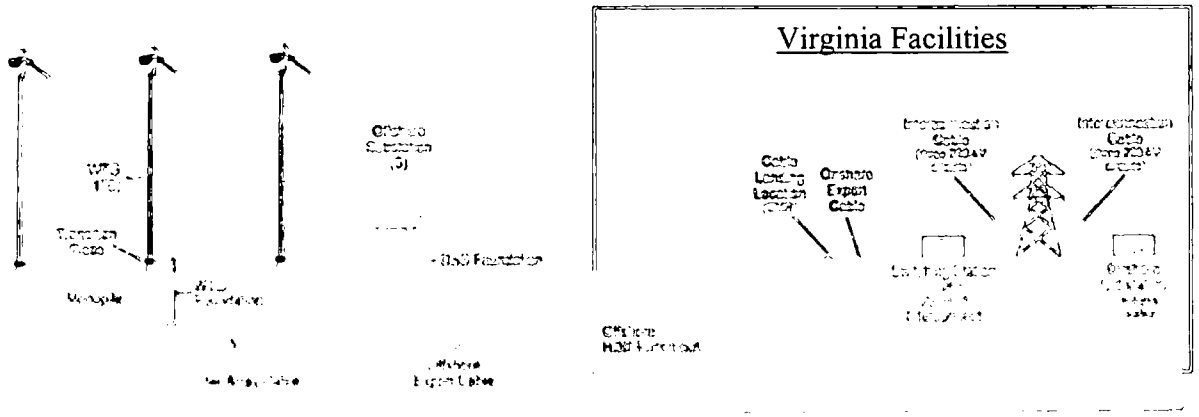
[93] Construction CAPEX per kW is calculated by dividing $9.8 billion of total construction CAPEX by 2,587 MW AC.

[94] *See* Attachment KK-24 for a copy of the EIA Case 22. Source: 2020 Annual Energy Outlook in the EIA report *Capital Cost and Performance Characteristic Estimates for Utility-Scale Electric Power Generating Technologies* prepared by Sargent & Lundy, released on February 5, 2020 and available at: https://www.eia.gov/analysis/studies/powerplants/capitalcost/pdf/capital_cost_AEO2020.pdf. This cost estimate was prepared for a generic 400 MW fixed-bottom Offshore Wind facility with Monopile Foundations, comprised of 10 MW wind turbine generators (for comparison, CVOW wind turbine generators are 14.7 MW each).

Q. PLEASE RECONCILE THE COST OF THE ONSHORE VIRGINIA FACILITIES WITH THE TOTAL ONSHORE ELECTRICAL INTERFACE COST.

A. The Virginia Facilities are shown in the red frame in the figure below.[95]

Figure 1: Basic CVOW Commercial Project Components



The estimated conceptual cost of the Virginia Facilities is approximately $1.1 billion, including:

- Competitively bid, approximately $478.2 million for Onshore Export Circuits along Routes 1, 2, and 5, which included direct pipe installation work associated with pulling the Offshore Export Circuits from approximately 1,800 feet offshore (per circuit), as well as the horizontal directional drilling and trenching work required to pull the Onshore Export Circuits from the Cable Landing Location to the Harpers Switching Station;[96]
- Approximately $296.1 million for three new overhead 230 kilovolt transmission circuits along the Harpers to Fentress proposed Route 1 between the new Harpers Switching Station and the existing Fentress Substation, along with transmission-related costs of partial rebuilds of Line #271 and Line #2240; and the Fentress Transmission Expansion related to the wreck and rebuild of Structures #2128/1-2 and Structures #588/254, #588/255, #588/256;

[95] Figure 1 was copied by Staff from page 2 of the Generation Appendix, the red frame was added by Staff.

[96] To add clarity, Staff reiterates that this amount covers the work that would begin from the Punch-out approximately 1,800 feet offshore, not 3.0 miles offshore as one could infer from page 7 of the Application.

- $219.7 million for the new Harpers Switching Station; and
- $154.5 million for the Fentress Transmission Expansion.[97]

The total onshore electrical interface cost is **[BEGIN EXTRAORDINARILY SENSITIVE]** [redacted].

[97] See Attachment KK-25 for a copy of the Company's response to Staff Interrogatory No. 06-75, Application at 7, Transmission Appendix at 22, Generation Appendix at 49.

[98] *See* Extraordinarily Sensitive Filing Schedule 46.b.1.i, Statement 1.

[99] The cost of the on-land PJM Network Upgrades is $215 million in the testimony of Staff witness Joshipura. According to the Company's response to Staff Interrogatory No. 04-37, attached hereto as Attachment KK-26, the increase to the $251 million figure was to allow for additional funding if the PJM estimate increases for the system network upgrades.

[redacted]

[END EXTRAORDINARILY SENSITIVE]

At a Virginia jurisdictional level, approximately 82.8% of the cost of the onshore electrical interface is embedded in the "Depreciation" line of the lifetime revenue requirement of the Project to be recovered through Rider OSW.[100] The transmission assets from Harpers to Fentress (Overhead) and the on-land PJM transmission network upgrades are shown in the Generation Appendix as *carve outs* from the total cost of onshore electrical interface in the Company's response to the Commission Order dated July 26, 2021.[101]

Q. WHAT IS THE TOTAL EXPECTED COST OF CONSTRUCTING, MAINTAINING, OPERATING, AND DECOMMISSIONING THE CVOW PROJECT (THE "TOTAL CVOW PLANT EXPENDITURES")?

[100] *See* Generation Appendix, part (a) at 155.

[101] *Id.* at 155-156, confirmed by Staff with the Company informally on February 15, 2022. Approximately 82.8% of the system level cost of the transmission assets from Harpers to Fentress (Overhead) are included in the $555 million "Depreciation" line in part (b) of the response, and approximately 82.8% of the system level cost of the on-land PJM transmission network upgrades are included in the $208 million "Depreciation" line in part (c) of the response.

A. Based on Staff's analysis of the Company's Filing Schedule 46,[102] the Total CVOW Plant Expenditures are currently estimated at **[BEGIN EXTRAORDINARILY SENSITIVE]** [redacted], **[BEGIN EXTRAORDINARILY SENSITIVE]** as illustrated in the chart below. This amount includes the expected cost of constructing, maintaining, operating, and decommissioning the Project, with the full estimated ITC benefit taken into account, but excluding financing costs.

[BEGIN EXTRAORDINARILY SENSITIVE]

[redacted]

[END EXTRAORDINARILY SENSITIVE]

Maintenance CAPEX is a budget for replacement of major components such as turbines, nacelles, and blades, as well as for the use of a wind turbine installation vessel

[102] *See* Extraordinarily Sensitive Filing Schedule 46.b.1.vi, Statement 3 for Construction CAPEX, ITC, Maintenance CAPEX, O&M, and ARO. Further details and cost breakdowns can be found in Extraordinarily Sensitive Filing Schedule 46.b.1.i, Statement 1 for Construction CAPEX; Extraordinarily Sensitive Filing Schedule 46.b.1.i, Statement 2 pt. 1 for the Maintenance CAPEX budget plan; Extraordinarily Sensitive Filing Schedule 46.b.1.i, Statement 2 pt. 2 for the O&M budget plan.

and project support[103] **[BEGIN EXTRAORDINARILY SENSITIVE]** [redacted] [redacted]. **[END EXTRAORDINARILY SENSITIVE]**

O&M expense includes operating expenses attributable to the CVOW offshore facility and substations,[104] as per the budget plan shown below. ARO accruals are excluded from O&M and instead included in the facility retirement cost in the chart above, to better reflect their purpose. **[BEGIN EXTRAORDINARILY SENSITIVE]**

[END EXTRAORDINARILY SENSITIVE]

[103] *See* Attachment KK-16 for a copy of the Company's response to Staff Interrogatory No. 04-59.

[104] *See* Extraordinarily Sensitive Attachment KK-3 for a copy of the Company's response to Staff Interrogatory No. 04-58, which provides a description of each operating expense component and an explanation for expense increases or decreases for certain components over the lifetime of the CVOW Project.

[105] *See* Extraordinarily Sensitive Filing Schedule 46.b.1.i, Statement 2 pt. 2 for the O&M budget plan. Numbers may not add up precisely to Sub-Total due to rounding done by Staff.

The O&M expense in the chart and table above does not include the ongoing O&M costs for the transmission assets from Harpers to Fentress, which will become transmission system assets upon energization, according to the Company, and will flow through Rider T.[106] The Company objected to a Staff's request to estimate these transmission-related O&M costs.

Facility retirement cost is the cost attributable to the CVOW Commercial Project's decommissioning, which the Company expects to incur in 2056. Such costs will be gradually recovered over the lifetime of the project through a combination of ARO accrual and ARC depreciation in Rider OSW.[107]

Q. HOW DOES THE TOTAL CVOW PLANT EXPENDITURES COMPARE WITH CVOW'S LONG-TERM REVENUE REQUIREMENT ("LTRR") FOR RATEPAYERS IN THE VIRGINIA JURISDICTION?

A. The Project's LTRR is currently estimated at $7.23 billion at the Virginia jurisdiction level. This amount includes the total CVOW plant expenditures and financing costs net of energy, capacity and REC benefits. Staff witness Welsh discusses the Project's LTRR in detail in his testimony.

[106] *See* Attachment KK-14 for a copy of the Company's response to Staff Interrogatory No. 04-60. *See also* pages 156 and 215 of the Generation Appendix.

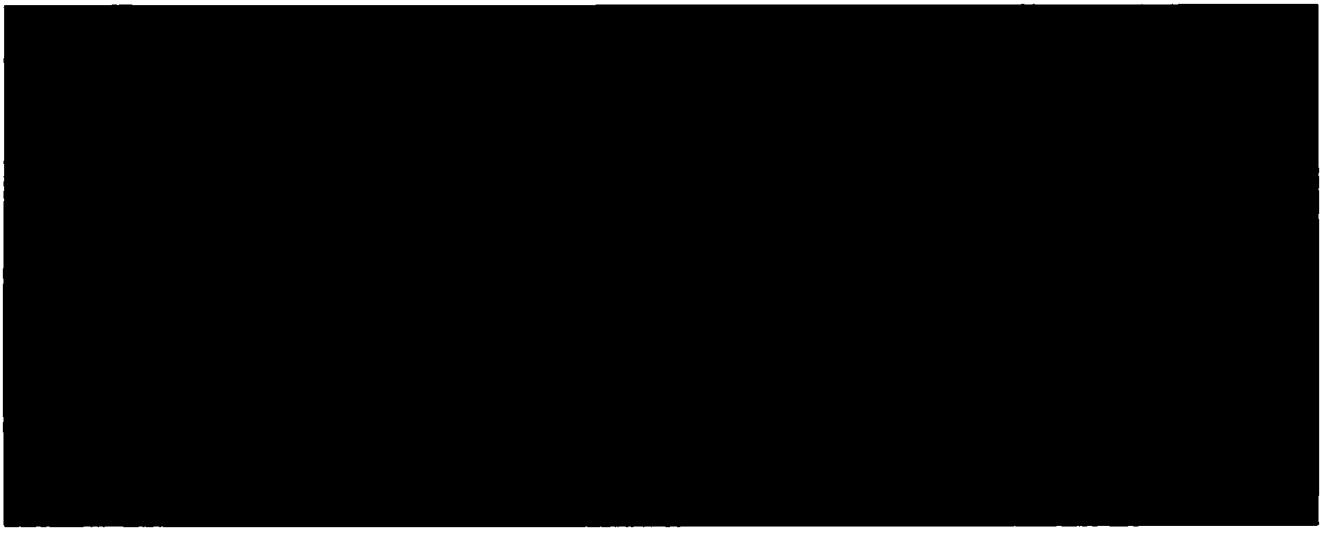
[107] *See* Extraordinarily Sensitive Filing Schedule 46.b.1.vi, Statement 3.

The Company's assessment of the Project's risks

Q. HOW DID THE COMPANY ASSESS THE RISKS OF THE CVOW COMMERCIAL PROJECT?

A. To obtain internal approval for the CVOW Commercial Project, the Company prepared a Detailed Risk Assessment which it included in its presentation to the Board of Directors.[108] The table below is a high-level summary of that assessment prepared by Staff; the summary table below should be read in conjunction with the Company's Detailed Risk Assessment mentioned above.

[BEGIN EXTRAORDINARILY SENSITIVE]



[108] *See* Filing Schedule 46.b.1.v, Statement 1, at 11, 13-24 (slides 10, 12-23).

[109] *Id.* at 16 (slide 15).

[redacted]

[redacted].

[redacted]

[redacted]

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[redacted].

[END EXTRAORDINARILY SENSITIVE]