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August 8, 2023

VIA ELECTRONIC FILING

Mr. Bernard Logan
Clerk of the Commission
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State Corporation Commission
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Re: *Commonwealth of Virginia ex rel. State Corporation Commission*
In re: Virginia Electric & Power Company's Integrated Resource Plan filing pursuant to Virginia Code § 56-597 et. seq.
Case No. PUR-2023-00066

Dear Mr. Logan:

Please find the attached Direct Testimony and Exhibits of Bryndis Woods, Phd (Public Version) filed on behalf of respondent Clean Virginia in the above-captioned matter. A redacted version is being filed by hand.

Should you have any questions about this filing, please do not hesitate to contact me.

Respectfully submitted,

/s/ William T. Reisinger

William T. Reisinger

cc: Certificate of Service

VIRGINIA ELECTRIC AND POWER COMPANY'S 2023 INTEGRATED RESOURCE PLAN

Case No. PUR-2023-00066

Direct Testimony of Bryndis Woods, PhD

On behalf of Clean Virginia

Public Version

August 8, 2023

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Summary of the Direct Testimony of Dr. Bryndis Woods

Clean Virginia Witness Bryndis Woods, PhD provides and overview of issues in Virginia Electric and Power Company's 2023 Integrated Resource Plan (IRP), including: environmental justice, Dominion's least-cost plan, load and energy forecast, compliance with the Virginia Clean Economy Act (VCEA), greenhouse gas emission forecasts, cost assumptions regarding coal plants and carbon dioxide (CO_2) emissions, and stakeholder engagement.

Dr. Woods' testimony addresses failures by the Company in its 2023 IRP to:

- Meet the basic obligations of the VCEA including energy efficiency requirements, renewable energy requirements and fossil fuel retirement requirements;
- Present useful modeling results: The Company fails to identify a preferred plan, a feasible least-cost plan, or present meaningfully distinct modeling results over the planning period as required by the Commission's 2020 IRP Final Order;
- Adequately account for the U.S. Environmental Protection Agency's (EPA) proposed new limits on coal units' CO_2 emissions as part of Section 111(d) of the Clean Air Act and the EPA's proposed Good Neighbor Plan—both of which will impact the Company's coal fleet—or consider a reasonable social cost of carbon; or
- Address environmental justice impacts of its resource planning decisions or conduct any stakeholder engagement as part of the 2023 IRP development.

As a result of these failures, Dr. Woods concludes that the Commission should not find Dominion's 2023 IRP to be reasonable and in the public interest.

Finally, Dr. Woods provides specific recommendations to the Commission concerning the Company's IRPs moving forward. The Commission should:

1. Require that the Company's IRPs consider environmental justice impacts of its resource decisions.
2. Establish a load forecasting working group that is led by the Commission and includes a broad range of representatives.
3. Mandate that Dominion assume new, increasing energy efficiency requirements in every three-year period after 2023-2025.
4. Require that the Company's Alternative Plans meet all its obligations under the VCEA by the dates specified.
5. Require that the Company assess the compliance costs associated with the EPA's proposed new regulations and model a social cost of carbon that is in line with the EPA's most recent proposed price.
6. Order Dominion to commence stakeholder meetings for its next IRP as soon as possible.

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I. Introduction and qualifications

Q. Please state your name, business address, and position.

A. My name is Bryndis Woods, PhD. I am a Senior Researcher at the Applied Economics Clinic, located at 6 Liberty Sq., PMB 98162, Boston, MA, 02109.

Q. Please describe the Applied Economics Clinic.

A. The Applied Economics Clinic is a 501(c)(3) non-profit consulting group. Founded in February 2017, the Clinic provides expert testimony, analysis, modeling, policy briefs, and reports for public interest groups on the topics of energy, environment, consumer protection, and equity, while providing on-the-job training to a new generation of technical experts.

Q. On whose behalf are you testifying in this case?

A. I am testifying on behalf of Clean Virginia.

Q. Please summarize your work experience and educational background.

A. I am a researcher with over a decade of experience in research and analysis, with a focus on energy and climate issues. I have authored more than seventy reports, journal articles, book chapters, and blog posts on topics related to renewable energy, energy efficiency, environmental justice, climate policy, and climate adaptation. I have presented my work at international conferences around the world, including the European Climate Change Adaptation Conference and the Annual Conference of the European Association of Environmental and Resource Economists. Prior to joining the Applied Economics Clinic, I worked as a researcher at the Nordic Centre of Excellence for Strategic Adaptation Research, examining crop choice as a climate change adaptation among Danish farmers. I also worked as an analyst at Business for Social Responsibility, working with bi- and multilateral development institutions and with corporate clients on issues including adaptation and resilience, climate adaptation governance, supply chain sustainability and climate risk management. I currently contribute work as a staff writer for the International Institute for Sustainable Development's Earth Negotiations Bulletin, reporting on international sustainable development conference processes including the Intergovernmental Panel on Climate Change, the Global Platform for Disaster Risk Reduction and the United Nations Framework Convention on Climate Change.

I have provided written testimony before the Massachusetts Department of Public Utilities in Docket No. DPU 14-153A/14-154A regarding Eversource's justification of the need for its proposed East Eagle Street Substation. I have also provided expert comments to the New York State Department of Environmental Conservation (DEC) regarding the Draft Title V Air Permit and the Draft Supplemental Environmental Impact Statement for Astoria Gas Turbine Power LLC's proposed Astoria Replacement Project.

I hold a PhD and a Master of Science—both in Environment and Natural Resources and both from the University of Iceland. I also hold a Bachelor of Arts in Sociology from the University of Michigan. My curriculum vitae is attached as Exhibit A.

Q. Have you previously testified before the Virginia State Corporation Commission ("the Commission")?

A. No, I have not.

Q. What is the purpose of your testimony?

A. My testimony focuses on issues in Virginia Electric and Power Company's ("Dominion" or "the Company") 2023 Integrated Resource Plan (IRP), including: environmental justice, Dominion's least-cost plan, load and energy forecast, compliance with the Virginia Clean Economy Act (VCEA), greenhouse gas emission forecasts, cost assumptions regarding coal plants and carbon dioxide (CO_2) emissions, and stakeholder engagement.

I address failures by the Company in its 2023 IRP to:

- Meet the basic obligations of the VCEA including energy efficiency requirements, renewable energy requirements and fossil fuel retirement requirements;
- Present useful modeling results: the Company fails to identify a preferred plan, a feasible least-cost plan, or present meaningfully distinct modeling results over the planning period;
- Account for federal regulations that impact its coal fleet or consider a reasonable social cost of carbon; or
- Address environmental justice impacts of its resource planning decisions or conduct any stakeholder engagement as part of the 2023 IRP development.

As a result of these failures, I conclude that the Commission cannot find Dominion's 2023 IRP to be reasonable and in the public interest, and I provide specific recommendations for the Company's IRPs moving forward.

Q. What information did you review in preparing your testimony in this case?

A. I reviewed the Company's 2020 IRP, 2021 and 2022 IRP updates, and 2023 IRP. I also reviewed the Company's testimony and discovery responses.

Q. Are you sponsoring any exhibits in this proceeding?

A. Yes, I sponsor Exhibits A and B.

- Exhibit A – Curriculum Vitae of Dr. Bryndis Woods
- Exhibit B – Company responses to the following information requests, referenced in my testimony:
    - Clean Virginia
        - Set 01-07
        - Set 01-10(f)
        - Set 01-16(a-c)
        - Set 01-17-i
        - Set 02-19(b)
        - Set 02-22(a-b)

    - Set 04-31
    - Set 02-23(a-e)
- Appalachian Voices
    - Set 05-04
    - Set 05-04 (KS)
    - Set 06-11
- Staff
    - Set 01-32
    - Set 01-52
    - Set 04-130
    - Set 05-136
- Microsoft
    - Set 01-05
- Sierra Club
    - Set 03-04

Q. Please describe Virginia Electric and Power Company.

A. Virginia Electric and Power Company ("the Company") is headquartered in Richmond, Virginia and serves approximately 2.7 million electric customers in Virginia and North Carolina. The Company is a subsidiary of Dominion Energy, Inc. ("Dominion")—one of the nation's largest energy producers, serving more than seven million customers across 16 states with electricity or gas.

Q. Please describe the Company's Integrated Resource Plan (IRP) obligations in Virginia.

A. Chapter 24 of Title 56 of the Code of Virginia requires electric utilities to file an IRP every three years. As part of preparing an IRP, each utility should forecast electric demand and "recommended plans to meet that forecasted demand and assure adequate and sufficient reliability of service."[1] These plans should include: generation from facilities the utility owns or intends to construct or purchase that are sufficient to meet forecasted demand; planned load and peak load reductions from demand reduction programs, such as energy efficiency programs; planned energy storage resources to ensure reliable energy supply; and diverse generation capacity resources to "reduce the risks associated with an over-reliance on any particular fuel or type of generation."[2]

After January 1, 2024, "each electric utility not subject to an annual review shall file an annual update to the integrated resource plan by October 15"[3] that complies with any relevant orders from the Commission. IRPs and IRP updates from 2024 onwards must propose the "most cost effective means of complying with current and pending state and federal environmental regulations" and "a long-term plan for energy efficiency measures to accomplish policy goals of reduction in customer bills, particularly for low-income,

[1] Va. Code § 56-599.
[2] Ibid.
[3] Ibid.

elderly, and disabled customers; reduction in emissions; and reduction in carbon intensity."[4] In addition, IRPs and IRP updates in 2024 or later must conduct "a facility retirement study for owned facilities located in the Commonwealth that emit carbon dioxide as a byproduct of combusting fuel" and a "stakeholder review process [that] provide[s] opportunities for the public to contribute information, input, and ideas on the utility's integrated resource plan, including the plan's development methodology, modeling inputs, and assumptions, as well as the ability for the public to make relevant inquiries, to the utility when formulating its integrated resource plan."[5]

Q. What are the key provisions of the Virginia Clean Economy Act (VCEA)?

A. Passed during the 2020 General Assembly session, the VCEA requires utilities to retire all carbon-emitting electric generating units that are located in Virginia by December 31, 2045,[6] created a renewable energy portfolio (RPS) program with a deficiency payment structure (for any utility "unable to meet the compliance obligations of the RPS Program"), created an energy efficiency resource standard (EERS), established mandatory renewable energy capacity and storage capacity development targets, and requires the Virginia State Corporation Commission ("Commission") to consider the social cost of carbon in applications for new generating facilities and to ensure that the development of new energy resources does not adversely impact historically economically disadvantaged communities.[7]

Q. Please summarize your findings and recommendations.

A. I find that Dominion's IRP is not reasonable or in the public interest because the Company's 2023 IRP fails to:

- Address potential environmental justice impacts related to its resource decisions in its 2023 IRP,
- Identify a feasible, least-cost plan or preferred plan,
- Present the cost of its short-term action plan, making it impossible to determine the impact of the Company's resource planning decisions on Virginia customers,
- Account for the degree of uncertainty related to the role of data centers in PJM's load forecast (which is adjusted by the Company),
- Assume additional energy efficiency requirements post-2025 as clearly stated in the VCEA,
- Build VCEA-mandated amounts of solar, onshore wind or energy storage capacity by the dates required,
- Present Alternative Plans that comply with the VCEA's mandate to retire all carbon-emitting generation by the end of 2045,
- Adequately account for federal regulations that impact its coal fleet or consider a social cost of carbon, and

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[4] Ibid.

[5] Ibid.

[6] Virginia Acts of Assembly. April 11, 2020. Chapter 1193 Section 56-585.5 (3) Generation of electricity from renewable and zero carbon sources. Available at: https://lis.virginia.gov/cgi-bin/legp604.exe?201+ful+CHAP1193+pdf.

[7] Ibid.

- Conduct any stakeholder engagement as part of the 2023 IRP development.

I conclude that the Commission should not find Dominion's 2023 IRP to be reasonable and in the public interest, and I provide specific recommendations for the Commission, including:

1. The Commission should not conclude that Dominion's 2023 IRP is either "reasonable" or "in the public interest"[8] because:
    a. It fails to identify a preferred plan, present a feasible least-cost plan, or provide meaningfully distinct Alternative Plans, as required by the Commission's 2020 IRP Final Order.
    b. It fails to meet the basic obligations of the VCEA in its Alternative Plans.
    c. It does not adequately account for EPA's proposed new limits on coal units' CO_2 emissions as part of Section 111(d) of the Clean Air Act, the EPA's proposed Good Neighbor Plan, and the federal government's social cost of carbon.
2. The Commission should require that the Company's IRPs consider environmental justice impacts of its resource decisions.
3. The Commission should establish a load forecasting working group that is led by the Commission and includes a broad range of representatives.
4. The Commission should mandate that Dominion assume new, increasing energy efficiency requirements in every three-year period after 2023-2025.
5. The Commission should require that the Company construct Alternative Plans that meet <u>**all**</u> its obligations under the VCEA, namely: the RPS; the development of solar, onshore wind, and energy storage capacity in the amounts and by the dates specified in the VCEA; <u>**and**</u> the retirement of all biogenic and non-biogenic carbon-emitting resources by the end of 2045, with those retirements taking place at a steady pace between 2025 and 2045.
6. The Commission should require that the Company assess the compliance costs associated with the EPA's proposed new limits on coal units' CO_2 emissions as part of Section 111(d) of the Clean Air Act and its Good Neighbor Plan and model a social cost of carbon that is in line with the EPA's most recent proposed price.
7. The Commission should order Dominion to commence stakeholder meetings for its next IRP as soon as possible; clearly communicate the information, materials, and data that Dominion must make available to stakeholders; and provide clear guidance for the Company regarding how many stakeholder meetings should be held and what topics should be addressed.

[8] Virginia State Corporation Commission. Case No. PUR-2020-00035. Dominion 2020 IRP Final Order. "Pursuant to Code § 56-599 C, the Commission must, after giving notice and an opportunity to be heard, determine whether Dominion's IRP is reasonable and in the public interest."

II. Dominion fails to address environmental justice issues in its 2023 IRP as ordered by the Commission.

Q. Does the Commission require Dominion to address environmental justice in its 2023 IRP?

A. Yes. According to the Commission's Final Order regarding Dominion's 2020 IRP, "[T]he Commission finds that the Company should address environmental justice in future IRPs and updates, as appropriate. As one example, the Company may consider the impact of unit retirement decisions on environmental justice communities or fenceline communities."[9]

Q. Has Dominion complied with the Commission's order to address environmental justice impacts of its resource planning?

A. No. Dominion's 2023 IRP does not consider or assess the impact of any of its Alternative Plans on environmental justice communities or fenceline communities.

Q. Does Dominion address environmental justice in any way in its 2023 IRP?

A. Yes. Dominion's 2023 IRP includes a section titled "Environmental Justice" that provides examples of how the Company approaches environmental justice evaluations on a case-by-case basis, rather than as part of long-term resource planning.

Section 9.1 of Dominion's 2023 IRP states that,

> *The Company believes that...environmental justice is best evaluated and carried out on a case-by-case basis, informed by the location of the project in question and project-specific characteristics. The Company has established an environmental justice review process for evaluating its specific projects and programs that implicate environmental justice consistent with relevant laws and regulations...the Company presents the results of these project-specific review processes in the relevant proceedings before the SCC, such as in its applications to construct new generating facilities or new transmission lines.*[10]

Dominion's IRP does not mention environmental justice outside of Section 9.1.

Q. Does Dominion provide any more detail regarding its environmental justice review process in its 2023 IRP?

A. No, Dominion's 2023 IRP does not provide any evidence of having performed an environmental justice review process and fails to explain whether or not it considers impacts on environmental justice communities or fenceline communities, as ordered by the Commission.

Q. What are the consequences of Dominion's failure to assess the environmental justice impacts of its

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[9] Commonwealth of Virginia. State Corporation Commission. February 1, 2021. Case No. PUR-2020-00035. FINAL ORDER. Re: Virginia Electric and Power Company's Integrated Resource Plan filing pursuant to Va. Code § 56-597 et seq. Page 14-15.

[10] Dominion Energy. 2023. "Integrated Resource Plan." Page 121.

resource planning decisions?

A. Dominion's failure to assess the environmental justice impacts of its resource planning decisions results in a lack of information for the public and the Commission to consider regarding how Dominion's resource decisions impact communities directly. For example, environmental justice impacts include community-level health, environmental, and economic impacts from resource additions or retirements.

Q. How should Dominion address the environmental justice impacts of its resource planning decisions?

A. I recommend that the Commission reiterate and clarify its requirement that the Company "consider the impact of unit retirement decisions on environmental justice communities or fenceline communities."[11] In the Company's IRPs, the Commission should specifically require the Company to:

- Present how the Company identifies potential environmental justice issues, including screening metrics,
- Conduct engagement with communities affected by potential environmental justice issues, and report on those efforts,
- Assess and present the community-level health, environmental, and economic impacts from planned resource additions or retirements,
- Assess and present the changes in air quality or water quality anticipated from resource decisions within Dominion's service territory,
- Assess and present how energy costs impact different communities within Dominion's service territory differently,
- Include Alternative Plans that directly address environmental justice issues, such as by siting distributed energy resources in environmental justice communities or by prioritizing fossil fuel-fired generation retirements in environmental justice communities, and
- Specify how energy efficiency, demand response, and distributed energy resource programs are being targeted at underserved and vulnerable environmental justice community households, such as by offering income- or disability-qualified benefits, or by targeting program dollars towards specific communities.[12]

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[11] Commonwealth of Virginia. State Corporation Commission. February 1, 2021. Case No. PUR-2020-00035. FINAL ORDER. Re: Virginia Electric and Power Company's Integrated Resource Plan filing pursuant to Va. Code § 56-597 et seq. Page 14-15.

[12] Kallay, J., A Napoleon, K. Takahashi, E. Sinclair, T. Woolf. 2021. *Opportunities for Evergy Kansas within its Integrated Resource Plan and Other Planning Processes.* Prepared for the Union of Concerned Scientists and CleanAirNow. Synapse Energy Economics. Available at: https://www.synapse-energy.com/sites/default/files/Equity_in_Evergy_KS_IRP_Report_21-051.pdf.

III. Dominion fails to identify a feasible least-cost plan or a preferred plan. The Company's Alternative Plans are too similar to provide meaningful comparisons of future resource pathway options.

Q. Did the Commission require Dominion to include a least-cost plan in its 2023 IRP?

A. Yes. In its 2020 IRP Final Order, the Commission required that the Company "include a least cost VCEA plan that would meet (i) applicable carbon regulations and (ii) the mandatory [Renewable Portfolio Standard (RPS)] Program requirements of the VCEA."[13]

Q. Does Dominion's 2023 IRP include a least-cost plan that meets applicable carbon regulations and Virginia's RPS?

A. No. The Company presents its Alternative Plan A as its least-cost plan (with a net present value of $109.7 billion), but that Plan is not fully compliant with the VCEA. Alternative Plan A only complies with Virginia's Renewable Portfolio Standard requirements and not with the carbon-emission reduction requirements of the VCEA. This section of the law requires Dominion to retire all carbon-emitting generating units by December 31, 2045.[14] The VCEA includes renewable portfolio standard (RPS) requirements, which mandate a percentage of Dominion's total electric energy sold that must come from renewable energy resources.[15] As I discuss in more detail in Section VI of my testimony, in 2024, 23 percent of Dominion's total energy sold must come from renewable resources, a share that increases to 41 percent in 2030, 59 percent in 2035, 79 percent in 2040, and 100 percent in 2045.[16] Alternative Plan A does not retire all carbon-emitting units by 2045 as required by the VCEA.

Q. What are Dominion's emission reduction requirements under the VCEA?

A. Dominion must retire all carbon-emitting generating units by December 31, 2045.[17] Dominion's Alternative Plan A does not meet this requirement and its emissions increase over the planning period—from about 25 million metric tons of CO_2 in 2023 to almost 45 million metric tons in 2048. In fact, Alternative Plan A has the highest CO_2 emissions of any of the five Alternative Plans presented in the 2023 IRP (see Figure 1, which is Figure 2.2.6 in Dominion 2023 IRP. This figure compares CO_2 emissions across Alternative Plans).

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[13] Commonwealth of Virginia. February 1, 2021. *2020 IRP Final Order.* Available at: https://scc.virginia.gov/docketsearch/DOCS/4r%24t01!.PDF#:~:text=FINAL%20ORDER%20On%20March%209%2C%202020%2C%20the%20State,a%20respondent%20by%20filing%20a%20notice%20of%20participation. Page 14.

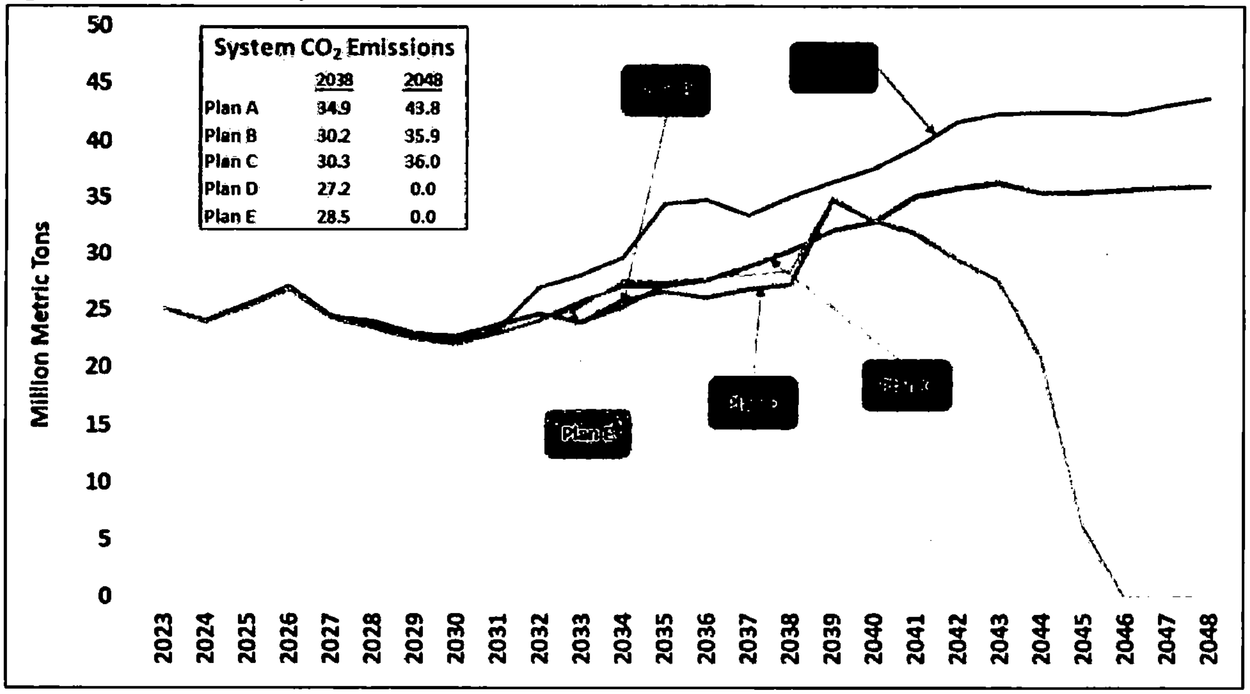
[14] Va. Code § 56-585.5 Section 56-585.5

[15] ""Renewable energy" means energy derived from sunlight, wind, falling water, biomass, sustainable or otherwise, (the definitions of which shall be liberally construed), energy from waste, landfill gas, municipal solid waste, wave motion, tides, and geothermal power, and does not include energy derived from coal, oil, natural gas, or nuclear power." Va. Code § 56-576.

[16] Va. Code § 56-585.5.

[17] Ibid.

Figure 1. CO_2 emissions by Alternative Plan



Source: Reproduced from Dominion 2023 IRP Figure 2.2.6 – System CO 2 Output from Company Fleet for Alternative Plans (based on current technology).

Q. Does the Company find that its least-cost plan represents a feasible path forward?

A. No. The Company concludes that Alternative Plan A (its least-cost plan) is not feasible. Dominion states that Alternative Plan A does not present a "true alternative path forward" because it does not meet the VCEA renewable energy capacity development targets and exhibits an "over-reliance on third-party solar [power purchase agreements, PPAs]."[18]

Q. Could the Company have used its least-cost plan to develop a "true alternative path forward"?

A. Yes. The Company could have iterated its least-cost plan—correcting and fine-tuning assumptions and modeling choices—until it represented a path forward that the Company deemed feasible. Electric-system resource planning is complex and almost always requires iteration to achieve reasonable results within the boundaries of real-world limitations, regulatory mandates, and expected future conditions. The Company's conclusion that impractical results from first-round modeling make it impossible to present a feasible plan to the Commission, as required by the Commission, is incorrect. Furthermore, the inclusion of a least-cost plan specifically designated by Dominion as infeasible is not adequate to meeting the requirements of the 2020 IRP Final Order.

Q. Does Dominion identify a preferred plan in its 2023 IRP?

[18] Dominion Energy. 2023. "Integrated Resource Plan." Page 23.

A. No. The Company's 2023 IRP does not designate a preferred plan; it only identifies a "short-term action plan" that identifies actions the Company expects to take "related to existing and proposed generation resources" over the next five years (2024 to 2029).[19] A short-term action plan is not a replacement for a preferred plan in IRP planning processes. A short-term action plan identifies specific near-term actions while a preferred plan identifies broader resource planning decisions within a longer-term context.

Q. Is Dominion required to identify a preferred plan?

A. No, Dominion is not required to select a preferred plan, but the selection of a preferred plan (usually, the least-cost plan that also meets public policy mandates and objectives and reliability requirements) is a common practice in utility IRP planning.[20] The selection of a preferred plan provides concrete guidance regarding the utility's intentions with respect to resource procurements and program offerings throughout the planning period.

Q. What are the consequences of failing to provide a feasible least-cost plan and a preferred plan?

A. The consequences of failing to provide a feasible least-cost plan include unnecessary costs borne by Virginia ratepayers together with Dominion's failure to meet the requirements of the 2020 IRP Final Order. By failing to identify a preferred plan Dominion leaves the Commission in the dark regarding intended resource procurements, resource retirements, and program offerings over the medium- and long-term.

Q. Does Dominion's short-term action plan identify specific resource additions and/or retirements?

A. Other than completing or continuing construction of projects already in development, Dominion's short-term action plan mentions only one specific generation capacity resource addition in the next five years: "continue development work for 970 [megawatts (MW)] of new gas-fired CTs."[21] Otherwise, the short-term action plan's very general description of future resource additions and retirements lacks any specific information regarding size, location, or expected date online. For example:

- "Meet targets under Virginia's mandatory RPS Program at a reasonable cost";
- "Continue to evaluate potential unit retirements or replacement of existing units in light of changing market conditions and regulatory requirements"; and
- "Continue to evaluate pilot energy storage projects associated with the battery storage pilot program established by the Grid Transformation and Securities Act of 2018 ("GTSA")."[22]

Q. Do Dominion's five Alternative Plans present meaningful comparisons regarding potential pathways

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[19] Dominion Energy. 2023. "Integrated Resource Plan." Page 37.

[20] Duncan, J., J. Eagles, D. Farnsworth, J. Shenot and J. Shipley. 2021. *Participating in Power: How to Read and Respond to Integrated Resource Plans.* Regulatory Assistance Project and Institute for Market Transformation. Available at: https://www.raponline.org/wp-content/uploads/2021/10/rap_imt_participating_in_power_how_to_read_and_respond_to_integrated_resource_plans_2021_october.pdf. Page 7.

[21] Dominion Energy. 2023. "Integrated Resource Plan." Page 37.

[22] Dominion Energy. 2023. "Integrated Resource Plan." Page 37.

forward for the Company's capacity resource development in the next five years?

A. No. According to the IRP: "Both the build plans and the carbon projections in all five Alternative Plans are similar for the first ten years."[23] Indeed, as Table 1 demonstrates, all five Alternative Plans are nearly identical in terms of resource mix over the first five years of the planning period. None of the five Alternative Plans add any resources in 2024 and all five Alternative Plans have identical resource additions in 2025 and 2026. In 2027 and 2028, resource additions vary little across the five Alternative Plans—Alternative Plans A, C and E are nearly identical as are Alternative Plans B and D. It is important to note that the source of the information presented in Table 1 below is Staff information request set 01-52, which is not consistent with the capacity additions presented in Dominion's 2023 IRP Figures 2.2.1 to 2.2.5. For example, Figures 2.2.1 to 2.2.5 indicate that none of the five Alternative Plans add any resources in 2024, 2025 or 2026.

Dominion's Alternative Plans provide very little insight by lacking meaningfully distinct pathways in the near future. Dominion's failure to provide a preferred plan for the full IRP planning period—and designation only of a short-term action plan for the next five years—is insufficient guidance regarding the Company's resource build out plans. In addition, Dominion's modeling resulted in five Alternative Plans that are overwhelmingly similar during the period of Dominion's short-term action plan focus (2024-2028), which is insufficient to allow meaningful review and assessment by IRP process stakeholders and their third-party experts.

[23] Dominion Energy. 2023. "Integrated Resource Plan." Page 30.

Table 1. Alternative Plans resource additions over next five years (megawatts, MW)

		2024	2025	2026	2027	2028
Solar	A	0	290	546	980	1,177
	B	0	290	546	843	981
	C	0	290	546	980	1,177
	D	0	290	546	843	981
	E	0	290	546	980	1,177
Wind	A	0	0	0	957	960
	B	0	0	0	957	960
	C	0	0	0	957	947
	D	0	0	0	957	960
	E	0	0	0	957	947
Storage	A	0	53	154	161	166
	B	0	53	154	161	249
	C	0	53	154	161	166
	D	0	53	154	161	249
	E	0	53	154	161	166
Fossil	A	0	0	0	0	0
	B	0	0	0	0	970
	C	0	0	0	0	0
	D	0	0	0	0	970
	E	0	0	0	0	0
Nuclear	A	0	0	0	0	0
	B	0	0	0	0	0
	C	0	0	0	0	0
	D	0	0	0	0	0
	E	0	0	0	0	0

Note: Dominion does not distinguish between onshore and offshore wind, so the "wind" category includes both.
Data source: Staff information request set 01-52.

Q. What are the consequences of the similarity of Dominion's five Alternative Plans over its short-term action plan focus (2024-2028)?

A. Providing a range of possible futures and possible capacity resource build-out alternatives in IRP planning permits a robust consideration of the costs, benefits, and tradeoffs associated with various resource pathways. Failure to provide an appropriate range of alternatives for comparison results in an overly myopic view of the potential resource pathways available. For example, according to IRP Figures 2.2.1 to 2.2.5, none of the five Alternative Plans presented by Dominion build the maximum annual distributed solar capacity allowed by the Company's modeling in the first five years of the planning period. According to the Company's response to Staff information request set 01-52, all five Alternative Plans build identical amounts of storage capacity in the first four years of the planning period. An Alternative Plan that emphasized distributed generation and storage resources would have been a useful comparison to other Alternative Plans that rely more heavily on utility-owned resources and PPAs.

Staff testimony in Dominion's 2020 IRP proceeding acknowledged the need for meaningfully distinct Alternative Plans—staff noted that "Although Staff requested numerous model runs through discovery, the Company only provided one additional model run and refused to provide any of the model runs requested by Staff" and staff's belief that "the results of these model runs would have created a more robust record and provided insight to the Commission on various resource combinations allowed to meet the requirements of the VCEA."[24]

Q. Do Dominion's five Alternative Plans present meaningfully distinct resource additions over the entire 25-year planning period?

A. No. Over the entire 25-year planning period, all five Alternative Plans add exactly the same amount of wind capacity, and—with the exception of Alternative Plan A, which the Company does not see as a "true alternative path forward"[25]—the remaining four Alternative Plans add very similar amounts of solar resources (see Table 2). Alternative Plans B and C also add almost exactly (or exactly) the same amount of storage, fossil, and nuclear resources. The same is true of Alternative Plans D and E. (Note: The "nuclear" capacity additions in Dominion's 2023 IRP are comprised entirely of small modular reactors (SMRs), which are a "classification of nuclear reactors designed to produce up to 300 MW of electricity per reactor").[26] It is important to note that the source of the information presented in Table 1 below is Staff information request set 01-52, which is not consistent with the capacity additions presented in Dominion's 2023 IRP Figures 2.2.1 to 2.2.5. For example, Figures 2.2.1 to 2.2.5 indicate that nuclear capacity additions total more than 1,600 MW in Alternative Plans B and C, more than 4,800 MW in Alternative Plan D, and more than 4,200 MW in Alternative Plan E.

Table 2. Alternative Plans cumulative resource additions (MW) at end of planning period (2048)

	Solar	Wind	Storage	Fossil	Nuclear
Plan A	2,649	1,521	3,049	9,300	0
Plan B	2,915	1,521	3,927	2,910	1,464
Plan C	2,905	1,521	4,019	2,910	1,464
Plan D	3,495	1,521	7,461	970	4,392
Plan E	3,543	1,521	7,970	970	3,904

Source: Staff information request set 01-52.

[24] Commonwealth of Virginia. September 29, 2020. In re: Virginia Electric and Power Company's Integrated Resource Plan filing pursuant to VA Code Section 56-597 et seq. Available at: https://www.scc.virginia.gov/docketsearch/DOCS/4p8s01!.PDF. Page 14.

[25] Dominion Energy. 2023. "Integrated Resource Plan." Page 23.

[26] Ibid. Page 10.

Q. Does Dominion's 2023 IRP provide enough information to determine whether its planning is reasonable and in the public interest as required by the Commission and Virginia law?

A. No. Because it fails to identify a preferred plan, present a feasible least-cost plan, or provide meaningfully distinct Alternative Plans, Dominion's 2023 IRP cannot be characterized as either "reasonable" or "in the public interest"[27] as required by the Commission's 2020 IRP Final Order. Dominion also fails to present the cost of its short-term action plan, making it impossible to determine the impact of the Company's resource planning decisions on Virginia customers. Dominion does present a customer bill projection for Alternative Plan B—however, this estimate is insufficient to determine likely costs to Dominion customers, because Dominion neither names Alternative Plan B as its preferred plan nor presents a customer bill projection for its short-term action plan.

IV. Dominion does not adequately account for uncertainties related to PJM's load forecast

Q. How does a load forecast impact IRP modeling?

A. Best practices in IRP modeling require accurate load forecasts predicting peak electric demand in future years. Load forecasts are used in IRP modeling to determine how much generating capacity will be needed to meet the utility's capacity requirements. An underestimate of future load will lead to underbuilding (or procuring) of capacity, harming energy reliability, while an overestimate of load will lead to overbuilding (or procuring) of capacity at customers' expense.

Q. Is Dominion required to use PJM's load and energy forecasts in its IRP modeling?

A. Yes. The Commission has required Dominion to use PJM's load and energy forecasts "for the Company's long-term planning."[28] PJM produces load and energy forecasts for the Dominion Energy Zone ("DOM Zone"), which includes—but is not limited to—the Company's service territory. According to the 2023 IRP, the Company "utilized the DOM Zone load forecast as published by PJM in its 2023 PJM Load Forecast Report dated January 2023 in the development of all Alternative Plans included in this 2023 Plan."[29] However, the 2023 IRP goes on to explain that Dominion adjusts both PJM's DOM Zone load and energy forecasts "for modeling purposes"[30] to reflect the Dominion Energy Load Serving Entity ("DOM LSE"). Dominion's adjustment "scales down" PJM's DOM Zone to represent only Dominion's DOM LSE Zone.[31] As I discuss below in Section V, Dominion also adjusts PJM's annual energy demand forecasts for use in its IRP.

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[27] Virginia State Corporation Commission. Case No. PUR-2020-00035. Dominion 2020 IRP Final Order. "Pursuant to Code § 56-599 C, the Commission must, after giving notice and an opportunity to be heard, determine whether Dominion's IRP is reasonable and in the public interest."

[28] Dominion Energy. 2023. "Integrated Resource Plan." Page 6.

[29] Ibid. Page 42.

[30] Ibid.

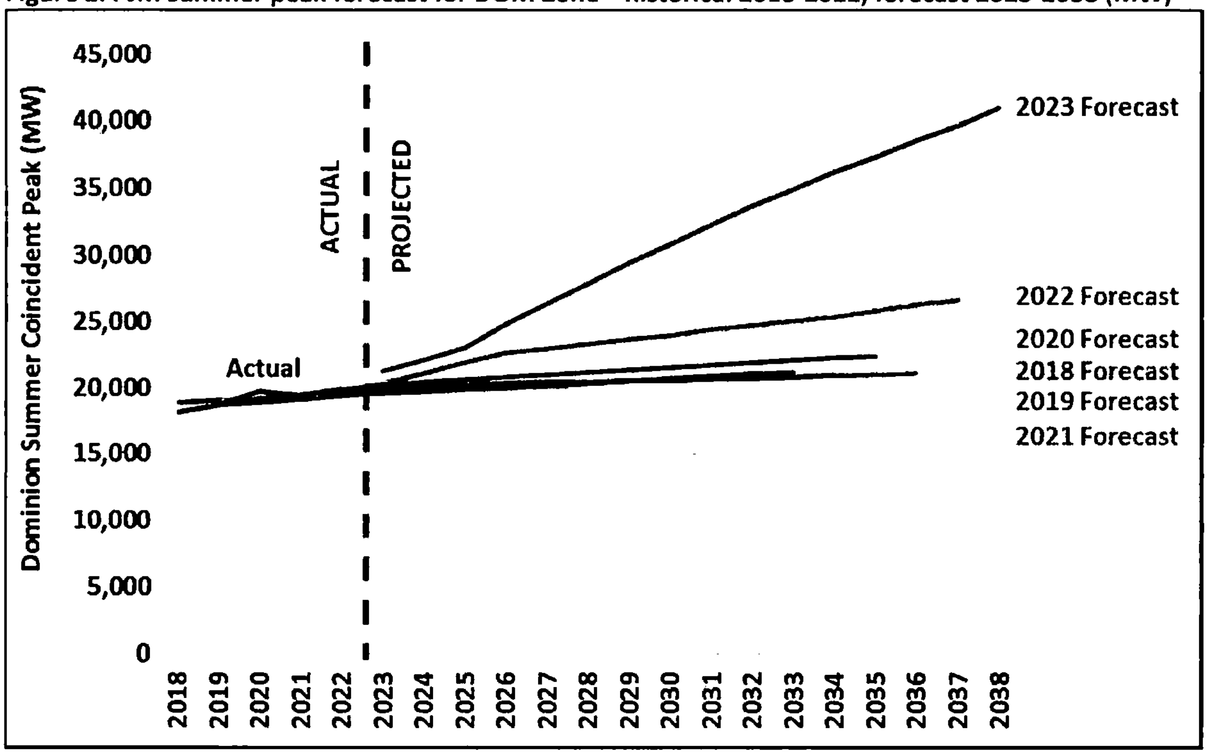
[31] Ibid.

Q. How have PJM's load forecasts for Dominion's service territory changed since Dominion's last IRP?

A. Historical load forecasts specific to Dominion's DOM LSE Zone are not available. However, given the scaling method utilized by Dominion, changes in PJM's load forecasts for the DOM Zone are a close proxy for changes in DOM LSE forecasts. PJM's DOM load forecasts have grown substantially higher in each successive vintage, from 20,799 MW in 2033 predicted in PJM's 2019 forecast up to 32,276 MW in 2033 predicted in the 2023 forecast (see Figure 2).

The bulk of this additional expected load comes from a prediction that new data centers will open in Virginia. These predicted data centers are alone expected to account for over 12,000 MW of total peak demand by 2038 (an amount equal to almost one-half of the DOM LSE Zone total peak load).[32] In comparison, electric vehicles are expected to contribute about 1,700 MW in the same timeframe.[33]

Figure 2. PJM summer peak forecast for DOM Zone—historical 2018-2022, forecast 2023-2038 (MW)



Data sources: 1) PJM Resource Adequacy Planning Department. January 2019. "PJM Load Forecast Report." Available at: https://www.pjm.com/planning/resource-adequacy-planning/load-forecast-dev-process.aspx; 2) PJM Resource Adequacy Planning Department. Jan 2020. "PJM Load Forecast Report." Available at: https://www.pjm.com/planning/resource-adequacy-planning/load-forecast-dev-process.aspx; 3) PJM Resource Adequacy Planning Department. Jan 2021. "PJM Load Forecast Report." Available at: https://www.pjm.com/planning/resource-adequacy-planning/load-forecast-dev-process.aspx; 4) PJM Resource Adequacy Planning Department. Jan 2022. "PJM Load Forecast Report." Available at:

[32] Ibid. Page 58.

[33] Ibid. Page 48.

https://www.pjm.com/planning/resource-adequacy-planning/load-forecast-dev-process.aspx; 5) PJM Resource Adequacy Planning Department. Jan 2023. "PJM Load Forecast Report." Available at: https://www.pjm.com/-/media/library/reports-notices/load-forecast/2023-load-report.ashx; 6) PJM. 2022. "Summer 2022 Weather Normalized RTO Coincident Peaks (MW)." Available at: https://www.pjm.com/-/media/planning/res-adeq/load-forecast/summer-2022-peaks-and-5cps.ashx; 7) PJM. 2021. "Summer 2021 Weather Normalized RTO Coincident Peaks (MW)." Available at: https://www.pjm.com/-/media/planning/res-adeq/load-forecast/summer-2021-peaks-and-5cps.ashx; 8) PJM. 2020. "Summer 2020 Weather Normalized RTO Coincident Peaks (MW)." Available at: https://www.pjm.com/-/media/planning/res-adeq/load-forecast/summer-2020-peaks-and-5cps.ashx; 9) PJM. 2019. "Summer 2019 Weather Normalized RTO Coincident Peaks (MW)." Available at: https://www.pjm.com/-/media/planning/res-adeq/load-forecast/summer-2019-peaks-and-5cps.ashx; 10) PJM. 2018. "Summer 2018 Weather Normalized RTO Coincident Peaks (MW)." Available at: https://www.pjm.com/-/media/planning/res-adeq/load-forecast/20181017-summer-2018-peaks-and-5cps.ashx.

Q. How many data centers are driving the forecasted increases in peak load?

A. In Dominion's response to Clean Virginia information request set 02-19b, the Company notes that PJM's load forecast "does not forecast individual data centers."[34] However, Dominion's response to Staff's information request set 04-130 acknowledges that "10 [data center] customers account for >80% of the Company's data center demand."[35] That means that, on average, each large data center amounts to 8 percent of total data center load (10,000 MW in 2038), or 800 MW.

Q. Does Dominion's 2023 IRP include a sensitivity analysis of its adjusted PJM load forecast?

A. Yes, Dominion's 2023 IRP includes a sensitivity analysis of its adjusted PJM load forecast, but only on Alternative Plan B. Dominion performs a sensitivity analysis that increases and decreases the adjusted PJM load forecast for Alternative Plan B by 5 percent.[36]

Q. Does Dominion's sensitivity analysis adequately account for uncertainties related to its adjusted PJM load forecast?

A. No. Dominion's sensitivity analysis does not adequately account for uncertainties related to PJM's load forecast. The sensitivity range explored (plus and minus 5 percent) is too narrow to encompass real uncertainties in future load, especially given the potential unnecessary costs to Dominion customers if some or none of the anticipated data centers materialize at all, or the risks to energy reliability if load is greater than forecasted.

A more risk-averse sensitivity analysis would have decreased and increased PJM's peak load forecast by a larger amount to reflect the possibility that data center load will be less or more than anticipated. The Company notes that, in its service territory, "the [data center] industry has grown on average 0.5 GW [equal to 500 MW] a year in the last three years."[37] For each large data center that does not materialize,

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[34] Clean Virginia Information Request Set 02-19(b).

[35] Staff Information Request Set 04-130.

[36] The Company also notes that "To properly use the PJM load forecast in the development of this 2023 Plan, the Company needed to adjust that forecast for modeling purposes." Dominion 2023 IRP. Page 42.

[37] Dominion Energy. 2023. "Integrated Resource Plan." Page 55.

Dominion's peak load forecast is reduced by 800 MW—an amount greater than the total annual average data center growth in each of the last three years. Conversely, there is also the risk that data centers of the future will be more energy-intensive than data centers today, due to "rack densification" (i.e. data servers allowing for more computing power in less space, therefore becoming more energy-intensive) or higher-than-anticipated growth in artificial intelligence.

Q. What would be the consequences of Dominion overestimating or underestimating peak load in its 2023 IRP?

A. The consequences of Dominion overestimating peak load in its 2023 IRP are that the Company would overbuild (or procure) generation capacity and overcharge customers for new capacity and associated transmission and distribution infrastructure that is not needed to reliably meet demand. For example, Dominion's short-term action plan indicates the Company's intentions to build 970 MW of gas-fired combustion turbine capacity by 2029. If peak load over the same period is lower than anticipated, this fossil fuel-fired generation capacity may not be needed to meet demand, but Dominion's customers would pay for it all the same.

The consequences of Dominion underestimating peak load in its 2023 IRP are that the Company would under build (or procure) generation capacity and be unable to reliably meet customer demand. This has, in fact, already happened for some data center customers in Dominion's territory when—in June 2022—Dominion told data centers that "new power delivery would be severely limited until January 2026 as it temporarily paused hookups for new data centers."[38]

Q. How does Dominion's IRP load forecast impact other regulatory proceedings?

A. Dominion's load forecast, as established in this IRP proceeding, is a foundational modeling exercise that is also highly relevant in other filings, like RPS, RGGI, and DSM filings.[39] Therefore, it is critically important that stakeholders and third-party have the opportunity to provide input during the development of Dominion's load forecast and review a draft load forecast. See my *Conclusions and recommendations* below for more detailed recommendations for the Commission regarding stakeholder engagement and a load forecasting working group.

V. Dominion's adjustment to PJM's annual energy demand forecast is based on unreasonable assumptions regarding energy efficiency

Q. How does Dominion describe its adjustments to PJM's annual energy demand forecast?

[38] Peter Cary Piedmont Journalism Foundation. July 20, 2023. "Dominion scrambles to meet soaring power demand." Fauquier Times. Available at: https://www.fauquier.com/news/article_41838802-2753-11ee-9875-935ae47126fb.html.

[39] See, for example: Appalachian Voices Comments on the 2022 RPS Hearing Examiner's Report. Available at: https://www.scc.virginia.gov/docketsearch/DOCS/7qv701!.PDF.

A. As described in the Company's response to Appalachian Voices information request set 05-04,[40] Dominion adjusts PJM's annual energy demand forecast by subtracting data centers from PJM's forecast, reducing the remaining PJM DOM Zone forecast down to represent only DOM LSE, adding data center energy back in and adjusting for retail choice, and subtracting non-data center retail choice and energy efficiency.

Q. Are Dominion's adjustments to PJM's annual energy demand forecast reasonable?

A. No. The Company's adjustments to PJM's annual energy demand forecast are based on unreasonable assumptions regarding energy efficiency. The remainder of this section provides a critique of these assumptions.

Q. What are Dominion's energy efficiency requirements under the VCEA?

A. Under the VCEA, Dominion's energy efficiency requirements through 2025 are specified as a cumulative percentage of 2019 energy retail sales, as follows:

- 2022: at least 1.25 percent;
- 2023: at least 2.5 percent;
- 2024: at least 3.75 percent; and
- 2025: at least 5.0 percent.

In addition, the VCEA also notes that, "For the time period 2026 through 2028, and for every successive three-year period thereafter, the Commission shall establish new energy efficiency savings targets."[41]

Q. Do Dominion's adjustments to PJM's annual energy demand forecast assume that the Company meets its energy efficiency requirements under the VCEA through the end of 2025?

A. Yes, in its annual energy demand forecast adjustment Dominion's forecasted energy efficiency savings meet its obligations under the VCEA through 2025. As the Company's response to Clean Virginia's information request set 01-12 indicates, Dominion forecasts that it will meet its energy efficiency requirements under the VCEA through the end of 2025 (see Table 3). It is important to note that the forecasted energy efficiency in Table 3 includes "Category 1 Programs," which consist of "previously approved [energy efficiency] programs that remain effective (i.e., that are still producing savings)", as well as "Category 2 Programs" (or "generic EE/DSM"), which represents "unidentified [energy efficiency] programs and measures designed to meet...the energy savings targets in the VCEA for 2022 through 2025."[42] In other words, Table 3 includes energy savings from both real, active energy efficiency programs and hypothetical, additional energy efficiency programs to meet VCEA efficiency requirements.

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[40] Appalachian Voices Information Request Set 05-04.

[41] Va Code § 56-596.2.

[42] Dominion Energy. 2023. "Integrated Resource Plan." Page 50.

Table 3. Dominion forecasted energy efficiency and Company VCEA targets

Year	Dominion Energy Efficiency	VCEA Target
2022	1,015,674	852,892
2023	1,785,312	1,705,783
2024	2,720,466	2,558,675
2025	3,640,232	3,411,567

Source: Clean Virginia Information Request Set 01-12.

Q. Does Dominion's most recent energy efficiency filing indicate that the Company is on track to meet its requirements under the VCEA through the end of 2025?

A. No. In its ongoing 2022 Demand Side Management (DSM) filing, the Company reports energy efficiency shares for 2022 through 2025 that are not compliant with its energy efficiency requirements under the VCEA—the Company anticipates that its cumulative energy efficiency savings in 2025 will be 2.8 percent (net) or 3.6 percent (gross) (see Figure 3). While the Commission has not yet conducted a proceeding to evaluate Dominion's compliance with these targets, the Commission has indicated that measurement will be based on net savings—that is, savings attributable to Dominion's energy efficiency programs. The Commission has stated that, for purposes of compliance, "the Company must factually establish the amount of savings that occurred as the result of its programs and measures."[43] Dominion projects it will fall short of its 5 percent requirement in 2025.

[43] See Case No. PUR-2021-00247, August 10, 2020 Final Order at 9.

Figure 3. Dominion's actual 2022 energy efficiency and forecasted energy efficiency for 2023-2025 from its application to continue existing and/or to design & operate new peak-shaving & energy efficiency programs or pilots as part of the Company's Demand Side Management (DSM) Portfolio

Data Reflective of 2023 EM&V report and actuals for 2022

Table 1

Net at Meter	YEAR	VCEA Target MWh	VCEA Target %	DSM1-8 MWh	DSM9 MWh	DSM10 MWh	DSM11 MWh	DSM12 MWh**	Opt-Outs MWh	DSM %**
	2022	852,892	1.25%	776,335	4,154	-	-	-	58,754	1.23%
	2023	1,705,783	2.50%	951,859	75,741	128,063	-	-	59,855	1.8%
	2024	2,558,675	3.75%	1,052,964	149,344	321,505	6,321	-	60,955	2.3%
	2025	3,411,567	5.00%	1,052,341	214,222	508,467	17,694	33,662	62,055	2.8%

Table 2

Gross at Meter	YEAR	VCEA Target MWh	VCEA Target %	DSM1-8 MWh	DSM9 MWh	DSM10 MWh	DSM11 MWh	DSM12 MWh**	Opt-Outs MWh	DSM %**
	2022	852,892	1.25%	1,220,054	4,781	-	-	-	58,754	1.9%
	2023	1,705,783	2.50%	1,414,902	87,751	154,418	-	-	59,855	2.5%
	2024	2,558,675	3.75%	1,518,443	176,763	372,158	6,321	-	60,955	3.1%
	2025	3,411,567	5.00%	1,516,260	255,015	570,460	17,694	40,228	62,055	3.6%

** DSM Phase 12 assumes same forecast as DSM Phase 9 only additional years in the future All values exclude NC and non-Jurisdictional DSM reductions

Source: Case No. PUR-2021-00247. DNV Energy Insights. June 15, 2023. "Evaluation, Measurement, and Verification Report for Virginia Electric and Power Company (Dominion Energy)." Page iii.

Q. What does Dominion assume for post-2025 energy efficiency requirements in its modeling?

A. Dominion assumes "a 5% energy savings target for 2026 and beyond."[44] In other words, the Company assumes that the Commission will leave mandatory cumulative energy efficiency targets at 2025 levels (relative to 2019 sales) through the end of the forecast period in 2048. The VCEA states that the Commission will establish "new energy efficiency savings targets" for 2026 through 2028 and every following three-year period.[45] It is difficult to see how Dominion's assumption of flat-lining energy efficiency requirements post-2025 can be consistent with the VCEA's clearly stated intention to set additional energy efficiency requirements post-2025. Additional energy efficiency requirements post-2025 could take the form of an increasing share of 2019 sales (i.e. greater than 5 percent cumulative savings relative to 2019 sales), or they could take the form of new, annual incremental savings targets (i.e. 2

[44] Dominion Energy. 2023. "Integrated Resource Plan." Page 50.

[45] Va. Code § 56-596.2(A)(3).

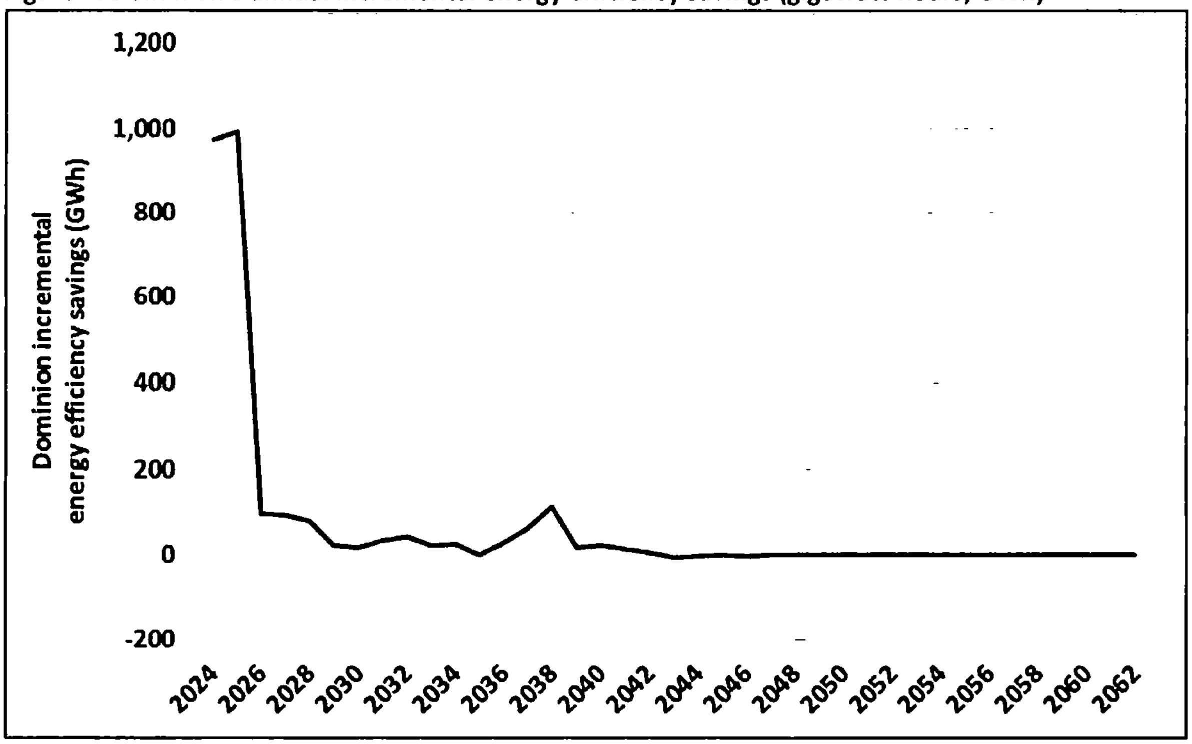
percent annual incremental savings relative to a prior year's sales).

Q. Describe Dominion's energy efficiency savings forecast.

A. Dominion's forecasted energy efficiency savings meet its obligations under the VCEA through 2025. However, after 2025, Dominion assumes that annual incremental energy savings drop drastically (from 995.5 gigawatt-hours (GWh) in 2025 to 97.0 GWh in 2026) and remain near zero throughout the remainder of the forecast period (which is consistent with the assumption that Dominion will maintain a 5 percent cumulative energy efficiency standard—relative to 2019 total sales—from 2025 forward).

Dominion's forecasted incremental energy efficiency savings range from 97 GWh to -3.1 GWh between 2026 and 2048, amounts equal to 0.1 percent or less of its 2019 total sales (68,231 GWh). This suggests that Dominion does not expect to achieve any meaningful energy savings after 2026 (see Figure 4). Dominion's forecasted amount of annual incremental energy efficiency is so low that it seems unlikely that it would keep up with the sunsetting of efficiency measures over time (that is, when a particular energy efficiency measure is no longer expected to provide energy savings). If energy efficiency measures sunsetting were the reason for Dominion's drop in annual incremental energy efficiency savings, I would expect the result to be a steady decline in cumulative efficiency savings levels throughout the modeled period.

Figure 4. Dominion's annual incremental energy efficiency savings (gigawatt-hours, GWh)



Data source: Appalachian Voices Information Request Set 05-04 (KS).

Q. How do energy efficiency resource standards in other states compare to that of Virginia?

A. According to the National Conference of State Legislatures, over 30 other states have mandatory energy efficiency resource standards, with Virginia's being the most recent.[46] Cumulative energy savings targets and annual incremental savings targets vary, but incremental targets are usually in the range of 1 to 3 percent of annual sales. For example:

- Arizona's energy efficiency resource standard established in 2010 required each investor-owned utility to achieve at least 22 percent cumulative annual energy savings (compared to 2019 retail electric sales) by the end of 2020.[47] In 2022, the Arizona Corporation Commission required two investor-owned utilities[48] to achieve at least 1.3 percent incremental annual energy efficiency savings over the next three-year planning period;
- Illinois' electric utilities are required to achieve cumulative energy savings of 16 percent by 2030 relative to 2014-2016 average annual sales;[49]
- Connecticut required 1.1 percent annual incremental energy efficiency savings for electric utilities through the end of 2021;
- Maryland requires electric utilities to reach 2 percent annual incremental energy efficiency savings by the end of 2023;
- Massachusetts required 2.7 percent annual incremental energy efficiency savings for electric utilities through the end of 2021; and
- New York's statewide energy efficiency targets require statewide energy savings of 3.0 percent for electric utilities in 2025 as a percentage of that year's sales.[50]

For comparison, Virginia's cumulative energy efficiency target is 5 percent of 2019 sales by the end of 2025 (or 1.25 percent annual incremental energy savings between 2022 and 2025)—which Dominion assumes it will achieve in its energy forecast. However, between 2026 and 2048, Dominion's forecasted incremental energy efficiency savings are 0.1 percent or less of its 2019 total sales.

Q. Does Dominion's energy efficiency forecast reflect the possibility that its energy efficiency requirements will increase post-2025?

A. No, Dominion's energy efficiency forecast assumes that its energy efficiency requirements will not increase post-2025. Dominion assumes that its energy efficiency requirement will remain at 5 percent of

[46] National Conference of State Legislatures. September 15, 2021. "Energy Efficiency Resource Standards." Available at: https://www.ncsl.org/energy/energy-efficiency-resource-standards-eers.
[47] Arizona Administrative Code. March 31, 2022. Title 14 Chapter 2. Corporation Commission – Fixed Utilities. Available at: https://apps.azsos.gov/public_services/Title_14/14-02.pdf.
[48] 1) Arizona Corporation Commission. February 7, 2022. Docket No. E-00000V-19-0034. Revised Amendment No. 2. Available at: https://docket.images.azcc.gov/E000017819.pdf?i=1644282783233. 2) Arizona Corporation Commission. February 7, 2022. Docket No. E-00000V-19-0034. Revised Amendment No. 1. Available at: https://docket.images.azcc.gov/E000017818.pdf?i=1644282783233.
[49] Illinois General Assembly. No date. Chapter 5 Section 8-103B Available at: https://www.ilga.gov/legislation/ilcs/documents/022000050K8-103B.htm.
[50] National Conference of State Legislatures. September 15, 2021. "Energy Efficiency Resource Standards." Available at: https://www.ncsl.org/energy/energy-efficiency-resource-standards-eers.

2019 sales between 2026 and the end of the planning period. This assumption is contrary to the expectations of the VCEA, which clearly states that the Commission will establish new energy efficiency targets for 2026 through 2028 and every three-year period that follows.[51] Dominion is also assuming that its customers will not be able to participate in new energy efficiency programs or benefit from greater energy efficiency savings, which would lower customer bills.

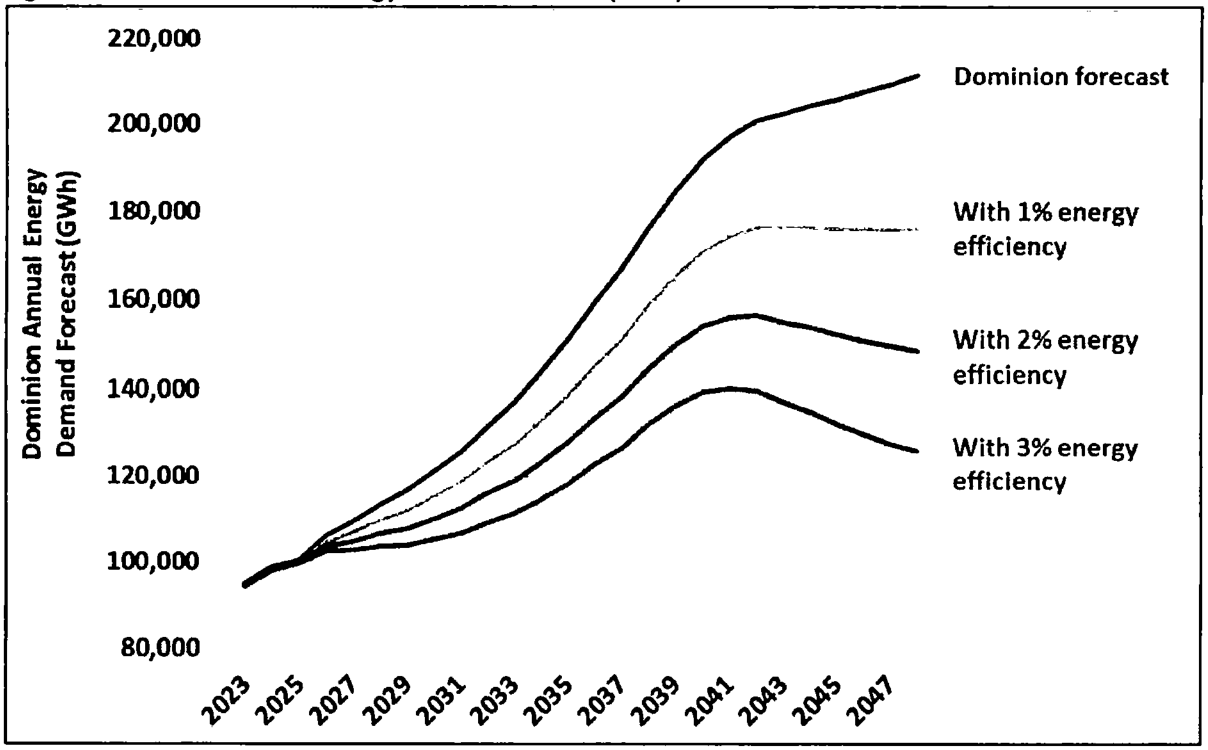
Q. How would Dominion's energy demand forecast change if it were adjusted for 1 to 2 percent annual incremental energy efficiency savings?

A. Dominion's annual energy demand forecasts account for energy efficiency savings to comply with VCEA mandates through the end of 2025. To better represent Dominion's post-2025 energy efficiency requirements—which are unlikely to remain at 2025 levels indefinitely—I adjusted Dominion's annual energy demand forecast to account for three higher levels of potential energy efficiency savings in IRP forecasting:

- **Moderate energy efficiency targets:** 1 percent annual incremental energy efficiency savings starting in 2026 reduces the annual energy demand forecast by 13.0 percent in 2048,
- **Higher energy efficiency targets:** 2 percent annual incremental energy efficiency savings starting in 2026 reduces the annual energy demand forecast by 26.5 percent in 2048, and
- **Highest energy efficiency targets:** 3 percent annual incremental energy efficiency savings starting in 2026 reduces the annual energy demand forecast by 40.4 percent in 2048 (see Figure 5).

[51] Va. Code § 56-596.2(A)(3).

Figure 5. Dominion annual energy demand forecast (GWh)



Data source: AEC calculations using Appalachian Voices Information Request Set 05-04 (KS).
Note: Figure 5 shows cumulative energy efficiency savings. Energy efficiency savings were calculated as annual incremental savings relative to the prior year's sales. Annual incremental energy efficiency savings are net of Dominion's forecasted annual incremental energy efficiency savings.

Q. What impact would more realistic energy efficiency assumptions have on Dominion's IRP planning?

A. Future annual energy demand that includes 1, 2, or 3 percent annual incremental energy savings (as represented above in Figure 5), would allow Dominion to avoid unnecessary capacity purchases and potentially avoid the need for gas-fired peaker plants as well, lowering costs for customers. Because energy efficiency reduces annual demand and peak demand, more energy efficiency means that less capacity is needed to meet peak demand (plus a reserve requirement). Therefore, if Dominion's energy demand forecast included more ambitious energy efficiency assumptions, the Company would require less generation from fewer capacity resources, resulting in cost savings for customers. Since energy efficiency measures have a direct impact on the amount of capacity resources needed to meet load and are less expensive than generation capacity on a per kWh basis,[52] it is prudent to model a range of possible energy

[52] 1) Molina, M. 2014. *The Best Value for America's Energy Dollar: A National Review of the Cost of Utility Energy Efficiency Programs.* American Council for an Energy-Efficient Economy. Available at: https://www.aceee.org/research-report/u1402; 2) Frick, N. M., S. Murphy, C. Miller., et al. August, 10 2021. *Still the One: Efficiency Remains a Cost-Effective Electricity Resource.* Available at: https://escholarship.org/content/qt5570z4bh/qt5570z4bh.pdf?t=qxo5d0.

efficiency futures. Such modeling provides insight into energy reliability in resource planning and is directly linked to the costs borne by ratepayers.

VI. Dominion's Alternative Plans do not build enough renewable energy and energy storage capacity to meet its obligations under the VCEA

Q. What are Dominion's solar and onshore wind capacity development requirements under the VCEA?

A. The 2020 VCEA requires Dominion to petition the Commission for approval to construct or acquire or enter into power purchase agreements (PPAs) to procure solar or onshore wind resources in the following amounts by the following dates (see Figure 6 below):

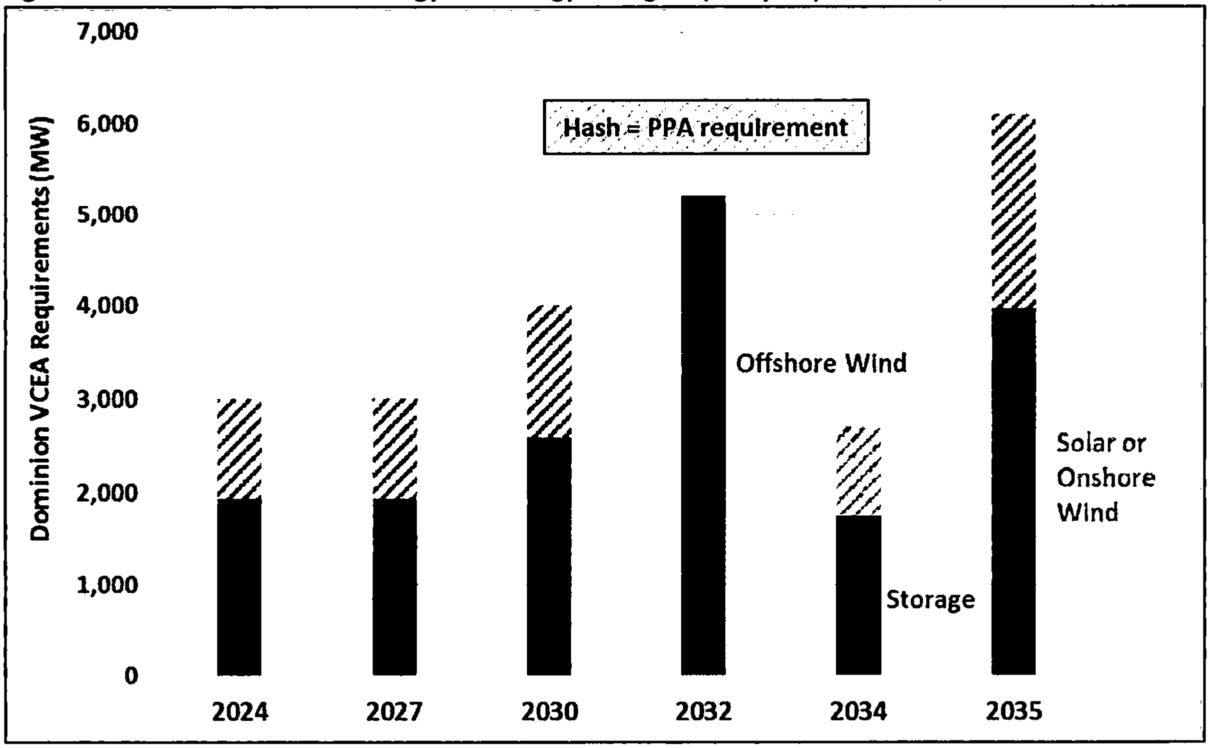
- At least 3,000 MW by December 31, 2024 (a minimum of 35 percent of this requirement must be met with PPAs);
- At least an additional 3,000 MW by December 31, 2027 (a minimum of 35 percent of this requirement must be met with PPAs);
- At least an additional 4,000 MW by December 31, 2030 (a minimum of 35 percent of this requirement must be met with PPAs);
- At least an additional 6,100 MW by December 31, 2035, for a total of 16,100 MW between 2024 and 2035; and
- By the end of 2035, at least 1,100 MW of the total 16,100 MW required must be met with solar resources that do not exceed 3 MW per individual project.[53]

Q. What are Dominion's offshore wind and energy storage capacity development requirements under the VCEA?

A. The VCEA provides that it is in the public interest for Dominion to construct or acquire up to 5,200 MW of offshore wind capacity by the end of 2032.[54] The law also requires Dominion to petition the Commission for approval to build or enter into power purchase agreements (PPAs) for 2,700 MW of energy storage resources by December 31, 2034. A minimum of 35 percent of this requirement must be met with PPAs, see Figure 6.[55]

[53] Va. Code § 56-585.5(D).
[54] Va. Code 56-585.1:11(B).
[55] Va. Code § 56-585.5(E)(2).

Figure 6. Dominion renewable energy and energy storage capacity requirements, 2024-2035



Source: Va. Code § 56-585.5(D)(2).
Note: By the end of 2035, a total of 16,100 MW of solar or onshore wind capacity is mandated—65 percent must be constructed or acquired and 35 percent must be in the form of PPAs. In addition, by the end of 2035, at least 1,100 MW must be solar generation that may not exceed 3 MW per project.

Q. How does the Company approach the VCEA's 35 percent PPA requirements across its Alternative Plans?

A. In its response to Microsoft information request set 01-05, the Company noted that Alternative Plans B through E (but not Alternative Plan A) assume 65 percent of VCEA targets are met with Company-owned resources and 35 percent are met with PPAs. The Company also notes that "The allocation between Company-owned resources and PPA resources is also consistent with the Commission's Final Order in the Company's most recent RPS Development Plan proceeding, Case No. PUR-2022-00124, where the Commission held that 'Code § 56-585.5 D, as written, does not permit more than 35% of capacity to come from third-party-owned resources.' (Final Order at 17.)"[56]

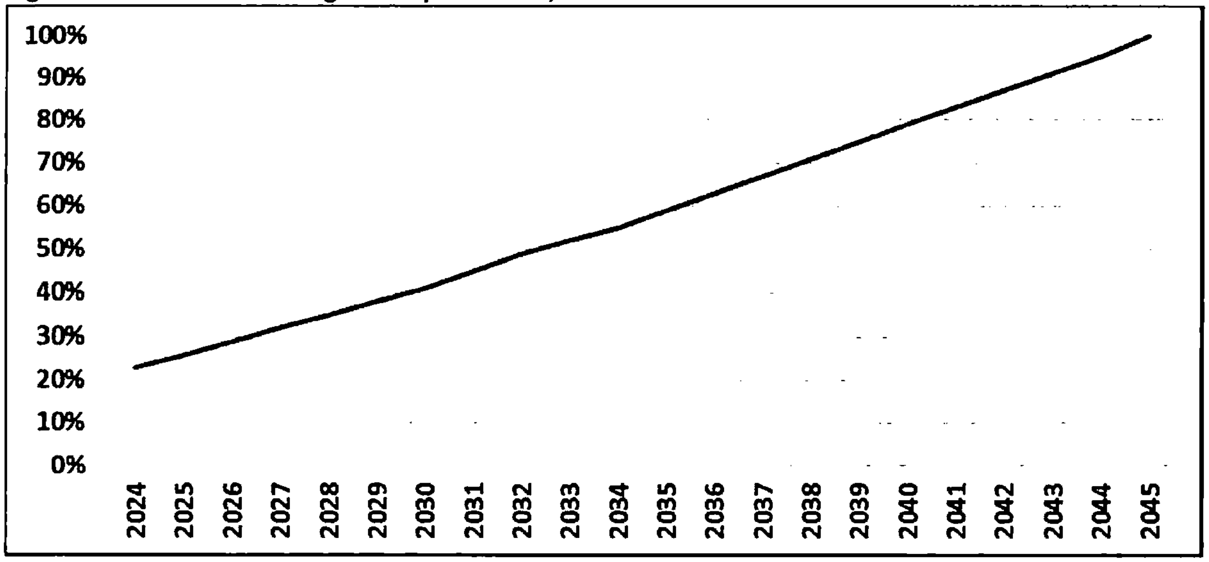
Q. What are Dominion's obligations under the VCEA's renewable energy standard?

A. The VCEA's renewable portfolio standard (RPS) mandates that a specified, increasing percentage of Dominion's total megawatt-hours of electric energy sold must come from renewable energy resources in

[56] Microsoft Information Request Set 01-05.

each year.[57] In 2024, 23 percent of Dominion's total energy sold must come from renewable resources (either owned by Dominion, acquired through PPAs or by the purchase of Renewable Energy Credits (RECs)), a share that increases to 41 percent in 2030, 59 percent in 2035, 79 percent in 2040, and 100 percent in 2045 (see Figure 7).[58]

Figure 7. Dominion RPS Program requirements, 2024-2045



Source: Va. Code § 56-585.5.

Between 2021 and 2024, the Company may comply with the RPS using renewable energy generated anywhere within the PJM region or by purchasing RECs. However, beginning in 2025, 75 percent of the renewable energy for RPS Program compliance must come from renewable resources located within Virginia.[59]

Q. Which Alternative Plans does the Company claim are in compliance with its various renewable energy and energy storage requirements under the VCEA?

A. Dominion's 2023 IRP claims Alternative Plan A complies with the RPS requirements and Alternative Plan B complies with the solar, wind and energy storage capacity development requirements of the VCEA.

> *Plan A...presents a least-cost plan that meets only applicable carbon regulations and the mandatory renewable energy portfolio standard program ("RPS Program") requirements of the Virginia Clean Economy Act ("VCEA").*

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[57] ""Renewable energy" means energy derived from sunlight, wind, falling water, biomass, sustainable or otherwise, (the definitions of which shall be liberally construed), energy from waste, landfill gas, municipal solid waste, wave motion, tides, and geothermal power, and does not include energy derived from coal, oil, natural gas, or nuclear power." See: https://lis.virginia.gov/cgi-bin/legp604.exe?201+ful+SB851ER.

[58] Va. Code § 56-585.5.

[59] Dominion Energy. 2023. "Integrated Resource Plan." Page 12.

> *Plan B... includes the significant development of solar, wind, and energy storage envisioned by the VCEA, petitioned by 2035 and built by 2038.*[60]

Alternative Plan A complies with the RPS but not the VCEA's renewable energy capacity requirements by the dates specified in the VCEA. Alternative Plan B complies neither with the RPS nor the VCEA's renewable energy capacity requirements by the dates specified in the VCEA.

Q. Does the Company's Alternative Plan B in fact comply with its renewable energy and energy storage development requirements under the VCEA?

A. No, the Company's Alternative Plan B does not build sufficient Company-owned capacity to meet the VCEA's renewable energy and energy storage development targets for solar and onshore wind by the dates required in the VCEA. The Company also presents very inconsistent information about its planned capacity additions between its IRP filing and its responses to discovery requests. Plan B fails to build:

- 1,950 MW (the 65 percent non-PPA share of the 3,000 MW target) of solar or onshore wind capacity by the end of 2024
  - According to Figure 2.2.2 in the Company's IRP, Alternative Plan B builds 0 MW of solar non-PPA and wind capacity by the end of 2024
  - According to Staff Set 01-52 Plan B (JLM), Alternative Plan B builds 0 MW of solar non-PPA and wind capacity by the end of 2024
- 3,900 MW of solar or onshore wind capacity by the end of 2027
  - According to Figure 2.2.2 in the Company's IRP, Alternative Plan B only builds 405 MW of solar non-PPA and wind capacity by the end of 2027
  - According to Staff Set 01-52 Plan B (JLM), Alternative Plan B only builds 2,436 MW of solar non-PPA and wind capacity by the end of 2027
- 6,500 MW of solar or onshore wind capacity by the end of 2030
  - According to Figure 2.2.2 in the Company's IRP, Alternative Plan B only builds 2,111 MW of solar non-PPA and wind capacity by the end of 2030
  - According to Staff Set 01-52 Plan B (JLM), Alternative Plan B only builds 3,014 MW of solar non-PPA and wind capacity by the end of 2030
- 1,755 MW of storage capacity by the end of 2032
  - According to Figure 2.2.2 in the Company's IRP, Alternative Plan B only builds 720 MW of storage capacity by the end of 2032
  - According to Staff Set 01-52 Plan B (JLM), Alternative Plan B only builds 1,615 MW of storage capacity by the end of 2032
- 10,465 MW (65 percent of the cumulative 16,100 MW target) of solar or onshore wind capacity by the end of 2035
  - According to Figure 2.2.2 in the Company's IRP, Alternative Plan B only builds 8,314 MW of

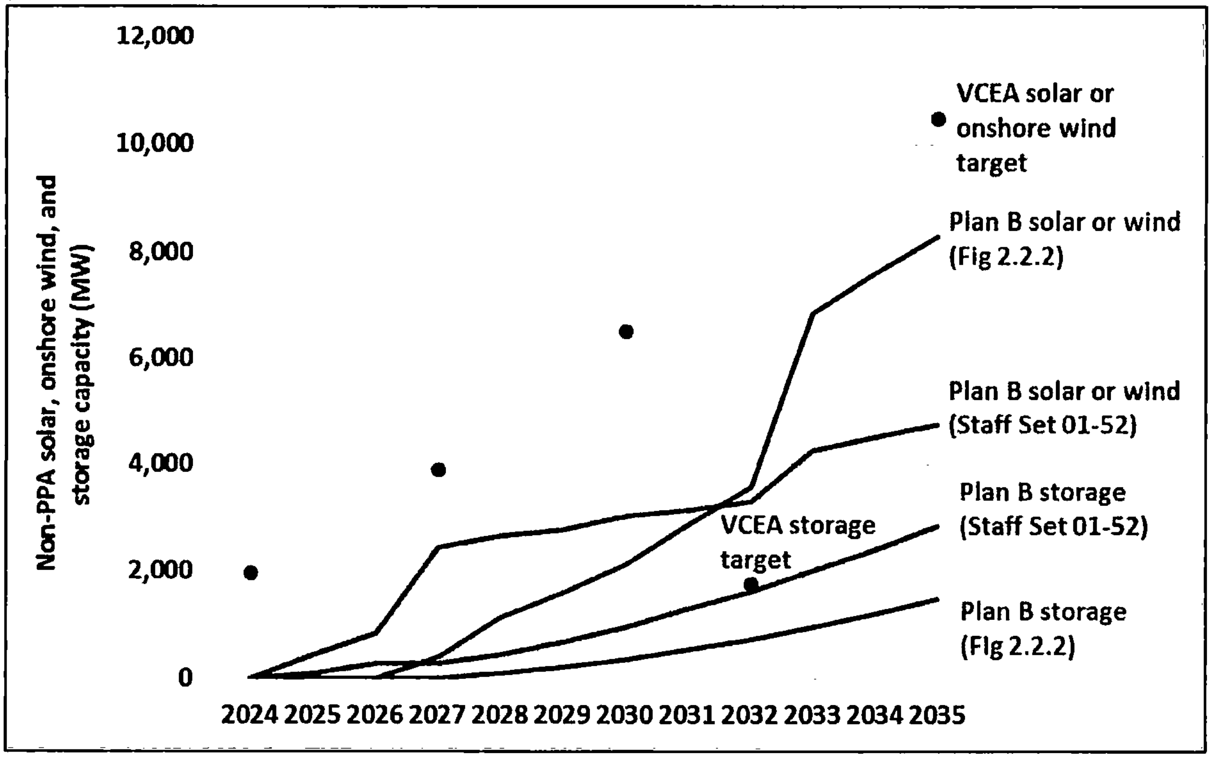
[60] Ibid. Page 2.

solar non-PPA and wind capacity by the end of 2035.[61]

- According to Staff Set 01-52 Plan B (JLM), Alternative Plan B only builds 4,736 MW of solar non-PPA and wind capacity by the end of 2035 (see Figure 8).

Alternative Plan B does develop 5,200 MW of offshore wind capacity by the end of 2035 as deemed in the public interest by the legislature, given that the plan includes "approximately 2.6 GW of additional offshore wind capacity"[62] in addition to the "nearly 2,600 MW of offshore wind"[63] already approved and under construction.

Figure 8. Alternative Plan B solar, onshore wind and storage capacity relative to VCEA requirements (MW)



[61] Plan B resource additions provided by the Company do not distinguish between onshore and offshore wind. The Company notes in its 2023 IRP that Plan B includes "approximately 2.6 GW of additional offshore wind capacity" and "0.6 GW of new onshore wind." Therefore, over 80 percent of the resource additions contained in the "wind" category are offshore wind, not onshore wind. Source: Dominion Energy. 2023. "Integrated Resource Plan." Page 23.

[62] Dominion Energy. 2023. "Integrated Resource Plan." Page 23.

[63] Ibid. Page 25.

Notes: 1) Plan B wind in this Figure includes both onshore and offshore wind because Dominion does not distinguish between onshore and offshore wind in its "wind" category. 2) Staff Set 01-52 Plan B (JLM) solar, wind, and storage capacity additions are adjusted for Dominion's utilization of PJM's Effective Load Carrying Capacity (ELCC) as provided in Staff Set 01-32. Note that I have submitted an information request asking Dominion to specify how these ELCCs change over time (as that information was not provided in Staff Set 01-32 nor in the IRP), but for the purposes of this Figure, I have assumed those ELCCs remain constant over the planning period. That assumption is likely to overestimate the amounts of future solar and wind capacity, and underestimate the amounts of future storage capacity.

Sources: 1) Dominion 2023 IRP. Figure 2.2.2; 2) Staff Set 01-52 Plan B (JLM); 3) https://lis.virginia.gov/cgi-bin/legp604.exe?201+ful+CHAP1193+pdf.

Q. Does the Company place any limits on onshore wind build out in its modeling?

A. Across all Alternative Plans, Dominion's modeling assumptions limit onshore wind builds to [BEGIN CONFIDENTIAL INFORMATION] [64] [END CONFIDENTIAL INFORMATION] and the Company does not allow the model to select wind PPAs because "to date, the Company has received minimal interest from vendors for the development of onshore wind PPAs within the Commonwealth."[65]

Q. Do the Company's modeling limits for onshore wind resources impact the ability of its Alternative Plans to meet its VCEA targets?

A. Yes. Under the VCEA, the Company is obligated to petition the Commission for approval to develop at least 16,100 MW of solar or onshore wind resources by the end of 2035, so limiting the ability of its model to select onshore wind resources, either as company-owned or as PPA options, limits the ability of its Alternative Plans to meet its VCEA obligations. Even if Dominion's model selected [BEGIN CONFIDENTIAL INFORMATION] [66] [END CONFIDENTIAL INFORMATION]—onshore wind resources would only add up to 740 MW by the end of 2048—about 7 percent of the VCEA requirement.

Q. What are the consequences of Dominion's failure to provide any Alternative Plans that comply with the renewable energy mandates of the VCEA by the dates required?

A. Dominion's failure to provide any Alternative Plans that comply with the VCEA's mandated renewable energy buildout by the dates required—in addition to leading to a future in which the Company is in violation of its legal obligations under Virginia law—means that communities that live in the proximity of Dominion's fossil fuel-fired resources will continue to suffer from local air pollution and negative health consequences, and communities that could benefit economically from the addition of renewable resources will miss out on those opportunities. Because Dominion has failed to meet the basic obligations of the VCEA in its Alternative Plans, the Commission should not find that this IRP is reasonable and in the public

[64] Dominion corrected response to Clean Virginia Information Request Set 01-10(f). CONFIDENTIAL.

[65] Staff Information Request Set 05-136.

[66] Dominion corrected response to Clean Virginia Information Request Set 01-10(f). CONFIDENTIAL.

interest. If the stakeholder engagement recommendations I discuss in the *Conclusions and recommendations* section below are taken up by the Commission, better stakeholder engagement is also more likely to result in feasible, low-cost VCEA compliant plans.

VII. Dominion's Alternative Plans would increase the Company's fleet greenhouse gas emissions through the mid-2040s and are not consistent with its obligations under the VCEA

Q. What are Dominion's greenhouse gas emission reduction requirements under the VCEA?

A. Dominion's greenhouse gas emission reduction requirements under the VCEA are that Dominion must retire all carbon-emitting generating units by December 31, 2045.[67]

Q. What are Dominion Energy's internal company greenhouse gas emission reduction goals?

A. On its company website, Dominion Energy presents the "Dominion Energy's Net Zero Commitment," which describes the Company as "committed to achieving Net Zero emissions by 2050."[68] Net zero emissions refers to the objective to negate the amount of greenhouse gas emissions, either by reducing emissions directly or by utilizing methods to prevent or remove emissions from the atmosphere—such as carbon capture and storage or reforestation.

Q. Does Dominion retire all carbon-emitting generating units by 2045 in its IRP planning?

A. No. Alternative Plans A, B, and C do not retire any resources over the planning period. Alternative Plans D and E retire all carbon-emitting units currently in operation, but also build 970 MW of gas-fired CT capacity that remains online throughout the planning period.[69]

Q. Are projected greenhouse gas emissions increasing or decreasing in Dominions 2023 IRP?

A. Projected greenhouse gas emissions are increasing in Dominion's 2023 IRP. According to the Company, "due the changes in retirements, as well as higher capacity factors for the Company's existing generators driven by the higher 2023 PJM Load Forecast, carbon emission projections are increasing."[70] While carbon emissions across all Alternative Plans dip slightly below 2023 levels by 2030, emissions for all Alternative Plans increase steadily between 2031 and 2039. After 2039, emissions continue to increase for Alternative Plans A, B and C, but decline sharply in Alternative Plans D and E.

Q. How do the greenhouse gas emissions profiles of Dominion's Alternative Plans compare to one

[67] Va. Code § 56-585.5(B)(3).

[68] Dominion Energy. No date. Dominion Energy's Net Zero Commitment. Available at: https://www.dominionenergy.com/our-company/netzero#:~:text=We're%20committed%20to%20achieving,our%20greenhouse%2Dgas%20emissions%20substantially.

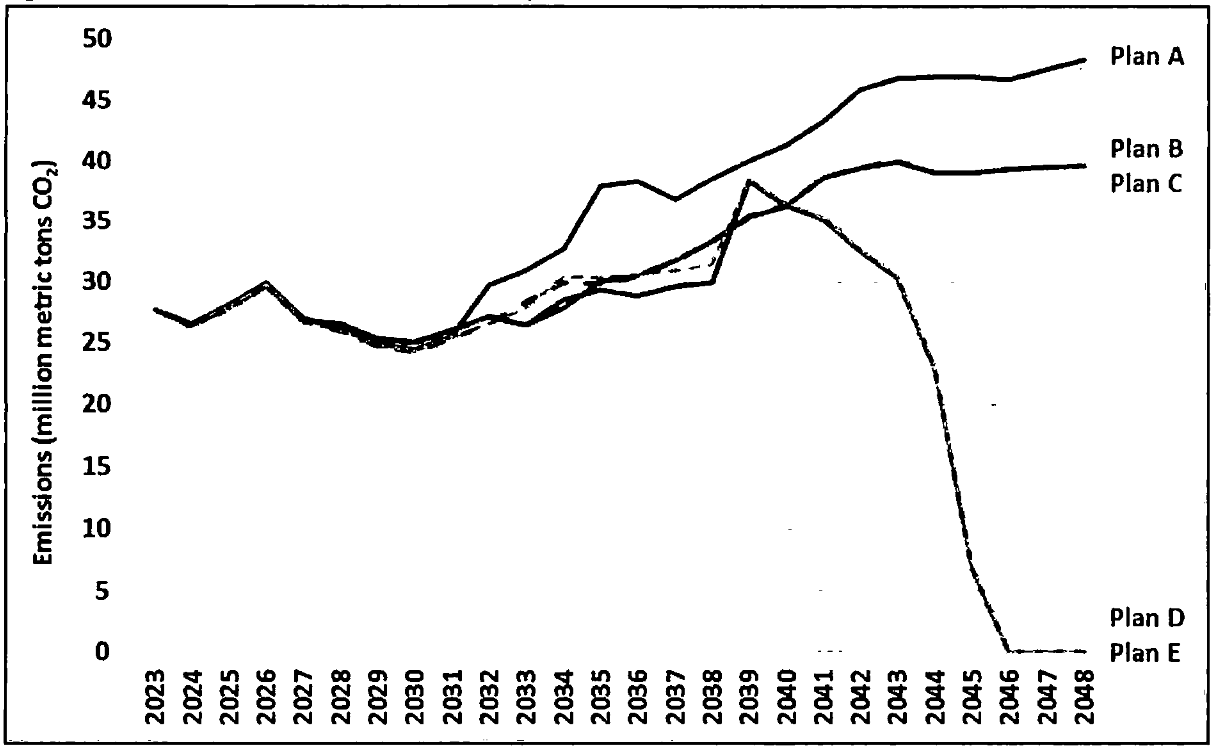
[69] Dominion Energy. 2023. "Integrated Resource Plan." Figures 2.2.4 and 2.2.5.

[70] Ibid. Page 30.

another?

A. All five Alternative Plans result in nearly identical (within 3 percent) CO_2 emissions over the first nine years of the planning period (2023 to 2031). Throughout the entire forecast period (2023 to 2048), Alternative Plans D and E have nearly identical CO_2 emissions, as do Alternative Plans B and C (see Figure 9). Alternative Plan A (Dominion's least-cost plan) has the highest emissions of all Alternative Plans.

Figure 9. Dominion 2023 IRP CO_2 emissions by Alternative Plan



Data source: Clean Virginia Information Request Set 01-17-i.

Q. How many of Dominion's Alternative Plans result in emission reductions over the forecast period?

A. Two of the five Alternative Plans presented by Dominion (Plans D and E) result in CO_2 emissions reductions over the forecast period (by the end of 2048), by retiring all carbon-emitting units currently in operation.

The remaining three Alternative Plans (Plans A, B, and C) result in increased emissions at the end of the forecast period. Plan A (Dominion's 'least-cost' plan) has the highest associated emissions—increasing by 74 percent between 2023 levels (27.8 million metric tons carbon dioxide) and 2048 levels (48.2 million metric tons carbon dioxide). Plans B and C emissions increase by 43 percent between 2023 and 2048 (see Figure 9).

Q. Has Dominion reported other projections of its greenhouse gas emissions that are inconsistent with its 2023 IRP?

A. Yes. Clean Virginia's information request set 01-17-i asked the Company to refer to its emissions Figure 2.2.6 and provide "a breakdown of emissions by Plan, by resource, and by year throughout the entire planning period." Dominion's response reports higher CO_2 emissions in 2038 than those reported in the 2023 IRP for all Alternative Plans. For Alternative Plans A, B, and C emissions reported in 01-17-i are higher than those in the IRP through 2048 (see Table 4).

Table 4. Dominion 2023 IRP reported CO_2 emissions by Alternative Plan

	2038		2048	
	IRP	Info Request	IRP	Info Request
Plan A	34.9	38.5	43.8	48.2
Plan B	30.2	33.3	35.9	39.6
Plan C	30.3	33.4	36.0	39.6
Plan D	27.2	30.0	0.0	0.0
Plan E	28.5	31.4	0.0	0.0

Sources: 1) Clean Virginia Information Request Set 01-17-i; 2) Dominion 2023 IRP, Figure 2.2.6 – System CO_2 Output from Company Fleet for Alternative Plans (based on current technology).

The emissions data Dominion provided in response to an information request about its 2023 IRP emissions Figure 2.2.6 are inconsistent with the data represented in the IRP itself.

Q. Which Alternative Plans does the Company claim comply with the VCEA requirement of retiring all carbon-emitting generating units by 2045?

A. The Company claims that Alternative Plans D and E comply with the VCEA requirement to retire all carbon-emitting generating units by the end of 2045. The primary difference between the two plans—as described by Dominion—is that Alternative Plan E selects new resources on a least-cost optimization basis without regard for VCEA requirements:

> *Plan D...retires all Company-owned carbon-emitting generation by the end of 2045, resulting in zero carbon dioxide ("CO_2") emissions from the Company's fleet in 2046.*
>
> *Plan E...is like Plan D in retiring all Company-owned carbon-emitting generation by the end of 2045. Plan E differs from Plan D in that all new generation resources were selected on a least-cost optimization basis without regard for the development targets for solar, wind, and energy storage resources in Virginia established through the VCEA.*[71]

Q. Is Dominion correct in claiming that Alternative Plans D and E comply with its VCEA requirement to retire all carbon-emitting generating units by 2045?

A. No. Alternative Plans D and E do not comply with the VCEA requirement to retire all carbon-emitting generating units by the end of 2045. Plans D and E both retain 153 MW of biomass-fired generating

[71] Dominion Energy. 2023. "Integrated Resource Plan." Page 3.

capacity as well as a 970 MW gas-fired combustion turbine beyond December 31, 2045—both of which are carbon-emitting resources.[72] Dominion maintains that these plans can be interpreted as having zero carbon emissions due to the Company's assumption that its 970 MW gas-fired CT will be "hydrogen capable by 2045."[73]

Q. Dominion states that Alternative Plan E differs from plan D because it does not select resources "with regard for the development targets for solar, wind, and energy storage resources in Virginia established through the VCEA."[74] Does Alternative Plan D's resource selection in fact comply with VCEA renewable energy and energy storage capacity development targets?

A. No, the Company's Alternative Plan D does not build sufficient Company-owned capacity to comply with the VCEA renewable energy and energy storage capacity development targets on time. In fact, Plan D builds exactly the same amount of non-PPA solar, onshore wind, and storage capacity between 2024 and 2035 as Plan B, that as shown in Figure 8 above, does not timely comply with VCEA requirements. It is also important to note that—regardless of whether we compare Plans B and D using Figures 2.2.2 and 2.2.4 from the Company's IRP or the Company's responses to Staff's information request set 01-52 which contain inconsistent information regarding the Company's planned capacity additions—Plans B and D have identical solar, wind, and storage capacity additions between 2024 and 2035.

Q. Did the Company consider costs associated with converting a gas-fired CT plant to run on hydrogen fuel?

A. Yes, in the Company's response to Clean Virginia information request set 01-16c, Dominion noted that it "included estimated costs to convert facilities for hydrogen blending of approximately $500/[kilowatt] in Plans D and E to support the net zero goals of those plans."[75]

Q. On what basis did the Company assume $500 per kilowatt to convert 970 MW of gas-fired combustion turbine capacity to run on hydrogen fuel?

A. The Company did not have a source for hydrogen conversion costs and so used $500 per kilowatt as a proxy value, without any basis. In the Company's response to Clean Virginia information request set 02-22b requesting the Company to provide the basis for its $500 per kilowatt assumption, Dominion stated that: "The estimated costs to convert facilities for hydrogen blending in 2045 is not yet known due to the future nature of the technology. Therefore, the Company used the $500/kW estimate in Plans D and E as a high-level proxy value. The Company will continue to review costs as the technology develops and will update the estimated costs in future IRPs as more cost information is available."[76]

Q. Did the Company consider any other costs associated with running a gas-fired CT plant on hydrogen

[72] Staff Information Request Set 01-52.

[73] Dominion Energy. 2023. "Integrated Resource Plan." Page 24.

[74] Ibid. Page 3.

[75] Clean Virginia Information Request Set 01-16c.

[76] Clean Virginia Information Request Set 02-22b.

fuel?

A. No, "the Company did not include costs for hydrogen fuel, hydrogen distribution, or hydrogen infrastructure beyond the plant itself."[77] According to a 2023 report from the U.S. Environmental Protection Agency (EPA) titled "Hydrogen in Combustion Turbine Electric Generating Units," blending more than 5 percent hydrogen in gas pipeline systems results in a "greater chance of pipeline leaks and the embrittlement of steel pipelines," noting that "the capital costs of new pipeline construction constitute a barrier to expanding hydrogen pipeline delivery infrastructure."[78] Other modifications are available for existing gas pipeline systems—such as installing additional compressor stations or using fiber reinforced polymer—but these entail costs as well. The report also finds that the costs of hydrogen fuel range from $1.00/kg for hydrogen produced from fossil fuels using steam methane reforming to $9.00/kg for hydrogen produced from solar using electrolysis.[79]

Q. Is all hydrogen fuel carbon emission free?

A. No, not all hydrogen fuel is free of carbon emissions. Of all the "colors" of hydrogen (see Figure 10 below), only green hydrogen results in zero CO_2 emissions. Hydrogen is an energy carrier, not an energy source, and is produced from various energy sources through processes such as electrolysis, steam methane reformation, or gasification using either fossil fuels directly or using electricity produced from renewables, fossil fuels or nuclear. Different methods of hydrogen production have different amounts of associated greenhouse gas emissions depending on both the process and the energy source. According to the International Energy Agency (IEA), hydrogen produced by electrolysis has a different emissions intensity depending on the emissions associated with the electricity used, and fossil-based hydrogen production methods also vary in emissions intensities based on the extent to which carbon capture technologies are incorporated.[80] Only green hydrogen (i.e. hydrogen created by electrolysis of water using electricity from renewable energy resources) results in zero CO_2 emissions.

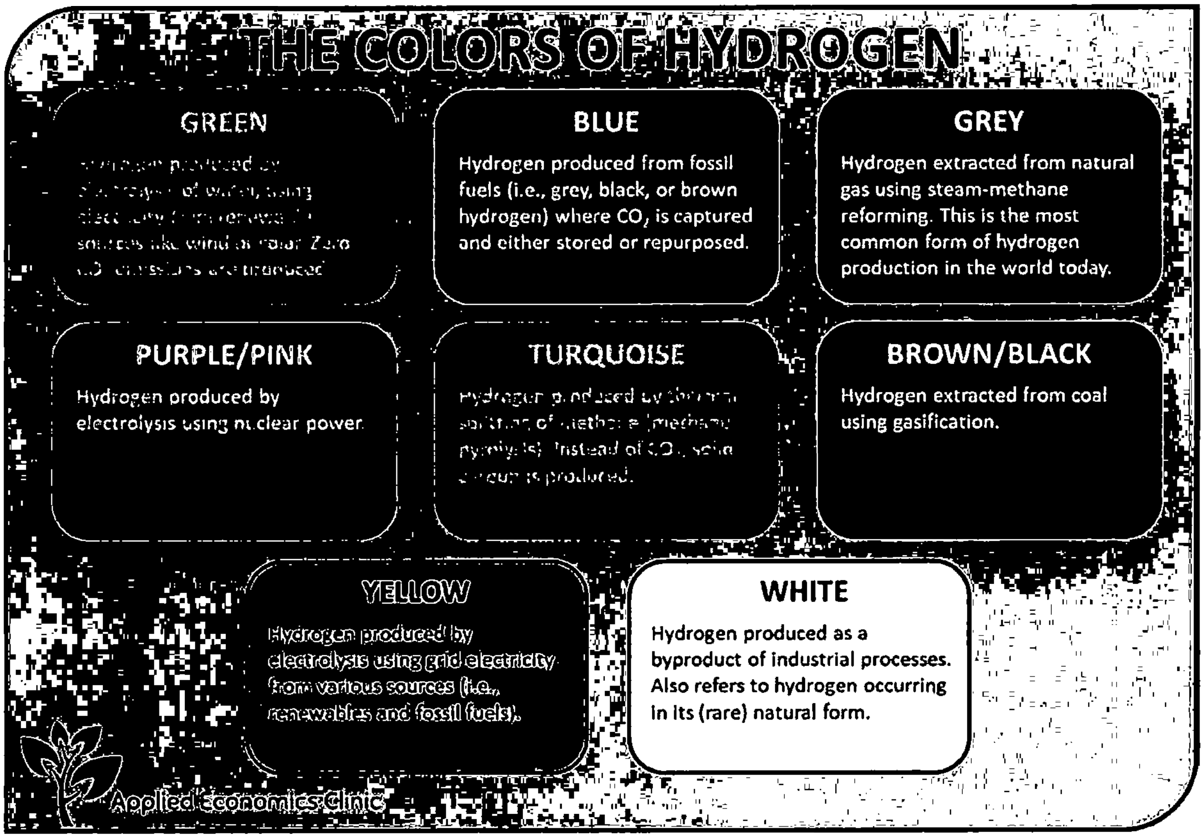
[77] Clean Virginia Information Request Set 02-22a.

[78] U.S. EPA. 2023. Hydrogen in Combustion Turbine Electric Generating Units Technical Support Document. Docket ID No. EPA-HQ-OAR-2023-0072. Available at: https://www.epa.gov/system/files/documents/2023-05/TSD%20-%20Hydrogen%20in%20Combustion%20Turbine%20EGUs.pdf. Page 25.

[79] Ibid. Page 33.

[80] IEA. 2023. "Executive Summary." In *Towards hydrogen definitions based on their emissions intensity.* Available at: https://www.iea.org/reports/towards-hydrogen-definitions-based-on-their-emissions-intensity.

Figure 10. The "colors" of hydrogen fuel



Q. What are the average greenhouse gas emissions associated with current global hydrogen production?

A. According to the International Energy Agency (IEA), in 2021, the average emissions intensity of global hydrogen production was 12 to 13 kilograms of CO_2-equivalent (CO_2e) emissions per kilogram of hydrogen produced.[81] Globally, most hydrogen produced today is made using fossil fuels.[82]

Q. Does Dominion specify the types of hydrogen it will produce or procure, or otherwise provide information regarding its planned sources of zero-carbon hydrogen?

A. No, Dominion does not specify the types of hydrogen it will produce or procure, or otherwise provide any information regarding its planned sources of zero-carbon hydrogen.

Q. Did the Company assess the feasibility of converting a gas-fired CT to run on 100 percent hydrogen fuel?

A. Yes. In its response to Clean Virginia Set 01-16a, Dominion stated that it "used publicly available market

[81] Ibid.

[82] IEA. 2023. "Executive Summary." In *Towards hydrogen definitions based on their emissions intensity*. Available at: https://www.iea.org/reports/towards-hydrogen-definitions-based-on-their-emissions-intensity.

data from major combustion turbine original equipment manufacturers" to determine if the plant will be capable of blending hydrogen.[83] In its response to Clean Virginia Set 04-31 asking for the "publicly available market data" referenced, Dominion provided the websites of three gas turbine manufacturers—GE Gas Power, Siemens Energy, and Mitsubishi Heavy Industries Group.[84] GE Gas Power's website notes that hydrogen capability "var[ies] based on gas turbine model, combustion model, combustion system and overall fuel composition."[85] In its response to Clean Virginia Set 01-16b, Dominion also stated that "at this stage, the Company has not progressed a design far enough to determine a percentage of hydrogen blending."[86]

Q. What is hydrogen blending and what percentage would be required to render a gas-fired power plant greenhouse gas emission free?

A. Hydrogen blending refers to combining hydrogen fuel together with methane gas for electric generation. One hundred percent green hydrogen is necessary to achieve 100 percent carbon emissions reduction (it is important to note that 100 percent green hydrogen eliminates carbon emissions but not NO_x or hydrogen emissions). According to EPA, because hydrogen and methane gas have different volume energy densities, the CO_2 emissions reduction from a hydrogen blend is smaller than the percentage of hydrogen blended in.[87] For example, achieving a 50 percent CO_2 reduction requires a fuel blend that is approximately 75 percent hydrogen by volume (see Figure 11). Only 100 percent hydrogen fuel can result in 100 percent CO_2 emission reduction.

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[83] Clean Virginia Information Request Set 01-16a.

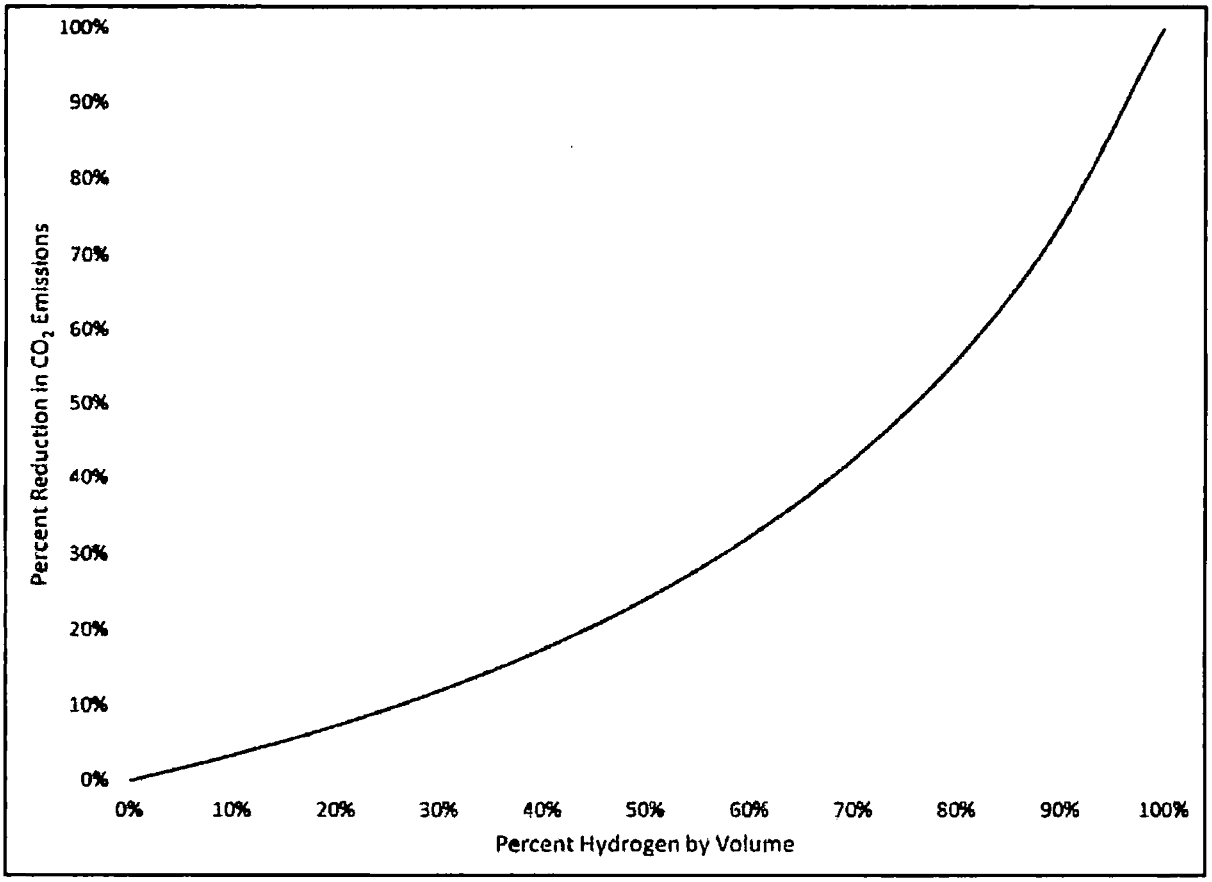
[84] Clean Virginia Information Request Set 04-31.

[85] General Electric Gas Power. No date. "Hydrogen fueled gas turbines." Available at: https://www.ge.com/gas-power/future-of-energy/hydrogen-fueled-gas-turbines.

[86] Clean Virginia Information Request Set 01-16b.

[87] U.S. EPA. 2023. Hydrogen in Combustion Turbine Electric Generating Units Technical Support Document. Docket ID No. EPA-HQ-OAR-2023-0072. Available at: https://www.epa.gov/system/files/documents/2023-05/TSD%20-%20Hydrogen%20in%20Combustion%20Turbine%20EGUs.pdf.

Figure 11. CO_2 emissions reductions by percent of hydrogen in blended fuel



Source: U.S. EPA. 2023. Hydrogen in Combustion Turbine Electric Generating Units Technical Support Document. Docket ID No. EPA-HQ-OAR-2023-0072. Available at: https://www.epa.gov/system/files/documents/2023-05/TSD%20-%20Hydrogen%20in%20Combustion%20Turbine%20EGUs.pdf. *Figure 1.*

Q. Do any U.S. power plants run on 100 percent hydrogen fuel today?

A. No, per EIA data, no commercial power plants in the United States run on 100 percent hydrogen fuel today.[88] According to the EPA, certain models of "smaller industrial or aeroderivative units" can combust "up to 100 percent hydrogen"[89] today, but most combustion turbines available today cannot combust more than 30 percent hydrogen fuel. According to the EPA:

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[88] 1) U.S. EPA. 2023. "Hydrogen Explained." Available at: https://www.eia.gov/energyexplained/hydrogen/use-of-hydrogen.php; 2) U.S. EPA. 2023. Hydrogen in Combustion Turbine Electric Generating Units Technical Support Document. Docket ID No. EPA-HQ-OAR-2023-0072. Available at: https://www.epa.gov/system/files/documents/2023-05/TSD%20-%20Hydrogen%20in%20Combustion%20Turbine%20EGUs.pdf.

[89] U.S. EPA. 2023. *Hydrogen in Combustion Turbine Electric Generating Units Technical Support Document.* Docket ID No. EPA-HQ-OAR-2023-0072. Available at: https://www.epa.gov/system/files/documents/2023-05/TSD%20-%20Hydrogen%20in%20Combustion%20Turbine%20EGUs.pdf.

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[C]ertain models of combustion turbines that are currently available can combust up to 100 percent hydrogen. These are generally smaller industrial or aeroderivative units. Several larger models of new and existing combustion turbines have demonstrated the ability to co-fire up to 30 percent hydrogen by volume without modification. For certain new larger models, combustor upgrades are available from manufacturers that allow the combustion turbines to increase their hydrogen co-firing to as high as 50 percent. In addition, many new facilities have announced plans to initially co-fire up to 30 percent hydrogen by volume and up to 100 percent in approximately 10 to 20 years. According to combustion turbine manufacturers, certain new models can be constructed at present that will, in the near future, be able to install pre-planned upgrades that will align to turbine compatibility and allow up to 100 percent hydrogen combustion. In addition, the world's three largest turbine manufacturers have made commitments to develop advanced technologies by 2030 or sooner that will enable additional models of new heavy-duty combustion turbines to fire 100 percent hydrogen while limiting emissions of NOX. For certain existing larger models, manufacturers are developing retrofits that will allow those units to safely increase their levels of hydrogen co-firing up to 100 percent.[90]

Q. Assuming it is feasible and cost-effective to convert a gas-fired CT to run on 100 percent hydrogen, would that result in zero greenhouse gas emissions?

A. No, assuming it is feasible and cost-effective to convert a gas-fired CT to run on 100 percent hydrogen, it would still not result in zero greenhouse gas emissions. First, only green hydrogen is a zero carbon-emission fuel—any other color of hydrogen entails carbon emissions. In addition, regardless of the share or type of hydrogen in question, the use of hydrogen results in two additional sources of greenhouse gas emissions:

1) hydrogen combustion emits nitrogen oxide (NO_x)—an indirect greenhouse gas and an air pollutant, and

2) any leaked hydrogen is itself an indirect greenhouse gas because it reduces the atmosphere's ability to remove methane and ozone (both greenhouse gases).

Research from the Massachusetts Institute of Technology describes hydrogen as a contributor to the creation of the greenhouse gases methane and ozone:

Because hydrogen reacts with tropospheric hydroxyl radicals, emissions of hydrogen to the atmosphere perturb the distributions of methane and ozone, the second and third most important greenhouse gases after carbon dioxide. Hydrogen is therefore an indirect greenhouse gas with a global warming potential GWP of 5.8 over a 100-year time horizon. A future hydrogen economy would therefore have greenhouse consequences and would

[90] U.S. EPA. 2023. *Hydrogen in Combustion Turbine Electric Generating Units Technical Support Document.* Docket ID No. EPA-HQ-OAR-2023-0072. Available at: https://www.epa.gov/system/files/documents/2023-05/TSD%20-%20Hydrogen%20in%20Combustion%20Turbine%20EGUs.pdf.

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not be free from climate perturbations.[91]

Research from Princeton University and the National Oceanic and Atmospheric Administration describes how hydrogen interacts in the atmosphere in ways that impact atmospheric concentrations of methane and ozone:

> *[Hydrogen's] reaction with the OH radical tends to increase tropospheric methane (CH_4) and ozone (O_3), which are two potent greenhouse gases. It also increases stratospheric water vapor, which is associated with stratospheric cooling and tropospheric warming. Recent global climate models have estimated that hydrogen has...a global warming potential (GWP) that lies in the range 11 ± 5 for a 100-year time horizon. Hence, [hydrogen] emissions are far from being climate neutral, and their largest impact is related to the perturbation of atmospheric CH_4, the second most important anthropogenic GHG.*[92]

Q. Are hydrogen leaks a concern for power plants that run on hydrogen?

A. Yes, hydrogen leaks are a concern for power plants that run on hydrogen, due to the fact that hydrogen leaks more easily than methane gas during fuel transmission as well as at the plant itself. Hydrogen molecules are much smaller than methane molecules, which makes it difficult to transport and more prone to leakage.[93] In addition, utilizing existing methane gas infrastructure to transport hydrogen creates more opportunities for leakage because hydrogen requires higher pipeline pressure and degrades pipeline integrity.[94] In other words, the act of hydrogen flowing through methane gas pipelines degrades those pipelines because methane gas pipelines were not engineered for the higher pressures needed to transport hydrogen.

Q. Has Dominion provided evidence sufficient to assure that hydrogen conversion and use of hydrogen fuel in its 970 MW gas-fired CT plant by 2045 can and will occur?

A. No, Dominion has not provided sufficient evidence to assure that hydrogen conversion and use of hydrogen fuel in its 970 MW gas-fired CT plant by 2045 can and will occur.

Q. Are Dominion's Plans D and E consistent with the VCEA, even if the Company's 970 MW gas-fired CT plant is assumed to be "hydrogen capable" by 2045?

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[91] Derwent, R., Simmonds, P., O'Doherty, S., Manning, A., Collins, W. and Stevenson, D. 2006. "Global Environmental Impacts of the Hydrogen Economy." Int. J. of Nuclear Hydrogen Production and Applications. 1(1): 57-67. Available at: http://agage.mit.edu/publications/global-environmental-impacts-hydrogen-economy.

[92] Bertagni, M., S. Pacala., F. Paulot, A. Porporato. 2022. "Risk of the hydrogen economy for atmospheric nature." Nature communications. Available at: https://www.nature.com/articles/s41467-022-35419-7.

[93] Cho, R. January 7, 2021. "Why We Need Green Hydrogen." Columbia Climate School. Available at: https://news.climate.columbia.edu/2021/01/07/need-green-hydrogen/. ("Because hydrogen is so much less dense than gasoline, it is difficult to transport. It either needs to be cooled to -253°C to liquefy it, or it needs to be compressed to 700 times atmospheric pressure so it can be delivered as a compressed gas").

[94] Verdonck, P.K.A. and Kammoun, M. 2021. "Is Hydrogen a Viable Alternative to Lithium Under the Current Energy Storage Regulatory Framework?" Oil, Gas & Energy Law Intelligence, 18(6). Available at: https://www.lexology.com/library/detail.aspx?g=e908442d-8b33-462c-ae23-9c1dcb917127.

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A. No, Dominion's Plans D and E are not consistent with the VCEA, even if the Company's 970 MW gas-fired CT plant is assumed to be "hydrogen capable" by 2045. Not only is the prospect of running Dominion's proposed gas-fired CT on hydrogen wholly speculative, but even if Dominion assumes that it would be feasible and cost-effective to run the CT on 100 percent green hydrogen, the plant would still emit NO_x and be at risk of leaking hydrogen resulting in indirect greenhouse gas emissions.

Q. With the exception of the 970 MW gas-fired CT plant, does all remaining carbon-emitting capacity retire by the end of 2045 in Alternative Plans D and E?

A. No, Alternative Plans D and E also retain 153 MW of biomass-fired generating capacity after 2045,[95] which is also a carbon-emitting resource.

Q. Does the Company provide any explanation about how retaining biomass-fired capacity beyond 2045 in Alternative Plans D and E is consistent with its claim that the Plans comply with VCEA's obligation to retire all carbon-emitting capacity?

A. No, the Company does not provide any explanation about how retaining biomass-fired capacity beyond 2045 in Alternative Plans D and E is consistent with its claim that the Plans comply with VCEA's obligation to retire all carbon-emitting capacity.

Q. In Alternative Plans D and E, when does all carbon-emitting capacity (except the 970 MW gas-fired CT and 153 MW of biomass-fired capacity) retire?

A. According to the Company's response to Staff information request set 01-52, Alternative Plans D and E have an identical fossil fuel-fired capacity retirement schedule: No retirements occur before 2039, with the exception of 245 MW of gas-fired capacity scheduled for retirement in 2025. (Note that this is inconsistent with the information provided in the Company's Figures 2.2.4 and 2.2.5 in its IRP, which does not show any planned retirements in 2025 for either Alternative Plans D or E). For both Alternative Plans D and E, 11,370 MW of coal, gas-fired CT and gas-fired combined cycle (CC) capacity remains online until 2038 (see Table 5). The first coal retirement will take place in 2040.

Table 5. Retirements of coal, gas CT and gas CC capacity in Dominion's Alternative Plans D and E

	2023-2038	2039	2040	2041	2042	2043	2044	2045
Gas CT	-245	0	0	-1,005	0	-782	0	-604
Gas CC	0	-594	-155	0	-1,195	0	0	-4,370
Coal	0	0	-439	0	0	0	-1,617	-610
Total	-245	-594	-593	-1,005	-1,195	-782	-1,617	-5,584

Source: Staff Information Request Set 01-52.

Q. What are the consequences of modeling 98 percent of planned retirements over a seven-year period in Alternative Plans D and E?

[95] Staff Information Request Set 01-52.

A. The consequences of modeling 98 percent of planned retirements over the seven-year period directly preceding the mandatory retirement deadline included in the VCEA (i.e. all carbon-emitting generation must be retired by the end of 2045 and 98 percent of total retirements take place between 2039 and 2045) is that renewable energy and energy storage resources are disadvantaged in terms of their ability to replace gas and coal resources that must retire according to VCEA requirements.

Dominion's modeling assumptions limit the annual amount of utility-scale solar, distributed solar, onshore wind and energy storage capacity additions to [BEGIN CONFIDENTIAL INFORMATION]

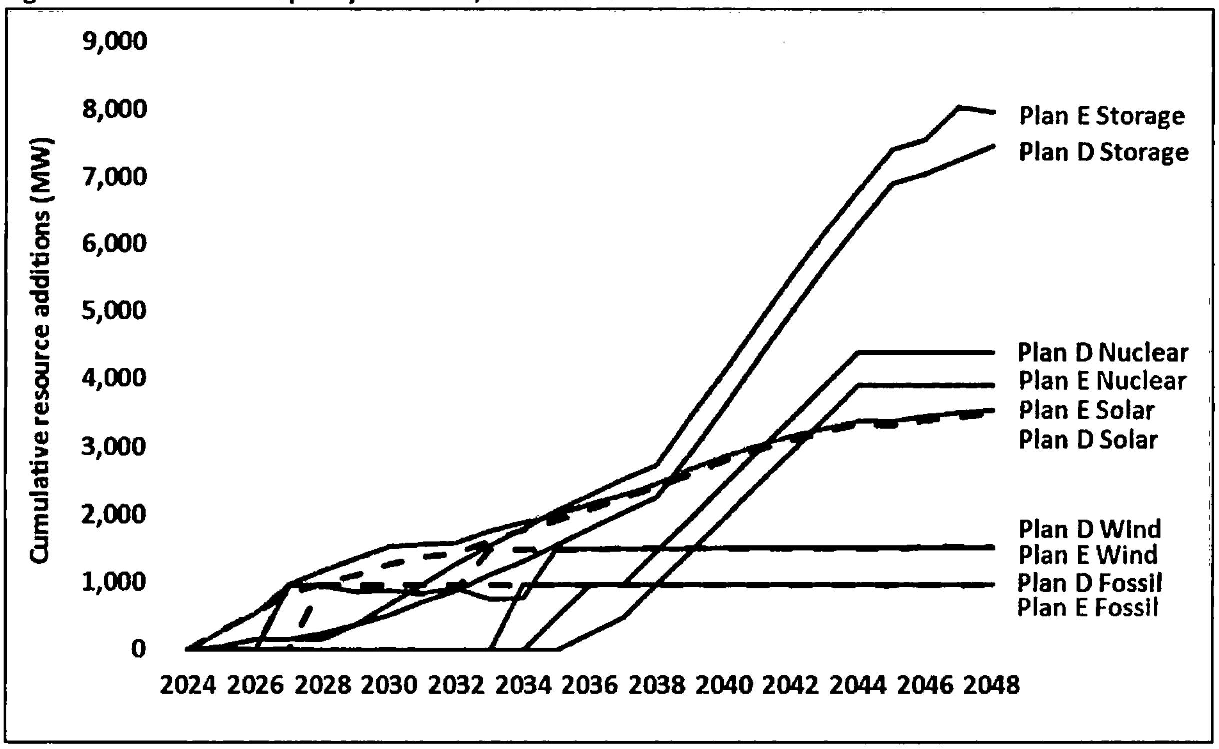
[96] [END CONFIDENTIAL INFORMATION]. Therefore, retiring large amounts of gas and coal-fired resources in a short amount of time makes it impossible for these resources to replace them.

Q. Are Alternative Plans D and E meaningfully distinct from one another?

A. No. Alternative Plans D and E are identical in terms of their retirement schedule for fossil fuel fired resources, and are nearly identical in terms of timing and amount of capacity additions (see Figure 12). The primary difference between capacity additions between Alternative Plans D and E is in the storage and nuclear categories. Plan E has more storage and less nuclear than Plan D, suggesting that storage is cost-effective under IRP assumptions. That is, Plan E capacity additions are least-cost optimized without regard for VCEA targets. (Note: again, the information the Company provided about capacity additions is inconsistent between Figures 2.2.4 and 2.2.5 in its IRP and its response to Staff information request set 01-52).

[96] Dominion corrected response to Clean Virginia Information Request Set 01-10(f).

Figure 12. Cumulative capacity additions, Alternative Plans D and E



Data source: Staff information request set 01-52.

Q. Do any of the Company's Alternative Plans comply with all VCEA requirements?

A. No, none of the Alternative Plans—as described by the Company itself—comply with all VCEA requirements: RPS targets, renewable energy and energy storage capacity development targets by the dates specified in the VCEA, and carbon-emitting generation unit retirement requirements.

VIII. Dominion does not adequately capture regulatory impacts on its coal units or the cost risks of emitting carbon dioxide

Q. Does Dominion's 2023 IRP adequately evaluate the future of the Company's coal units?

A. No. Dominion's 2023 IRP does not adequately evaluate the futures of the Company's coal units. The IRP takes a short-sighted and unrealistic approach to evaluating the Company's coal fleet. The Company chose to ignore some of the risks of keeping its coal fleet on-line—namely the costs of compliance with proposed or finalized EPA regulations that would lead to a retire versus retrofit decision in the late 2020's or 2030's. Instead, the Company's plans take a "blind eye" approach: all Alternative Plans include the Company's 439 MW Clover, 1,617 MW Mount Storm, and 610 MW VA Hybrid Energy Center (VA City) coal units operating through at least 2038.[97] But it is simply poor planning to assume that none of these units would retire

[97] Ibid. Figures 2.2.1 through 2.2.5.

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between now and then given the myriad pressures to retire coal in the short to medium term—primarily environmental compliance and competition from lower-cost resource options. In particular, the Mount Storm units are more than 50 years old today,[98] yet the Company expects them to operate until they are at least 65 years old.

Q. Are there both final and proposed EPA rules that would impact the future of Dominion's coal units?

A. Yes, in recent months the agency has issued a final rule on the transport of ozone—the Good Neighbor Rule—and a proposed rule for limiting CO_2 under Section 111(d) of the Clean Air Act. Both rules represent substantial risks for coal generation going forward, primarily by presenting coal owners with the choice of installing costly emission controls or accelerated retirement to achieve compliance. Despite these risks, the Company did not address the impact of either rule (or a similar type of rule) in its IRP, nor did the Company consider any plan that accelerated coal retirements at Clover, Mt Storm and VA City.[99]

Q. Please describe the EPA's Good Neighbor Plan.

A. In February 2022, the U.S. EPA proposed the Good Neighbor Plan, which was the latest version of ozone air transport rules that address how upwind polluters contribute to downwind ozone levels.[100] The rule, which was finalized in March 2023, will lead many coal units that are currently lacking in the most effective NO_x control (selective catalytic reduction (SCR)) to either install those controls, purchase costly emission allowances, or retire.

The Good Neighbor Plan limits NO_x emissions to reduce the formation of ground-level ozone in states that are downwind from the emission source. Per the Clean Air Act, the EPA sets National Ambient Air Quality Standards (NAAQS) for ground-level ozone levels based on its adverse impacts on human health. When those NAAQS limits are periodically updated, all states have an obligation to limit upwind emission sources. In 2015, EPA lowered the ozone NAAQS to 70 parts per billion (ppb) to address public health concerns—down from a previous limit of 75 ppb in the 2008 NAAQs.[101] The Good Neighbor Plan requires that 22 upwind states, including Virginia and West Virginia, reduce their NO_x emissions at power plants to avoid affecting other states' abilities to meet their 2015 ozone NAAQS levels.[102]

The EPA's final rule would effectively require coal units over 100 MW in capacity that do not have SCR to install one, retire, or purchase substantial emission allowances for compliance. For units currently without an SCR, the rule would require that the unit achieve an emission rate commensurate with a SCR by 2030 at

[98] Ibid. Appendix 5A.
[99] Ibid.
[100] U.S. EPA. 2023. "Good Neighbor Plan for 2015 Ozone NAAQS." Available at: https://www.epa.gov/csapr/good-neighbor-plan-2015-ozone-naaqs
[101] U.S. EPA. 2023. "Ozone National Ambient Air Quality Standards (NAAQS)." Available at:https://www.epa.gov/ground-level-ozone-pollution/ozone-national-ambient-air-quality-standards-naaqs
[102] U.S. EPA. 2023. "Good Neighbor Plan for 2015 Ozone NAAQS." Available at: https://www.epa.gov/csapr/good-neighbor-plan-2015-ozone-naaqs

the latest.[103]

Q. Are any of Dominion's coal units lacking SCR controls?

A. Yes, the Clover and Virginia City Hybrid Energy Center coal plants do not have SCR and would therefore either need to install the control, retire, or purchase allowances to comply with the final Good Neighbor Plan.[104]

Q. Did Dominion consider the compliance costs associated with the Good Neighbor Plan in developing its IRP?

A. No, Dominion did not consider the compliance costs associated with the Good Neighbor Plan in developing its IRP. The Company ignored compliance costs by failing to evaluate the Good Neighbor Plan in this IRP. In Dominion's response to Clean Virginia information request set 02-23, the Company said that the reason it did not consider the Good Neighbor Plan was because the rule was published in the Federal Register after the IRP was filed in May 2023.[105] However, the rule was proposed in February of 2022 and finalized by EPA in March 2023, which gave the Company time to at least consider the proposed version of the rule. Regardless, the regulation of ozone transport is nothing new. It has been regulated in previous EPA rules that were updated or replaced after ozone NAAQS limits were reduced. The latest ozone NAAQS limit was imposed in 2015 and, until the Good Neighbor Plan, there had not been a corresponding transport rule for 2015 NAAQS. Thus, the industry was not taken by surprise when a new transport rule was proposed. Dominion, at the very least, should have considered the impacts that a new ozone transport rule would have on its fleet, rather than ignore the possibility that a proposed EPA rule would become a final EPA rule.

Q. Please describe the EPA's proposed CO_2 pollution standard.

A. In May 2023, the EPA proposed new limits on coal units' CO_2 emissions as part of Section 111(d) of the Clean Air Act. This rule would require that existing coal units would have to: 1) install carbon capture and sequestration (CCS) technology by 2030 that capture 90 percent of those emissions; or 2) retire before 2032 without CCS; or 3) retire before 2035 without CCS but operate at a 20 percent annual capacity factor starting in 2030.[106] This rule would effectively shut down all coal generation in the United States in the next

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[103] United States Environmental Protection Agency. March 2023. "Regulatory Impact Analysis for the Final Federal Good Neighbor Plan Addressing Regional Ozone Transport for the 2015 Ozone National Ambient Air Quality Standard." Pp. 50-52. Available at: https://www.epa.gov/system/files/documents/2023-03/SAN%208670%20Federal%20Good%20Neighbor%20Plan%2020230315%20RIA_Final.pdf

[104] Company response to Clean Virginia Information Request Set 02-23(a). The Company indicates the only the Mount Storm coal plant has SCR.

[105] Company response to Clean Virginia Information Request Set 02-23(b-e).

[106] United States Environmental Protection Agency. May 2023. "Clean Air Act Section 111 Regulation of Greenhouse Gas Emissions from Fossil Fuel-Fired Electric Generating Units." Page 13. Available at: https://www.epa.gov/system/files/documents/2023-05/111%20Power%20Plants%20Stakeholder%20Presentation2_4.pdf

decade—with the exception of units whose owners elect to install expensive CCS technology.

Q. Did the Company consider the impacts of EPA's proposed CO_2 pollution standard in its 2023 IRP?

A. No, the Company did not consider the impacts of EPA's proposed CO_2 pollution standard, which would require CCS or retirement of coal units in the next decade. In the Company's response to Sierra Club information request set 03-04, Dominion stated that it had not evaluated the cost of complying with this rule and that it would only do so once it was finalized.[107] A CO_2 emissions limit is one of myriad risks to the future of the Company's coal fleet that should compel Dominion to evaluate the potential consequences of a proposed regulation. Moreover, as discussed in Section 7 of my testimony, the Company's IRP also fails to comply with carbon reductions that are settled law in Virginia.

Q. Did the Company adequately capture the cost risks of emitting CO_2?

A. No, the Company did not adequately capture the cost risks of emitting CO_2. Most of the Company's modeling scenarios assume that Virginia leaves the RGGI market in 2023 and incurs zero costs of emitting CO_2 until 2036, at which point Dominion's IRP includes a small federal carbon cost starting at $3 per ton.[108] Thus, the costs of emitting carbon in the analysis period are close to nothing when compared to the latest proposal for the social cost of carbon from the EPA, which is between $120 and $340 per metric ton of 2020 emissions.[109] The Company claimed that it "continues to believe that some federal economic incentive will be required for the country to reduce emissions and will revisit this assumption in future modeling."[110] But the inclusion of a miniscule carbon cost starting in 2036 hardly represents the cost risks of the proposed EPA rule nor any future limitations on carbon emissions.

Q. Did the Company capture the externality costs to society of emitting carbon?

A. No, unlike in previous years, the Company elected to not model a social cost of carbon.[111] Dominion claimed that because the federal carbon price forecast that they reviewed was too high that including a social cost of carbon would be "duplicative."[112] However, the latest proposal for the social cost of carbon from the EPA is between $120 and $340 per metric ton of 2020 emissions (depending on the discount rate)

[107] Company response to Sierra Club Information Request Set 03-04.

[108] Dominion Energy. 2023. "Integrated Resource Plan." Appendix 4N.

[109] United States Environmental Protection Agency. September 2022. "Supplementary Material for the Regulatory Impact Analysis for the Supplemental Proposed Rulemaking, 'Standards of Performance for New, Reconstructed, and Modified Sources and Emissions Guidelines for Existing Sources: Oil and Natural Gas Sector Climate Review': EPA External Review Draft of Report on the Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific Advances." p.3. Available at: https://www.epa.gov/system/files/documents/2022-11/epa_scghg_report_draft_0.pdf

[110] Dominion Energy. 2023. "Integrated Resource Plan." Page 75.

[111] Ibid.

[112] Ibid.

and the value grows over time.[113] This is substantially divergent from Dominion's modeling of zero costs from 2024 through 2035, and the Company's post-2035 proxy for federal carbon costs at $3 per ton is simply not comparable.

IX. Dominion failed to conduct stakeholder engagement as part of its 2023 IRP

Q. Are stakeholder engagement processes as part of utility IRP development common practice elsewhere in the country?

A. Yes. Several states require utilities conduct stakeholder engagement processes as part of IRP development, before an IRP is filed.[114] Examples include:

- **Arkansas:** community stakeholder engagement must occur through a committee composed of "retail and wholesale customers, independent power supplies, marketers, and other interested entities in the service area."[115] Stakeholders must review the utility's IRP objectives, assumptions, and needs in the early stages of the planning process, and a stakeholder-led report detailing their concerns about the IRP is included as part of the IRP submission.[116]
- **Hawaii:** Within 120 days of the IRP docket opening, the Public Utilities Commission must establish an Advisory Group comprised of representatives of public and private entities in utility territories.[117] The role of the Advisory Group is to "provide the utility with the benefit of community perspectives by participating in the utility's integrated resource planning process and representing diverse community, environmental, social, political, or cultural interests."[118] The Advisory Group is required to attend meetings during the key phases of the IRP planning process. Utilities must also provide "public hearings, meetings or forums, public outreach programs, an opportunity to submit comments" to the public, including parties that may not be adequately

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[113] United States Environmental Protection Agency. September 2022. "Supplementary Material for the Regulatory Impact Analysis for the Supplemental Proposed Rulemaking, 'Standards of Performance for New, Reconstructed, and Modified Sources and Emissions Guidelines for Existing Sources: Oil and Natural Gas Sector Climate Review': EPA External Review Draft of Report on the Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific Advances." Page 3. Available at: https://www.epa.gov/system/files/documents/2022-11/epa_scghg_report_draft_0.pdf

[114] Cooke, Alan. 2021. "Integrated Resource Planning in the U.S. Overview." [PowerPoint]. Pacific Northwest National Laboratory. Presented to the South Carolina Office of Regulatory Staff. Available at: https://eta-publications.lbl.gov/sites/default/files/sc_commission_day_1_irps_in_us_review_of_requirements_final.pdf. Slide 5.

[115] Arkansas Public Service Commission. June 2007. *Resource Planning Guidelines for Electric Utilities.* Available at: https://www.sos.arkansas.gov/uploads/rulesRegs/Arkansas%20Register/2007/jun_2007/126.03.07-003.pdf. Page 3

[116] Ibid. Page 3.

[117] Hawaii Public Utilities Commission. March 14, 2011. Docket No. 2009-0108 - F-1 of Revised Docket. "Instituting a Proceeding to Investigate Proposed Amendments To the Framework for Integrated Resource Planning." Available at: https://dms.puc.hawaii.gov/dms/DocumentViewer?pid=A1001001A11C14B71121I26750. Page 11 (or 111).

[118] Ibid. Page 8 (or 109).

represented in the Advisory Group.[119]

- **Indiana:** Indiana's administrative code 170 IAC requires utilities to "solicit, consider and timely respond to all relevant input related to the development of the utility's IRP provided by interested parties, the OUCC [Office of Utility Consumer Counselor]; and commission staff."[120] Prior to the IRP filing, utilities must hold at least three meetings in the utility's service territory to provide an introduction to the IRP and stakeholder engagement process, explain the IRP's load forecast, evaluate existing resources, and discuss supply-side and demand-side resource alternatives.[121] Utilities must publish meeting agendas and supporting materials to the utility website at least seven calendar days prior to each meeting and post meeting minutes within 15 calendar days after each meeting. Utilities must also take "reasonable steps" to notify customers, the commission and interested parties of its public advisory process. As part of the IRP filing, utilities must submit a description of how stakeholder input was used in developing the IRP.[122]
- **Oregon:** Guideline 2 of Order No. 07-002, originally passed in 1989 but revised in 2007, requires utilities to allow significant public involvement in IRP development, including the opportunity to make inquiry of utilities and timely opportunities to comment and inform the plan.[123] Under the same guideline, utilities must provide access to review and comment on the draft IRP prior to its final filing.

Q. Did Dominion conduct a stakeholder engagement process as part of the 2023 IRP's development?

A. No, Dominion did not conduct a stakeholder engagement process in the development of its 2023 IRP. When asked to clarify whether stakeholder input was solicited and/or received as part of the 2023 IRP development, the Company responded that it "has received stakeholder input from various parties in past proceedings before the Commission, including past litigated IRPs and RPS Program-related proceedings."[124] This level of engagement is insufficient because it fails to provide stakeholders with the opportunity to make inquiries of the Company as it develops its IRP or provide feedback on the Company's IRP, such as the Company's chosen methodology, modeling inputs, or assumptions.

Q. Is Dominion required to conduct a stakeholder engagement process for future IRPs?

A. Yes. In April 2023, Virginia amended Section 56-599(D) of the Virginia Code to require each utility to conduct a stakeholder review process as part of its IRP development, including allowing the public to

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[119] Ibid. Page 9 (or 110).

[120] Indiana Utility Regulatory Commission. 2023. 170 IAC 4-7-2.6 (c). Available at: http://iac.iga.in.gov/iac/iac_title?iact=170&iaca=&submit=+Go

[121] Indiana Utility Regulatory Commission. 2023. 4-7-2.6 (e)(1). Available at: http://iac.iga.in.gov/iac/iac_title?iact=170&iaca=&submit=+Go.

[122] Indiana Utility Regulatory Commission. 2023. 4-7-4 (30)(C). Available at: http://iac.iga.in.gov/iac/iac_title?iact=170&iaca=&submit=+Go

[123] Oregon Public Utility Commission. January 8, 2007. Order No. 07-002 Guideline 2: Procedural requirements. Available at: https://apps.puc.state.or.us/orders/2007ords/07-002.pdf

[124] Clean Virginia Information Request Set 01-07.

review and provide feedback on the IRP's methodology, modeling, and assumptions. The Code of Virginia requires stakeholder engagement for IRP preparation as follows:

> *As part of preparing any integrated resource plan pursuant to this section, each utility shall conduct outreach to engage the public in a stakeholder review process and provide opportunities for the public to contribute information, input, and ideas on the utility's integrated resource plan, including the plan's development methodology, modeling inputs, and assumptions, as well as the ability for the public to make relevant inquiries, to the utility when formulating its integrated resource plan. Each utility shall report its public outreach efforts to the Commission. The stakeholder review process shall include representatives from multiple interest groups, including residential and industrial classes of ratepayers. Each utility shall, at the time of the filing of its integrated resource plan, report on any stakeholder meetings that have occurred prior to the filing date.* [125]

Q. Does Dominion commit to future stakeholder engagement as part of its IRP process?

A. Yes. In its response to Appalachian Voices information request set 06-11, Dominion indicated that it "will comply with any legal requirement to conduct a stakeholder process."[126]

Q. What are some of the benefits of IRP stakeholder engagement processes?

A. According to research conducted by Berkeley Lab researchers on behalf of the U.S. Department of Energy's Office of Electricity, Energy Resilience Division, stakeholder engagement processes help:

- educate stakeholders on utility plans;
- make utility decision-making for resource planning more transparent;
- create opportunities for feedback on the utility's resource plan;
- facilitate robust, informed dialogue on resource options and decisions;
- create opportunities for improvements to the utility's planning assumptions and methods; and
- facilitate stakeholder buy-in.[127]

Stakeholder engagement also reduces areas of disagreement and conflict between the utility and other stakeholders prior to the IRP's filing, which allows for a more focused review by the Commission. In other words, the issues being brought to the Commission's attention after a robust stakeholder engagement effort are fewer—in general—than when stakeholder engagement is not conducted. By failing to provide meaningful stakeholder engagement during the development of its 2023 IRP, the Company has—in effect—forced all areas of disagreement and conflict before the Commission in the IRP proceeding itself.

Q. How does stakeholder engagement help ensure the development of IRPs that are reasonable and in

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[125] Virginia General Assembly. April 12, 2023. Chapter 753 Section 56-599(D). Available at: https://lis.virginia.gov/cgi-bin/legp604.exe?231+ful+CHAP0753

[126] Appalachian Voices Information Request Set 06-11.

[127] Frick, N. M. March 4, 2021. *Training on Integrated Resource Planning for the South Carolina Office of Regulatory Staff.* [PowerPoint]. Berkeley Lab. Available at: https://eta-publications.lbl.gov/sites/default/files/stakeholder_engagement_practices.pdf.

the public interest?

A. Stakeholder engagement can result in valuable feedback that strengthens the IRP's methodology, modeling, and assumptions and results in more robust and reliable utility resource plans.

For example, AES Indiana's stakeholder engagement process during the development of its 2022 IRP involved five public advisory meetings (the agendas, presentations and minutes for which are available on the Company's website)[128] and five technical meetings (among stakeholders that signed non-disclosure agreements and had access to confidential materials) between January 2022 and October 2022 covering topics including:

- IRP planning and model overview;
- Baseline energy and load forecast;
- Load scenarios;
- Results from all-source RFPs;
- Commodity forecasts;
- Reliability planning and analysis;
- Portfolio metrics and scorecards;
- Preliminary model results; and
- Analysis of preferred resource plan.[129]

In its 2022 IRP, AES Indiana notes that stakeholder feedback resulted in several changes to its IRP, including:

- "faster modeling runtimes" and a "proven approach to modeling DSM as a resources"[130] due to modeling software transitions suggested by stakeholders;
- "extensive collaboration with stakeholders on DSM which resulted in improvement and agreement on the DSM bundling methodology";[131] and
- An expansion of "IRP Scorecard Evaluation metrics for portfolio evaluation, including the addition of the portfolio Reliability Analysis and reliability scoring criteria."[132]

In Arkansas, both Southwestern Electric Power Company (SWEPCO) and Entergy held stakeholder engagement processes as part of their 2021 IRP process. Entergy held two stakeholder meetings—the first

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[128] AES Indiana. No date. "Integrated Resource Plan." Available at: https://www.aesindiana.com/integrated-resource-plan.

[129] AES Indiana. 2022. "2022 Integrated Resource Plan – Non-technical Summary." Available at: https://www.aesindiana.com/sites/default/files/2023-01/AES-Indiana_2022-IRP_Non-Technical-Summary_f0111.pdf. Page 7.

[130] AES Indiana. 2022. "2022 Integrated Resource Plan." Available at: https://www.aesindiana.com/sites/default/files/2022-12/AES-Indiana-2022-IRP-Volume-I.pdf. Page 4.

[131] Ibid.

[132] Ibid.

14 months before their IRP filing deadline and the second 3 months before their IRP filing deadline.[133] SWEPCO held one stakeholder meeting about three months before its IRP filing deadline.[134] According to the stakeholder-led reports filed as part of each IRP submission, both utilities provided stakeholders with information and materials related to IRP modeling ahead of stakeholder meetings and were responsive to stakeholder requests.[135] SWEPCO also provided stakeholders with a draft IRP in advance of their one stakeholder meeting.[136] SWEPCO's 2021 IRP indicates that stakeholder feedback helped inform its scorecard metrics[137] while Entergy's 2021 IRP indicates that stakeholder feedback helped inform its sensitivity analyses.[138]

Q. What are best practices regarding stakeholder engagement processes?

A. Best practices in IRP stakeholder engagement include conducting stakeholder engagement wherever possible, ensuring stakeholder engagement is culturally and linguistically appropriate, ensuring stakeholder engagement entails multiple meetings with multiple modes of participation, investing in long-term stakeholder relationships, conducting outreach to facilitate engagement, and documenting how stakeholder feedback is utilized.[139]

Guidance provided by the National Association of Regulatory Utility Commissioners explains that a stakeholder engagement process should assemble "diverse stakeholders who are representative of the constituencies affected by commission decision-making."[140] These stakeholders include (but are not

[133] "21 IRP August 2020 Stakeholder Kickoff - Entergy Arkansas." Accessed September 15, 2022. https://cdn.entergy-arkansas.com/userfiles/content/IRP/2021/21IRP_August_2020_Stakeholder_Kickoff.pdf

[134] "SWEPCO IRP Stakeholder Conference." Southwestern Electric Power Company. Accessed September 15, 2022. https://www.swepco.com/lib/docs/community/projects/2021-09-15_SWEPCO2021StakeholderMeeting.pdf.

[135] 1) Southwestern Electric Power Company. 2021. "2021 Integrated Resource Plan – Stakeholder Committee Report." Available at: https://www.sierraclub.org/sites/www.sierraclub.org/files/SWEPCO%20IRP%20Stakeholders%20Report%2011.12.21.pdf; 2) Entergy Arkansas LLC. 2021. "2021 Integrated Resource Plan." Available at: https://cdn.entergy-arkansas.com/userfiles/content/IRP/2021/2021_EAL_Integrated_Resource_Plan.pdf. Pages 141-152.

[136] Southwestern Electric Power Company. 2021. "2021 Integrated Resource Plan – Stakeholder Committee Report." Available at: https://www.sierraclub.org/sites/www.sierraclub.org/files/SWEPCO%20IRP%20Stakeholders%20Report%2011.12.21.pdf.

[137] Southwestern Electric Power Company. 2021. "2021 Integrated Resource Plan Report." Available at: https://www.swepco.com/lib/docs/community/projects/DocketNo07-011-USWEPCOIRP12-15-2021Filed.pdf. Page 97.

[138] Entergy Arkansas LLC. 2021. "2021 Integrated Resource Plan." Available at: https://cdn.entergy-arkansas.com/userfiles/content/IRP/2021/2021_EAL_Integrated_Resource_Plan.pdf. Page 50.

[139] SEPA. 2023. *Embedding Equity in Utility Transformation.* Available at: https://sepapower.org/resource/embedding-equity-in-utility-transformation/#:~:text=Utilities%20should%20focus%20on%20energy,parts%20of%20the%20energy%20system; p.12.

[140] McAdams, J. 2021. *Public Utility Commission Stakeholder Engagement: A Decision-Making Framework.* Available at: https://pubs.naruc.org/pub/7A519871-155D-0A36-3117-96A8D0ECB5DA. p. 22.

limited to) environmental groups, low-income and consumer advocates, state legislators, and transportation electrification organizations and advocates.[141] Utilities should set stakeholder engagement timelines by working backward from final dates, designing timelines to accommodate the need for stakeholder flexibility, and clearly communicating timelines to stakeholders early in the process.[142] For example, In AES Indiana's 2022 IRP: The IRP was submitted in December 2022 and its stakeholder engagement meetings took place between January 2022 and October 2022. That means participating stakeholders were contacted and agreed to participate prior to January 2022.

Q. What are the consequences to the 2023 IRP of Dominion's failure to conduct a stakeholder engagement process?

A. Dominion's failure to conduct a stakeholder engagement process leaves it vulnerable to critical weaknesses in its IRP methods, modeling, and assumptions—such as those discussed in this testimony—that could have been addressed with stakeholder feedback. Had these issues been addressed during the IRP's development, the IRP might have been more reasonable and/or in the public interest.

Q. How should Dominion structure its stakeholder engagement processes to provide an opportunity for timely input into its next IRP's development?

A. In my opinion, a robust stakeholder engagement process must begin at least a full calendar year prior to final IRP submission to allow for meaningful participation and feedback. According to Virginia law, and on the advice of counsel, my understanding is the next IRP will be filed on October 15, 2024. On that basis, the Commission should order Dominion to commence stakeholder meetings as soon as possible. The Commission should also clearly communicate the information, materials, and data that Dominion must make available to stakeholders, such as (but not limited to): modeling inputs and outputs, modeling assumptions, Company workpapers, Alternative Plans, sensitivity analyses, and load and energy forecasts. Finally, the Commission should also provide clear guidance for the Company regarding the minimum number of stakeholder meetings to be held, providing in-person and remote meeting options, providing language translation and interpretation services, what kinds of stakeholders should be represented, and what topics should be addressed.

In addition, given the degree to which PJM's load forecast (and the Company's adjustments to it and sensitivity analysis of it) influence the Company's IRP results, I also recommend the Commission establish a load forecasting working group that would conduct its work during the development of PJM's next load forecast. The load forecasting working group should be led by the Commission, and include, at a minimum:

- Dominion representatives,
- PJM representatives,
- Data center industry representatives,

[141] Ibid.

[142] McAdams, J. 2021. *Public Utility Commission Stakeholder Engagement: A Decision-Making Framework.* Available at: https://pubs.naruc.org/pub/7A519871-155D-0A36-3117-96A8D0ECB5DA. p. 30.

- Ratepayer advocates,
- Low-income, vulnerable, and marginalized community representatives,
- Independent, third-party load forecasting, energy efficiency, and demand side management experts, and
- Advocacy organizations.

X. Conclusions and recommendations

Q. What do you recommend to the Commission?

A. For the reasons explained in this testimony, I recommend the following:

1. Regarding environmental justice, the Commission should require that the Company's IRPs:
    a. "Consider the impact of unit retirement decisions on environmental justice communities or fenceline communities."[143]
    b. Present how the Company identifies potential environmental justice issues, including screening metrics.
    c. Conduct engagement with communities affected by potential environmental justice issues, and report on those efforts.
    d. Assess and present the community-level health, environmental, and economic impacts from planned resource additions, retirements, or lack of retirements.
    e. Assess and present the changes in air quality or water quality anticipated from resource decisions within Dominion's service territory.
    f. Assess and present how energy costs impact different communities within Dominion's service territory differently.
    g. Include Alternative Plans that directly address environmental justice issues, such as by siting distributed energy resources in environmental justice communities or by prioritizing fossil fuel-fired generation retirements in environmental justice communities, and
    h. Specify how energy efficiency, demand response, and distributed energy resource programs are being targeted towards underserved and vulnerable environmental justice community households, such as by offering income- or disability-qualified benefits, or by targeting program dollars at specific communities.[144]

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[143] Commonwealth of Virginia. State Corporation Commission. February 1, 2021. Case No. PUR-2020-00035. FINAL ORDER. Re: Virginia Electric and Power Company's Integrated Resource Plan filing pursuant to Va. Code § 56-597 et seq. Page 14-15.

[144] Kallay, J., A Napoleon, K. Takahashi, E. Sinclair, T. Woolf. 2021. *Opportunities for Evergy Kansas within its Integrated Resource Plan and Other Planning Processes.* Prepared for the Union of Concerned Scientists and CleanAirNow. Synapse Energy Economics. Available at: https://www.synapse-energy.com/sites/default/files/Equity_in_Evergy_KS_IRP_Report_21-051.pdf.

2. Regarding the absence of a feasible least-cost plan or preferred plan in the Company's 2023 IRP:
    a. The Commission should not conclude that Dominion's 2023 IRP is either "reasonable" or "in the public interest"[145] because it fails to identify a preferred plan, present a feasible least-cost plan, or provide meaningfully distinct Alternative Plans, as required by the Commission's 2020 IRP Final Order.
3. Regarding the Company's utilization of PJM's load forecast:
    a. Given the degree to which PJM's load forecast influence the Company's IRP results, I recommend the Commission establish a load forecasting working group that is led by the Commission and includes a broad range of representatives, including from: Dominion; PJM; data center industry; ratepayer advocates; low-income, vulnerable, and marginalized communities; independent, third-party experts; and advocacy organizations.
4. Regarding Dominion's energy efficiency assumptions as part of the Company's adjustments to PJM's energy forecast:
    a. The Commission should mandate that Dominion assume new, increasing energy efficiency requirements in every three-year period after 2023-2025.
5. Regarding the Company's planned renewable energy and energy storage capacity in its Alternative Plans:
    a. Because Dominion has failed to meet the basic obligations of the VCEA in its Alternative Plans, the Commission should find that this IRP is reasonable and in the public interest.
    b. The Commission should require the Company to construct each Alternative Plan such that it meets VCEA-mandated solar, onshore wind, and energy storage capacity requirements by the dates specified in the VCEA.
6. Regarding Alternative Plans D and E, which the Company claims are compliant with the VCEA's requirement to retire all carbon-emitting generation by the end of 2045:
    a. Because Dominion's Plans D and E are not consistent with the VCEA, even if the Company's 970 MW gas-fired CT plant is assumed to be "hydrogen capable" by 2045, the Commission should not find that this IRP is reasonable and in the public interest.
    b. The Commission should require that the Company construct each Alternative Plan such that it retires all biogenic and non-biogenic carbon-emitting resources by the end of 2045, with those retirements taking place at a steady pace between 2025 and 2045.
    c. In addition, the Commission should require that the Company construct each Alternative Plan such that it meets <u>**all**</u> its obligations under the VCEA, namely: the RPS; the development of solar, onshore wind, and energy storage capacity in the amounts and by the dates specified in the VCEA; <u>**and**</u> the retirement of all biogenic and non-biogenic

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[145] Virginia State Corporation Commission. Case No. PUR-2020-00035. Dominion 2020 IRP Final Order. "Pursuant to Code § 56-599 C, the Commission must, after giving notice and an opportunity to be heard, determine whether Dominion's IRP is reasonable and in the public interest."

carbon-emitting resources by the end of 2045, with those retirements taking place at a steady pace between 2025 and 2045.

7. Regarding potential regulatory impacts on the Company's coal units and costs of emitting carbon dioxide:
    a. Because the Company chose to ignore the EPA's proposed new limits on coal units' CO_2 emissions as part of Section 111(d) of the Clean Air Act, the EPA's proposed Good Neighbor Plan, and the federal government's social cost of carbon, the Commission should not find that this IRP is reasonable and in the public interest.
    b. The Commission should require that the Company assess the compliance costs associated with the EPA's proposed new limits on coal units' CO_2 emissions as part of Section 111(d) of the Clean Air Act and its Good Neighbor Plan and model a social cost of carbon that is in line with the EPA's most recent proposed price.
8. Regarding stakeholder engagement:
    a. The Commission should order Dominion to commence stakeholder meetings as soon as possible for its next IRP.
    b. The Commission should clearly communicate the information, materials, and data that Dominion must make available to stakeholders, such as (but not limited to): modeling inputs and outputs, modeling assumptions, Company workpapers, Alternative Plans, sensitivity analyses, and load and energy forecasts.
    c. The Commission should also provide clear guidance for the Company regarding the minimum number of stakeholder meetings to be held, providing in-person and remote meeting options, providing language translation and interpretation services, what kinds of stakeholders should be represented, and what topics should be addressed.

Q. Does this conclude your testimony?

A. Yes.

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Exhibit A

CV of Bryndis Woods, Phd

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Bryndis Woods, Ph.D., Senior Researcher

6 Liberty Sq., PMB 98162, Boston, MA, 02109 ⌘ bryndis.woods@aeclinic.org ⌘ 781-999-5751

PROFESSIONAL EXPERIENCE

Applied Economics Clinic, Arlington, MA. *Senior Researcher*, 2017 – Present

Assistant Director, Oct. 2022 – Jan. 2023

Board Member—Staff Representative, April 2019 – Jan. 2020

Conducts research and analysis on electric utility regulation, energy markets, and energy policy. Clients are primarily public service organizations working on topics related to the environment, consumer rights, the energy sector, and community equity.

International Institute for Sustainable Development's Earth Negotiations Bulletin (IISD-ENB), Boston, MA. *Staff Writer*, 2017 – Present

Responsible for writing and editing the Earth Negotiations Bulletin and IISD's other conference reporting services. Develop clear and succinct summaries of international processes, including the Intergovernmental Panel on Climate Change and the United Nations Framework Convention on Climate Change.

Nordic Centre of Excellence for Strategic Adaptation Research (NORD-STAR), Reykjavik, Iceland. *Doctoral Researcher*, 2012 – 2020.

Responsible for leading research on agricultural adaptation in Denmark. Performed survey design, distribution and analysis, principal component analysis, cluster analysis, and content analysis.

Business for Social Responsibility (BSR), Copenhagen, Denmark. *Analyst*, 2015 – 2016.

Responsible for detailed research and analysis, outreach, communications, writing, technical assistance, strategy and partnership development, and direct client work on sustainable development issues including adaptation and resilience, climate adaptation governance, supply chain sustainability and climate risk management. Split time between partnership development team – that works with bi- and multilateral development institutions – and consulting services – that works with member companies.

University of Iceland, Reykjavik, Iceland. *Researcher/Lecturer*, 2012 – 2013.

Led research on international climate negotiations and policy using economic game theory and discourse analysis. Lectured on the economics of climate change for a Master's level course "Global Climate Change: Past, Present and Future" in the Department of Environment and Natural Resources.

EDUCATION

University of Iceland, Reykjavik, Iceland

Doctor of Philosophy, Environment and Natural Resources, 2020

University of Iceland, Reykjavik, Iceland

Master of Science, Environment and Natural Resources, 2012

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University of Michigan, Ann Arbor, MI

Bachelor of Arts, Sociology, High Distinction, 2009

AFFILIATIONS

Global Development and Environment Institute, Tufts University, Medford, MA.

Visiting Scholar, 2017 – 2020

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CV dated August 2023

Exhibit B

Company responses to selected discovery from Clean Virginia, Appalachian Voices, SCC Staff, Microsoft

Virginia Electric and Power Company
Case No. PUR-2023-00066
Clean Virginia
Set 1

The following response to Question No. 7 of the First Set of Interrogatories and Requests for Production of Documents propounded by Clean Virginia received on June 1, 2023, was prepared by or under the supervision of:

Jarad L. Morton
Manager – Integrated Strategic Planning
Dominion Energy Services, Inc.

As it pertains to legal matters, the following response to Question No. 7 of the First Set of Interrogatories and Requests for Production of Documents propounded by Clean Virginia received on June 1, 2023, was prepared by or under the supervision of:

Vishwa B. Link
McGuireWoods LLP

Question No. 7

Please refer to page 23 of the Company's 2023 IRP:

"The Company's options for meeting customers' future capacity and energy needs are: (i) supply-side resources, (ii) demand-side resources, and (iii) market purchases. A balanced approach—which includes the consideration of options for maintaining and enhancing rate stability, increasing energy independence, promoting economic development, incorporating input from stakeholders, and minimizing adverse environmental impact—will help the Company meet growing demand while protecting customers from a variety of potential challenges."

Please clarify whether stakeholder input was solicited and/or received as part of the 2023 IRP development. If so, please provide the following information:

a. A list of stakeholders from whom input was received.

b. A list of topics on which stakeholder input was solicited.

c. A summary of stakeholder engagement efforts, including a list of virtual and/or in-person events and their timing.

d. A summary of how stakeholder input was incorporated into the IRP process.

e. Presentations and other documents provided to stakeholders during the development of the IRP.

f. Please describe any changes made in the modeling methodology that resulted from stakeholder input.

g. Please describe any changes made in the modeling assumptions that resulted from stakeholder input.

Response:

The Company objects to this request as overly broad, unduly burdensome, and potentially voluminous because it seeks extensive information, for an unknown period, on past stakeholder processes and input. Further, the Company objects to this request to the extent the burden of deriving or ascertaining the response is substantially the same for the Company as it is for Clean Virginia. See 5 VAC 5-20-260. Subject to and notwithstanding these objections, the Company provides the following response.

The Company has received stakeholder input from various parties in past proceedings before the Commission, including past litigated IRPs and RPS Program-related proceedings. The Company evaluates the input and makes refinements as appropriate. See, for instance, Sections 4.1.2 and 4.12 of the 2023 Plan for refinements made in this 2023 Plan.

Virginia Electric and Power Company
Case No. PUR-2023-00066
Clean Virginia
Set 1

The following response to Question No. 10(a) through (e) of the First Set of Interrogatories and Requests for Production of Documents propounded by Clean Virginia received on June 1, 2023, was prepared by or under the supervision of:

Jarad L. Morton
Manager – Integrated Strategic Planning
Dominion Energy Services, Inc.

The following response to Question No. 10(f) through (h) of the First Set of Interrogatories and Requests for Production of Documents propounded by Clean Virginia received on June 1, 2023, was prepared by or under the supervision of:

Corey J. Riordan
Project Construction Controls Consultant
Dominion Energy Services, Inc.

Question No. 10

Regarding new resource builds in PLEXOS:

a. Were all new resource types assumed to be owned by the Company?

   i. If not, please explain what resources types were assumed not to be owned by the Company and the assumed cost structure for such cases.

b. If the ITC was applied to any resources, please explain what percentage was applied to each resource type by year.

c. If the PTC was applied to any resources, please explain what dollar figure per MWh was applied to each resource type by year.

d. Were any additional tax credits modeled for domestic manufacturing per the Inflation Reduction Act (IRA) for any new resources?

   i. If so, please describe the tax credit amount and how it was applied, including if it was an adder to the PTC or ITC.

e. Were any additional tax credits modeled for location in an "energy community" per the IRA for any new resources?

Virginia Electric and Power Company
Case No. PUR-2023-00066
Clean Virginia
Set 1

The following response to Question No. 16(c) and (d) of the First Set of Interrogatories and Requests for Production of Documents propounded by Clean Virginia received on June 1, 2023, was prepared by or under the supervision of:

Jarad L. Morton
Manager – Integrated Strategic Planning
Dominion Energy Services, Inc.

The following response to Question No. 16(a) and (b) of the First Set of Interrogatories and Requests for Production of Documents propounded by Clean Virginia received on June 1, 2023, was prepared by or under the supervision of:

Corey J. Riordan
Project Construction Controls Consultant
Dominion Energy Services, Inc.

As it pertains to legal matters, the following response to Question No. 16 of the First Set of Interrogatories and Requests for Production of Documents propounded by Clean Virginia received on June 1, 2023, was prepared by or under the supervision of:

Vishwa B. Link
McGuireWoods LLP

Question No. 16

Please refer to page 30 of the Company's IRP:

"However, to address energy and capacity needs during more extreme weather scenarios, especially in the winter, the Company included 970 MW of new CT generation as early as 2028 in Plans B and D. These units will be capable of blending hydrogen in the future and critical to meeting grid reliability needs much sooner than 2035."

a. Please provide any and all supporting documents and workpapers on which the Company relied to conclude that new CT generation "will be capable of blending hydrogen."

b. For the new CT generation specified as being "capable of blending hydrogen" in Plans B and D, please specify what percentage of fuel can be blended as hydrogen. Please provide any and all supporting documents and workpapers on which the Company relied to arrive at a percent hydrogen blend.

c. Did the Company consider the cost of hydrogen in Plans B or D? If so, please provide the assumed cost of hydrogen.

d. Did the Company consider the source of future hydrogen supply? If so, please provide detailed information about the Company's hydrogen fuel sourcing options and considerations.

Response:

a. The Company objects to this request as overly broad, unduly burdensome, and potentially voluminous to the extent it seeks "any and all supporting documents and workpapers on which the Company relied to conclude that new CT generation 'will be capable of blending hydrogen.'" Subject to and notwithstanding this objection, the Company provides the following response.

The Company used publicly available market data from major combustion turbine original equipment manufacturers.

b. The Company objects to this request as overly broad, unduly burdensome, and potentially voluminous to the extent it seeks "any and all supporting documents on which the Company relied to arrive at a percent hydrogen level blend." Further, the Company objects to this request as it calls for a speculative response. Subject to and notwithstanding these objections, the Company provides the following response.

At this stage, the Company has not progressed a design far enough to determine a percentage of hydrogen blending.

c. The Company objects to this request on the basis that "cost of hydrogen" is vague and undefined. Subject to and notwithstanding this objection, the Company provides the following response assuming "cost of hydrogen" refers to hydrogen fuel costs.

No, hydrogen fueling costs are not included in Plans B and D. The Company clarifies that the CTs included in Plan B were not modeled as capable of blending hydrogen during the Study Period. However, the Company included estimated costs to convert facilities for hydrogen blending of approximately $500/kw in Plans D and E to support the net zero goals of those plans.

d. The market for hydrogen supply is not yet established; however the Company will continue to monitor and evaluate the market as it develops and will present information as it becomes available in future Plans and update filings. As noted in the Executive Summary of the 2023 Plan, "Over the long term, achieving the clean energy goals of Virginia, North Carolina, and the Company will require supportive legislative and regulatory policies, technological advancements, grid modernization, and broader investments across the economy. This includes support for the testing and deployment of technologies, such as long duration energy storage; renewable natural gas; vehicle-to-grid; hydrogen; advanced nuclear; and carbon capture and sequestration, all of which have the potential to significantly reduce greenhouse gas emissions."

Virginia Electric and Power Company
Case No. PUR-2023-00066
Clean Virginia
Set 1

The following response to Question No. 17 of the First Set of Interrogatories and Requests for Production of Documents propounded by Clean Virginia received on June 1, 2023, was prepared by or under the supervision of:

Jarad L. Morton
Manager – Integrated Strategic Planning
Dominion Energy Services, Inc.

As it pertains to legal matters, the following response to Question No. 17 of the First Set of Interrogatories and Requests for Production of Documents propounded by Clean Virginia received on June 1, 2023, was prepared by or under the supervision of:

Vishwa B. Link
McGuireWoods LLP

Question No. 17

Please refer to Figure 2.2.6 of the Company's IRP:

a. Please provide detailed information regarding each Plan's associated emissions, including:

   i. A breakdown of emissions by Plan, by resource, and by year throughout the entire planning period.

   ii. Assumed emissions rates and factors for all fuels.

Response:

i. See Attachment CV Set 01-17(i) (JLM).

ii. The Company objects to this request on the basis that "emission factor" is vague and undefined. Subject to and notwithstanding this objection, the Company provides the following response.

   See Attachment CV Set 01-17(ii) (JLM) for the emission rates used in the 2023 Plan.

Virginia Electric and Power Company
Case No. PUR-2023-00066
Clean Virginia
Set 2

The following response to Question No. 19(a) and (c) of the Second Set of Interrogatories and Requests for Production of Documents propounded by Clean Virginia received on June 29, 2023, was prepared by or under the supervision of:

Karim Siamer
Lead Economist
Dominion Energy Virginia

The following response to Question No. 19(b) of the Second Set of Interrogatories and Requests for Production of Documents propounded by Clean Virginia received on June 29, 2023, was prepared by or under the supervision of:

Stan Blackwell
Director – Customer Service & Strategic Partnerships
Dominion Energy Virginia

As it pertains to legal matters, the following response to Question No. 19 of the Second Set of Interrogatories and Requests for Production of Documents propounded by Clean Virginia received on June 29, 2023, was prepared by or under the supervision of:

Vishwa B. Link
McGuireWoods LLP

Question No. 19

Refer to Company response to APV Set 02-11 (KS).

a. Please provide any calculations used to develop the peak demand assumptions for data centers in Dominion's territory.

b. Please provide the five largest data centers that contribute to energy growth between 2023 and 2030.
   i. Please identify which of these data centers are planned versus existing.
   ii. For each of these five existing or planned data centers, is the Company aware of their plans to elect for retail choice or not? Please explain.
   iii. For each of the new data centers, please provide the Company's awareness of the project's status, including the operational date and energy requirements.

c. As found in the "Step 1-10 Peak" tab, please provide the basis for the "2023 PJM Data Center Forecast (per PJM)" including any supporting documentation and calculations used.

Response:

a. Peak demand assumptions for data centers in the Company's service territory were developed by PJM based on information provided by the Company and by other entities such as NOVEC and Mecklenburg (member of Old Dominion Electric Cooperative, ODEC). For a detailed explanation of PJM's methodology, please refer to https://www.pjm.com/-/media/planning/res-adeq/load-forecast/load-forecast-supplement.ashx

b. The Company objects to this request to the extent it seeks confidential customer information for which the Company does not have authorization to provide. Consistent with Dominion Energy Virginia's Privacy Policy, the Company is committed to protecting customers' personal data while providing safe, reliable, and affordable services. See https://www.dominionenergy.com/privacy. The Company also objects because "aware of their plans" in subpart (ii) and "each of the new data centers" in subpart (iii) is vague and overly broad, unduly burdensome, and potentially voluminous to the extent it seeks information on all new data centers of which the Company is aware. Subject to and notwithstanding these objections, the Company provides the following response.

   The Company does not forecast individual data centers. See page 56 of the 2023 Plan for a description of how the Company forecasts the data center industry.

c. See Company's responses to CV Set 02-19(a) and APV Set 05-02.

Virginia Electric and Power Company
Case No. PUR-2023-00066
Clean Virginia
Set 2

The following response to Question No. 22(a) of the Second Set of Interrogatories and Requests for Production of Documents propounded by Clean Virginia received on June 29, 2023, was prepared by or under the supervision of:

Jarad L. Morton
Manager – Integrated Strategic Planning
Dominion Energy Services, Inc.

The following response to Question No. 22(b) of the Second Set of Interrogatories and Requests for Production of Documents propounded by Clean Virginia received on June 29, 2023, was prepared by or under the supervision of:

Kelsi C. Jewell
Business Development Manager
Dominion Energy Virginia

Question No. 22

Refer to Company's response to CV Set 01-16

a. Please confirm that the Company's IRP assumes zero costs for the following:
   i. hydrogen fuel
   ii. hydrogen distribution
   iii. other hydrogen infrastructure beyond the plant itself
   iv. If any of the above are denied, please provide the costs that were included.

b. Please provide the basis for the Company's "estimated costs to convert facilities for hydrogen blending of approximately $500/kw in Plans D and E".

Response:

a. As stated in the Company's response to CV Set 01-16, the Company did not include costs for hydrogen fuel, hydrogen, distribution, or hydrogen infrastructure beyond the plant itself.

b. The estimated costs to convert facilities for hydrogen blending in 2045 is not yet known due to the future nature of the technology. Therefore, the Company used the $500/kW estimate in Plans D and E as a high-level proxy value. The Company will continue to review costs as the technology develops and will update the estimated costs in future IRPs as more cost information is available.

Virginia Electric and Power Company
Case No. PUR-2023-00066
Clean Virginia
Set 4

The following response to Question No. 31 of the Fourth Set of Interrogatories and Requests for Production of Documents propounded by Clean Virginia received on July 20, 2023, was prepared by or under the supervision of:

Corey J. Riordan
Project Construction Controls Consultant
Dominion Energy Services, Inc.

Question No. 31

Refer to Company response to Clean Virginia Set 01-16b. Dominion stated that it "used publicly available market data from major combustion turbine original equipment manufacturers" to determine if its planned 970 MW gas-fired CT capacity will be capable of blending hydrogen.

a. Please provide the publicly available market data from major combustion turbine original equipment manufacturers referenced.

Response:

Please see the following websites for the publicly available market data the Company used:
https://www.ge.com/gas-power/future-of-energy/hydrogen-fueled-gas-turbines
https://www.siemens-energy.com/global/en/priorities/future-technologies/hydrogen/zehtc.html
https://solutions.mhi.com/clean-fuels/hydrogen-gas-turbine/

Virginia Electric and Power Company
Case No. PUR-2023-00066
Clean Virginia
Set 2

The following response to Question No. 23 of the Second Set of Interrogatories and Requests for Production of Documents propounded by Clean Virginia received on June 29, 2023, was prepared by or under the supervision of:

Jorge L. Serrano 23
Power Generation Operations Support
Dominion Energy Virginia

As it pertains to legal matters, the following response to Question No. 23 of the Second Set of Interrogatories and Requests for Production of Documents propounded by Clean Virginia received on June 29, 2023, was prepared by or under the supervision of:

Vishwa B. Link
McGuireWoods LLP

Question No. 23

Regarding the Company's coal units:

a. Please indicate which of the Company's units currently have SCR (selective catalytic reduction) technology.

b. Please indicate whether the Company plans to install SCR on any of its units. If so, please specify the unit, installation date, costs, and reason for installing SCR.

c. Has the Company conducted an analysis of the costs of compliance with the Good Neighbor Rule through the purchase of NOx allowances?

   i. If so, please provide these compliance costs and any supporting analysis used to develop them.

d. Has the Company conducted an analysis of the costs of compliance with the Good Neighbor Rule through the installation of SCR at any of its coal units?

   i. If so, please specify the unit, the SCR costs and any supporting analysis used to develop those costs.

e. Has the Company conducted an evaluation of whether to retrofit or retire any of its coal units due to the Good Neighbor Rule requirements?

i. If so, please provide this evaluation as well as the supporting assumptions and calculations used therein.

ii. If not, please explain why not.

Response:

a. Mount Storm 1, 2, 3

b. – e. The Company objects to this request to the extent it would require original work. Further, the Company objects to this request as not relevant or reasonably calculated to lead to the production of admissible evidence in this proceeding as it seeks information on a rule that was published after the Company filed its 2023 Plan on May 1, 2023. The 2023 Plan is based on a "snapshot in time" of current technologies, market information, projections, and laws and regulations. The rule referenced in the request was not published until June 5, 2023, after the Company filed its 2023 Plan, and will not take effect until August 4, 2023. The Company has ongoing efforts to evaluate the Good Neighbor Rule that will consider several factors including, but not limited to, the cost of allowances, emission projections, cost of fuel, and a supplemental rule which the EPA is projecting will be issued in 2026. Subject to and notwithstanding these objections, the Company provides the following response.

The Company is aware of the rule but has not yet completed any analysis related thereto. The Company will study the rule and provide updates in future IRP proceedings as appropriate.

c) Confirmed.

d) See the Company's response to APV Set 05-02.

Virginia Electric and Power Company
Case No. PUR-2023-00066
Appalachian Voices
Set 5

The following response to Question No. 4 of the Fifth Set of Interrogatories and Requests for Production of Documents propounded by Appalachian Voices received on June 9, 2023, was prepared by or under the supervision of:

Karim Siamer
Lead Economist
Dominion Energy Virginia

Question No. 4

Reference the response to AV set 2 #11, attachment, tab Step2E. Lines 11 to 16 (2016A through 2020A), column O Total is not the sum of the monthly columns C through N, as it is for 2013A through 2015A and 2021A through 2022A.

a) Explain this discrepancy.

b) If this is an error, provide a corrected version of this data request response attachment.

Response:

a) The discrepancy in lines 11 to 16 (2016A through 2020 A) is due to the inadvertent exclusion of data center choice in the "Total" column. Data center choice is included in the monthly figures but not the annual total that was hardcoded. Please note that the affected data was for informational purposes only and the corrections do not impact any of the subsequent calculations.

b) See Attachment APV Set 05-04 (KS).

Steps

Energy
1. Start with monthly PJM Dom Zone Energy forecast.
2. Develop Dom Zone Data Center monthly energy based on annual data center obtained from PJM, and apply DEV monthly shape.
3. Subtract monthly data center energy from monthly PJM DOM Zone Energy Forecast. This provides Dom Zone Energy excluding Data Centers.
4. Develop DOM LSE to DOM Zone monthly energy ratio using historical data (2015-2022) with retail choice added back and data centers excluded.
5. Multiply 3x4 to get a forecast that includes retail choice and excludes data centers.
6. Calculate DEV portion of data center forecast implied in PJM forecast.
This is done by taking non-NOVEC data center forecast included in PJM forecast, and multiplying by two factors.
a. The first factor brings the non-NOVEC forecast to DOM LSE data center forecast. This factor also encapsulates any forecast updates since the forecast was provided to PJM.
b. The second factor is applied in order to exclude retail choice data centers out of DOM LSE data centers.
7. Make adjustments to the Step 5 output to add Step 6 output (data centers), then subtract DSM and non-data center Choice.
Peak
Please follow the last tab steps (self-explanatory).

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Step1E

PJM 2023 DOM Zone Energy (MWh)													
	Source: PJM Load Forecast Data from PJM (https://www.pjm.com/planning/resource-adequacy-planning/load-forecast-dev-process)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2023	11,115	9,555	9,470	8,383	9,125	10,208	11,650	11,400	9,783	9,184	9,529	11,093	120,495
2024	11,770	10,611	10,081	9,063	9,796	10,834	12,329	12,043	10,439	9,882	10,180	11,827	128,855
2025	12,332	10,653	10,671	9,654	10,428	11,489	13,033	12,734	11,172	10,619	10,894	12,649	136,328
2026	13,379	11,627	11,786	10,758	11,610	12,707	14,326	14,053	12,459	11,910	12,182	13,999	150,796
2027	14,407	12,570	12,847	11,800	12,721	13,796	15,464	15,236	13,598	13,042	13,324	15,192	163,997
2028	15,498	14,136	13,921	12,818	13,880	14,883	16,570	16,395	14,673	14,165	14,390	16,276	177,605
2029	16,543	14,448	14,917	13,841	14,954	15,914	17,708	17,512	15,737	15,307	15,475	17,418	189,774
2030	17,555	15,353	15,895	14,831	15,975	16,889	18,759	18,538	16,770	16,318	16,442	18,494	201,819
2031	18,490	16,214	16,862	15,802	16,997	17,938	19,883	19,643	17,892	17,431	17,504	19,664	214,320
2032	19,478	17,818	17,877	16,767	17,982	18,930	20,889	20,694	18,881	18,393	18,522	20,720	226,951
2033	20,363	17,924	18,802	17,632	18,938	19,853	21,843	21,709	19,833	19,366	19,461	21,684	237,408
2034	21,214	18,681	19,646	18,440	19,834	20,711	22,740	22,626	20,694	20,288	20,333	22,603	247,810
2035	22,006	19,368	20,443	19,211	20,625	21,475	23,610	23,475	21,501	21,163	21,143	23,483	257,503
2036	22,739	20,875	21,160	19,967	21,388	22,260	24,469	24,271	22,381	22,009	21,932	24,425	267,876
2037	23,439	20,696	21,948	20,699	22,147	23,067	25,319	25,147	23,235	22,866	22,810	25,352	276,725
2038	24,206	21,415	22,771	21,498	23,000	23,922	26,220	26,118	24,160	23,791	23,735	26,352	287,188

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Step2E

Data Center Plan

DOM LSE (Including Data Center Retail Choice)

Total Sales

MWH

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
	2013A	259,812	230,556	243,352	250,218	245,341	271,068	283,505	269,975	292,425	266,312	279,131	300,292	3,191,987
	2014A	303,724	280,532	287,233	276,515	305,142	318,596	327,486	312,883	346,502	317,620	322,756	367,681	3,766,668
	2015A	353,535	336,451	339,084	329,370	342,060	365,335	362,111	367,206	376,632	360,887	354,218	422,682	4,309,573
	2016A	426,448	424,575	396,557	422,100	420,867	461,994	489,182	497,296	484,068	479,009	477,986	518,244	5,498,326
	2017A	512,552	483,397	496,834	510,076	542,869	543,303	585,174	570,088	558,542	587,314	578,683	585,528	6,554,360
	2018A	593,040	563,926	598,641	612,610	641,135	662,899	690,938	674,492	696,759	681,914	698,851	711,981	7,827,185
	2019A	738,055	694,624	712,225	751,965	784,754	797,080	846,887	879,218	1,031,760	862,345	882,603	917,855	9,899,371
	2020A	926,941	883,741	924,938	927,822	987,067	1,015,930	1,080,190	1,119,330	1,103,531	1,118,221	1,105,683	1,163,681	12,357,075
	2021A	1,194,897	1,151,245	1,186,999	1,240,122	1,281,105	1,346,519	1,409,991	1,423,961	1,433,866	1,428,683	1,420,344	1,483,402	16,001,135
	2022F	1,505,332	1,440,974	1,497,233	1,546,747	1,637,852	1,690,127	1,759,150	1,804,511	1,785,977	1,742,038	1,750,647	1,900,477	20,061,063
	2023P	1,896,447	1,770,340	1,798,239	1,830,574	1,885,289	1,991,002	2,119,494	2,125,286	2,124,109	2,150,488	2,165,455	2,299,488	24,156,210
	2024P	2,227,746	2,155,472	2,113,847	2,153,802	2,218,720	2,344,724	2,444,430	2,452,174	2,449,897	2,483,401	2,500,076	2,659,556	28,203,845
	2025P	2,385,838	2,228,584	2,261,356	2,325,839	2,398,643	2,534,778	2,655,826	2,656,322	2,653,248	2,694,073	2,712,713	2,898,944	30,406,165
	2026P	2,825,730	2,643,061	2,689,474	2,746,207	2,836,634	2,998,868	3,145,453	3,146,798	3,142,817	3,192,301	3,213,814	3,429,300	36,010,459
	2027P	3,049,756	2,853,843	2,904,707	2,966,787	3,066,070	3,241,642	3,402,602	3,403,872	3,398,605	3,454,927	3,477,762	3,714,510	38,935,082
	2028P	3,294,344	3,194,001	3,139,539	3,207,430	3,316,321	3,506,442	3,682,966	3,684,179	3,677,513	3,741,203	3,765,508	4,025,294	42,234,739
	2029P	3,558,773	3,332,462	3,393,310	3,467,469	3,586,712	3,792,557	3,985,814	3,986,997	3,978,806	4,050,420	4,076,331	4,360,923	45,570,573
	2030P	3,883,678	3,637,638	3,704,743	3,786,456	3,918,199	4,143,352	4,356,546	4,357,972	4,348,017	4,428,984	4,456,908	4,771,378	49,793,872
	2031P	4,232,751	3,965,480	4,039,301	4,129,131	4,274,317	4,520,224	4,754,790	4,756,539	4,744,652	4,835,715	4,865,800	5,212,399	54,331,099
	2032P	4,653,574	4,516,222	4,442,344	4,541,832	4,703,068	4,974,003	5,233,777	5,236,232	5,222,088	5,325,062	5,357,770	5,742,672	59,948,643
	2033P	5,095,944	4,775,746	4,866,060	4,975,729	5,153,909	5,451,175	5,737,498	5,740,748	5,724,152	5,839,812	5,875,259	6,300,610	65,536,642
	2034P	5,596,318	5,245,351	5,345,214	5,466,343	5,663,648	5,990,718	6,306,780	6,311,154	6,291,779	6,421,750	6,460,289	6,931,279	72,030,623
	2035P	6,137,301	5,753,048	5,863,241	5,996,758	6,214,776	6,574,096	6,922,225	6,927,952	6,905,515	7,051,063	7,092,928	7,613,352	79,052,256
	2036P	6,707,207	6,512,478	6,409,005	6,555,596	6,795,510	7,188,831	7,570,771	7,578,005	7,552,261	7,714,390	7,759,737	8,332,433	86,676,224
	2037P	7,316,891	6,860,095	6,992,862	7,153,444	7,416,830	7,846,552	8,264,604	8,273,577	8,244,230	8,424,226	8,473,277	9,102,017	94,368,606
	2038P*	8,004,476	7,504,753	7,649,997	7,825,670	8,113,806	8,583,910	9,041,247	9,051,064	9,018,959	9,215,869	9,269,530	9,957,354	103,236,637
Monthly S	2020A	7.5%	7.2%	7.5%	7.5%	8.0%	8.2%	8.7%	9.1%	8.9%	9.0%	8.9%	9.4%	100.0%
	2021A	7.5%	7.2%	7.4%	7.8%	8.0%	8.4%	8.8%	8.9%	9.0%	8.9%	8.9%	9.3%	100.0%
	2022F	7.5%	7.2%	7.5%	7.7%	8.2%	8.4%	8.8%	9.0%	8.9%	8.7%	8.7%	9.5%	100.0%
	2023P	7.9%	7.3%	7.4%	7.6%	7.8%	8.2%	8.8%	8.8%	8.8%	8.9%	9.0%	9.5%	100.0%
	2024P	7.9%	7.6%	7.5%	7.6%	7.9%	8.3%	8.7%	8.7%	8.7%	8.8%	8.9%	9.4%	100.0%
	2025P	7.8%	7.3%	7.4%	7.6%	7.9%	8.3%	8.7%	8.7%	8.7%	8.9%	8.9%	9.5%	100.0%
	2026P	7.8%	7.3%	7.5%	7.6%	7.9%	8.3%	8.7%	8.7%	8.7%	8.9%	8.9%	9.5%	100.0%
	2027P	7.8%	7.3%	7.5%	7.6%	7.9%	8.3%	8.7%	8.7%	8.7%	8.9%	8.9%	9.5%	100.0%
	2028P	7.8%	7.6%	7.4%	7.6%	7.9%	8.3%	8.7%	8.7%	8.7%	8.9%	8.9%	9.5%	100.0%
	2029P	7.8%	7.3%	7.4%	7.6%	7.9%	8.3%	8.7%	8.7%	8.7%	8.9%	8.9%	9.6%	100.0%
	2030P	7.8%	7.3%	7.4%	7.6%	7.9%	8.3%	8.7%	8.8%	8.7%	8.9%	9.0%	9.6%	100.0%
	2031P	7.8%	7.3%	7.4%	7.6%	7.9%	8.3%	8.8%	8.8%	8.7%	8.9%	9.0%	9.6%	100.0%
	2032P	7.8%	7.5%	7.4%	7.6%	7.8%	8.3%	8.7%	8.7%	8.7%	8.9%	8.9%	9.6%	100.0%
	2033P	7.8%	7.3%	7.4%	7.6%	7.9%	8.3%	8.8%	8.8%	8.7%	8.9%	9.0%	9.6%	100.0%
	2034P	7.8%	7.3%	7.4%	7.6%	7.9%	8.3%	8.8%	8.8%	8.7%	8.9%	9.0%	9.6%	100.0%
	2035P	7.8%	7.3%	7.4%	7.6%	7.9%	8.3%	8.8%	8.8%	8.7%	8.9%	9.0%	9.6%	100.0%
	2036P	7.7%	7.5%	7.4%	7.6%	7.8%	8.3%	8.7%	8.7%	8.7%	8.9%	9.0%	9.6%	100.0%
	2037P	7.8%	7.3%	7.4%	7.6%	7.9%	8.3%	8.8%	8.8%	8.7%	8.9%	9.0%	9.6%	100.0%
	2038P*	7.8%	7.3%	7.4%	7.6%	7.9%	8.3%	8.8%	8.8%	8.7%	8.9%	9.0%	9.6%	100.0%
Average	Average Monthly Shapes	7.8%	7.4%	7.4%	7.6%	7.9%	8.3%	8.7%	8.7%	8.7%	8.9%	8.9%	9.6%	100.0%
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Zone DC (per PJM)
	2023	2,418	2,284	2,304	2,355	2,436	2,576	2,710	2,712	2,706	2,755	2,773	2,967	30,997

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Step2E

	2024	3,014	2,847	2,873	2,936	3,037	3,212	3,378	3,381	3,373	3,435	3,457	3,699	38,642			
	2025	3,580	3,382	3,412	3,488	3,608	3,815	4,012	4,016	4,006	4,080	4,106	4,394	45,897			
	2026	4,668	4,410	4,450	4,548	4,705	4,975	5,232	5,237	5,225	5,321	5,354	5,730	59,856			
	2027	5,659	5,346	5,394	5,514	5,703	6,031	6,343	6,348	6,334	6,450	6,491	6,946	72,558			
	2028	6,658	6,289	6,346	6,487	6,709	7,095	7,462	7,468	7,451	7,588	7,636	8,172	85,360			
	2029	7,598	7,178	7,242	7,403	7,657	8,097	8,516	8,523	8,504	8,660	8,715	9,326	97,420			
	2030	8,521	8,049	8,122	8,302	8,588	9,081	9,550	9,559	9,537	9,712	9,773	10,459	109,254			
	2031	9,475	8,950	9,031	9,231	9,548	10,096	10,619	10,628	10,604	10,799	10,867	11,629	121,477			
	2032	10,404	9,828	9,917	10,137	10,485	11,087	11,661	11,671	11,645	11,858	11,933	12,771	133,399			
	2033	11,223	10,602	10,698	10,935	11,311	11,960	12,579	12,590	12,561	12,792	12,872	13,776	143,897			
	2034	12,005	11,340	11,442	11,696	12,098	12,792	13,454	13,466	13,435	13,682	13,768	14,735	153,914			
	2035	12,719	12,014	12,123	12,392	12,818	13,553	14,255	14,267	14,235	14,496	14,588	15,611	163,071			
	2036	13,452	12,707	12,822	13,106	13,557	14,335	15,077	15,090	15,056	15,332	15,429	16,511	172,474			
	2037	14,131	13,348	13,469	13,768	14,241	15,058	15,838	15,851	15,815	16,105	16,207	17,345	181,176			
	2038	14,902	14,076	14,204	14,519	15,018	15,880	16,701	16,716	16,678	16,984	17,091	18,291	191,058			
	2039	16,052	15,163	15,300	15,639	16,177	17,105	17,990	18,006	17,965	18,295	18,410	19,702	205,803		Data Centers Assumed Growth Rate Year 2039	7.7%
	2040	17,021	16,078	16,224	16,583	17,153	18,138	19,077	19,093	19,050	19,399	19,522	20,892	218,231		Data Centers Assumed Growth Rate Year 2040	6.0%
	2041	17,763	16,779	16,931	17,306	17,901	18,929	19,908	19,925	19,880	20,245	20,373	21,803	227,743		Data Centers Assumed Growth Rate Year 2041	4.4%
	2042	18,239	17,229	17,385	17,770	18,381	19,436	20,442	20,459	20,418	20,787	20,919	22,387	233,845		Data Centers Assumed Growth Rate Year 2042	2.7%
	2043	18,421	17,401	17,558	17,948	18,565	19,630	20,646	20,664	20,617	20,995	21,128	22,611	236,184		Data Centers Assumed Growth Rate Beyond Year 2042	1.0%
	2044	18,605	17,575	17,734	18,127	18,750	19,826	20,853	20,871	20,823	21,205	21,339	22,837	238,546		Non-Data Centers Assumed Growth Rate Beyond Year 203	0.5%
	2045	18,791	17,751	17,911	18,308	18,938	20,025	21,061	21,079	21,031	21,417	21,553	23,065	240,931			
	2046	18,979	17,928	18,090	18,492	19,127	20,225	21,272	21,290	21,242	21,631	21,768	23,296	243,340			
	2047	19,169	18,108	18,271	18,676	19,318	20,427	21,484	21,503	21,454	21,848	21,986	23,529	245,774			
	2048	19,361	18,289	18,454	18,863	19,512	20,632	21,699	21,718	21,668	22,066	22,206	23,764	248,231			
	2049	19,554	18,472	18,639	19,052	19,707	20,838	21,916	21,935	21,885	22,287	22,428	24,002	250,714			
	2050	19,750	18,656	18,825	19,242	19,904	21,046	22,135	22,155	22,104	22,510	22,652	24,242	253,221			
	2051	19,947	18,843	19,013	19,435	20,103	21,257	22,357	22,376	22,325	22,735	22,878	24,484	255,753			
	2052	20,147	19,031	19,203	19,629	20,304	21,469	22,580	22,600	22,548	22,962	23,107	24,729	258,311			
	2053	20,348	19,222	19,395	19,825	20,507	21,684	22,806	22,826	22,774	23,192	23,338	24,976	260,894			
	2054	20,552	19,414	19,589	20,024	20,712	21,901	23,034	23,054	23,002	23,424	23,572	25,226	263,503			
	2055	20,757	19,608	19,785	20,224	20,919	22,120	23,264	23,285	23,232	23,658	23,807	25,478	266,138			
	2056	20,965	19,804	19,983	20,426	21,128	22,341	23,497	23,518	23,464	23,895	24,045	25,733	268,799			
	2057	21,175	20,002	20,183	20,630	21,339	22,564	23,732	23,753	23,699	24,134	24,286	25,990	271,487			
	2058	21,386	20,202	20,385	20,837	21,553	22,790	23,969	23,990	23,935	24,375	24,529	26,250	274,202			
	2059	21,600	20,404	20,589	21,045	21,768	23,018	24,209	24,230	24,175	24,619	24,774	26,513	276,944			
	2060	21,816	20,608	20,794	21,256	21,986	23,248	24,451	24,472	24,417	24,865	25,022	26,778	279,713			
	2061	22,034	20,814	21,002	21,468	22,206	23,481	24,696	24,717	24,661	25,113	25,272	27,046	282,510			
	2062	22,255	21,022	21,212	21,683	22,428	23,715	24,943	24,964	24,907	25,365	25,525	27,316	285,336			

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Step3E

PJM 2023 DOM Zone Energy (MWh) Net of DC													
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2023	8,697	7,271	7,166	6,028	6,689	7,632	8,940	8,688	7,077	6,429	6,756	8,126	89,498
2024	8,756	7,764	7,208	6,127	6,759	7,622	8,951	8,662	7,066	6,447	6,723	8,128	90,213
2025	8,752	7,271	7,259	6,166	6,820	7,674	9,021	8,718	7,166	6,539	6,788	8,255	90,431
2026	8,711	7,217	7,336	6,210	6,905	7,732	9,094	8,816	7,234	6,589	6,828	8,269	90,940
2027	8,748	7,224	7,453	6,286	7,018	7,765	9,121	8,888	7,264	6,592	6,833	8,246	91,439
2028	8,840	7,847	7,575	6,331	7,171	7,788	9,108	8,927	7,222	6,577	6,754	8,104	92,245
2029	8,945	7,270	7,675	6,438	7,297	7,817	9,192	8,989	7,233	6,647	6,760	8,092	92,354
2030	9,034	7,304	7,773	6,529	7,387	7,808	9,209	8,979	7,233	6,606	6,669	8,035	92,565
2031	9,015	7,264	7,831	6,571	7,449	7,842	9,264	9,015	7,288	6,632	6,637	8,035	92,843
2032	9,074	7,990	7,960	6,630	7,497	7,843	9,228	9,023	7,236	6,535	6,589	7,949	93,552
2033	9,140	7,322	8,104	6,697	7,627	7,893	9,264	9,119	7,272	6,574	6,589	7,908	93,511
2034	9,209	7,341	8,204	6,744	7,736	7,919	9,286	9,160	7,259	6,606	6,565	7,868	93,896
2035	9,287	7,354	8,320	6,819	7,807	7,922	9,355	9,208	7,266	6,667	6,555	7,872	94,432
2036	9,287	8,168	8,338	6,861	7,831	7,925	9,392	9,181	7,325	6,677	6,503	7,914	95,402
2037	9,308	7,348	8,479	6,931	7,906	8,009	9,481	9,296	7,420	6,761	6,603	8,007	95,549
2038	9,304	7,339	8,567	6,979	7,982	8,042	9,519	9,402	7,482	6,807	6,644	8,061	96,130

Step4E

Date	DOM Zone: Datacenter Taken Out	DOM LSE: Datacenter Taken Out - Retail Choice Added Back	LR	Years	- multiple -
1/1/2014	9,690,570	8,304,989	85.70%		
2/1/2014	7,888,443	6,815,539	86.40%	Date	Average of LR
3/1/2014	8,091,471	7,011,783	86.66%	Jan	85.04%
4/1/2014	6,246,631	5,438,260	87.06%	Feb	85.56%
5/1/2014	7,013,367	6,099,391	86.97%	Mar	85.10%
6/1/2014	8,162,964	7,055,464	86.43%	Apr	85.95%
7/1/2014	8,724,344	7,546,923	86.50%	May	85.56%
8/1/2014	8,242,842	7,095,205	86.08%	Jun	85.96%
9/1/2014	7,335,540	6,351,309	86.58%	Jul	85.70%
10/1/2014	6,520,449	5,629,432	86.34%	Aug	85.83%
11/1/2014	7,410,699	6,283,590	84.79%	Sep	86.48%
12/1/2014	8,138,290	6,909,606	84.90%	Oct	86.21%
1/1/2015	9,238,843	7,858,543	85.06%	Nov	85.51%
2/1/2015	9,265,089	7,890,201	85.16%	Dec	84.97%
3/1/2015	7,852,440	6,735,279	85.77%	**Total Result**	**85.65%**
4/1/2015	6,199,703	5,338,559	86.11%		
5/1/2015	7,418,283	6,382,475	86.04%		
6/1/2015	8,427,703	7,273,586	86.31%		
7/1/2015	9,065,919	7,803,132	86.07%		
8/1/2015	8,623,681	7,419,576	86.04%		
9/1/2015	7,541,839	6,508,757	86.30%		
10/1/2015	6,395,571	5,535,450	86.55%		
11/1/2015	6,515,213	5,611,015	86.12%		
12/1/2015	7,032,765	5,982,187	85.06%		
1/1/2016	8,904,779	7,572,534	85.04%		
2/1/2016	7,821,117	6,687,932	85.51%		
3/1/2016	6,829,333	5,792,728	84.82%		
4/1/2016	6,229,606	5,352,857	85.93%		
5/1/2016	6,719,511	5,715,234	85.05%		
6/1/2016	7,862,848	6,751,907	85.87%		
7/1/2016	9,515,372	8,152,342	85.68%		
8/1/2016	9,524,264	8,168,874	85.77%		
9/1/2016	7,682,868	6,617,326	86.13%		
10/1/2016	6,439,597	5,537,725	85.99%		
11/1/2016	6,633,035	5,703,274	85.98%		
12/1/2016	8,025,655	6,862,065	85.50%		
1/1/2017	8,198,072	7,029,165	85.74%		

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Step4E

2/1/2017	6,558,908	5,666,827	86.40%						
3/1/2017	7,304,238	6,263,466	85.75%						
4/1/2017	6,293,534	5,439,711	86.43%						
5/1/2017	6,748,127	5,811,374	86.12%						
6/1/2017	7,937,002	6,893,092	86.85%						
7/1/2017	9,157,155	7,969,534	87.03%						
8/1/2017	8,305,555	7,250,292	87.29%						
9/1/2017	6,960,348	6,097,145	87.60%						
10/1/2017	6,526,301	5,706,722	87.44%						
11/1/2017	6,760,813	5,855,320	86.61%						
12/1/2017	8,405,186	7,213,313	85.82%						
1/1/2018	9,593,888	8,242,792	85.92%						
2/1/2018	6,851,240	5,951,063	86.86%						
3/1/2018	7,716,957	6,660,947	86.32%						
4/1/2018	6,140,803	5,353,374	87.18%						
5/1/2018	7,313,667	6,379,996	87.23%						
6/1/2018	7,916,119	6,903,758	87.21%						
7/1/2018	8,683,430	7,552,681	86.98%						
8/1/2018	8,950,403	7,798,141	87.13%						
9/1/2018	7,774,462	6,799,263	87.46%						
10/1/2018	6,884,376	5,995,541	87.09%						
11/1/2018	7,074,047	6,075,504	85.88%						
12/1/2018	7,953,392	6,829,184	85.87%						
1/1/2019	8,696,803	7,463,981	85.82%						
2/1/2019	7,107,558	6,124,415	86.17%						
3/1/2019	7,318,045	6,299,796	86.09%						
4/1/2019	5,920,900	5,186,734	87.60%						
5/1/2019	7,254,279	6,303,892	86.90%						
6/1/2019	7,602,286	6,629,922	87.21%						
7/1/2019	9,264,291	7,994,203	86.29%						
8/1/2019	8,637,834	7,424,555	85.95%						
9/1/2019	7,389,756	6,364,748	86.13%						
10/1/2019	6,403,459	5,539,342	86.51%						
11/1/2019	6,909,962	5,922,852	85.71%						
12/1/2019	7,720,308	6,585,298	85.30%						
1/1/2020	7,798,730	6,656,827	85.36%						
2/1/2020	6,991,694	5,970,639	85.40%						
3/1/2020	6,443,752	5,418,208	84.08%						
4/1/2020	5,599,656	4,786,701	85.48%						
5/1/2020	6,073,038	5,116,952	84.26%						

Step4E

6/1/2020	7,392,520	6,292,635	85.12%						
7/1/2020	9,425,900	8,022,644	85.11%						
8/1/2020	8,512,449	7,259,037	85.28%						
9/1/2020	6,708,506	5,780,950	86.17%						
10/1/2020	6,029,948	5,155,164	85.49%						
11/1/2020	6,184,134	5,248,478	84.87%						
12/1/2020	8,022,119	6,714,464	83.70%						
1/1/2021	8,384,041	7,062,812	84.24%						
2/1/2021	7,685,500	6,531,734	84.99%						
3/1/2021	6,818,209	5,765,392	84.56%						
4/1/2021	5,875,719	5,007,942	85.23%						
5/1/2021	6,430,746	5,436,599	84.54%						
6/1/2021	7,729,992	6,566,023	84.94%						
7/1/2021	8,860,061	7,466,082	84.27%						
8/1/2021	8,861,924	7,514,760	84.80%						
9/1/2021	7,062,246	6,042,257	85.56%						
10/1/2021	6,335,319	5,346,238	84.39%						
11/1/2021	6,728,764	5,612,035	83.40%						
12/1/2021	7,181,435	6,001,039	83.56%						
1/1/2022	9,175,048	7,626,470	83.12%						
2/1/2022	7,101,665	5,967,646	84.03%						
3/1/2022	6,791,455	5,666,010	83.43%						
4/1/2022	5,976,336	4,996,488	83.60%						
5/1/2022	6,744,241	5,689,551	84.36%						
6/1/2022	7,582,295	6,380,463	84.15%						
7/1/2022	8,975,167	7,553,316	84.16%						
8/1/2022	8,651,107	7,298,463	84.36%						

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StepSE

	1	2	3	4	5	6	7	8	9	10	11	12	
	85.0%	85.6%	85.1%	85.9%	85.6%	86.0%	85.7%	85.8%	86.5%	86.2%	85.5%	85.0%	
[illegible]													
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2023	7,396	6,222	6,098	5,180	5,723	6,560	7,662	7,457	6,120	5,542	5,777	6,905	76,642
2024	7,446	6,643	6,134	5,266	5,783	6,552	7,671	7,435	6,110	5,558	5,749	6,906	77,253
2025	7,443	6,222	6,178	5,300	5,836	6,597	7,731	7,483	6,197	5,637	5,805	7,015	77,441
2026	7,407	6,175	6,243	5,337	5,908	6,646	7,793	7,567	6,256	5,680	5,838	7,026	77,878
2027	7,439	6,181	6,343	5,403	6,005	6,675	7,817	7,628	6,282	5,683	5,843	7,007	78,305
2028	7,518	6,714	6,447	5,442	6,135	6,695	7,806	7,662	6,245	5,670	5,776	6,886	78,994
2029	7,606	6,221	6,531	5,533	6,243	6,719	7,877	7,715	6,255	5,730	5,781	6,876	79,088
2030	7,682	6,249	6,615	5,611	6,321	6,712	7,892	7,707	6,255	5,695	5,703	6,827	79,268
2031	7,666	6,215	6,665	5,647	6,373	6,740	7,939	7,737	6,303	5,718	5,676	6,827	79,507
2032	7,716	6,836	6,774	5,698	6,414	6,741	7,908	7,744	6,258	5,633	5,634	6,755	80,112
2033	7,772	6,265	6,897	5,756	6,526	6,785	7,939	7,827	6,289	5,668	5,634	6,720	80,078
2034	7,832	6,281	6,982	5,796	6,619	6,807	7,958	7,862	6,277	5,695	5,614	6,686	80,407
2035	7,898	6,292	7,080	5,861	6,680	6,809	8,017	7,903	6,284	5,748	5,606	6,689	80,866
2036	7,897	6,989	7,096	5,896	6,701	6,812	8,049	7,880	6,335	5,756	5,561	6,724	81,696
2037	7,915	6,287	7,216	5,957	6,765	6,884	8,125	7,978	6,417	5,828	5,646	6,804	81,823
2038	7,912	6,279	7,291	5,999	6,830	6,913	8,157	8,070	6,471	5,868	5,681	6,850	82,321
2039	7,948	6,283	7,378	6,057	6,911	6,937	8,191	8,112	6,495	5,891	5,675	6,846	82,725
2040	7,984	6,287	7,467	6,112	6,993	6,962	8,226	8,155	6,519	5,913	5,669	6,843	83,133
2041	8,020	6,291	7,556	6,177	7,076	6,986	8,260	8,198	6,543	5,936	5,662	6,839	83,544
2042	8,056	6,295	7,647	6,238	7,160	7,010	8,295	8,241	6,567	5,959	5,656	6,836	83,959
2043	8,092	6,298	7,738	6,299	7,245	7,035	8,329	8,285	6,592	5,981	5,650	6,832	84,377
2044	8,129	6,302	7,831	6,361	7,331	7,060	8,364	8,329	6,616	6,004	5,643	6,828	84,798
2045	8,165	6,306	7,925	6,423	7,418	7,084	8,399	8,373	6,641	6,027	5,637	6,825	85,223
2046	8,202	6,310	8,020	6,486	7,505	7,109	8,435	8,417	6,665	6,050	5,631	6,821	85,652
2047	8,239	6,314	8,116	6,550	7,595	7,134	8,470	8,461	6,690	6,073	5,624	6,818	86,084
2048	8,276	6,318	8,213	6,615	7,685	7,159	8,505	8,506	6,715	6,097	5,618	6,814	86,520
2049	8,314	6,322	8,312	6,680	7,776	7,184	8,541	8,551	6,740	6,120	5,612	6,810	86,960
2050	8,351	6,326	8,411	6,745	7,868	7,209	8,577	8,596	6,765	6,143	5,606	6,807	87,403
2051	8,389	6,330	8,512	6,811	7,961	7,234	8,613	8,641	6,790	6,167	5,599	6,803	87,851
2052	8,427	6,333	8,614	6,878	8,056	7,260	8,649	8,687	6,816	6,190	5,593	6,800	88,302
2053	8,465	6,337	8,717	6,946	8,151	7,285	8,685	8,733	6,841	6,214	5,587	6,796	88,756
2054	8,503	6,341	8,822	7,014	8,248	7,311	8,721	8,779	6,866	6,238	5,581	6,792	89,215
2055	8,541	6,345	8,927	7,083	8,346	7,336	8,758	8,825	6,892	6,262	5,574	6,789	89,678
2056	8,579	6,349	9,034	7,153	8,445	7,362	8,794	8,872	6,917	6,285	5,568	6,785	90,144
2057	8,618	6,353	9,143	7,221	8,545	7,388	8,831	8,919	6,943	6,309	5,562	6,782	90,615
2058	8,657	6,357	9,252	7,294	8,646	7,413	8,868	8,966	6,969	6,334	5,556	6,778	91,090
2059	8,696	6,361	9,363	7,365	8,749	7,439	8,905	9,013	6,995	6,358	5,550	6,774	91,568
2060	8,735	6,365	9,475	7,438	8,852	7,465	8,943	9,061	7,021	6,382	5,543	6,771	92,051
2061	8,775	6,368	9,589	7,511	8,957	7,492	8,980	9,109	7,047	6,406	5,537	6,767	92,538
2062	8,814	6,372	9,704	7,585	9,064	7,518	9,018	9,157	7,073	6,431	5,531	6,764	93,029

Dom Zone-LSE Ratio

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
CAGR 2023-2038	0.5%	0.1%	1.2%	1.0%	1.2%	0.4%	0.4%	0.5%	0.4%	0.4%	-0.1%	-0.1%	0.5%

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	Average C[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	100.0%						
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	PJM Derived DOM LSE DC (Retail Choice adjusted)	# of Hours	Non-NOVEC Data Center Forecast (per PJM)			DC Forecast Update Reduction Factor	Choice Reduction Factor
	2023	1 648	1 743	1 759	1 798	1 880	1 987	2 068	2 070	2 045	2 103	2 117	2 265	23 682	8760	24 199		2023P	102%	96%
	2024	2 178	2 057	2 076	2 172	2 195	2 321	2 441	2 443	2 438	2 482	2 406	2 673	27 926	8784	28 885		2024P	107%	96%
	2025	2 343	2 213	2 233	2 283	2 361	2 497	2 626	2 628	2 622	2 671	2 687	2 876	30 047	8760	31 860		2025P	99%	95%
	2026	2 784	2 629	2 653	2 712	2 805	2 966	3 120	3 123	3 115	3 173	3 193	3 417	35 690	8760	39 371		2026P	95%	95%
	2027	3 012	2 845	2 871	2 934	3 035	3 210	3 376	3 379	3 371	3 433	3 454	3 697	38 616	8760	44 984		2027P	90%	95%
	2028	3 266	3 085	3 113	3 182	3 292	3 481	3 661	3 664	3 655	3 723	3 746	4 009	41 876	8784	51 029		2028P	80%	95%
	2029	3 524	3 329	3 359	3 433	3 551	3 755	3 949	3 953	3 944	4 016	4 041	4 325	45 178	8760	57 147		2029P	83%	95%
	2030	3 856	3 643	3 676	3 757	3 886	4 109	4 322	4 326	4 316	4 395	4 423	4 733	49 441	8760	63 803		2030P	81%	95%
	2031	4 197	3 965	4 001	4 089	4 230	4 473	4 704	4 708	4 698	4 784	4 814	5 152	53 814	8760	70 529		2031P	80%	95%
	2032	4 624	4 368	4 407	4 505	4 660	4 927	5 182	5 187	5 175	5 270	5 303	5 675	59 283	8784	77 779		2032P	80%	95%
	2033	5 049	4 770	4 813	4 919	5 089	5 381	5 659	5 664	5 651	5 755	5 791	6 198	64 718	8760	84 971		2033P	80%	95%
	2034	5 546	5 239	5 286	5 403	5 589	5 910	6 216	6 221	6 207	6 321	6 361	6 807	71 105	8760	92 689		2034P	80%	95%
	2035	6 084	5 747	5 799	5 928	6 132	6 484	6 819	6 825	6 809	6 934	6 978	7 468	78 008	8760	100 743		2035P	81%	95%
	2036	6 669	6 298	6 356	6 497	6 721	7 106	7 474	7 481	7 464	7 601	7 649	8 185	85 501	8784	109 404		2036P	82%	96%
	2037	7 260	6 858	6 920	7 074	7 317	7 737	8 137	8 144	8 126	8 275	8 327	8 911	93 086	8760	117 844		2037P	83%	96%
	2038	7 958	7 518	7 586	7 754	8 020	8 481	8 920	8 927	8 907	9 070	9 128	9 768	102 036	8760	127 302		2038P*	84%	96%
	2039	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	10,522	[illegible]	8760					
	2040	[illegible]	8,610	[illegible]	[illegible]	[illegible]	[illegible]	10,216	[illegible]	10,201	[illegible]	10,458	[illegible]	[illegible]	8784				This factor brings the non-NOVEC Data Centers in PJM Forecast to DOM LSE level. It also incorporates any updates to the data center forecasts available at the time of IRP forecast since it was submitted to PJM.	
	2041	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	11,644	121,628	8760					
	2042	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	10,907	[illegible]	11,872	11,956	[illegible]	8760					
	2043	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	8760					
	2044	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	12,230	[illegible]	8784					
	2045	10,036	9,480	9,566	[illegible]	[illegible]	10,499	[illegible]	11,258	[illegible]	[illegible]	11,510	[illegible]	128,671	8760					
	2046	10,136	9,575	9,661	[illegible]	10,219	[illegible]	[illegible]	[illegible]	[illegible]	11,552	[illegible]	12,441	[illegible]	8760					
	2047	10,237	9,671	9,754	9,974	10,317	10,909	[illegible]	[illegible]	11,458	11,668	[illegible]	12,566	131,257	8760					
	2048	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	11,892	12,726	[illegible]	8784					
	2049	10,443	[illegible]	9,954	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	12,818	[illegible]	8760					
	2050	10,548	9,964	10,054	10,277	10,630	11,240	[illegible]	[illegible]	[illegible]	[illegible]	12,097	12,946	[illegible]	8760					
	2051	10,653	10,063	10,154	10,379	10,736	11,352	11,940	11,950	11,923	[illegible]	12,218	13,076	[illegible]	8760					
	2052	[illegible]	10,191	10,284	10,512	10,873	11,497	[illegible]	12,103	12,075	12,297	12,374	[illegible]	138,331	8784					
	2053	10,867	10,265	[illegible]	10,588	10,952	[illegible]	[illegible]	12,190	[illegible]	[illegible]	12,464	13,339	139,532	8760					
	2054	10,976	10,368	10,462	10,694	[illegible]	11,696	[illegible]	12,312	[illegible]	12,510	12,589	13,472	140,726	8760					
	2055	11,086	10,472	10,566	10,801	11,172	11,813	12,425	12,435	12,407	12,635	12,715	13,607	142,133	8760					
	2056	11,227	10,606	[illegible]	10,939	[illegible]	11,964	[illegible]	12,594	12,565	12,796	[illegible]	13,781	143,946	8784					
	2057	11,308	10,682	10,779	11,018	11,397	12,051	12,674	12,685	12,656	12,889	12,970	13,880	144,990	8760					
	2058	11,422	10,789	10,887	11,128	11,510	12,171	12,801	12,812	12,783	13,018	13,100	14,019	146,440	8760					
	2059	11,536	10,897	10,995	11,239	11,626	12,293	12,929	12,940	12,911	13,148	13,231	14,159	147,904	8760					
	2060	11,683	11,036	11,136	11,383	11,774	12,450	13,094	13,105	13,076	13,316	13,400	14,340	149,792	8784					
	2061	11,768	11,116	11,216	11,465	11,859	12,540	13,189	13,200	13,170	13,412	13,497	14,444	150,877	8760					
	2062	11,885	11,227	[illegible]	[illegible]	11,978	12,665	13,321	13,332	13,302	13,546	13,632	14,585	[illegible]	8760					

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Step6E-a

	As Provided to PJM for the 2023 Load Report	As Updated in January 2023				
Year	Non-NOVEC Data centers Forecast	DOM LSE Data Centers Forecast (Including Customer Choice)	DC Forecast Update Reduction Factor	DOM LSE Data Centers Forecast (Excluding Customer Choice)	DOM LSE Data Centers Forecast (Including Customer Choice)	Choice Reduction Factor
2023P	24,156,210	23,626,347	102%	23,101,627	24,156,210	96%
2024P	28,203,845	28,045,424	101%	27,113,787	28,203,845	96%
2025P	30,406,165	30,734,819	99%	28,980,587	30,406,165	95%
2026P	36,010,459	37,912,044	95%	34,367,019	36,010,459	95%
2027P	38,935,082	43,236,067	90%	37,115,077	38,935,082	95%
2028P	42,234,739	49,013,790	86%	40,222,543	42,234,739	95%
2029P	45,570,573	54,856,136	83%	43,366,867	45,570,573	95%
2030P	49,793,872	61,148,127	81%	47,383,309	49,793,872	95%
2031P	54,331,099	67,762,775	80%	51,703,770	54,331,099	95%
2032P	59,948,643	74,897,976	80%	57,087,185	59,948,643	95%
2033P	65,536,642	81,964,092	80%	62,446,208	65,536,642	95%
2034P	72,030,623	89,546,708	80%	68,693,970	72,030,623	95%
2035P	79,052,256	97,451,980	81%	75,459,627	79,052,256	95%
2036P	86,676,224	105,957,914	82%	82,807,899	86,676,224	96%
2037P	94,368,606	114,234,545	83%	90,234,782	94,368,606	96%
2038P*	103,236,637	123,158,046	84%	98,714,347	103,236,637	96%

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DOM LSE Energy Equivalent (GWH) After Datacenters Add Back & Any DSM & Customer Loss Reductions (Retail Choice)													
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2023	8,813	7,568	7,443	6,585	7,158	8,063	9,227	9,020	7,733	7,194	7,464	8,727	94,995
2024	9,097	8,202	7,712	6,919	7,478	8,331	9,519	9,286	8,021	7,516	7,746	9,055	98,885
2025	9,164	7,869	7,830	7,040	7,624	8,468	9,671	9,431	8,211	7,705	7,915	9,276	100,204
2026	9,564	8,232	8,308	7,499	8,135	8,976	10,215	9,998	8,754	8,245	8,445	9,820	106,192
2027	9,814	8,445	8,616	7,779	8,453	9,238	10,487	10,304	9,029	8,503	8,705	10,076	109,450
2028	10,132	9,185	8,952	8,060	8,829	9,522	10,755	10,616	9,276	8,776	8,930	10,276	113,307
2029	10,476	8,957	9,283	8,398	9,194	9,821	11,109	10,954	9,572	9,125	9,227	10,572	116,688
2030	10,880	9,296	9,681	8,797	9,606	10,168	11,491	11,319	9,943	9,469	9,533	10,932	121,114
2031	11,201	9,580	10,052	9,162	10,001	10,554	11,918	11,731	10,368	9,879	9,897	11,347	125,691
2032	11,675	10,580	10,563	9,625	10,471	11,005	12,364	12,211	10,798	10,281	10,339	11,797	131,711
2033	12,154	10,428	11,089	10,097	11,007	11,498	12,871	12,766	11,302	10,798	10,824	12,283	137,117
2034	12,701	10,907	11,640	10,618	11,595	12,048	13,444	13,357	11,849	11,391	11,374	12,862	143,787
2035	13,301	11,425	12,253	11,206	12,200	12,627	14,106	14,004	12,462	12,057	11,985	13,524	151,150
2036	13,884	12,651	12,826	11,811	12,812	13,252	14,789	14,638	13,162	12,730	12,611	14,268	159,432
2037	14,483	12,518	13,501	12,442	13,469	13,946	15,522	15,395	13,901	13,474	13,369	15,070	167,092
2038	15,167	13,159	14,231	13,155	14,229	14,710	16,329	16,257	14,728	14,304	14,195	15,963	176,426
2039	15,818	13,744	14,904	13,815	14,926	15,386	17,050	16,984	15,436	15,023	14,889	16,712	184,688
2040	16,395	14,239	15,510	14,403	15,552	15,990	17,690	17,633	16,070	15,660	15,503	17,374	192,018
2041	16,795	14,610	15,950	14,820	16,006	16,410	18,136	18,093	16,507	16,106	15,926	17,825	197,185
2042	17,085	14,854	16,283	15,128	16,348	16,702	18,453	18,422	16,812	16,418	16,213	18,131	200,850
2043	17,224	14,953	16,469	15,286	16,535	16,828	18,596	18,574	16,945	16,552	16,314	18,244	202,520
2044	17,388	15,054	16,682	15,474	16,746	16,987	18,776	18,756	17,110	16,720	16,451	18,398	204,542
2045	17,495	15,147	16,843	15,607	16,902	17,088	18,892	18,878	17,217	16,823	16,526	18,484	205,902
2046	17,632	15,246	17,035	15,765	17,091	17,222	19,037	19,036	17,356	16,958	16,635	18,603	207,618
2047	17,770	15,346	17,229	15,926	17,282	17,357	19,184	19,196	17,492	17,097	16,747	18,722	209,350
2048	17,939	15,454	17,451	16,118	17,509	17,518	19,368	19,390	17,663	17,271	16,891	18,879	211,450
2049	18,053	15,548	17,620	16,256	17,675	17,622	19,489	19,516	17,770	17,382	16,969	18,965	212,863
2050	18,195	15,650	17,819	16,425	17,870	17,758	19,643	19,678	17,911	17,524	17,081	19,092	214,645
2051	18,338	15,754	18,020	16,597	18,067	17,896	19,798	19,840	18,054	17,667	17,196	19,219	216,445
2052	18,512	15,875	18,251	16,798	18,295	18,066	19,988	20,037	18,231	17,845	17,345	19,384	218,628
2053	18,628	15,964	18,429	16,944	18,467	18,175	20,113	20,170	18,344	17,957	17,427	19,479	220,095

2054	18,775	16,070	18,637	17,121	18,670	18,316	20,272	20,337	18,490	18,104	17,545	19,610	221,947
2055	18,923	16,178	18,847	17,299	18,875	18,458	20,432	20,505	18,638	18,253	17,664	19,743	223,816
2056	19,103	16,305	19,089	17,508	19,114	18,635	20,629	20,710	18,822	18,437	17,820	19,915	226,086
2057	19,223	16,396	19,274	17,660	19,293	18,747	20,757	20,847	18,938	18,554	17,906	20,013	227,609
2058	19,375	16,507	19,491	17,843	19,505	18,894	20,922	21,020	19,090	18,706	18,029	20,150	229,533
2059	19,529	16,618	19,711	18,028	19,720	19,041	21,088	21,194	19,244	18,860	18,153	20,288	231,475
2060	19,715	16,751	19,963	18,246	19,969	19,224	21,292	21,406	19,434	19,052	18,315	20,467	233,834
2061	19,839	16,845	20,157	18,404	20,156	19,340	21,425	21,548	19,555	19,172	18,406	20,569	235,416
2062	19,997	16,960	20,384	18,594	20,378	19,492	21,595	21,727	19,712	19,330	18,534	20,711	237,415

Non-Data Center CHOICE ENERGY (GWH)

Note: Since the Choice Reduction Factor in Step 6 takes out retail choice from DEV data centers, we only need to subtract non-data center retail choice

Year	1	2	3	4	5	6	7	8	9	10	11	12	Annual
2023	350	324	341	328	354	385	414	415	368	366	338	336	4,319
2024	350	335	341	328	354	385	414	415	368	366	338	336	4,330
2025	350	324	341	328	354	385	414	415	368	366	338	336	4,319
2026	350	324	341	328	354	385	414	415	368	366	338	336	4,319
2027	350	324	341	328	354	385	414	415	368	366	338	336	4,319
2028	350	335	341	328	354	385	414	415	368	366	338	336	4,330
2029	350	324	341	328	354	385	414	415	368	366	338	336	4,319
2030	350	324	341	328	354	385	414	415	368	366	338	336	4,319
2031	350	324	341	328	354	385	414	415	368	366	338	336	4,319
2032	350	335	341	328	354	385	414	415	368	366	338	336	4,330
2033	350	324	341	328	354	385	414	415	368	366	338	336	4,319
2034	350	324	341	328	354	385	414	415	368	366	338	336	4,319
2035	350	324	341	328	354	385	414	415	368	366	338	336	4,319
2036	350	335	341	328	354	385	414	415	368	366	338	336	4,330
2037	350	324	341	328	354	385	414	415	368	366	338	336	4,319
2038	350	324	341	328	354	385	414	415	368	366	338	336	4,319
2039	350	324	341	328	354	385	414	415	368	366	338	336	4,319
2040	350	335	341	328	354	385	414	415	368	366	338	336	4,330
2041	350	324	341	328	354	385	414	415	368	366	338	336	4,319

Step7E

2042	350	324	341	328	354	385	414	415	368	366	338	336	4,319
2043	350	324	341	328	354	385	414	415	368	366	338	336	4,319
2044	350	335	341	328	354	385	414	415	368	366	338	336	4,330
2045	350	324	341	328	354	385	414	415	368	366	338	336	4,319
2046	350	324	341	328	354	385	414	415	368	366	338	336	4,319
2047	350	324	341	328	354	385	414	415	368	366	338	336	4,319
2048	350	335	341	328	354	385	414	415	368	366	338	336	4,330
2049	350	324	341	328	354	385	414	415	368	366	338	336	4,319
2050	350	324	341	328	354	385	414	415	368	366	338	336	4,319
2051	350	324	341	328	354	385	414	415	368	366	338	336	4,319
2052	350	335	341	328	354	385	414	415	368	366	338	336	4,330
2053	350	324	341	328	354	385	414	415	368	366	338	336	4,319
2054	350	324	341	328	354	385	414	415	368	366	338	336	4,319
2055	350	324	341	328	354	385	414	415	368	366	338	336	4,319
2056	350	335	341	328	354	385	414	415	368	366	338	336	4,330
2057	350	324	341	328	354	385	414	415	368	366	338	336	4,319
2058	350	324	341	328	354	385	414	415	368	366	338	336	4,319
2059	350	324	341	328	354	385	414	415	368	366	338	336	4,319
2060	350	335	341	328	354	385	414	415	368	366	338	336	4,330
2061	350	324	341	328	354	385	414	415	368	366	338	336	4,319
2062	350	324	341	328	354	385	414	415	368	366	338	336	4,319

DSM (GWH)

Year	1	2	3	4	5	6	7	8	9	10	11	12	Annual
2023	79	73	74	65	71	79	89	92	84	85	93	106	990
2024	177	164	157	140	146	157	179	176	159	159	163	188	1,964
2025	272	242	240	215	219	241	271	265	240	237	239	278	2,960
2026	277	248	247	222	225	252	283	276	249	242	249	287	3,057
2027	287	258	256	230	232	262	292	287	256	247	255	292	3,152
2028	302	279	268	236	244	269	297	294	257	250	254	284	3,234
2029	304	268	267	240	246	269	304	298	259	255	258	292	3,259

Step7E

2030	308	272	268	243	247	269	308	298	260	255	254	293	3,276
2031	313	276	272	246	248	274	311	299	264	257	255	296	3,312
2032	314	289	277	250	249	279	312	304	266	257	261	297	3,355
2033	317	283	281	250	254	282	314	309	269	259	264	298	3,379
2034	326	289	287	253	259	284	315	310	266	259	262	295	3,405
2035	330	291	286	254	258	281	316	309	263	259	261	297	3,405
2036	333	303	286	255	255	282	320	307	268	261	260	305	3,435
2037	343	303	295	261	258	290	326	312	273	263	266	309	3,498
2038	354	314	305	269	267	299	334	325	282	269	276	319	3,612
2039	353	313	304	266	270	301	335	329	285	272	280	321	3,629
2040	354	324	304	266	273	300	337	332	282	277	282	321	3,652
2041	361	318	307	271	276	300	343	331	285	276	279	322	3,668
2042	362	318	307	271	274	304	345	330	288	276	277	324	3,676
2043	356	315	306	270	270	306	345	331	290	276	281	327	3,673
2044	355	325	305	267	272	305	341	334	289	274	282	324	3,673
2045	356	315	307	266	275	306	341	337	287	277	283	323	3,674
2046	357	314	306	269	275	304	343	336	286	279	283	323	3,673
2047	356	314	304	270	275	301	345	334	287	279	281	325	3,673
2048	355	323	305	270	271	305	343	331	288	277	281	325	3,673
2049	354	315	306	270	271	306	342	334	290	275	283	327	3,673
2050	354	315	306	268	274	306	341	335	291	275	284	325	3,673
2051	354	315	306	266	277	306	340	336	291	276	284	324	3,674
2052	354	315	306	264	279	306	339	337	291	276	285	322	3,674
2053	354	315	306	261	282	306	338	338	292	277	286	320	3,674
2054	354	315	306	259	285	306	337	339	292	277	286	318	3,675
2055	354	315	306	257	288	306	336	340	292	278	287	316	3,676
2056	353	315	306	255	291	306	335	341	293	278	288	315	3,676
2057	353	315	307	253	294	306	334	342	293	279	288	313	3,677
2058	353	315	307	251	297	306	333	343	293	279	289	311	3,678
2059	353	315	307	248	300	306	332	344	294	280	289	309	3,678
2060	353	315	307	246	303	307	331	345	294	280	290	308	3,679
2061	353	315	307	244	307	307	330	346	294	281	291	306	3,680
2062	353	315	307	242	310	307	329	347	295	281	291	304	3,681

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Step1-10 Peak

	Step1	Step2	Step3	Step4	Step5	Step6	Step7	Step8	Step9	Step10
Year	2023 PJM Dom Zone CP Forecast - Summer	2023 PJM Data Center Forecast (per PJM)	2023 PJM Dom Zone CP Forecast (Net of Data Centers)	DOM LSE Equivalent (Net of Data Centers) Prior to Retail Choice and DSM Netting	Non-NOVEC Data Centers (per PJM)	DOM LSE Data Centers (Non-Retail Choice)	CP PJM-derived (DEV Data Centers Added Back) Prior to Choice and DSM Netting	Non-Data Centers Retail Choice Peak	DSM Peak	DOM LSE CP PJM-derived after Choice and DSM Netting
2023	21,274	3,803	17,471	14,972	2,956	2,891	17,863	668	198	16,998
2024	22,126	4,683	17,443	14,948	3,497	3,381	18,329	668	396	17,266
2025	23,058	5,574	17,484	14,983	3,856	3,636	18,619	668	604	17,348
2026	24,823	7,305	17,518	15,013	4,775	4,328	19,341	668	655	18,019
2027	26,375	8,838	17,537	15,029	5,453	4,681	19,710	668	701	18,341
2028	27,906	10,352	17,554	15,043	6,167	5,061	20,105	668	722	18,715
2029	29,414	11,833	17,581	15,067	6,917	5,469	20,535	668	734	19,133
2030	30,794	13,247	17,547	15,037	7,727	5,987	21,025	668	735	19,622
2031	32,276	14,749	17,527	15,020	8,543	6,518	21,538	668	742	20,129
2032	33,641	16,111	17,530	15,023	9,387	7,155	22,177	668	758	20,752
2033	34,957	17,416	17,541	15,032	10,281	7,833	22,865	668	783	21,415
2034	36,221	18,619	17,602	15,085	11,215	8,603	23,688	668	785	22,235
2035	37,367	19,728	17,639	15,116	12,199	9,446	24,562	668	790	23,104
2036	38,517	20,800	17,717	15,183	13,207	10,322	25,505	668	778	24,059
2037	39,690	21,900	17,790	15,246	14,257	11,262	26,507	668	790	25,050
2038	40,998	23,107	17,891	15,332	15,409	12,350	27,683	668	822	26,193

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Virginia Electric and Power Company
Case No. PUR-2023-00066
Appalachian Voices
Set 6

The following response to Question No. 11 of the Sixth Set of Interrogatories and Requests for Production of Documents propounded by Appalachian Voices received on June 12, 2023, was prepared by or under the supervision of:

Jarad L. Morton
Manager – Integrated Strategic Planning
Dominion Energy Services, Inc.

Question No. 11

Aside from formal litigated Commission proceedings that allow for the participation of interested parties, does Dominion contemplate initiating any additional stakeholder meetings or processes to solicit input on modeling assumptions/constraints, the planning process, generation options, and non-wires alternatives on a going forward basis?

Response:

The Company will comply with any legal requirement to conduct a stakeholder process.

Virginia Electric and Power Company
Case No. PUR-2023-00066
Staff Set 4

The following response to Question No. 130 of the Fourth Set of Interrogatories and Requests for Production of Documents propounded by Virginia State Corporation Commission Staff received on July 3, 2023, was prepared by or under the supervision of:

Stan Blackwell
Director – Customer Service & Strategic Partnerships
Dominion Energy Virginia

Question No. 130

Please state whether the Company agrees with the following. If the Company disagrees, please explain why:

(a) >80% of the Company's data center demand is located within Loudon County, Virginia.

(b) 10 customers account for >80% of the Company's data center demand.

Response:

(a) No. The Company stated on page 55 of the 2023 Plan that "There are data centers located in other areas of Virginia, but roughly 80% of the industry is located in Loudoun County." The demand is close to 80%. When combined with adjacent counties with significant data center development, the demand is greater than 80% of the Company's data center demand.

(b) Yes.

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Virginia Electric and Power Company
Case No. PUR-2023-00066
Staff Set 5

The following response to Question No. 136 of the Fifth Set of Interrogatories and Requests for Production of Documents propounded by Virginia State Corporation Commission Staff received on July 7, 2023, was prepared by or under the supervision of:

Jarad L. Morton
Manager – Integrated Strategic Planning
Dominion Energy Services, Inc.

Question No. 136

Please refer to the Company's Integrated Resource Plan at pages 25-29. Did the Company allow PLEXOS to select energy storage PPAs or wind PPAs? If the answer is in the negative, please provide a narrative explanation for why not. If the answer is in the affirmative, please provide a narrative explanation for why these resources were not selected for any of the Alternative Plans.

Response:

The Company's energy storage resources were modeled as 65% Company owned and 35% PPA. The Company did not allow PLEXOS to select wind PPAs. To date, the Company has received minimal interest from vendors for the development of onshore wind PPAs within the Commonwealth.

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Virginia Electric and Power Company
Case No. PUR-2023-00066
Microsoft Corporation
Set 1

The following response to Question No. 5 of the First Set of Interrogatories and Requests for Production of Documents propounded by Microsoft Corporation received on July 3, 2023, was prepared by or under the supervision of:

Vishwa B. Link
McGuireWoods LLP

Question No. 5

On page Nos. 66-67 the following statement is made: "For Alternative Plans B through E, the Company modeled solar PPAs as 35% of the solar generation capacity placed in service over the Study Period in accordance with the Va. Code § 56-585.5." In reference thereto:

a. Please clarify what the statement means.

b. What is the significance of the 35%?

Response:

a. The Virginia Clean Economy Act, Va. Code § 56-585.5 *et seq.*, sets targets for the Company to develop 16,100 MW of solar or onshore wind generating capacity and 2,700 MW of energy storage capacity by 2035. The Va. Code § 56-585.5 D further allocates these development targets by stating that 35% (or at least 35% in the case of energy storage) shall be procured from facilities owned by third parties (*i.e.*, PPAs) and the remainder—or 65%—shall be constructed or acquired by the Company. The 65% to 35% split is reflected in the Company's Alternative Plans B through E. The allocation between Company-owned resources and PPA resources is also consistent with the Commission's Final Order in the Company's most recent RPS Development Plan proceeding, Case No. PUR-2022-00124, where the Commission held that "Code § 56-585.5 D, as written, does not permit more than 35% of capacity to come from third-party-owned resources." (Final Order at 17.)

b. See the Company's response to subpart (a).

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Virginia Electric and Power Company
Case No. PUR-2023-00066
Sierra Club
Set 3

The following response to Question No. 4 of the Third Set of Interrogatories and Requests for Production of Documents propounded by the Sierra Club received on June 20, 2023, was prepared by or under the supervision of:

Jarad L. Morton
Manager – Integrated Strategic Planning
Dominion Energy Services, Inc.

As it pertains to legal matters, following response to Question No. 4 of the Third Set of Interrogatories and Requests for Production of Documents propounded by the Sierra Club received on June 20, 2023, was prepared by or under the supervision of:

Vishwa B. Link
McGuireWoods LLP

Question No. 4

Please state whether the Company has evaluated the cost of complying with new proposed carbon pollution regulations[3].

(a) If yes, please provide all such analyses and explain how the Company believes the regulations will impact the optimal portfolio or the costs of its preferred portfolio.

(b) If no, please state whether the Company plans to issue any updates that evaluate the impact that these proposed rules would have on the optimal portfolio or the costs of its preferred portfolio.

3 *See New Source Performance Standards for Greenhouse Gas Emissions from New, Modified, and Reconstructed Fossil Fuel-Fired Electric Generation Units; Emission Guidelines for Greenhouse Gas Emissions from Existing Fossil Fuel-Fired Electric Generating Units; and Repeal of the Affordable Clean Energy Rule,* 88 Fed. Reg. 33240 (Proposed May 23, 2023).

Response:

The Company objects to this request to the extent it would require original work. Further, the Company objects to this request to the extent it implies the Company needs to update its modeling. The 2023 Plan is based on a "snapshot in time" of current technologies, market information, projections, and laws and regulations. The regulation referenced in the request was issued as a proposed set of options for public comment. almost three weeks after the Company filed its 2023 Plan, and could substantially change when issued as a final rule expected next year.

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Finally, the Company objects to this request as vague because the Company does not have "a preferred portfolio." Subject to and notwithstanding these objections, the Company provides the following response.

No, the Company has not evaluated the cost of complying with the referenced carbon pollution regulation.

(a) Not applicable.

(b) The Company has no plans to issue an update evaluating the impact of the proposed rule and there is no requirement for the Company to do so. Changes in regulations, when issued as final, will be modeled in future IRPs.

Virginia Electric and Power Company
Case No. PUR-2023-00066
Virginia State Corporation Commission Staff
Set 1

The following response to Question No. 32 of the First Set of Interrogatories and Requests for Production of Documents propounded by Virginia State Corporation Commission Staff received on June 2, 2023, was prepared by or under the supervision of:

William A. Coyle
Manager – Market Analytics
Virginia Electric and Power Company

Jarad L. Morton
Manager – Integrated Strategic Planning
Dominion Energy Services, Inc.

As it pertains to legal matters, the following response to Question No. 32 of the First Set of Interrogatories and Requests for Production of Documents propounded by Virginia State Corporation Commission Staff received on June 2, 2023, was prepared by or under the supervision of:

Vishwa B. Link
McGuireWoods LLP

Question No. 32

Please provide the assumed capacity values for solar, onshore wind, and offshore wind generating resources and storage resources included in the Plexos model for purposes of meeting the PJM system coincident peak. Please confirm that these capacity factor assumptions were based on PJM's Effective Load Carrying Capability ("ELCC") for solar generating resources.

Response:

The Company objects to the premise of this request as vague because it seems to relate "capacity factor" to the ELCC, which are unrelated concepts. Notwithstanding and subject to this objection, the Company provides the following response assuming the second part of the request intended to ask about the "capacity value" of solar resources.

For the purposes of the 2023 Plan, the Company utilized the December 2022 PJM ELCC study to estimate the capacity value of solar, wind, and storage resources, which is the most recently available guidance from PJM. This approach indicates the capacity value of tracking solar is currently 55%, decreasing over time as solar saturation grows. For offshore wind, the capacity value is currently 43%, and decreases over time as offshore wind saturation grows. For onshore wind, the class rating is 18%. For energy storage, the starting capacity value is 82% for four-hour systems, and increases after 2026.

Virginia Electric and Power Company
Case No. PUR-2023-00066
Virginia State Corporation Commission Staff
Set 1

The following response to Question No. 52 of the First Set of Interrogatories and Requests for Production of Documents propounded by Virginia State Corporation Commission Staff received on June 2, 2023, was prepared by or under the supervision of:

Jarad L. Morton
Manager – Integrated Strategic Planning
Dominion Energy Services, Inc.

Question No. 52

Please refer to page Appendix 5T and provide the data underlying the Winter Capacity Charts for Plans A, B, C, D, and E as shown therein in an executable Microsoft Excel format with underlying formulae intact.

Response:

See the sheet titled: "TABLE - Cap (W)" in the following attachments:

- Attachment Staff Set 01-52 (Plan A) (JLM)
- Attachment Staff Set 01-52 (Plan B) (JLM)
- Attachment Staff Set 01-52 (Plan C) (JLM)
- Attachment Staff Set 01-52 (Plan D) (JLM)
- Attachment Staff Set 01-52 (Plan E) (JLM)

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Excerpt from Response to CV Set 1-10(f) (ES)

Redacted

CERTIFICATE OF SERVICE

I hereby certify that a true copy of the foregoing was served this 8th day of August, 2023, by e-mail to:

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