

**COMMONWEALTH OF VIRGINIA
STATE CORPORATION COMMISSION**

PETITION OF

VIRGINIA ELECTRIC & POWER COMPANY

Case No. PUR-2022-00006

For revision of rate adjustment clause: Rider E, for the recovery of costs incurred to comply with state and federal environmental regulations pursuant to § 56-585.1 A 5 e of the Code of Virginia.

DIRECT TESTIMONY

of

DEVI GLICK

on behalf of the

SIERRA CLUB

May 24, 2022

(PUBLIC VERSION)

Summary of the Direct Testimony of Devi Glick

Dominion has not demonstrated the prudence of moving forward with Phase 2 of the BAWT project at Mt. Storm. This conclusion is based on both the contemporaneous analysis conducted by the Company in 2021 at the time it decided to move forward with Phase 2, and prior analysis it had conducted throughout and following Phase 1 (2016–2018). During the pause between Phase 1 and Phase 2, Dominion incurred additional costs to delay the project and did not use the information it had available to adequately re-evaluate whether continuing with the BAWT project was in the best interest of ratepayers. Dominion also failed to evaluate the regulatory risks associated with continued reliance on Mt. Storm, including the risk of additional environmental compliance costs from increased stringency in ELG regulations, Clean Water Act temperature limit compliance, and CO₂ prices at any point during the project.

Dominion knew when it began Phase 2 in 2021 that Mt. Storm had earned only marginal net revenues between 2016 and 2021 and that the plants utilization had been falling. The Company had been systematically revising down its projections for Mt. Storm, and during the time Dominion was set to re-start Phase 2, the Company's 2021 contemporaneous analysis projected only marginal future performance. This was in stark contrast with Dominion's earlier findings (from 2016–2018) which relied on overly optimistic capacity factors and energy and capacity price forecasts to support projections of large future revenues.

I recommend that the Commission disallow all costs associated with Phase 2 of the BAWT project at Mt. Storm. At the very least, the Commission should deny Phase 2 costs until Dominion performs an updated economic analysis that accounts for additional environmental costs including the cost of chillers, a more stringent ELG standard, and a higher CO₂ price. The Commission should also require Dominion to stop the practice of uneconomically self-committing Mt. Storm and instead allow the PJM market operator to commit and dispatch the plant only when it is economic to do so. Allowing Dominion to uneconomically self-commit the plant as its utilization falls will result in excess costs for ratepayers.

TABLE OF CONTENTS

LIST OF TABLES ii

LIST OF FIGURES ii

1. Introduction and Purpose of Testimony..... 1

2. Findings and Recommendations 6

3. Mt. Storm’s Plant Background and ELG Compliance Background 9

4. Dominion’s Decision to Move Forward with Phase 2 of the BAWT Project
at Mt. Storm Was Not Prudent Based on What the Company Knew When
it Started Phase 2..... 13

5. Coal-Fired Power Plants Like Mt. Storm Will Become Increasingly
Uneconomic in the Future 41

6. Unit Commitment and Dispatch Practices at Mt. Storm 51

7. Conclusions and Recommendations..... 60

LIST OF TABLES

Table 1: Remaining Plant Balance at Mt. Storm as of September 30, 2021.....	11
Table 2: Regulatory and Construction Timeline for BAWT project	14
ES Table 3: Summary of Dominion Studies from 2017–2021, Mt. Storm NPV.....	25
ES Table 4: Actual Capacity Factors at Mt. Storm (2016–2021)	44
ES Table 5: Projected Capacity Factors at Mt. Storm (2021–2030)	44
ES Table 6: Operational Statistics and Revenue / Losses from Mt. Storm (2016– 2022)	58

LIST OF FIGURES

Figure 1: BAWT Project Spending at Mt. Storm.....	22
ES Figure 2: ES NPV of Dominion’s Projections for Mount Storm by Year of Study	26
ES Figure 3: Mt. Storm’s Projected Net Revenue from 2021 IRP Update	32
Figure 4: PJM day-ahead LMPs (\$/kWh)	34
ES Figure 5: Dominion’s Projected Capacity Factors for Mt. Storm Across All Studies 2016–2021.....	35
Figure 6: Dominion’s Energy Market Prices from 2015, 2018 and 2021 IRPs	38
Figure 7: Dominion Capacity Market Prices from 2015, 2018, and 2021 IRPs.....	39
Figure 8: Historical Levelized Cost of Energy for Wind and Solar PV Technologies	45
Figure 9: Forecast of Overnight Capital Cost for New Solar PV, Wind, and Battery Storage.....	47

1. INTRODUCTION AND PURPOSE OF TESTIMONY

1 **Q Please state your name and occupation.**

2 **A** My name is Devi Glick. I am a Senior Principal at Synapse Energy Economics, Inc.
3 (Synapse). My business address is 485 Massachusetts Avenue, Suite 3, Cambridge,
4 Massachusetts 02139.

5 **Q Please describe Synapse Energy Economics.**

6 **A** Synapse is a research and consulting firm specializing in energy and environmental
7 issues, including electric generation, transmission and distribution system
8 reliability, ratemaking and rate design, electric industry restructuring and market
9 power, electricity market prices, stranded costs, efficiency, renewable energy,
10 environmental quality, and nuclear power.

11 Synapse's clients include state consumer advocates, public utilities commission
12 staff, attorneys general, environmental organizations, federal government agencies,
13 and utilities.

14 **Q Please summarize your work experience and educational background.**

15 **A** At Synapse, I conduct economic analysis and write testimony and publications that
16 focus on a variety of issues related to electric utilities. These issues include power
17 plant economics, electric system dispatch, integrated resource planning,
18 environmental compliance technologies and strategies, and valuation of distributed

1 energy resources. I have submitted expert testimony before state utility regulators
2 in more than a dozen states.

3 In the course of my work, I develop in-house models and perform analysis using
4 industry-standard electricity power system models. I am proficient in the use of
5 spreadsheet analysis tools, as well as optimization and electric dispatch models. I
6 have directly run EnCompass and PLEXOS and have reviewed inputs and outputs
7 for several other models.

8 Before joining Synapse, I worked at Rocky Mountain Institute, focusing on a wide
9 range of energy and electricity issues. I have a master's degree in public policy and
10 a master's degree in environmental science from the University of Michigan, as well
11 as a bachelor's degree in environmental studies from Middlebury College. I have
12 more than ten years of professional experience as a consultant, researcher, and
13 analyst. A copy of my current resume is attached as Exhibit DG-1.

14 **Q On whose behalf are you testifying in this case?**

15 **A** I am testifying on behalf of Sierra Club.

1 **Q Have you testified previously before the State Corporation Commission of**
2 **Virginia?**

3 **A** Yes, I submitted testimony in Case No. PUR-2018-00195 in which Virginia Electric
4 and Power Company (Dominion or the Company) requested costs for effluent
5 limitation guidelines (ELG) and coal combustion residuals (CCR) compliance.

6 **Q What is the purpose of your testimony in this proceeding?**

7 **A** In this proceeding, I review a request by Dominion for approval of costs to install
8 the bottom ash water transport (BAWT) project at its Mt. Storm Power Station to
9 comply with ELG. I review the information that Dominion had available at the time
10 that it decided to move forward with Phase 1 and Phase 2 of the BAWT project. I
11 also evaluate the prudence of the Company's decision to continue investing in and
12 operating Mt. Storm relative to retirement and replacement with alternatives.

13 **Q How is your testimony structured?**

14 **A** In Section 2, I summarize my findings and recommendations for the Commission.

15 In Section 3, I provide an overview of the Mt. Storm power plant and introduce the
16 BAWT project for which the Company is requesting cost recovery in this docket.

17 In Section 4, I summarize the regulatory and construction timeline for the BAWT
18 project and identify critical project decision-points and milestones for Phases 1 and

1 2 of the project. I evaluate the information that the Company had available before it
2 commenced each phase of the project, including prior studies, actual data on the
3 historical economic performances, and the Company's most recent integrated
4 resource plan (IRP). I review the Company's projections on the cost and the value
5 the plant would provide, and then I calculate the value it actually *did* provide. Based
6 on all the data available to me, and to Dominion, I evaluate the prudence of the
7 Company's decisions to move forward with Phase 2.

8 In Section 5, I discuss the market and regulatory risks that the Company faces over
9 the next decade in continuing to operate Mt. Storm.

10 In Section 6, I discuss Dominion's unit-commitment and dispatch practices at Mt.
11 Storm and recommend changes that can reduce the operational losses likely to be
12 incurred and passed on to ratepayers.

13 **Q What information do you rely upon for your analysis, findings, and**
14 **observations?**

15 **A**My analysis relies primarily on the workpapers, exhibits, and discovery responses
16 of Dominion's witnesses. I also rely on other publicly available documents and data,
17 which are cited throughout my testimony.

1 Q Are you sponsoring any exhibits?

2 A Yes. I am sponsoring the following exhibits:

Exhibit Number	Description of Exhibit	Confidential or Non-Confidential
Exhibit DG-1	Resume of Devi Glick	Public
Exhibit DG-2	Dominion Response to Sierra Club Request No. 2-21	Public
Exhibit DG-3	Dominion Response to Sierra Club Request No. 2-22	Public
Exhibit DG-4	Dominion Response to Sierra Club Request No. 2-5, <i>Supplemental Extraordinarily Sensitive Attachment Sierra Club Set 2-5 (JS)</i>	ES / Confidential
Exhibit DG-5	Dominion Response to Sierra Club Request No. 2-6	Public
Exhibit DG-6	Dominion Response to Sierra Club Request No. 2-5, Confidential Attachment <i>Mt Storm Bottom Ash Project Status Update 10-04-19</i>	ES / Confidential
Exhibit DG-7	Dominion Response to Sierra Club Request No. 2-5, Confidential Attachment <i>Mt Storm Bottom Ash Project Status Update 07122021</i>	ES / Confidential
Exhibit DG-8	Dominion Response to Sierra Club Request No. 2-5, Confidential Attachment <i>Mt. Storm Bottom Ash - Continuation Discussion Points - Comments</i>	ES
Exhibit DG-9	Dominion Response to Sierra Club Request No. 2-10, ES Attachment <i>2017_Analysis_Retirement Study 2017 IRP DISCOVERABLE</i>	ES / Confidential
Exhibit DG-10	Dominion Response to Sierra Club Request No. 2-10, ES Attachment <i>2017_Analysis_Vista Project - DISCOVERABLE (Nov 2017)</i>	ES / Confidential

Exhibit Number	Description of Exhibit	Confidential or Non-Confidential
Exhibit DG-11	Dominion Response to Sierra Club Request No. 2-10, ES Attachment <i>2018_Analysis_Retirement and Cofire Study - DISCOVERABLE</i>	ES / Confidential
Exhibit DG-12	Dominion Response to Sierra Club Request No. 2-10, ES Attachment <i>2019_Analysis_Vista 2.0 FINAL - Mar 2019 DISCOVERABLE</i>	ES
Exhibit DG-13	Dominion Response to Sierra Club Request No. 2-10, ES Attachment <i>2020_Analysis_2020.3.9 - Vista 3.0 FINAL DISCOVERABLE</i>	ES
Exhibit DG-14	Dominion Response to Sierra Club Request No. 2-10, ES Attachment <i>2021_Analysis_Unit Evaluation - FINAL (July 2021)_DISCOVERABLE_rev 9 22 2021</i>	ES / Confidential
Exhibit DG-15	Dominion Response to Sierra Club Request No. 2-13	Public
Exhibit DG-16	Dominion Response to Sierra Club Request No. 2-10, ES Attachment <i>2016_Analysis_Life Extension Analysis - DRAFT AS OF 12-16-2015 DISCOVERABLE</i>	ES / Confidential
Exhibit DG-17	Dominion Response to Sierra Club Request No. 2-7, <i>Attachment 2-07 (KC)</i> .	Public
Exhibit DG-18	Dominion Response to Staff Request No. 1-06	Public

2. FINDINGS AND RECOMMENDATIONS

- 1 Q Please summarize your findings.
- 2 A My primary findings are:

- 1 1. Dominion has not demonstrated the prudence of moving forward with
2 Phase 2 of the BAWT project at Mt. Storm based on the contemporaneous
3 analysis conducted by the Company at the time it decided to move forward
4 with Phase 2 of the project in 2021. Specifically, the Company’s 2021
5 updated IRP analysis projected marginal to negative net revenues at Mt.
6 Storm over the next decade.
- 7 2. During the pause between Phase 1 and Phase 2, Dominion incurred
8 additional costs to delay the project; and Dominion did not use the
9 information available to it to adequately re-evaluate whether continuing
10 with the BAWT project was in the best interest of ratepayers.
- 11 3. Dominion knew at the time it began Phase 2 in 2021 that Mt. Storm had
12 earned only marginal net revenues between 2016 and 2021, and that the
13 Company had been systematically revising down its projections for Mt.
14 Storm. The Company’s contemporaneous analysis from 2021, when
15 Dominion was set to restart Phase 2, projected only marginal future
16 revenues. This was in contrast with Dominion’s Phase 1 projections of large
17 future revenues at Mt. Storm.
- 18 4. Dominion’s Phase 1 projections were driven in large part by the Company’s
19 overly optimistic capacity factor, energy price, and capacity price forecasts.

- 1 5. Dominion also failed, during both Phase 1 and Phase 2, to evaluate other
2 risks of continued reliance on Mt. Storm, including the risk of additional
3 environmental compliance costs from increased stringency in ELG
4 regulations, Clean Water Act temperature limit compliance, and CO₂
5 prices.
- 6 6. Despite decreasing utilization of Mt. Storm, Dominion self-committed Mt.
7 Storm [BEGIN CONFIDENTIAL / ES] ██████████ [END
8 CONFIDENTIAL / ES] of the time that the unit was available in 2021.
9 This practice incurs unnecessary costs for Dominion ratepayers relative to
10 economic commitment and dispatch practices.

11 Based on those findings, I offer the following recommendations:

- 12 1. Because the Company failed to demonstrate the prudence of moving
13 forward with Phase 2, the Commission should disallow all costs associated
14 with Phase 2 of the BAWT project at Mt. Storm.
- 15 2. Alternatively, the Commission should deny Phase 2 costs until Dominion
16 performs an updated economic analysis that includes the effect of additional
17 environmental costs including the cost of the chillers, a more stringent ELG
18 standard, and a higher CO₂ price.

- 1 3. Because Dominion both (a) incurred costs to store the BAWT equipment
2 and extend its warranty when it paused the project between Phase 1 and 2,
3 and (b) failed to use available analysis and information indicating it was not
4 prudent to continue moving forward with Phase 2 of the project, the
5 Commission should disallow the avoidable costs incurred as a result of the
6 pause.
- 7 4. Dominion should stop the practice of uneconomically self-committing Mt.
8 Storm, especially as the plant’s utilization falls, and instead allow the PJM
9 market operator to only commit and dispatch the plant when it is economic
10 to do so.

3. MT. STORM’S PLANT BACKGROUND AND ELG COMPLIANCE BACKGROUND

11 **Q Describe the Mt. Storm Power Station.**

12 **A**Mt. Storm is a three-unit power plant located near Bismarck, West Virginia with a
13 combined capacity of approximately 1,621 MW.¹ Unit 1 is 567 MW, Unit 2 is 570
14 MW, and Unit 3 is 537 MW.² Units 1–3 were built in 1965, 1966, and 1973

1 Direct Testimony of Rick Boyd at 3.

2 Dominion Response to Sierra Club Request No. 2-20, *ES Attachment 2-20 (KLC)* This document contains voluminous spreadsheet data in numerous tabs and can be produced upon request.

1 respectively.³ The Company has not planned a retirement date for the units; but for
2 planning purposes in its 2020 IRP, Dominion assumed a 2044 retirement date.⁴ The
3 plant is 100 percent owned by Dominion.

4 **Q What is Dominion asking for in its application?**

5 **A**In this rider docket, Dominion is asking for an adjustment to Rider E for the BAWT
6 project capital and operations and maintenance (O&M) expenses. Specifically, the
7 Company is asking for recovery of:

- 8 • \$119.7 million in projected capital costs (excluding financing costs)⁵
- 9 • \$17.8 million in total O&M costs⁶

10 The proposed BAWT project will replace the current sluiced “once-through”
11 system with a new system that recirculates bottom ash transport water in a closed
12 loop, separating the bottom ash for removal.

13 **Q What environmental controls has Dominion already installed at Mt. Storm?**

14 **A**Between 2002 and 2024 Dominion installed selective catalytic controls (SCR) at
15 Mt. Storm to control NO_x emissions, and wet scrubbers to control SO₂, mercury,

3 U.S. ENERGY INFORMATION ADMINISTRATION (EIA), Form 860: Annual Electric
Generator Report (2021), available at <https://www.eia.gov/electricity/data/eia860/>.

4 Dominion Response to Sierra Club Request No. 2-21 (attached as Exhibit DG-2).

5 Direct Testimony of Rick Boyd at 8.

6 *Id.*

1 and particulate matter emissions. Dominion also installed electrostatic precipitators
2 to control particulate matter at the plant when it first came online.⁷ These emission
3 control projects together cost \$830 million dollars in \$2022.

4 **Q What is the remaining undepreciated balance for Mt. Storm?**

5 **A** Dominion has a large undepreciated plant balance at Mt. Storm totaling more than
6 \$537 million.

**Table 1: Remaining Plant Balance at
Mt. Storm as of September 30, 2021**

Unit	Total (Millions)
Mt. Storm Unit 1	\$182
Mt. Storm Unit 2	\$149
Mt. Storm Unit 3	\$206
Total	\$537

*Source: Dominion Response to Sierra Club Request
No. 2-22 (attached as Exhibit DG-3)*

7 **Q Is it concerning that Dominion is seeking to make another large investment in**
8 **Mt. Storm on top of the current undepreciated balance?**

9 **A** Yes. The proposed BAWT project cost will increase the undepreciated balance by
10 around 20 percent. And as I discuss in Section 5, the current BAWT is just one of
11 several large investments that Dominion will likely be required to make at Mt.

7 EIA Form 860, *supra* note 3.

1 Storm if it continues to operate the plant. All of which should factor into whether
2 Mt. Storm continues to operate.

3 In the eyes of a utility, a large undepreciated balance is a barrier to retirement.
4 Dominion has an incentive to keep the plants online because, if it retires any of the
5 units early, it risks not recovering the remaining undepreciated balance. But to keep
6 the plants online, the Company will need to continue investing in O&M as well as
7 any necessary future major capital expenditures. If future environmental
8 regulations require additional, large capital investments or increased O&M, and the
9 Company opts to continue investing in the plants rather than retiring it, those
10 expenses will further inflate the undepreciated plant balance and make early
11 retirement even more of a challenge. Then, when the plant inevitably retires before
12 the mid-2040s, the Company will be left with substantial stranded assets.

13 **Q Are you aware of any precedent for disallowing coal plant capital costs that are**
14 **unsupported by a contemporaneous retirement analysis?**

15 **A** Yes. The Virginia State Corporation Commission denied Dominion \$18 million in
16 cost recovery for the wet-to-dry conversion for coal-fired Chesterfield Units 3 and
17 4 in Case No. PUR-2018-00195. The Commission found that Dominion invested
18 “additional long-term environmental compliance capital into these units” despite

1 the Company's own analysis that showed that it was more economic to retire or
2 convert the units to burn gas by 2020.⁸

**4. DOMINION'S DECISION TO MOVE FORWARD WITH PHASE 2
OF THE BAWT PROJECT AT MT. STORM WAS NOT
PRUDENT BASED ON WHAT THE COMPANY
KNEW WHEN IT STARTED PHASE 2.**

3 **Q Can you provide a timeline of the BAWT project?**

4 **A** Dominion divided the BAWT project in two distinct phases:

- 5 • Phase 1 consisted of front-end engineering and design, procurement of
6 conveyor equipment, site preparation, and construction of equipment
7 foundations.⁹
- 8 • Phase 2, if completed, will consist of the final engineering, mobilization of
9 the major equipment to Mt. Storm, mobilization of the construction
10 contractor, assembly of the equipment, siting and erection of the
11 equipment, installation of all piping and electrical, the commissioning of the

8 *Petition of Virginia Electric and Power Company for approval of a rate adjustment clause, designated Rider E, for the recovery of costs incurred to comply with state and federal environmental regulations pursuant to § 56-585.1 A 5 e of the Code of Virginia, Case No. PUR-2018-00195, Final Order (August 5, 2019), available at <https://bit.ly/3wB90Cl>.*

9 Direct Testimony of Rick Boyd at 5.

1 equipment, and demobilization of the construction contractor from the
 2 site.¹⁰

3 Dominion completed Phase 1 at the end of 2019.¹¹ Around this same time
 4 (November 2019) the U.S. Environmental Protection Agency (EPA) published a
 5 proposed revision to the ELG rule that extended the compliance date by two years.
 6 Based on this change, the Company coordinated with the West Virginia
 7 Department of Environmental Protection (WVDEP) pushing back compliance until
 8 March 31, 2024.¹² In Q2 of 2021, Dominion resumed Phase 2.¹³ I summarize the
 9 regulatory and construction timeline for the BAWT in Table 2 below.

Table 2: Regulatory and construction timeline for BAWT project

Date	Regulatory action	Company action
Q2 2013	EPA provided notification that it planned to revise ELG rules for steam electric generating power plants.	Company began internal review of technologies that could meet the proposed guidelines at Mt. Storm.
Q2 2014	Mt. Storm WV NPDES permit issued.	
Q2 2015		Company initiated an engineering study on the installation of a closed loop BAWT system.
Q4 2015	EPA promulgated proposed ELG revisions.	Dominion completed 2016 Life Extension Analysis (Exhibit DG-16).

10 *Id.* at 5–6.

11 *Id.* at 5.

12 *Id.*

13 *Id.* at 6.

Date	Regulatory action	Company action
Q1 2016		Dominion selected submerged flight conveyor system to meet ELG guidelines; reserved a manufacturing slot with United Conveyor Company (UCC).
Q1 2017		Dominion completed 2017 Generation Planning analysis for 2017 IRP (Exhibit DG-9).
Q3 2017	Part of ELG rule stayed by EPA.	Company signed a contract with UCC.
Q4 2017		Dominion completed 2017 Project Vista analysis (Exhibit DG-10).
Q1 2018		Dominion completed Retire/Co-fire/Repower Study for 2018 IRP (Exhibit DG-11).
Q1 2019		Dominion completed 2019 Unit Analysis (Exhibit DG-12).
Q4 2019		Phase 1 completed. Phase 2 put on hold.
Q1 2020		Dominion completed 2020 Unit Analysis (Exhibit DG-13).
2020	Compliance deadlines delayed by two years.	Company requested March 31, 2024 as target project compliance date with WVDEP.
Q2 2021		Phase 2 work started.
Q3 2021		Dominion completed 2021 Unit Evaluation (Exhibit DG-14).
Q3-Q4 2021	EPA issued a notice that it intended to review the ELG requirements and may propose more stringent regulations in the fall of 2022. ¹⁴	Company issued RFP for construction and installation, and awarded contract.
Q1 2022		Phase 2 construction work began.

14 Direct Testimony of Thomas Effinger at 3–4.

Date	Regulatory action	Company action
Q2 2022		UCC materials / equipment shipped to site
Q2 2022- Q3 2023		Construction
Q4 2023		Tie-in of new system during scheduled outage in 2023
Q1 2024		Project expected to be completed

Source: Direct Testimony of Ricky Boyd at 4-6; Direct Testimony of Thomas Effinger at 3; Witness RDB, Schedule 3.

1 **Q How much did Dominion anticipate the project would cost?**

2 **A** Dominion projects that the BAWT project will cost a total of \$119.7 million
3 according to Company's Application.¹⁵ [BEGIN CONFIDENTIAL / ES] [REDACTED]

4 [REDACTED]

5 [REDACTED]

6 [REDACTED]

7 [REDACTED]

8 [REDACTED]

15 Direct Testimony of Rick Boyd at 8.

16 Dominion Response to Sierra Club Request No. 2-5, ES Attachment *Supplemental Extraordinarily Sensitive Attachment Sierra Club Set 02-05 (JS)* (attached as ES Exhibit DG-4).

17 Exhibit DG-5; Dominion Response to Sierra Club Request No. 2-6 (attached as Exhibit DG-5).

1
2
3
4
5
6
7
8
9
10
11
12

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED] [END CONFIDENTIAL / ES]

Q Explain the postponement of Phase 2 of the BAWT project.

A In Q4 of 2019, the ELG compliance deadline for West Virginia was moved from December 2021 to December 2023. Based on this change, Dominion management negotiated a new compliance deadline with WVDEP of March 31, 2024.²¹ When Dominion decided to pause the project, it acknowledged that delaying compliance would incur additional costs for (1) United Conveyor Company (UCC) to store the equipment that it had already fabricated; (2) extending the warranties with UCC for one additional year for the equipment;²² [BEGIN CONFIDENTIAL / ES]

18 Dominion Response to Sierra Club Request No. 2-5, ES Attachment *Mt Storm Bottom Ash Project Status Update 10-04-19* (attached as Exhibit DG-6).
19 Dominion Response to Sierra Club Request No. 2-5, ES Attachment *Mt Storm Bottom Ash Project Status Update 07122021* (attached as Exhibit DG-7).
20 Exhibit DG-4.
21 Direct Testimony of Rick Boyd at 5.
22 *Id.* at 6-7.

1
2
3
4
5
6
7
8
9
10
11
12
13

[REDACTED]

[REDACTED] [END CONFIDENTIAL / ES]²³

Q Explain what costs Dominion incurred during the project’s pause.

A During the pause between Q4 2019 and Q2 2021, Dominion paid UCC [BEGIN
CONFIDENTIAL / ES] [REDACTED] [END CONFIDENTIAL / ES] to store
the fabricated equipment and [BEGIN CONFIDENTIAL / ES] [REDACTED]
[END CONFIDENTIAL / ES] to extend the warranty on the equipment for a
total of [BEGIN CONFIDENTIAL / ES] [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED] [END CONFIDENTIAL / ES] but it is
clear that the storage and warranty expenses were avoidable if the project had
proceeded as originally scheduled.

23 Dominion Response to Sierra Club Request No. 2-5, ES Attachment *Mt. Storm Bottom Ash - Continuation Discussion Points – Comments* (attached as Exhibit DG-8).

24 Exhibit DG-4.

25 Exhibit DG-8.

1 **Q Did Dominion utilize the time the project was paused to evaluate whether it**
2 **was still prudent to move forward with Phase 2 of the BAWT project?**

3 **A** It appears not. Even though the Company performed an IRP analysis during the
4 pause, there is no evidence that it ever considered stopping the project. The pause
5 of roughly 18 months from Q4 2019–Q2 2021 gave Dominion the opportunity to re-
6 evaluate whether installing the project and continuing to operate the Mt. Storm
7 Power plant was still in the best interest of ratepayers. And the timing of the pause
8 was well-aligned with Dominion’s publication of its 2020 IRP and 2021 updated
9 IRP analysis. The 2020 IRP and 2021 IRP update showed that Mt. Storm was only
10 marginal at best, and likely uneconomic over the next decade. But Dominion
11 appears to have ignored these results and instead restarted Phase 2 of the project in
12 Q2 of 2021.

13 It may have been reasonable for the Company to incur **[BEGIN**
14 **CONFIDENTIAL / ES]** [REDACTED] **[END CONFIDENTIAL / ES]** to pause
15 the project, *if* Dominion used that opportunity to re-evaluate the economics of
16 continuing with Phase 2. It may even have been reasonable for Dominion not to act
17 on the results of its own analysis, *if* the project was already complete and the costs
18 no longer avoidable. But it is very concerning that Dominion completed an IRP
19 update analysis during the pause between Phases 1 and 2, when the majority of the

1 project spending was still avoidable, found that the plant was marginal at best,²⁶ and
2 then ignored the results and proceeded with the project anyway. This highlights a
3 larger concern regarding Dominion’s pattern of siloed decisions that Dominion
4 makes distinct from the Company’s analysis and resource planning processes.

5 **Q Is this the first time Dominion has failed to use the results of its own analysis**
6 **to evaluate the economics of continued investment in its existing fossil**
7 **resources?**

8 **A** No, unfortunately it is not. In Case No. PUR-2018-00195 Dominion ignored several
9 pieces of analysis that the Company itself had conducted at the time it decided to
10 invest in Wet-to-Dry conversion technology for Chesterfield Units 3 and 4.
11 Specifically, the Company ignored its 2015 IRP results as well as subsequent 2015
12 analysis. Both of these analyses showed, and indeed contained summary
13 conclusions indicating, that Dominion should continue operation of Units 3 and 4

26 Dominion Response to Sierra Club Request No. 2-10, ES Attachment
2021_Workbook_Retirement Analysis - 7 27 2021 - FINAL_DISCOVERABLE_rev 9 22
2021. This document contains voluminous spreadsheet data in numerous tabs and can
be produced upon request.

1 only over the short term, and that the Company should avoid life-extending capital
2 expenditures.²⁷

3 **Q What portion of the project cost was avoidable if Dominion had decided not to**
4 **proceed with Phase 2 of the project?**

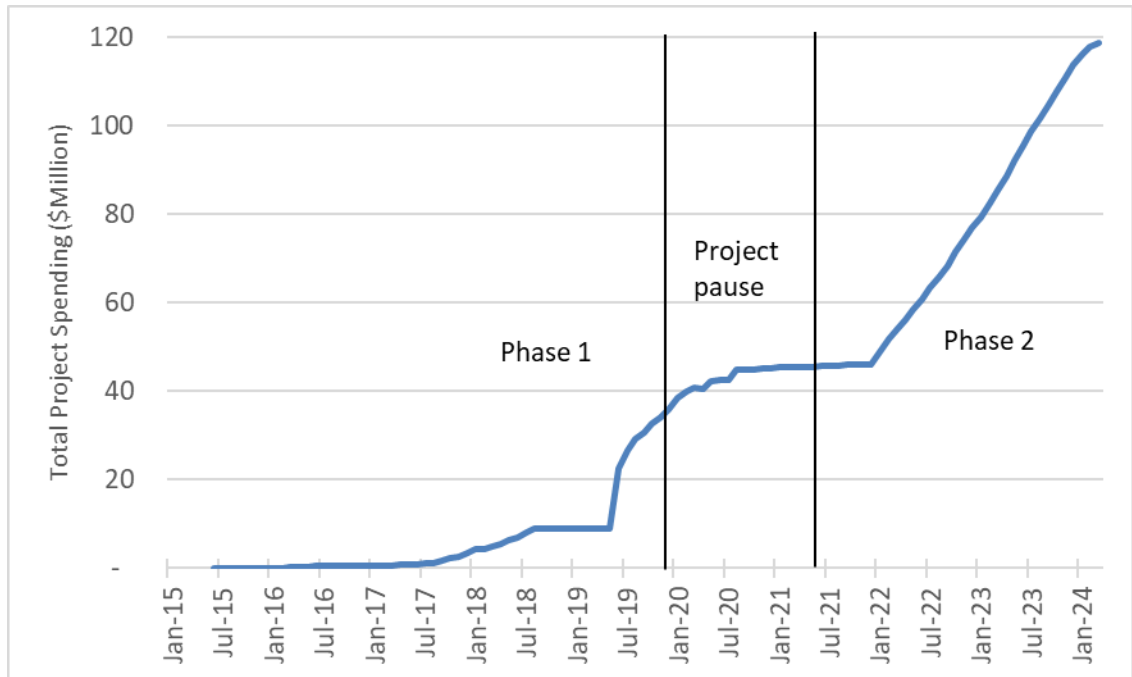
5 **A** Dominion spent around one-third of the total project cost during Phase 1, which
6 ended in Q4 of 2019 as shown in Figure 1. When Phase 2 began in Q2 of 2021, 62
7 percent of the project budget had yet to be spent. This works out to approximately
8 \$74 million of avoidable costs if the Company decided not to move forward with
9 Phase 2 of the project. [BEGIN CONFIDENTIAL / ES] [REDACTED]
10 [REDACTED] [END
11 CONFIDENTIAL / ES] As of the filing of this testimony (May 2022), 49 percent
12 of the projected project cost has yet to be incurred according to the Company's
13 Schedule 46A.²⁹

27 *Petition of Virginia Electric and Power Company for approval of a rate adjustment clause, designated Rider E, for the recovery of costs incurred to comply with state and federal environmental regulations pursuant to § 56-585.1 A 5 e of the Code of Virginia, Case No. PUR-2018-00195, Final Order (August 5, 2019), available at <https://bit.ly/3ly0qOl>.*

28 Exhibit DG-4.

29 Schedule 46A, St, 4A – Mt. Storm.

Figure 1: BAWT Project Spending at Mt. Storm



Source: Schedule 46A, St, 4A – Mt. Storm.

1 **Q** **What information did Dominion have at the time it decided to move forward**
2 **with Phase 2 of the project that it should have used to evaluate the prudence of**
3 **continuing with the BAWT project?**

4 **A** Dominion had three key types of analysis and data at the time it decided to move
5 forward with Phase 2, each of which indicated that continued investment in Mt.
6 Storm was likely not prudent:

7 1. A series of seven retirement and life extension analyses studies that
8 Dominion conducted between December 2015 and March 2020, each of
9 which projected substantial net revenues over the next decade (between

1 2018–2033) at Mt. Storm. None of those projection have come close to
2 materializing.³⁰

3 2. Dominion’s actual cost and revenue data from the plant between 2016–2021
4 which showed that, in contrast with projections, the plant had performed
5 only marginally.³¹

6 3. Dominion’s most recent analysis, its 2021 IRP³² update, which the
7 Company completed right when it was restarting Phase 2. This analysis
8 showed that Mt. Storm was projected to perform marginally at best, and
9 likely uneconomically, over the next decade.

30 Dominion Response to Sierra Club Request No. 2-10, ES Attachment *2017_Analysis_Retirement Study 2017 IRP DISCOVERABLE* (attached as Exhibit DG-9), ES Attachment *2017_Analysis_Vista Project - DISCOVERABLE (Nov 2017)* (attached as Exhibit DG-10), ES Attachment *2018_Analysis_Retirement and Cofire Study - DISCOVERABLE* (attached as Exhibit DG-11), ES Attachment *2019_Analysis_Vista 2.0 FINAL - Mar 2019 DISCOVERABLE* (attached as Exhibit DG-12), ES Attachment *2020_Analysis_2020.3.9 - Vista 3.0 FINAL DISCOVERABLE* (attached as Exhibit DG-13).

31 Dominion Response to Sierra Club Request No. 2-19, ES Attachment *Sierra Club Set 02-19 (JRV)*; Dominion Response to Sierra Club Request No. 2-16, ES Attachment *Sierra Club 02-16(a-h) (JLS)*, Confidential Attachment *Sierra Club Set 2-16(k) (RC)*, Confidential Attachment *Sierra Club Set 2-16 (l-m) (TAH)*, Confidential Attachment *Sierra Club Set 2-16 (i) (BKC)*, Confidential Attachment *Sierra Club Set 2-16 (j) (BKC)*. These attachments contain voluminous spreadsheet data in numerous tabs and can be produced upon request.

32 Dominion Response to Sierra Club Request No. 2-10, ES Attachment *2021_Analysis_Unit Evaluation - FINAL (July 2021) DISCOVERABLE_rev 9 22 2021* (attached as Exhibit DG-14).

1 **Q Describe the retirement and life extension analysis that the Company**
2 **performed between 2016 and 2021.**

3 **A** Dominion conducted seven unit replacement and retirement studies between
4 December 2015 and July 2021. All except the first from December 2015 were
5 conducted using the PLEXOS modeling software. Dominion provided slide decks
6 with the results from these seven studies and excel workpapers for all PLEXOS
7 analysis (Dominion did not provide the spreadsheets for its earliest 2016 analysis
8 conducted using Strategist, which it claimed was unavailable).³³ The Company also
9 completed an analysis that it prepared between 2016 and 2021 which provided
10 short-term budget estimates for the cost of the Mt. Storm project. I used each of
11 these pieces of analysis to evaluate the information that Dominion had available to
12 it at various points during Phase 1 and prior to the start of Phase 2.

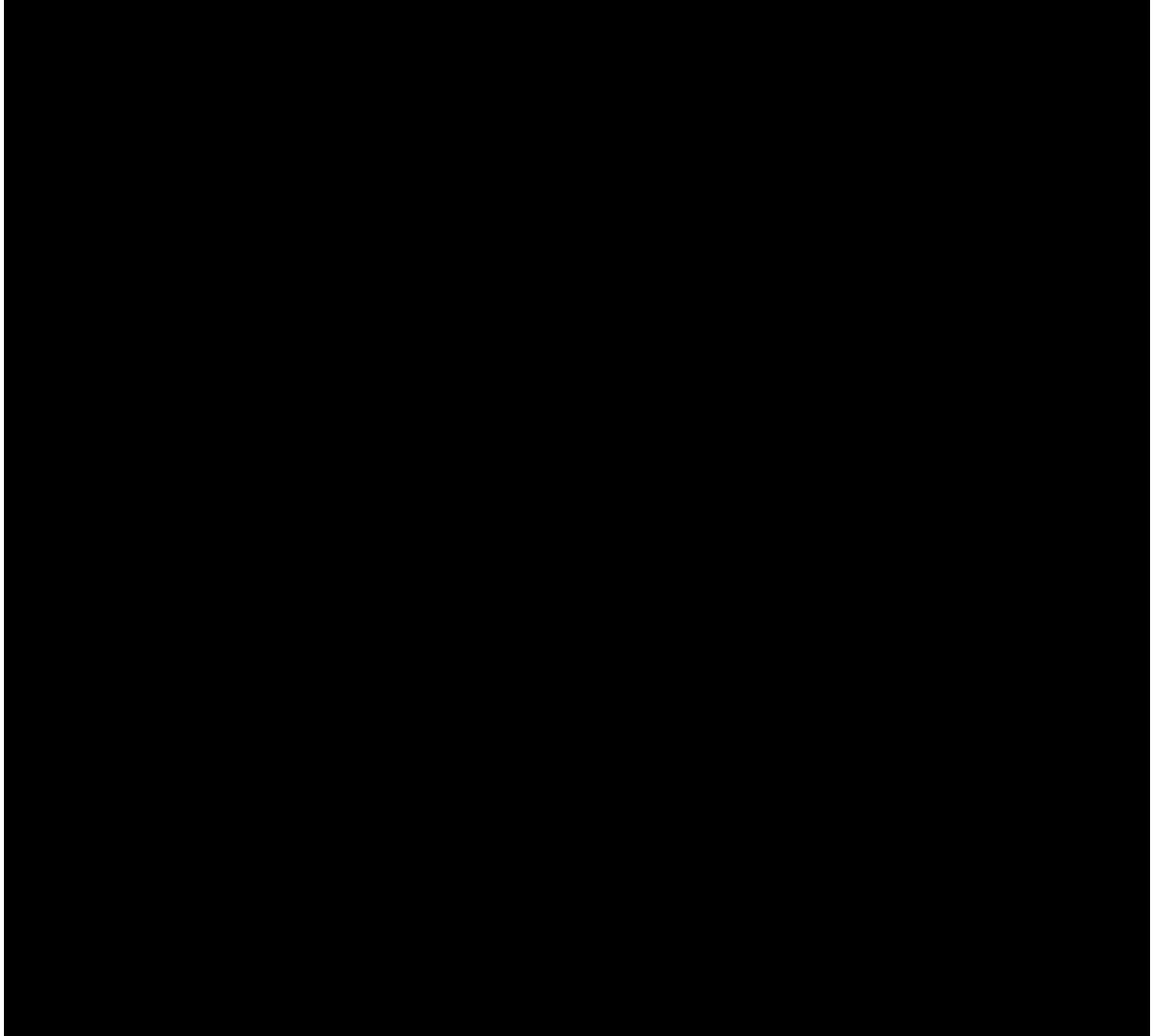
13 **Q Did Dominion’s projections change over time?**

14 **A** Yes. ES Table 3 below summarizes the results of the retirement studies that
15 Dominion performed between 2017–2021 (including the most recent IRP Update
16 analysis) showing the range of Mt. Storm plant net present value (NPV) estimates
17 across those studies. A negative value indicates the plant is uneconomic.

33 Dominion Response to Sierra Club Request No. 2-13 (attached as Exhibit DG-15).

**ES Table 3: Summary of Dominion Studies
from 2017–2021, Mt. Storm NPV (\$ Million)**

[BEGIN CONFIDENTIAL / ES]



[END CONFIDENTIAL / ES]

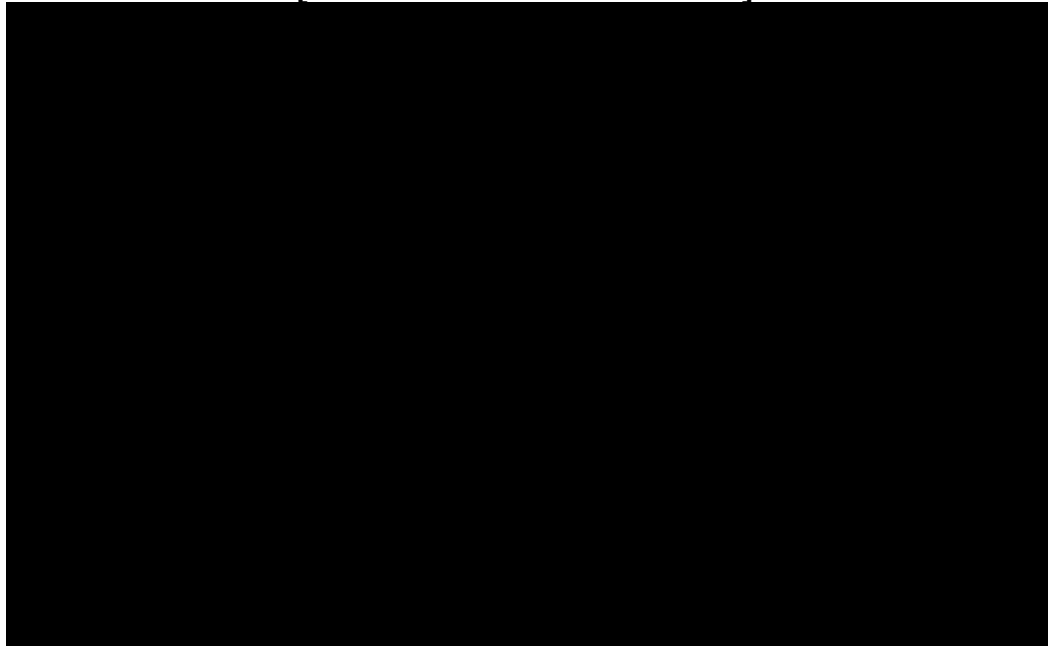
Sources: Exhibits DG-9, DG-10, DG-11, DG-12, DG-13, DG 14, DG-15.

- 1 ES Figure 2 displays graphically the range of Mt. Storm NPV’s Dominion projected
- 2 across scenarios and sensitivities from the same set of studies. This figure also

1 shows that there is a clear downward or “value reduction” trend over time with
2 Dominion’s calculated NPVs associated with keeping Mt. Storm online. In other
3 words, with each new study (with the exception of 2020), the Company revised Mt.
4 Storm’s economic outlook downward.

**ES Figure 2: ES NPV of Dominion’s Projections
for Mount Storm by Year of Study**

[BEGIN CONFIDENTIAL / ES]



[END CONFIDENTIAL / ES]

Sources: Exhibits DG-9, DG-10, DG-11, DG-12, DG-13, DG 14, DG-15.

5 **[BEGIN CONFIDENTIAL / ES]** [REDACTED]

6 [REDACTED]

7 [REDACTED]

1 [REDACTED]

2 [END CONFIDENTIAL / ES]

3 In 2017 and 2018, the Company was projecting [BEGIN CONFIDENTIAL / ES]

4 [REDACTED] [END CONFIDENTIAL / ES] in value from

5 operating Mt. Storm relative to retirement. But starting in 2019, Dominion's

6 projections of the plant's [BEGIN CONFIDENTIAL / ES] [REDACTED]

7 [REDACTED] [END CONFIDENTIAL /

8 ES] Despite the fact that Dominion had all of these studies and all this information

9 when it decided to move forward with Phase 2, it seemingly did not see this pattern

10 of [BEGIN CONFIDENTIAL / ES] [REDACTED]

11 [REDACTED] [END CONFIDENTIAL / ES] as concerning or worthy of prompting

12 reconsideration of the BAWT project. As discussed above with the Chesterfield

13 project, this is not the first time Dominion has ignored the results of its own analysis

14 when making investment decisions.

1 **Q** **What else did you find when reviewing the projections that Dominion created**
2 **during Phase 1 of the project?**

3 **A** *2016 Life Extension Analysis and 2017 Retirement Study*: Dominion provided limited
4 input data³⁴ and no outputs associated with its 2016 analysis,³⁵ and it provided only
5 minimal summary outputs from its March 2017 analysis.³⁶ As a result, I was unable
6 to fully scrutinize the Company’s modeling from before late 2017.

7 *2017 Project Vista Analysis*: The earliest piece of analysis for which Dominion
8 provided an annual break-down of the Company’s revenue projections is the *Project*
9 *Vista Analysis from November 2017*:³⁷ **[BEGIN CONFIDENTIAL / ES]** [REDACTED]

10 [REDACTED]
11 [REDACTED]

34 Dominion Response to Sierra Club Request No. 2-10, ES Attachment *2016_Inputs_Mt Storm bluesheet workpaper as of 11 2 2015*. This document contains voluminous spreadsheet data in numerous tabs and can be produced upon request.

35 Exhibit DG-18; Dominion Response to Sierra Club Request No. 2-10, ES Attachment *2016_Analysis_Life Extension Analysis - DRAFT AS OF 12-16-2015 DISCOVERABLE* (attached as Exhibit DG-16).

36 Exhibit DG-9; Dominion Response to Sierra Club Request No. 2-10, ES Attachment *2017_Workbook_Retirement Analysis (March 2017)*. This document contains voluminous spreadsheet data in numerous tabs and can be produced upon request.

37 Exhibit DG-10; Dominion Response to Sierra Club Request No. 2-10, ES Attachment *2017_Workbook_Vista Analysis - DISCOVERABLE (Nov 2017)*. This document contains voluminous spreadsheet data in numerous tabs and can be produced upon request.

1 [REDACTED]
2 [REDACTED]
3 [REDACTED]
4 [REDACTED]
5 [REDACTED] [END CONFIDENTIAL / ES]
6 *2018 IRP Retirement Analysis:* [BEGIN CONFIDENTIAL / ES] [REDACTED]
7 [REDACTED]
8 [REDACTED]
9 [REDACTED]
10 [REDACTED]
11 [REDACTED]
12 [REDACTED]
13 [REDACTED] [END CONFIDENTIAL / ES]
14 *2019 Unit Analysis:* [BEGIN CONFIDENTIAL / ES] [REDACTED]
15 [REDACTED]
16 [REDACTED]

38 *Id.*

39 Dominion Response to Sierra Club 2-10, ES Attachment *2018 Workbook Retirement & Cofire Analysis_MASTER - 3 5 2018*. This document contains voluminous spreadsheet data in numerous tabs and can be produced upon request.

1 [REDACTED]

2 [REDACTED]

3 [REDACTED] [END CONFIDENTIAL / ES]

4 *2020 Unit Analysis:* [BEGIN CONFIDENTIAL / ES] [REDACTED]

5 [REDACTED]

6 [REDACTED]

7 [REDACTED]

8 [REDACTED] [END CONFIDENTIAL / ES]

9 **Q What does Dominion’s most recent 2021 IRP update show about the projected**
10 **performance of Mt. Storm?**

11 **A** Dominion’s 2021 IRP update showed that Mt. Storm was projected to perform
12 [BEGIN CONFIDENTIAL / ES] [REDACTED]

13 [REDACTED]

40 Dominion Response to Sierra Club Request No. 2-10, ES Attachment *2019_Workbook_VISTA 2.0 - DISCOVERABLE*. This document contains voluminous spreadsheet data in numerous tabs and can be produced upon request.

41 Dominion Response to Sierra Club Request No. 2-10, ES Attachment *2020_Workbook_VISTA 3.0 - DISCOVERABLE (Full)*. This document contains voluminous spreadsheet data in numerous tabs and can be produced upon request.

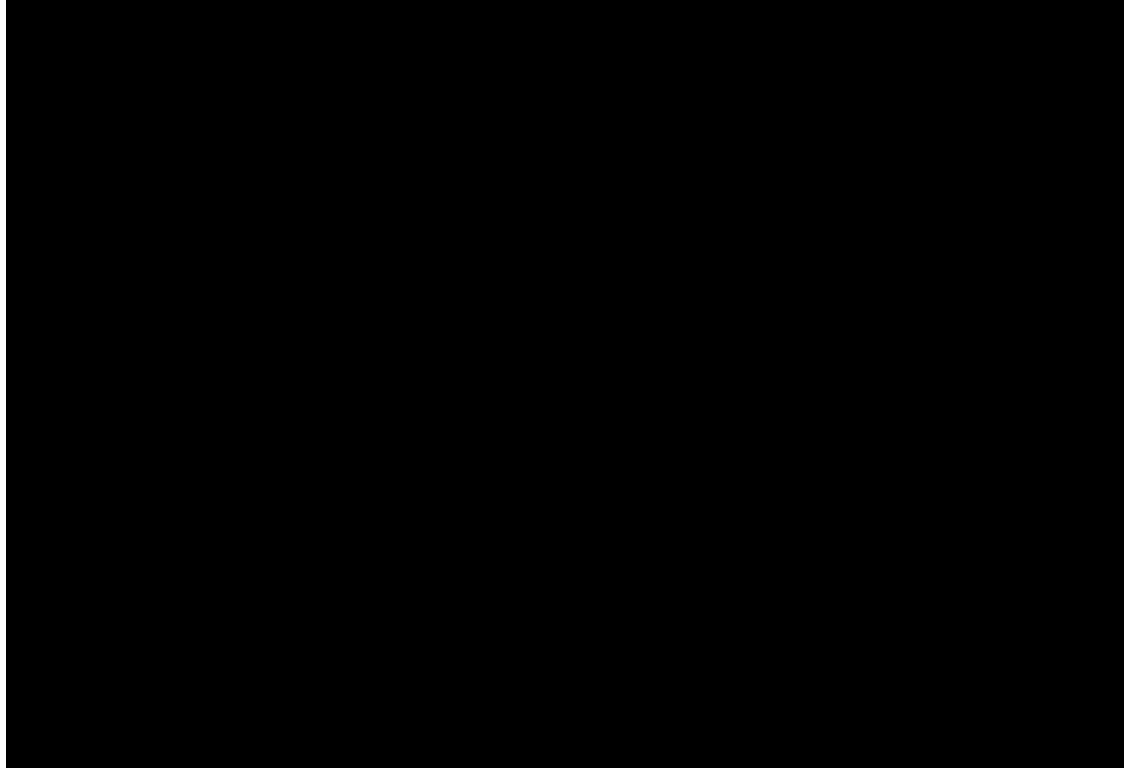
1 [REDACTED]
2 [REDACTED]
3 [REDACTED]
4 [REDACTED]
5 [REDACTED]
6 [REDACTED]
7 [REDACTED]
8 [REDACTED]
9 [REDACTED]
10 [REDACTED]
11 [REDACTED] [END CONFIDENTIAL
12 /ES]

42 Dominion Response to Sierra Club Request No. 2-10, ES Attachment *2021_Workbook_Retirement Analysis - 7 27 2021 - FINAL_DISCOVERABLE_rev 9 22 2021*. This document contains voluminous spreadsheet data in numerous tabs and can be produced upon request.

43 *Id.*

ES Figure 3: Mt. Storm’s Projected Net Revenue from 2021 IRP Update

[BEGIN CONFIDENTIAL / ES]



[END CONFIDENTIAL / ES]

Source: Dominion Response to Sierra Club Request No. 2-10, ES Attachment 2021_Workbook_Retirement Analysis - 7 27 2021 - FINAL_DISCOVERABLE_rev 9 22 2021. This document contains voluminous spreadsheet data in numerous tabs and can be produced upon request.

1 **Q How did Mt. Storm actually perform in recent years?**

2 **A The Company’s own data shows that Mt. Storm has [BEGIN CONFIDENTIAL**

3 **/ES]** 

4 

1
2
3
4
5
6
7

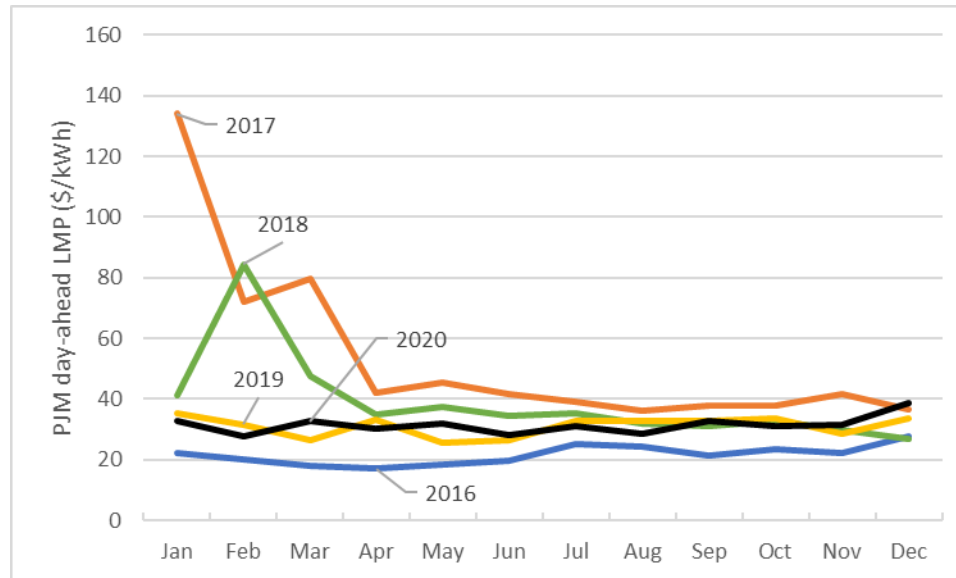
[REDACTED]

[REDACTED] [END CONFIDENTIAL / ES] were driven in large part by a spike in locational marginal prices (LMPs) at the Dominion hub in January 2018 as a result of cold weather events, when average LMPs were more than double what was seen in the next two years (2019 and 2020).⁴⁵ Figure 4 below shows the monthly average LMPs for Dominion’s hub for each year between 2016 and 2020.

44 Dominion Response to Sierra Club Request No. 2-19, ES Attachment *Sierra Club Set 02-19 (JRV)*; Dominion Response to Sierra Club Request No. 2-16, ES Attachment *Sierra Club 02-16(a-h) (JLS)*, Confidential Attachments *Sierra Club Set 2-16(k) (RC)*, *Sierra Club Set_2-16 (l-m) (TAH)*, *Sierra Club Set 2-16 (i) (BKC)*, *Sierra Club Set 2-16 (j) (BKC)*. These attachments contain voluminous spreadsheet data in numerous tabs and can be produced upon request.

45 PJM INTERCONNECTION, Data Miner (last accessed May 20, 2022), available at <https://bit.ly/3MCcOcb>.

Figure 4: PJM Day-Ahead LMPs (\$/kWh)



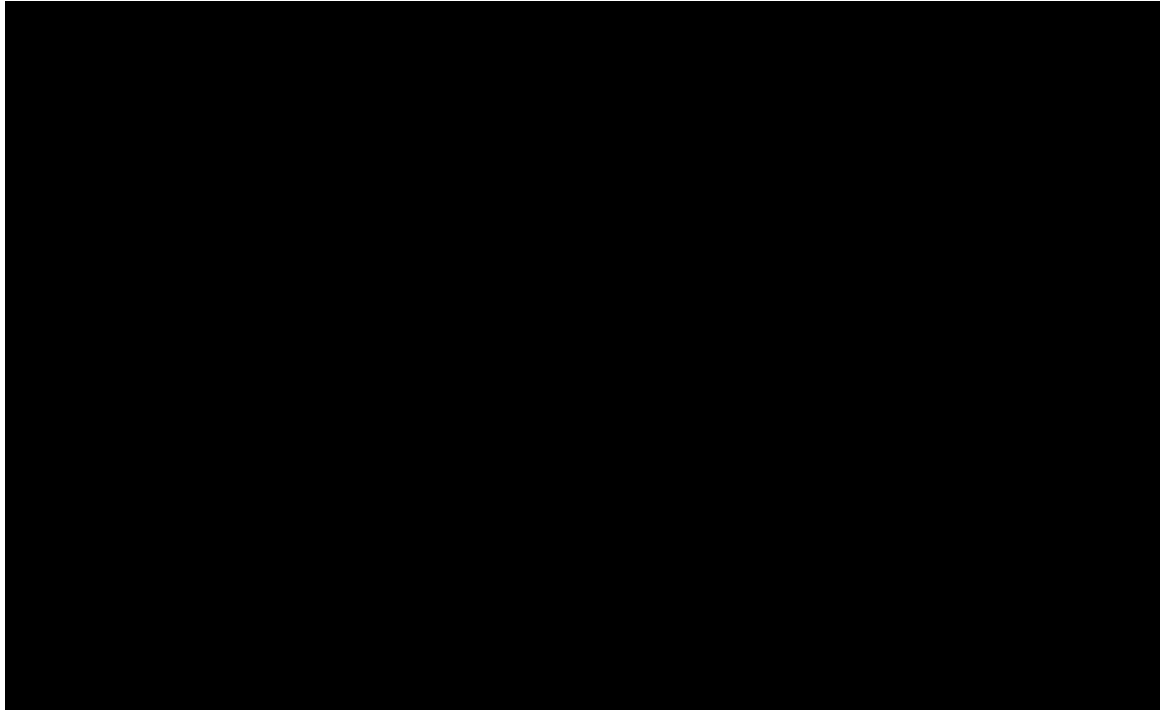
Source: PJM INTERCONNECTION, Data Miner, supra note 45.

1 **Q** What do you observe about changes in Mt. Storm’s utilization across
2 projections as compared to the Plant’s actual utilization?

3 **A** Dominion’s average annual capacity factor projections for Mt. Storm have
4 [BEGIN CONFIDENTIAL / ES] [REDACTED] [END CONFIDENTIAL / ES] with
5 nearly every subsequent forecast the Company produced between 2016 and 2021,
6 as shown in ES Figure 5 below.

**ES Figure 5: Dominion’s Projected Capacity Factors
for Mt. Storm Across All Studies 2016–2021**

[BEGIN CONFIDENTIAL / ES]



[END CONFIDENTIAL / ES]

Note: All projections from 2016–2017 are from Dominion’s Blue Sheets; all projections from 2018–2021 are from Dominion’s PLEXOS output workbooks.

Source: Dominion Response to Sierra Club Request 2-10, All ES Workbooks. This document contains voluminous spreadsheet data in numerous tabs and can be produced upon request.

1 The Plant’s actual average annual capacity factor has dropped quite significantly

2 **[BEGIN CONFIDENTIAL / ES]** 

1 [REDACTED] [END CONFIDENTIAL / ES] Dominion's most recent
2 forecast, which the Company prepared as part of its 2021 IRP, shows the [BEGIN
3 CONFIDENTIAL / ES] [REDACTED]
4 [REDACTED] [END CONFIDENTIAL / ES]

5 It is concerning that Dominion considered it prudent to restart Phase 2 of the
6 project, committing tens of million in avoidable spending on a plant that it now
7 projects will operate [BEGIN CONFIDENTIAL / ES] [REDACTED]
8 [REDACTED] [END CONFIDENTIAL / ES] This low utilization is also concerning
9 because there are risks to reliability of continued coal operation when units operate
10 at low capacity factors and increase the amount of cycling required. The increased
11 degradation can lead to higher forced outage rates.⁴⁸ A forced outage at even one
12 coal unit represents the loss of hundreds of MW of capacity, increasing reliability
13 risk on the system.

46 Dominion Response to Sierra Club Request No. 2-16(d), ES Attachment *Sierra Club Set 02-16(a-h) (JLS)*. This document contains voluminous spreadsheet data in numerous tabs and can be produced upon request.

47 Dominion Response to Sierra Club Request No. 2-10, ES Attachment *2021 Workbook Retirement Analysis - 7 27 2021 - FINAL DISCOVERABLE rev 9 22 2021*. This document contains voluminous spreadsheet data in numerous tabs and can be produced upon request.

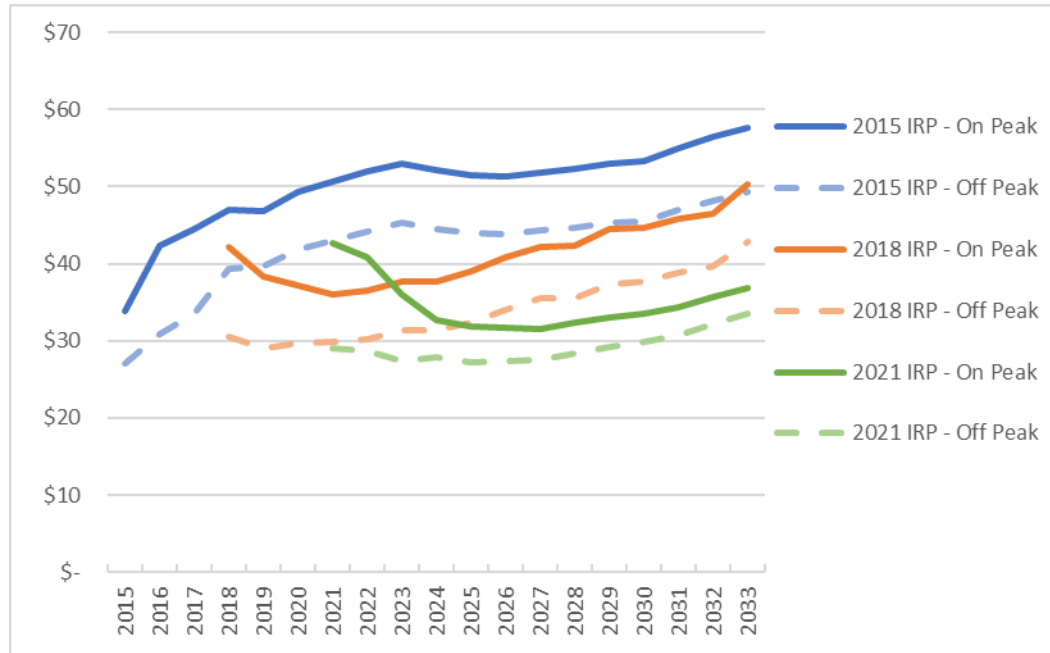
48 N. Kumar et al., *Power Plant Cycling Costs*, NATIONAL RENEWABLE ENERGY LABORATORY (April 2012), available at <https://bit.ly/3lR395P>.

1 **Q** **Which inputs were the largest driver of Dominion’s projected finding that the**
2 **Plant will continue to be economic?**

3 **A** Dominion relied on high energy and capacity market prices forecasts developed by
4 ICF to deliver high projected NPV during Phase 1 of the project.

5 For its energy market price forecasts (shown in Figure 6 below), ICF’s high energy
6 market prices projections drove the Company’s findings of high net revenues from
7 keeping Mt. Storm online. Specifically, in its 2015 projection, ICF projected that
8 on-peak prices would increase by 70 percent between 2015 and 2033 and off-peak
9 prices would increase by 84 percent over the same time period. With its subsequent
10 projection, published in 2017, ICF adjusted its forecast downward but still projected
11 an increase of 19 percent and 40 percent for on- and off-peak prices respectively
12 between 2018 and 2033. By its 2021 IRP, the Company once again adjusted down
13 its forecast: this time it projected a 14 percent drop in peak energy market prices by
14 2033 relative to 2021 levels, and only a 16 percent increase in off-peak prices over
15 this same time period. What is most striking is that ICF’s latest peak energy price
16 forecast from 2021 projects on-peak energy prices than are below its projected off-
17 peak prices from its 2015 IRP.

Figure 6: Dominion’s Energy Market Prices from 2015, 2018 and 2021 IRPs

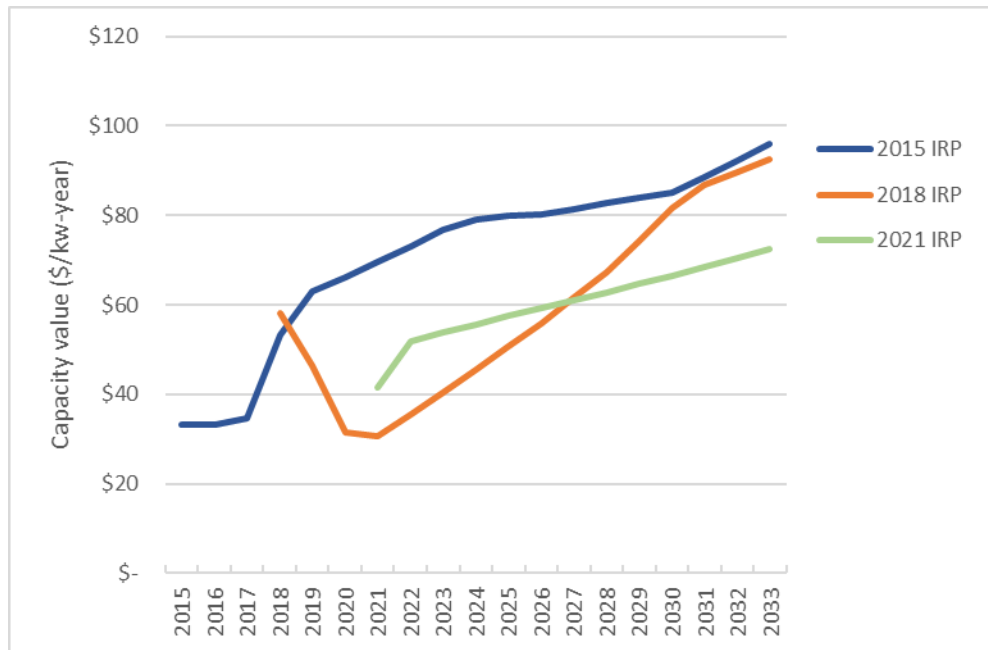


Source: Dominion Response to Sierra Club Request No. 2-07, Attachment 02-07(KC) (attached as Exhibit DG-17); Dominion 2018 IRP, Appendix 4 – ICF Commodity Price Forecasts for Virginia Electric and Power Company. Fall 2017 Forecast.

1 Dominion also relied on ICF’s capacity market price forecasts for its IRP and
 2 retirement studies (shown in Figure 7 below). ICF’s 2015 capacity price forecast
 3 projected a large increase in capacity market prices, with prices jumping above
 4 \$50/kw-year by 2018, rising to nearly 80/kW-year by 2025, and reaching over
 5 \$90/kw-year by 2033. In ICF’s subsequent forecast prepared in late 2017, ICF’s
 6 capacity prices dropped back down to below \$40/kW-year before 2022, but then
 7 began rising again each year, reaching \$90/kW-year by 2033. ICF’s most recent

1 capacity forecast projects slightly higher capacity prices in the near term than its
2 2018 forecast, but projects much slower growth in capacity prices over the long
3 term.

Figure 7: Dominion Capacity Market Prices from 2015, 2018, and 2021 IRPs



Source: Exhibit DG-17; Dominion 2018 IRP, Appendix 4 – ICF Commodity Price Forecasts for Virginia Electric and Power Company. Fall 2017 Forecast.

4 **Q How did Dominion’s assumed retirement dates for Mt. Storm impact this**
5 **analysis?**

6 **A** Dominion’s assumption that Mt. Storm will continue to operate beyond 2040 is
7 unsupported by modeling. Sierra Club Witness Rachel Wilson noted this in Case
8 PUR-2020-00035 (Dominion’s 2020 IRP), finding that Dominion’s assumed

1 retirement date for Mt. Storm of 2043 was hard-coded into the Company’s 2020
2 IRP modeling and did not reflect an optimized resource planning decision. Ms.
3 Wilson further noted that the Company’s modeling did not include full sustaining
4 capital cost estimates, and therefore it omitted a substantial portion of the costs
5 required to keep Mt. Storm online for another two decades.⁴⁹ The Commission
6 agreed with Ms. Wilson that these were shortcomings and ordered Dominion to
7 address these issues in its 2021 IRP update.⁵⁰

8 **Q What should Dominion’s 2016–2021 studies, along with the actual unit**
9 **performance during Phase 1, have indicated to the Company regarding the**
10 **reasonableness of moving forward with Phase 2 of the project?**

11 **A** The [BEGIN CONFIDENTIAL / ES] [REDACTED] [END
12 CONFIDENTIAL / ES] in projected revenues between the Company’s 2017 and
13 2018 analysis conducted during Phase 1 and the analyses conducted after (or at the
14 conclusion of) Phase 1 in 2019, 2020, and 2021—coupled with [BEGIN
15 CONFIDENTIAL / ES] [REDACTED] [END

49 *Virginia Electric and Power Company’s Integrated Resource Plan Filing Pursuant to Virginia Code § 56-597 et seq.*, Case PUR-2020-00035, Direct Testimony of Rachel Wilson (September 15, 2020), available at <https://bit.ly/3yXz2kV>.

50 *Virginia Electric and Power Company’s Integrated Resource Plan Filing Pursuant to Virginia Code § 56-597 et seq.*, Case PUR-2020-00035, Final Order (February 1, 2021), available at <https://bit.ly/39N5VWV>.

1 **CONFIDENTIAL / ES]**—should have indicated to Dominion that the economics
2 of Mt. Storm were changing and it was no longer prudent to move forward with the
3 ELG retrofits. The Company is permitted to sometimes be wrong, but it is
4 unreasonable to ignore this kind of information and move forward with a project
5 that will unnecessarily incur costs of tens of millions of dollars, such as would be
6 seen in Phase 2.

**5. COAL-FIRED POWER PLANTS, SUCH AS MT. STORM, WILL
BECOME INCREASINGLY UNECONOMIC IN THE FUTURE**

7 **Q What does the future look like for coal-fired generating units in the United**
8 **States and in the PJM region?**

9 **A Existing coal-fired generating units will be become even less economic than they are**
10 today, because of both economic and regulatory forces that will increase the costs
11 of operation at coal units relative to other types of capacity. Between 2016 and 2020,
12 around 11 GW of coal retired each year in the United States. Although the levels
13 dropped to 4.6 GW in 2021, an additional 12.7 GW of coal generation is scheduled
14 to retire in 2022.⁵¹

51 U.S. ENERGY INFORMATION ADMINISTRATION, *Coal will account for 85% of U.S. electric generating capacity retirements in 2022* (January 11, 2022), available at <https://bit.ly/3MPZ4KE>.

1 Regionally, capacity prices from the most recent PJM capacity auction were lower
2 than they have been in the past decade. Renewables, nuclear, and natural gas-fired
3 generators increased their cleared capacity, while more than eight gigawatts (GW)
4 of coal capacity failed to clear. Analysis from Bloomberg New Energy Finance
5 reports that of the coal-fired power plants on the PJM grid, approximately 70
6 percent will be uneconomic by 2023.⁵²

7 **Q What are the economic forces that affect the operation of existing coal units?**



8 **A A range of factors have contributed to these retirements. These include flat**
9 electricity demand growth, sustained low gas prices, and increased competition
10 from renewables as technological improvements and scale economies have
11 dramatically and steadily lowered the costs of wind and solar energy production. All
12 of those trends are expected to persist in the future. Even for coal units that have
13 staved off full retirement, competition from gas and renewables has led to decreases
14 in capacity factors,⁵³ as we have seen at Mt. Storm.

52 Will Wade, *Most Coal Plants in Biggest U.S. Grid Are Becoming Money-Losers*, BLOOMBERG (June 8, 2021), available at <https://bloom.bg/3Nt2ByK>.

53 U.S. ENERGY INFORMATION ADMINISTRATION, *U.S. Coal Consumption in 2018 Expected to be the Lowest in 39 Years* (December 28, 2018), available at <https://bit.ly/3Nvq3eI>.

1 **Q Have these market changes led to additional risks associated with continued**
2 **operation of coal units?**

3 **A Yes. Coal-fired generators are intended to operate as baseload generators that run**
4 with high capacity factors. Increased penetration of renewable energy technologies
5 and lower cost gas generation means that coal units are increasingly being called
6 upon to operate at lower loading levels, ramp up and down more frequently, and
7 cycle (start and stop) more often (as discussed above). But coal units were not
8 designed to operate like peaker plants, so this leads to increased wear and tear on
9 the component parts, which contributes to increased costs and/or outages at the
10 units.

11 As discussed above, Dominion’s data shows that Mt. Storm’s utilization has
12 **[BEGIN CONFIDENTIAL / ES]** 
13  **[END CONFIDENTIAL / ES]**
14 (as shown in ES Table 4). And the Company’s most recent 2021 projections show
15 that the Company projects the plant’s capacity factor will **[BEGIN**

54 Dominion Response to Sierra Club Request No. 2-16(d), ES Attachment *Sierra Club Set 02-16(a-h) (JLS)*. This document contains voluminous spreadsheet data in numerous tabs and can be produced upon request.

1 CONFIDENTIAL / ES] [REDACTED]
2 [REDACTED] [END CONFIDENTIAL / ES], as shown in ES Table 5 below.

ES Table 4: Actual Capacity Factors at Mt. Storm (2016–2021)

[BEGIN CONFIDENTIAL / ES]

[REDACTED]

[END CONFIDENTIAL / ES]

Source: Dominion Response to Sierra Club Request No. 2-16, ES Attachment Sierra Club Set 02-16(a-h) (JLS). This document contains voluminous spreadsheet data in numerous tabs and can be produced upon request.

ES Table 5: Projected Capacity Factors at Mt. Storm (2021–2030)

[BEGIN CONFIDENTIAL / ES]

[REDACTED]

[END CONFIDENTIAL / ES]

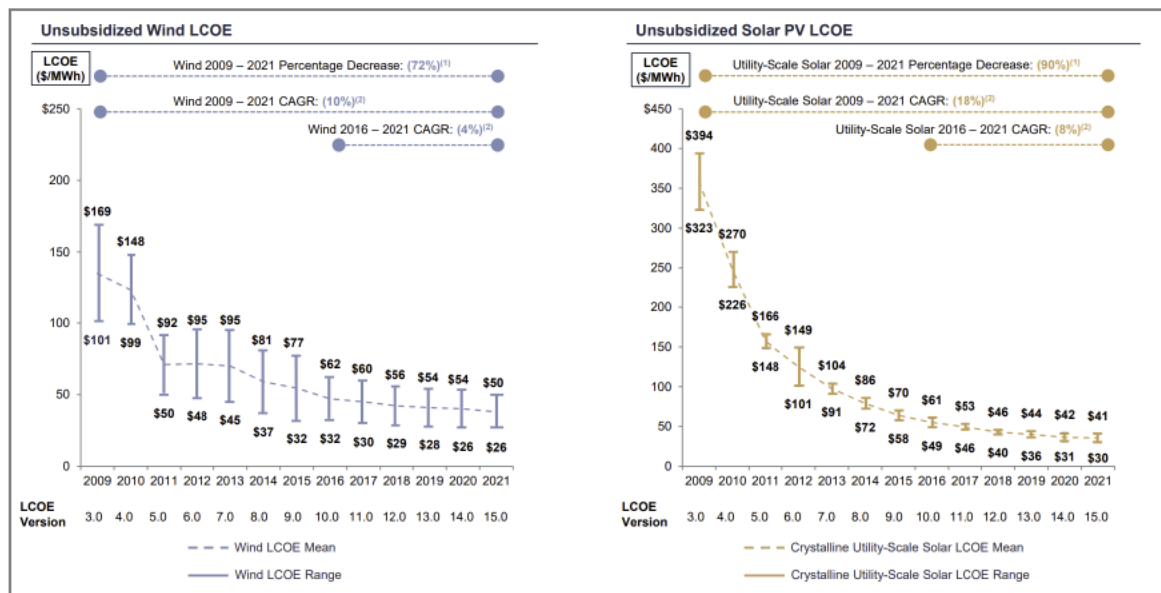
Source: Dominion Response to Sierra Club Request No. 2-10, ES Attachment 2021_Workbook_Retirement Analysis - 7 27 2021 -FINAL_DISCOVERABLE_rev 9 22 2021. This document contains voluminous spreadsheet data in numerous tabs and can be produced upon request.

55 Dominion Response to Sierra Club Request No. 2-10, ES Attachment 2021_Workbook_Retirement Analysis - 7 27 2021 -FINAL_DISCOVERABLE_rev 9 22 2021. This document contains voluminous spreadsheet data in numerous tabs and can be produced upon request.

1 Q Explain how renewables have become a driving factor in coal-plant
 2 retirements.

3 A The costs of clean generation technologies have fallen dramatically over the
 4 previous decade. On a levelized cost of energy (LCOE) basis, costs for wind are now
 5 72 percent lower than the costs in 2009, with a compound annual rate of decline of
 6 10 percent per year. Costs for solar are now 90 percent lower than in 2009, with a
 7 compound annual rate of decline of 18 percent per year. Those annual trends are
 8 shown in Figure 8.

Figure 8: Historical Levelized Cost of Energy for Wind and Solar PV Technologies



Source: LAZARD, Levelized Cost of Energy Analysis (Version 15.0 October 2021), available at <https://bit.ly/3wxCJML>.

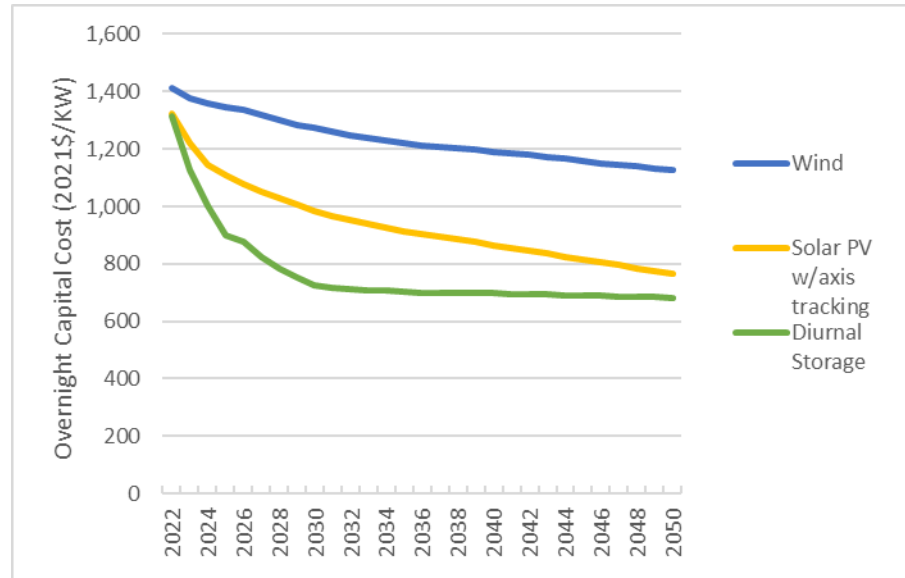
1 Battery storage technologies have experienced similar cost declines, but over a
2 shorter period of time. Bloomberg New Energy Finance (BNEF) analyzed historical
3 battery storage costs, finding that costs for lithium-ion batteries have fallen 89
4 percent between 2012 and 2020.⁵⁶ U.S. EIA data from August 2021 demonstrates
5 the recent accelerating cost reduction trend, as battery storage costs have declined
6 27 percent *annually* between 2015 and 2019.⁵⁷

7 These three technologies are predicted to experience continued cost declines,
8 though at varying rates. Figure 9 below shows the U.S. EIA's forecasts used in
9 developing AEO 2022 for solar PV, wind, and storage resources.

56 BLOOMBERGNEF, *Electric Vehicle Outlook* (2021), available at <https://bit.ly/3GcGcDs>.

57 U.S. ENERGY INFORMATION ADMINISTRATION, *Battery Storage in the United States: An Update on Market Trends* (August 16, 2021), available at <https://bit.ly/3LyKrdn>.

Figure 9: Forecast of Overnight Capital Cost for New Solar PV, Wind, and Battery Storage



Source: U.S. ENERGY INFORMATION ADMINISTRATION, Annual Energy Outlook at Table 55 (2021), available at <https://bit.ly/3MKezEg>.

1 A 2021 report by Australia’s Clean Energy Council states that “large-scale battery
 2 storage is now the superior choice for electricity peaking services, providing
 3 significant cost, flexibility, and emissions advantages when compared to equivalent
 4 open-cycle gas turbine plants.”⁵⁸

58 CLEAN ENERGY COUNCIL, *Battery Storage: The New, Clean Peaker* (April 10, 2021), available at <https://bit.ly/3LEcLLk>.

1 **Q** **What are the regulatory forces that challenge the operation of existing units?**

2 **A** One such regulatory force is the increase to renewable portfolio standard (RPS)
3 policies in neighboring states that also operate in the PJM market. The volume of
4 zero-variable cost resources on the grid in PJM will increase in future years as
5 neighboring states increase their renewable energy targets, implement more
6 stringent targets for carbon dioxide emissions reductions, or both. In 2018, for
7 example, New Jersey increased its RPS to 50 percent by 2030.⁵⁹ In 2019, Maryland
8 legislators passed a bill that also increases its RPS to 50 percent by 2030.⁶⁰ The
9 District of Columbia increased its RPS to 100 percent renewable energy by 2040.⁶¹
10 The locational marginal price for energy will decline as a greater number of these
11 renewable generators come online, further lowering energy revenues earned by coal
12 units.

59 U.S. ENERGY INFORMATION ADMINISTRATION, *Today in Energy: Updated Renewable Portfolio Standards Will Lead to More Renewable Electricity Generation* (February 27, 2019), available at <https://bit.ly/3wBLwgi>.

60 Catherine Morehouse, *Maryland 50% RPS Bill Doubles Offshore Wind Target, Expands Solar-Carve Out*, UTILITY DIVE (April 10, 2019), available at <https://bit.ly/3luJ4SB>.

61 Robert Walton, *DC Eases Path for Renewable Generators as it Pursues 100% Goal*, UTILITY DIVE (February 13, 2019), available at <https://bit.ly/39JDRU4>.

1 **Q Are there other environmental regulatory risks associated with the continued**
2 **operation of the Mt. Storm power plant that Dominion has not taken into**
3 **account in its most recent analysis?**

4 **A** Yes. Dominion may incur additional compliance costs at Mt. Storm associated with
5 several current and future environmental rules, including increased ELG
6 stringency, the Clean Water Act temperature limit compliance, and a CO₂ price.

7 First, the EPA issued a notice in August of 2021 indicating that that it intends to
8 review and strengthen the ELG requirements in light of the 2020 revisions and may
9 propose future changes.⁶² This review will very likely result in more stringent ELG
10 compliance requirements, given the change in control technologies available since
11 the rule modifications were proposed (the EPA may decide, for example, that the
12 current voluntary compliance program should become the baseline compliance
13 requirement). Any changes or updates to the ELG requirements will most likely
14 require Dominion to install additional retrofits at Mt. Storm, which will require
15 additional capital investments.⁶³

62 Effluent Limitation Guidelines and Standards for the Steam Electric Power
Generating Point Source Category, 86 FEDERAL REGISTER 41801 (August 3, 2021),
available at <https://bit.ly/3a9AdDb>.

63 *Id.*

1 Second, Dominion also will have to install a chiller to address compliance with
2 temperature discharge requirements, in its National Pollution Discharge
3 Elimination Permit, which limits the temperature differential between Dominion's
4 discharge water and the water body it is flowing into. Dominion indicated that it has
5 been seeking a variance from the WVDEP since 2007 but will now move forward
6 with installing chillers to ensure compliance with the temperature limit by October
7 31, 2022.⁶⁴ The Company provided no information on the cost of the chiller
8 technology.

9 Third, the CO₂ price that Dominion relied on for its 2021 IRP modeling was low
10 relative to both historical CO₂ prices on which the Company has relied, and CO₂
11 prices relied on currently by other utilities. This means that Dominion is likely
12 under-estimating the cost of operating fossil-fuel power generators in the event that
13 a CO₂ price is implemented.

14 Finally, we know that President Biden has announced the goal of net-zero carbon
15 dioxide emissions on the country's power grid by 2035, and that this will likely
16 result in additional future policies. Even though there are not policies currently in
17 place explicitly intended to achieve this goal, it is reasonable to assume that they

64 Dominion Response to Staff Request No. 1-06 (attached as Exhibit DG-18).

1 will consist of a combination of incentives for zero-carbon energy and additional
2 costs for fossil-fueled generators. Earlier this year, the U.S. Court of Appeals for
3 the D.C. Circuit struck down President Trump’s Affordable Clean Energy Rule,
4 requiring the EPA to draft new regulations governing emissions of CO₂ from power
5 plants.⁶⁵ I expect new carbon emission regulations from the EPA in the next four
6 years, beyond what I have already outlined above.

6. UNIT COMMITMENT AND DISPATCH PRACTICES AT MT. STORM

7 **Q How do generation owners operating in a regional transmission organization**
8 **such as PJM earn revenues?**

9 **A** At a fundamental level, generation owners bid their units into the market at their
10 variable cost of production (fuel plus variable O&M). The grid operator stacks these
11 bids from low to high and dispatches the generators in merit order until total
12 generation meets the load. The grid operator does this for every hour in a year. The
13 bid from the most expensive generator dispatched in a given hour becomes the
14 market energy price in that hour, and all dispatched generators receive that price
15 for each MWh they generate.

65 Valerie Volcovici, *U.S. Court Deals Final Blow to Trump EPA’s Clean Power Rule Replacement*, REUTERS (January 19, 2021), available at <https://reut.rs/3PAIxfD>.

1 **Q What is a unit commitment status?**

2 **A** The term unit commitment refers to the decision made by the utility or the market
3 operator, in this case PJM, on whether to “commit” or turn on (and “decommit”
4 or turn off) and operate a unit at its minimum operating level and therefore make it
5 available to the market for energy production. This is distinct but related to unit
6 dispatch which refers to the decision by the utility or the market operator on how
7 to operate a unit above its minimum operating level once the unit has been
8 committed online.

9 **Q What commitment status options are available to PJM market participants?**

10 **A** PJM specifies the commitment status options available to market participants like
11 Dominion. Those commitment status options include:

- 12 1. *Economic*: The unit is available for economic dispatch by PJM.
- 13 2. *Must-Run (Self-Commit)*: The unit operator commits the unit regardless of
14 PJM’s determination of an economic or reliability basis for having the unit
15 online. The unit is committed at its economic minimum and allowed to
16 move up to its economic maximum.
- 17 3. *Emergency*: The unit will not be scheduled by PJM unless the market
18 operator calls for maximum emergency generation.

1 4. *Unavailable*: The unit is out of service and will not be scheduled.⁶⁶

2 **Q How do generators typically operate within the PJM market?**

3 **A Generators operating within the PJM market generally commit their available units**
4 as either economic or must-run.

5 For units committed economically, the market operator, PJM, has the responsibility
6 for unit commitment and dispatch decisions. Those decisions prioritize reliability
7 for the system as a whole, but then select plants to commit and dispatch based on
8 short-term economics to ensure customers are served by the lowest-cost resources
9 available to the system. PJM algorithms compare the costs inclusive of both the
10 startup and operating costs of a particular unit with the costs of all other units
11 available to the market to determine whether that unit will be online the next day.
12 A plant committed as “economic” will operate only if it is the least-cost option
13 available to the market (*i.e.*, has a lower variable cost than other resources available
14 at the time).

66 PJM INTERCONNECTION, *PJM Real-Time Energy Market* at 7 (June 12, 2017), available at <https://bit.ly/3MEu3cN>.

1 **Q** Why do some power plants use a self-commitment or must-run status?

2 **A** While economic commitment and dispatch tends to be the norm for dispatchable
3 power plants, for units such as Mt. Storm with long startup and shutdown times,
4 utilities often instead elect to maintain control of unit commitment decisions and
5 utilize a “must-run” commitment status. For these units, the utility determines
6 independently, and potentially with minimal regard for economics, when to commit
7 a unit. A unit designated as must-run will operate with a power output no less than
8 its minimum operating level.⁶⁷ The unit receives market revenue (and incurs
9 variable operational costs) but does not set the market price of energy. If the market
10 price of energy falls below its operational cost, a must-run unit will not turn off and
11 can incur losses that a utility often seeks to recover from ratepayers.

12 Because units operated by the market follow short-term economic signals, they tend
13 to cycle off when market prices are low and therefore do not generally incur
14 significant operational losses.

67 Minimum operating level is an output threshold often determined operationally, and below which a generator is either less stable or operates inefficiently. Once the unit commitment decision is made, the level of generation output (above the minimum) is generally left to the market. The operating level is based upon the marginal running cost assumptions provided by the owner in the form of offers or bids to PJM.

1 **Q** **What drives a power plant operator such as Dominion to uneconomically self-**
2 **commit its units?**

3 **A** There are many factors that drive a power plant operator to uneconomically self-
4 commit its units, but four main ones are: (1) a failure to critically evaluate the
5 economics of daily unit commitment decisions; (2) a failure to follow the results of
6 such daily unit commitment analysis; (3) incomplete accounting of variable unit
7 costs in unit dispatch bids; and (4) minimum take provisions in fuel contracts that
8 “lock in” costs that would otherwise be variable.

9 **Q** **Do generators ever incur negative net energy revenues in a given hour?**

10 **A** Yes. If a generator is online and selected to dispatch its energy in a given hour, and
11 the price per MWh that it received was lower than its total production cost, it would
12 incur net operational losses.

13 Sometimes it is reasonable and even expected for a plant to incur negative net
14 energy revenues in a given hour. Coal units cannot turn on and off instantly—they
15 have long start-up and shut-down times, and non-nominal start-up costs that
16 market operators such as PJM incorporate into commitment and dispatch
17 decisions. Therefore, it may be reasonable to operate the unit at its minimum
18 operating level during low-priced hours if the projected revenues during the high-
19 priced hours are larger than the projected losses.

1 But it is not reasonable for a Company such as Dominion to self-commit a unit
2 without robust analysis demonstrating that projected losses from operating and
3 dispatching are lower than projected revenues (taking into account startup cost and
4 times).

5 **Q Has this practice been documented in other jurisdictions?**

6 **A** Yes. Regulators have opened dockets in Indiana, Minnesota, and Missouri to
7 investigate “uneconomic dispatch” practices of the coal units in those states.⁶⁸ I
8 served as an expert witness in several of those dockets.

9 **Q Why would a plant owner choose to self-commit its plants in a high number of**
10 **hours?**

11 **A** This practice increases the likelihood that a unit would dispatch generation.
12 Generation owners have justified this practice by saying that it allows the generators
13 to avoid start-up, shutdown, and cycling costs. But market operators take these
14 factors into account when operating units, and therefore this should not be a barrier
15 to economic commitment. Previous research has found that vertically integrated
16 utilities are more likely to engage in this behavior because they can absorb any

68 See Catherine Morehouse, *Ex-FERC Commissioners Debate Solutions to Coal Self Commitments Said to Cost Millions*, UTILITY DIVE (June 1, 2020), available at <https://bit.ly/3G8BVAI>.

1 market losses through their rate base, meaning that ratepayers ultimately pay for
2 the uneconomic operation of coal units.⁶⁹

3 **Q How has Dominion historically committed the Mt. Storm power plant?**

4 **A** I only have unit commitment data from 2021 and the first two months of 2022. This
5 data shows that Dominion self-committed Mt. Storm [BEGIN CONFIDENTIAL
6 / ES] [REDACTED] [END CONFIDENTIAL / ES] of the time that the unit
7 was online, and economically committed it [BEGIN CONFIDENTIAL / ES] [REDACTED]
8 [REDACTED] [END CONFIDENTIAL / ES] of the time. The unit was
9 unavailable [BEGIN CONFIDENTIAL / ES] [REDACTED] [END
10 CONFIDENTIAL / ES] of the time in 2021 [BEGIN CONFIDENTIAL / ES]
11 [REDACTED] [END CONFIDENTIAL / ES] of the time during the first two
12 months of 2022.⁷⁰ It is unclear why the Company self-commits its units with such
13 high frequency.

14 We can see from the plant's operational data, displayed in ES Table 6 below, which
15 we have for the entire period 2016–2021, that Dominion has reduced slightly the
16 percent of time the plant is online from [BEGIN CONFIDENTIAL / ES] [REDACTED]

69 *Id.*

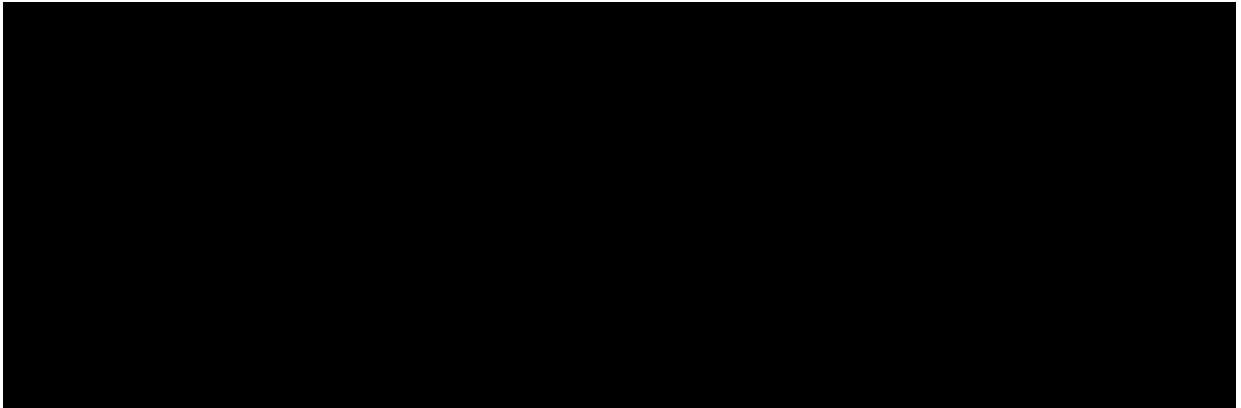
70 Dominion Response to Informal Staff Request No. 1-05, Confidential Attachment *Staff Set 1-05 (WAH) CONF*. This document contains voluminous spreadsheet data in numerous tabs and can be produced upon request.

1 [REDACTED] [END CONFIDENTIAL / ES]

2 This likely means that Dominion has decreased how much it self-commits the plant,
3 or else has actively taken the plant offline when it is projected to perform
4 uneconomically. But the plant's capacity factor has dropped much more
5 dramatically than its time online. The combination of these two trends indicates
6 that when the plant is online, it is operating at a lower level (likely its minimum
7 operating level) much more frequently than in the past.

ES Table 6: Operational Statistics and Revenue / Losses from Mt. Storm (2016-2022)

[BEGIN CONFIDENTIAL / ES]



[END CONFIDENTIAL / ES]

Source: Dominion Response to Informal Staff Request No. 1-05, Attachment Informal Staff Set 1-05 (WAH) CONF; Dominion Response to Sierra Club Request No. 2-16(d), ES Attachment Sierra Club Set 02-16(a-h) (JLS). This document contains voluminous spreadsheet data in numerous tabs and can be produced upon request.

1 **Q Did Dominion's dispatch practices result in net operational revenues or**
2 **operational losses?**

3 **A Both, depending on the year. [BEGIN CONFIDENTIAL / ES]** [REDACTED]
4 [REDACTED]
5 [REDACTED] **[END**
6 **CONFIDENTIAL / ES]**

7 **Q What are the implications of these net operational losses?**

8 **A** Net operational losses over the period of a month or more indicate that Dominion
9 may be self-committing its units into the PJM market in hours when it is
10 uneconomic to do so, and that ratepayers are subsidizing this uneconomic
11 generation. Given the inflexibility of coal units, it can sometimes make sense to
12 leave a unit online for short periods of time, even when there are lower-cost
13 resources available, in order to be available to provide electricity during hours of
14 high demand. However, the unit must be projected to be economic overall across a
15 multi-day or week period (inclusive of all commitment costs) to avoid excess,
16 unjustified costs to ratepayers. Sustained losses over many months, like those
17 incurred at Mt. Storm in some years, demonstrate that the unit has been
18 uneconomic relative to the market during many time periods.

1 **Q Are these losses avoidable?**

2 **A** Yes. If Dominion switches Mt. Storm to economic commitment status at all times
3 and lets the PJM market operator decide when to commit and dispatch the unit, it
4 should avoid substantial losses.

7. CONCLUSIONS AND RECOMMENDATIONS

5 **Q Please summarize your findings.**

6 **A** Dominion has not demonstrated the prudence of moving forward with Phase 2 of
7 the BAWT project at Mt. Storm, based on both the contemporaneous analysis
8 conducted by the Company at the time it decided to move forward with Phase 2 in
9 2021 and prior analysis it had conducted throughout and following Phase 1 (2016–
10 2018). During the pause between Phase 1 and Phase 2, Dominion incurred
11 additional costs to delay the project and did not use the information before it to
12 adequately re-evaluate whether continuing with the BAWT project was in the best
13 interest of ratepayers. Dominion also failed to evaluate regulatory risks associated
14 with continued reliance on Mt. Storm, including the risk of additional
15 environmental compliance costs from increased stringency in ELG regulations,
16 Clean Water Act temperature limit compliance, and CO₂ prices at any point in the
17 project.

1 Dominion knew at the time it began Phase 2 in 2021 that Mt. Storm had earned only
2 marginal net revenues between 2016 and 2021. The Company had been
3 systematically revising down its projections for Mt. Storm, and during the time
4 Dominion was set to re-start Phase 2, the Company's 2021 contemporaneous
5 analysis projected only marginal future performance from Mt. Storm. This was in
6 stark contrast with Dominion earlier findings (from 2016–2018) which relied on
7 overly optimistic capacity factor and energy and capacity price forecasts to support
8 projections of large future revenues.

9 I also find that even as Mt. Storm's capacity factor fell, Dominion continued
10 uneconomically committing Mt. Storm into the PJM market (Dominion self-
11 committed the unit [BEGIN CONFIDENTIAL / ES] ██████████ [END
12 CONFIDENTIAL / ES] of the time that the unit was available in 2021). This
13 practice incurred unnecessary costs for Dominion ratepayers relative to economic
14 commitment and dispatch practices and will continue to do so in the future.

15 **Q Please summarize your recommendations.**

16 **A** Because the Company failed to demonstrate the prudence of moving forward with
17 Phase 2, I recommend that the Commission disallow all costs associated with Phase
18 2 of the BAWT project at Mt. Storm. At the very least the Commission should deny
19 Phase 2 costs until Dominion performs an updated economic analysis that accounts

1 for additional environmental costs including the cost of the chillers, a more
2 stringent ELG standard, and a higher CO₂ price

3 Additionally, since Dominion both (a) incurred costs to store the BAWT equipment
4 and extend its warranty when it paused the project between Phases 1 and 2, and (b)
5 failed to use the analysis and information available to it that indicated that it was not
6 prudent to continue moving forward with Phase 2 of the project, the Commission
7 should also, at the very least, disallow the avoidable costs incurred as a result of the
8 pause.

9 Dominion should also stop the practice of uneconomically self-committing Mt.
10 Storm, especially as the unit's utilization falls. It should instead economically
11 commit the unit and allow the PJM market operator to only commit and dispatch
12 the plant when its economic to do so.

13 **Q Does this conclude your testimony?**

14 **A** Yes.