ELECTRONICALLY FILED - 2020 November 12 8:57 AM - SCPSC - Docket # 2020-125-E - Page 1 of 39

PUBLIC VERSION

DIRECT TESTIMONY OF
ELIZABETH A. STANTON, PHD
ON BEHALF OF
SIERRA CLUB
DOCKET NO. 2020-125-E

INTRODUCTION AND QUALIFICATIONS

Q: Please state your name, position, and business address for the record

A: My name is Elizabeth A. Stanton, Ph.D. I am the Director and Senior Economist of the Applied Economics Clinic, 1012 Massachusetts Avenue, Arlington MA 02476.

Q: Please summarize your professional and educational qualifications.

A: I am the founder and Director of the Applied Economics Clinic, a non-profit consulting group. The Applied Economics Clinic ("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. The Clinic provides training to the next generation of expert technical witnesses and analysts through applied, on-the-job experience for graduate students in related fields and works proactively to support diversity among both student workers and professional staff.

I am a researcher and analyst with nearly two decades of professional experience as a political and environmental economist. I have authored more than 150 reports, policy studies, white papers, journal articles, and book chapters as well as more than 45 expert comments and oral and written testimony in public proceedings on topics related to energy, the economy, the environment, and equity. My articles have been published in *Ecological Economics*, *Climatic Change*, *Environmental and Resource Economics*, *Environmental Science & Technology*, and other journals. I have also published books,

including *Climate Change and Global Equity* (Anthem Press, 2014) and *Climate Economics: The State of the Art* (Routledge, 2013), which I co-wrote with Frank Ackerman. I am also co-author of *Environment for the People* (Political Economy Research Institute, 2005, with James K. Boyce) and co-editor of *Reclaiming Nature: Worldwide Strategies for Building Natural Assets* (Anthem Press, 2007, with Boyce and Sunita Narain).

My recent work includes Integrated Resource Plan (IRP) and Demand-Side Management (DSM) planning review, analysis, and testimony of state climate laws as they relate to proposed capacity additions, and other issues related to consumer and environmental protection in the electric and gas sectors.

In my previous position as a Principal Economist at Synapse Energy Economics, I provided expert testimony in electric and gas sector dockets and led studies examining environmental regulation, cost-benefit analyses, and the economics of energy efficiency and renewable energy. Prior to joining Synapse, I was a Senior Economist with the Stockholm Environment Institute's (SEI) Climate Economics Group, where I was responsible for leading the organization's work on the Consumption-Based Emissions Inventory (CBEI) model and on water issues and climate change in the western United States. While at SEI, I led domestic and international studies commissioned by the United Nations Development Programme, Friends of the Earth-U.K., and Environmental Defense Fund, among others.

I earned my Ph.D. in economics at the University of Massachusetts-Amherst and taught economics at Tufts University, the University of Massachusetts-Amherst, and the College

ELECTRONICALLY FILED - 2020 November 12 8:57 AM - SCPSC - Docket # 2020-125-E - Page 2 of 39

of New Rochelle, among other colleges and universities. My curriculum vitae is attached to this testimony as Exhibit EAS-1.

Q: Have you previously testified as an expert witness in any formal hearing before regulatory bodies?

A: Yes. I have submitted expert testimony and comments in dockets in the District of Columbia, Florida, Illinois, Indiana, Louisiana, Massachusetts, Minnesota, New Hampshire, New York, Puerto Rico, and Vermont as well as several federal dockets.

Q: Have you previously testified as an expert witness before the Public Service Commission of South Carolina ("Commission")?

A: No.

Q: On whose behalf are you testifying in this proceeding?

A: I am submitting this testimony on behalf of the Sierra Club.

ELECTRONICALLY FILED - 2020 November 12 8:57 AM - SCPSC - Docket # 2020-125-E - Page 3 of 39

Q: Are you sponsoring any exhibits?

A: Yes, I am sponsoring the following exhibits:

Exhibit Number	Description of Exhibit	Confidential or Non-Confidential
Exhibit EAS-1	Resume of Elizabeth A. Stanton, PhD	Non-Confidential
Exhibit EAS-2	DESC Responses to Sierra Club 1-9 and 2-7	Non-Confidential
Exhibit EAS-3	DESC Response to Sierra Club 1-11, Attachment "Sierra Club 1-11 response g, h, i.xlsx", and DESC Response to Sierra Club 2-8, Attachment "Sierra Club 2-8 response g, h, i, l, m, n.xlsx"	Non-Confidential
Exhibit EAS-4	DESC Response to Sierra Club 1-11, Attachment "1-11 j,k response.xlsx" and DESC Response to Sierra Club 2-8, Attachment "2-8 j,k response.xlsx"	Non-Confidential
Exhibit EAS-5	DESC Response to Sierra Club 1-11, Attachment "1-11 a, c, d, e, f.xlsx" and DESC Responses to Sierra Club 2-8, Attachment "2-8 a, c, d, e, f.xlsx"	Non-Confidential
Exhibit EAS-6	DESC Response to Sierra Club 1-31, Confidential Attachment "Wateree Unit 2 Generator Return to Service - Governance and Analysis - May 19.pptx,"	Confidential
Exhibit EAS-7	DESC Response to Sierra Club 3-2, Attachment "Sierra Club 3-2.xlsx" and Attachment "2012-2019 Rate Case Projects"	Non-Confidential
Exhibit EAS-8	DESC Response to Sierra Club 1-28, Attachment "DESC2M_0CO_BG (CONFIDENTIAL).xlsm"	Confidential
Exhibit EAS-9	DESC Response to Staff 2-26, Docket No. 2019-226-E (2020 IRP)	Non-Confidential
Exhibit EAS-10	DESC Response to Sierra Club 1-19	Non-Confidential
Exhibit EAS-11	DESC Response to Sierra Club 3-3	Non-Confidential
Exhibit EAS-12	Sierra Club Request 4-4	Non-Confidential

Q: What is the purpose of your direct testimony in this proceeding?

A: The purpose of my direct testimony is to evaluate the economics of the coal-fired units owned by Dominion Energy South Carolina ("DESC" or "the Company") and assess the degree to which both recovery of capital costs incurred at the Wateree, Williams, and Cope plants during the period from 2012 through 2019 and continued investment in and operation of these units in the future are just and reasonable.

ELECTRONICALLY FILED - 2020 November 12 8:57 AM - SCPSC - Docket # 2020-125-E - Page 4 of 39

Q: Please identify the documents and filings on which you base your opinions regarding DESC's coal plant economics.

A: I base my opinions regarding DESC's coal plant economics on the following documents and filings:

- DESC's 2020 Rate Case Application (including testimony and discovery responses)
- DESC's *2020 Integrated Resource Plan* (IRP) (including testimony and public discovery responses)
- 2014 SCE&G Depreciation Study
- DESC's Fuel Cost Reports[1] for January 2018 through August 2020

OVERVIEW OF TESTIMONY AND CONCLUSIONS

Q: How is your testimony organized?

A: My testimony is organized into six sections, outlined below:

1. DESC's Coal Units and Coal-Related Costs for Which It Is Seeking Recovery
2. DESC's Wateree, Williams, and Cope Plants are Not Economic
3. DESC's Historic Capital Expenses for Non-Economic Coal Plants Should Not Be Allowed in Rates
4. Forward-Looking Economic Analysis of the DESC Coal Plants
5. DESC Needs to Conduct a Retirement Analysis Before Investing More Money into Its Coal Plants
6. Recommendations and Conclusions for the Commission

[1] SC PSC No. 2006-192-E. January 2018 - August 2020. *Dominion Energy South Carolina, Incorporated's (f/k/a South Carolina Electric & Gas Company) Information Related to Fuel Costs Filed Pursuant to Order Number 79-21, Docket Number 18,362.* Submitted by Dominion Energy South Carolina. Available at: https://dms.psc.sc.gov/Web/Dockets/Detail/96397

ELECTRONICALLY FILED - 2020 November 12 8:57 AM - SCPSC - Docket # 2020-125-E - Page 5 of 39

Q: Please summarize your primary conclusions.

A: DESC is asking for recovery through customer rates of its capital and operations and maintenance (O&M) spending on the Wateree, Williams, and Cope coal plants, with capital expenditures totaling $411 million. These plants have not performed reliably and have lost ratepayers money over the eight years since DESC's last rate case. The $246 million for non-environmental expenditures and $165 million for environmental expenditures requested by DESC for Wateree, Williams, and Cope were incurred to keep these plants running in future years, [redacted] Investments made in plants that have been uneconomic [redacted] are not just and reasonable.

Q: Please summarize your primary recommendations.

A: I recommend that:

- The Commission disallow $411 million in past spending on capital projects incurred and requested in this rate case proceeding for the Wateree, Williams, and Cope coal plants.
- The Commission place a cap on future capital expenditures intended to prolong the lives of the Williams, Wateree, and Cope coal units as generating assets, at least until DESC conducts an analysis showing whether or not continuing to operate each of its existing coal-fired units is the least-cost alternative compared to other supply-side and demand-side resource options.
- The Commission require DESC to seek approval of any expenditure that exceeds that cap before that expenditure can be recovered from ratepayers.

ELECTRONICALLY FILED - 2020 November 12 8:57 AM - SCPSC - Docket # 2020-125-E - Page 6 of 39

ELECTRONICALLY FILED - 2020 November 12 8:57 AM - SCPSC - Docket # 2020-125-E - Page 7 of 39

1. DESC's WATEREE, WILLIAMS, AND COPE PLANTS ARE NOT ECONOMIC

Q: Which generating units do you focus on in your testimony?

A: My testimony focuses on the Wateree, Williams, and Cope coal-fired units.

Q: What are DESC's plans regarding the future operation of these units?

A: In its 2020 IRP, DESC plans to retire Wateree in 2044, Williams in 2047, and Cope in 2071.

Q: What is the basis for DESC's assumed coal unit retirement dates?

A: In its responses to Sierra Club 1-9 and 2-7, DESC states that no retirement dates have been set for the Wateree, Williams, and Cope coal-fired units. However, DESC assumes in its 2020 IRP that each of these units will retire at the end of their useful life, which were based on an estimated 75-year lifespan derived from the 2014 SCE&G Depreciation Study.[2]

Q: What types of coal unit expenses is DESC seeking to recover in this case?

A: DESC is seeking to recover capital and O&M expenditures.

Q: What is the timeframe upon which DESC's rate case application is based?

A: DESC uses 2019 as the "Test Year" and 2012 through 2019 as the "Review Period" for its rate case application.

Q: What level of O&M expenses did DESC incur at its coal units during this timeframe?

A: DESC has incurred a total of $363.6 million[3] in O&M expenses from 2012 through 2019 for its Wateree, Williams, and Cope coal plants (see Table 1).[4]

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[2] *See* DESC Responses to Sierra Club 1-9 and Sierra Club 2-7, attached as Exhibit EAS-2.
[3] Historical costs have been adjusted to 2019 dollars, using the CPI-U.
[4] *See* DESC Response to Sierra Club 1-11 (Attachment "Sierra Club 1-11 response g, h, i.xlsx"), and DESC Response to Sierra Club 2-8 (Attachment "Sierra Club 2-8 response g, h, i, l, m, n.xlsx"), attached as Exhibit EAS-3.

Table 1. Historical O&M Expenses for Wateree, Williams, and Cope

O&M Expenses (2019$, millions)	2012	2013	2014	2015	2016	2017	2018	2019	TOTAL
Wateree	$15.9	$23.8	$20.0	$24.4	$18.3	$18.1	$18.2	$26.3	$165.1
Williams	$8.6	$10.7	$14.3	$11.6	$17.6	$18.7	$12.5	$10.4	$104.4
Cope	$16.5	$9.4	$10.2	$13.7	$11.6	$10.3	$13.7	$8.7	$94.1
TOTAL	$41.0	$43.8	$44.5	$49.8	$47.5	$47.1	$44.4	$45.4	$363.6

Source: DESC Response to Sierra Club 1-11(Attachment "Sierra Club 1-11 response g, h, i,.xlsx"), and DESC Response to Sierra Club 2-8 (Attachment "Sierra Club 2-8 response g, h, i, l, m, n.xlsx")

Q: What level of capital expenses did DESC incur at its coal units during this timeframe?

A: DESC has incurred a total of $410.8 million in capital expenses from 2012 through 2019 for its Wateree, Williams, and Cope coal plants (see Table 2).[5]

Table 2. Historical Capital Expenditures for Wateree, Williams, and Cope

Capital Expenses (2019$, millions)	2012	2013	2014	2015	2016	2017	2018	2019	TOTAL
Wateree	$30.5	$21.2	$26.4	$20.2	$10.1	$21.5	$15.1	$36.7	$181.7
Williams	$4.2	$11.7	$11.7	$11.6	$10.6	$37.5	$18.2	$28.6	$134.1
Cope	$15.8	$10.0	$5.4	$7.4	$6.3	$5.5	$9.7	$34.9	$94.9
TOTAL	$50.5	$42.9	$43.5	$39.3	$26.9	$64.4	$43.0	$100.2	$410.8

Source: DESC Response to Sierra Club 1-11 (Attachment "1-11 j,k response.xlsx"), and DESC Response to Sierra Club 2-8 (Attachment "2-8 j,k response.xlsx")

2. DESC's WATEREE, WILLIAMS, AND COPE PLANTS ARE NOT ECONOMIC

Q: Do DESC's Wateree, Williams, and Cope coal plants generate revenue sufficient to cover their expenses?

A: No. DESC's Wateree, Williams, and Cope coal plants each generate revenue that is less than their expenses (see Table 3): Wateree's 2019 revenue was 42 percent of its costs (a loss of $80 million), Williams' revenue was 51 percent of its costs (a loss of $68 million),

[5] *See* DESC Response to Sierra Club 1-11, Attachment "1-11 j,k response.xlsx" and DESC Response to Sierra Club 2-8, Attachment "2-8 j,k response.xlsx", attached as Exhibit EAS-4.

ELECTRONICALLY FILED - 2020 November 12 8:57 AM - SCPSC - Docket # 2020-125-E - Page 8 of 39

and Cope's revenue was 49 percent of its costs (a loss of $53 million). Since 2012, DESC has lost $1.65 billion at the Wateree, Williams and Cope plants.

Table 3. Historical Revenue Loss for Wateree, Williams, and Cope

Revenue Loss (2019$, millions)	2012	2013	2014	2015	2016	2017	2018	2019	TOTAL
Wateree	$136	$101	$95	$86	$61	$67	$61	$80	$687
Williams	$85	$89	$78	$73	$56	$75	$59	$68	$582
Cope	$73	$67	$51	$44	$29	$32	$37	$53	$386
TOTAL	$293	$256	$224	$203	$146	$174	$156	$201	$1,655

Source: Calculations based on DESC Responses to Sierra Club 1-11 (Attachment "1-11 a, c, d, e, f.xlsx") and DESC Responses to Sierra Club 2-8 (Attachment "2-8 a, c, d, e, f.xlsx")

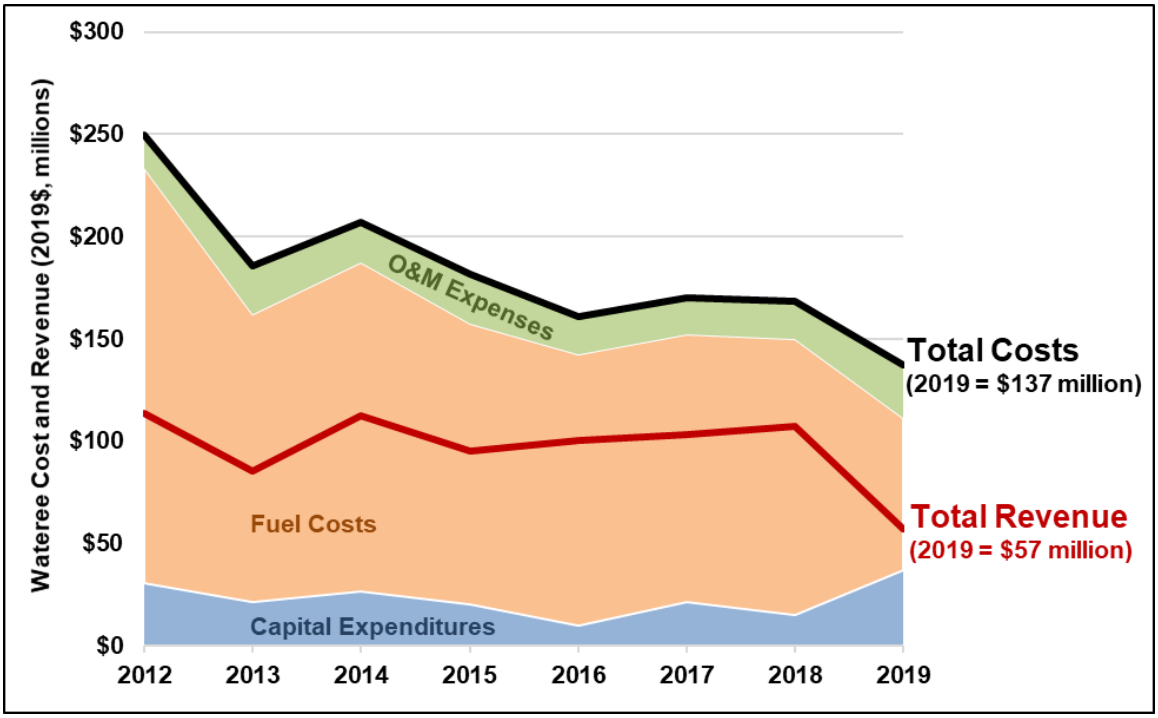
In Figures 1, 2, and 3, I depict the historical costs of each plant (shown as a stacked area graph adding up to the black total costs line) together with estimated historical revenues of each plant (shown as a red line). I estimated historical revenues[6] based on generation in MWh calculated from DESC's reported capacity and capacity factors for each year and plant and DESC's 2020 system-wide revenue rate of $27.35 per MWh applied (as a nominal) value in each historical year.[7]

[6] DESC does not provide historical plant revenues in its 2020 IRP or rate case filings. In its response to Sierra Club 1-11 and 2-8, DESC stated "The Company does not track revenue on a plant-by-plant basis." *See* Exhibit EAS-3.

[7] *See* DESC Responses to Sierra Club 1-11, Attachment "1-11 a, c, d, e, f.xlsx", and DESC Responses to Sierra Club 2-8, Attachment "2-8 a, c, d, e, f.xlsx", attached as Exhibit EAS-5.

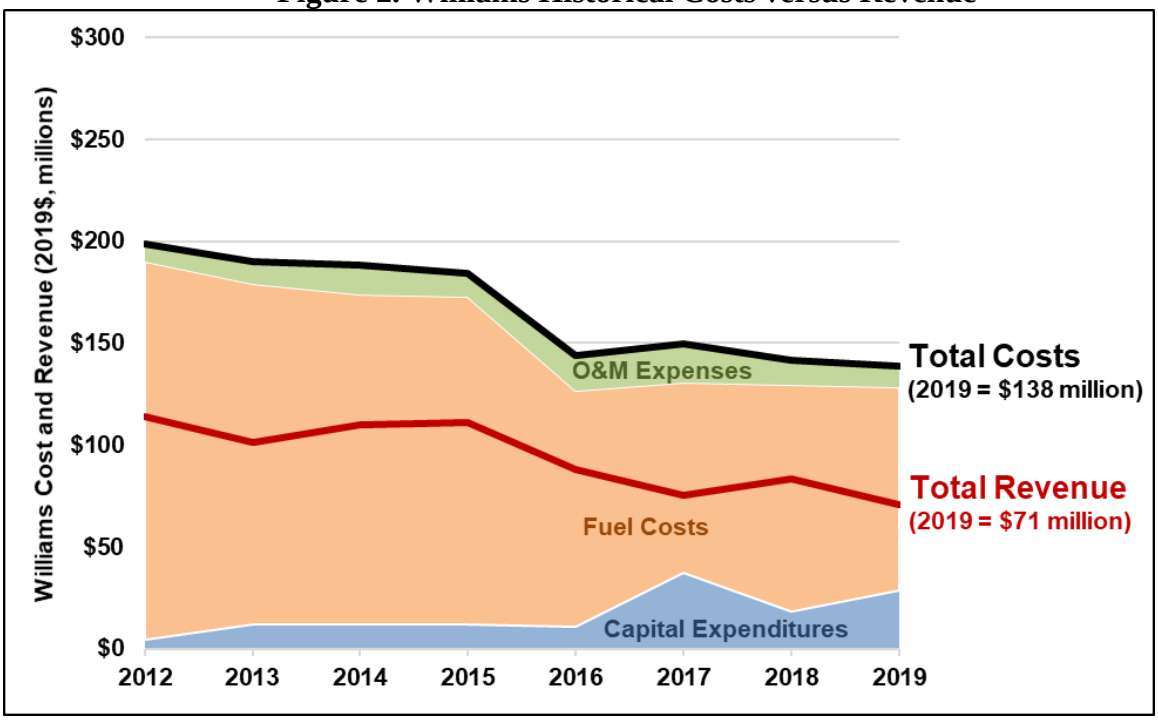
ELECTRONICALLY FILED - 2020 November 12 8:57 AM - SCPSC - Docket # 2020-125-E - Page 9 of 39

Figure 1. Wateree Historical Costs versus Revenue



Source: DESC Response to Sierra Club 1-11 (Attachments "1-11 j,k response.xlsx", "Sierra Club 1-11 response g, h, i,.xlsx", and "1-11 a, c, d, e, f.xlsx")

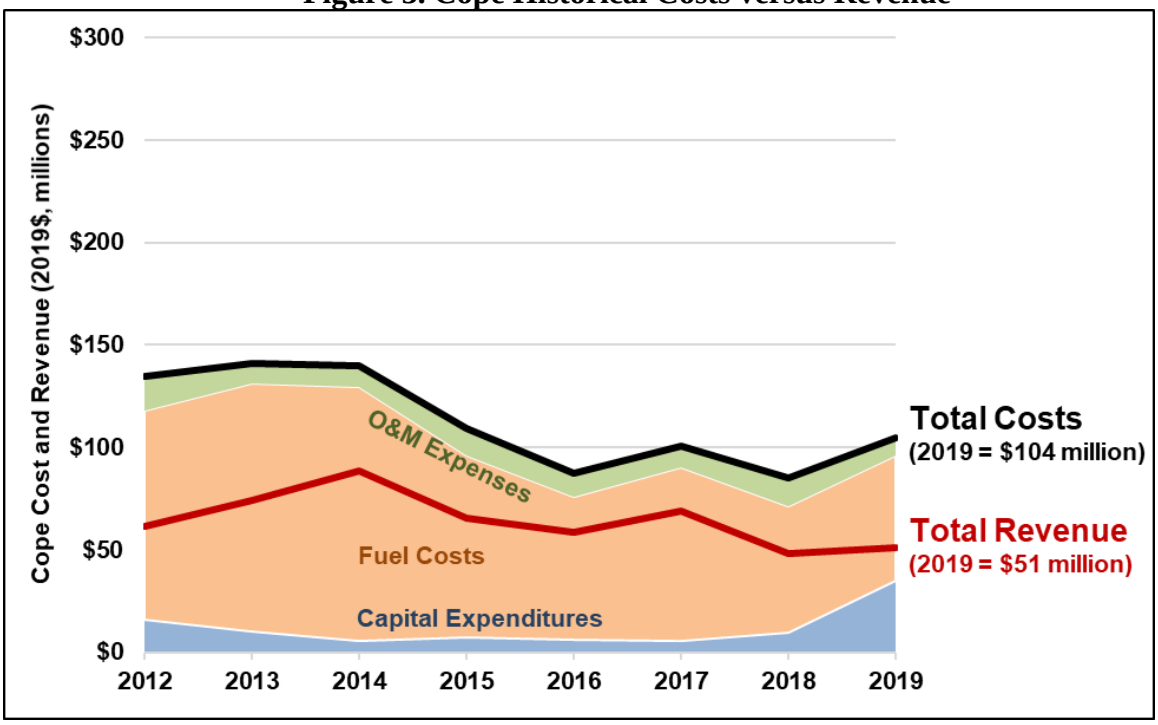
Figure 2. Williams Historical Costs versus Revenue



Source: DESC Response to Sierra Club 1-11 (Attachments "1-11 j,k response.xlsx", "Sierra Club 1-11 response g, h, i,.xlsx", and "1-11 a, c, d, e, f.xlsx")

ELECTRONICALLY FILED - 2020 November 12 8:57 AM - SCPSC - Docket # 2020-125-E - Page 10 of 39

Figure 3. Cope Historical Costs versus Revenue



Source: DESC Response to Sierra Club 2-8 (Attachments "2-8 j,k response.xlsx", "Sierra Club 2-8 response g, h, i, l, m, n.xlsx", and "2-8 a, c, d, e, f.xlsx")

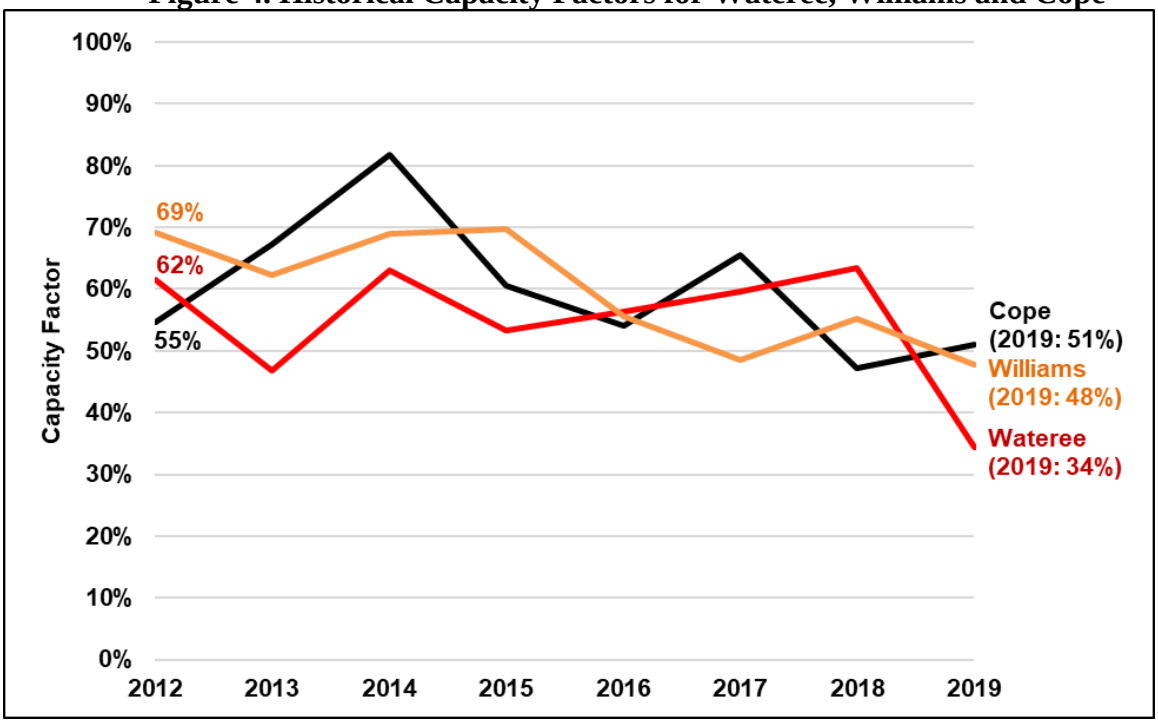
Q: What were the capacity factors of the Wateree, Williams, and Cope Units between 2012 and 2020?

A: As shown in **Figure 4,** below, all three coal plants have seen shrinking capacity factors since 2012 from 62 percent in 2012 down to 34 percent in 2019 for Wateree, 69 percent to 48 percent for Williams, and 55 percent to 51 percent for Cope.[8]

[8] *See* Exhibit EAS-5.

ELECTRONICALLY FILED - 2020 November 12 8:57 AM - SCPSC - Docket # 2020-125-E - Page 11 of 39

Figure 4. Historical Capacity Factors for Wateree, Williams and Cope



Source: DESC Responses to Sierra Club 1-11 (Attachment "1-11 a, c, d, e, f.xlsx") and DESC Responses to Sierra Club 2-8 (Attachment "2-8 a, c, d, e, f.xlsx")

Q: Have the Wateree, Williams, and Cope coal plants performed reliably for ratepayers in recent years?

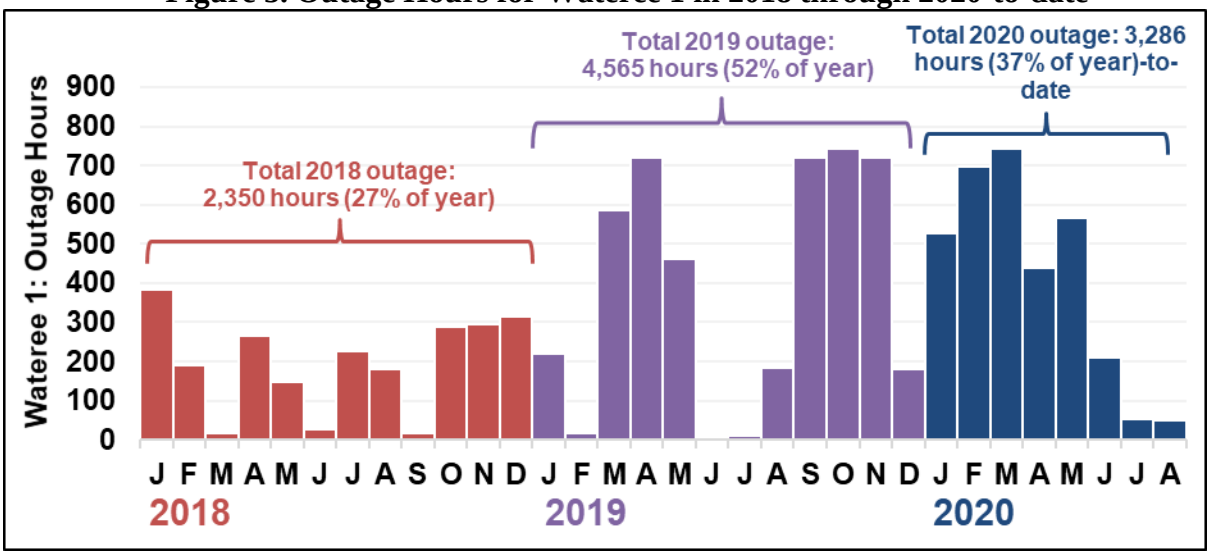
A: No. Since 2018, three out of four units have had years in which they were available to provide generation less than half of the time due to repairs and other emergencies. Wateree 1's outages added up to 52 percent of its hours in 2019 (see Figure 5). Wateree 2's outages added up to 56 percent of its hours in 2019 (see Figure 6) and this unit has been shut down since January 2020 and is not expected to be online until 2022.[9] Williams' outages accounted for 38 and 43 percent of its hours, respectively, in years 2018 and 2019 (see Figure 7), and Cope's outage rate has already reached 50 percent in

[9] DESC Response to Sierra Club 1-31, Confidential Attachment "Wateree Unit 2 Generator Return to Service - Governance and Analysis - May 19.pptx", attached as Exhibit EAS-6.

ELECTRONICALLY FILED - 2020 November 12 8:57 AM - SCPSC - Docket # 2020-125-E - Page 12 of 39

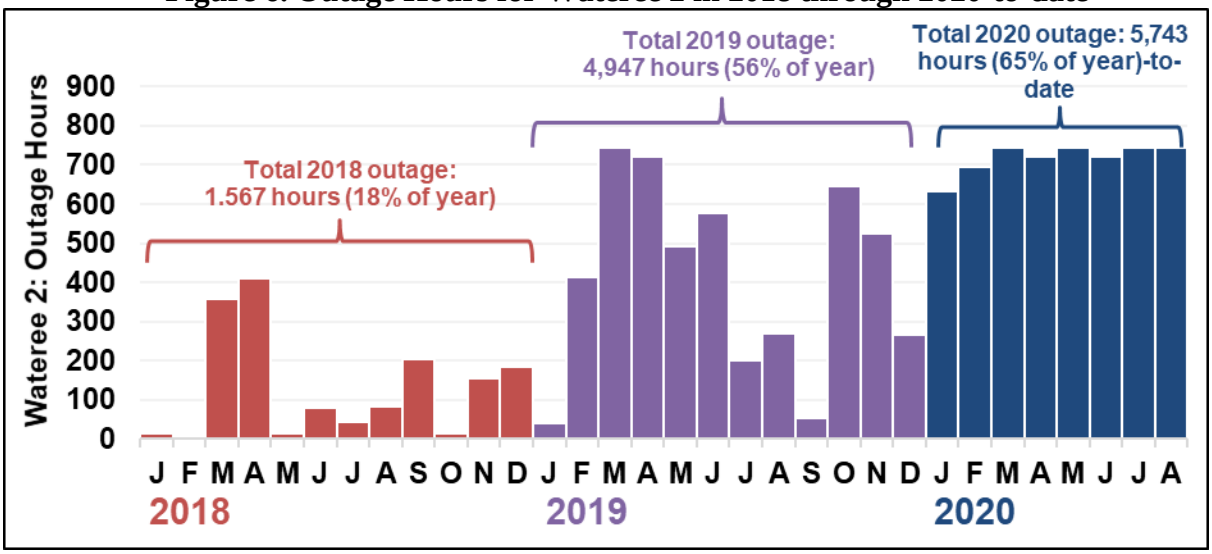
2020 (see Figure 8). This unavailability of three out of four units is a serious reliability concern for DESC's customers.

Figure 5. Outage Hours for Wateree 1 in 2018 through 2020-to-date



Source: SC PSC No. 2006-192-E. January 2018 - August 2020. Dominion Energy South Carolina, Incorporated's (f/k/a South Carolina Electric & Gas Company) Information Related to Fuel Costs Filed Pursuant to Order Number 79-21, Docket Number 18,362. Submitted by Dominion Energy South Carolina. Available at: https://dms.psc.sc.gov/Web/Dockets/Detail/96397

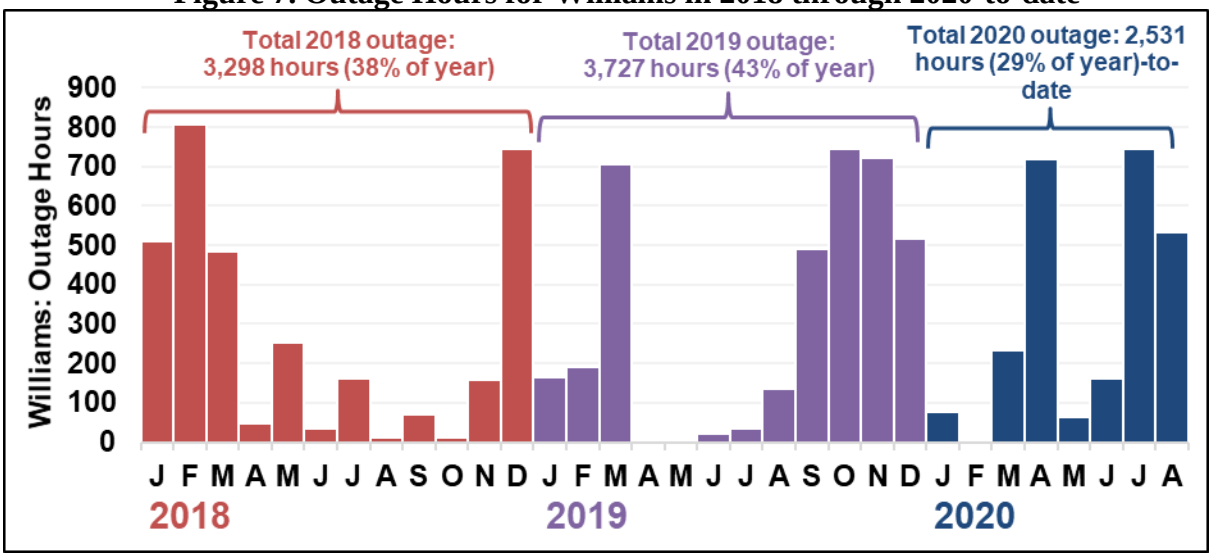
Figure 6. Outage Hours for Wateree 2 in 2018 through 2020-to-date



Source: SC PSC No. 2006-192-E. January 2018 - August 2020. Dominion Energy South Carolina, Incorporated's (f/k/a South Carolina Electric & Gas Company) Information Related to Fuel Costs Filed Pursuant to Order Number 79-21, Docket Number 18,362. Submitted by Dominion Energy South Carolina. Available at: https://dms.psc.sc.gov/Web/Dockets/Detail/96397

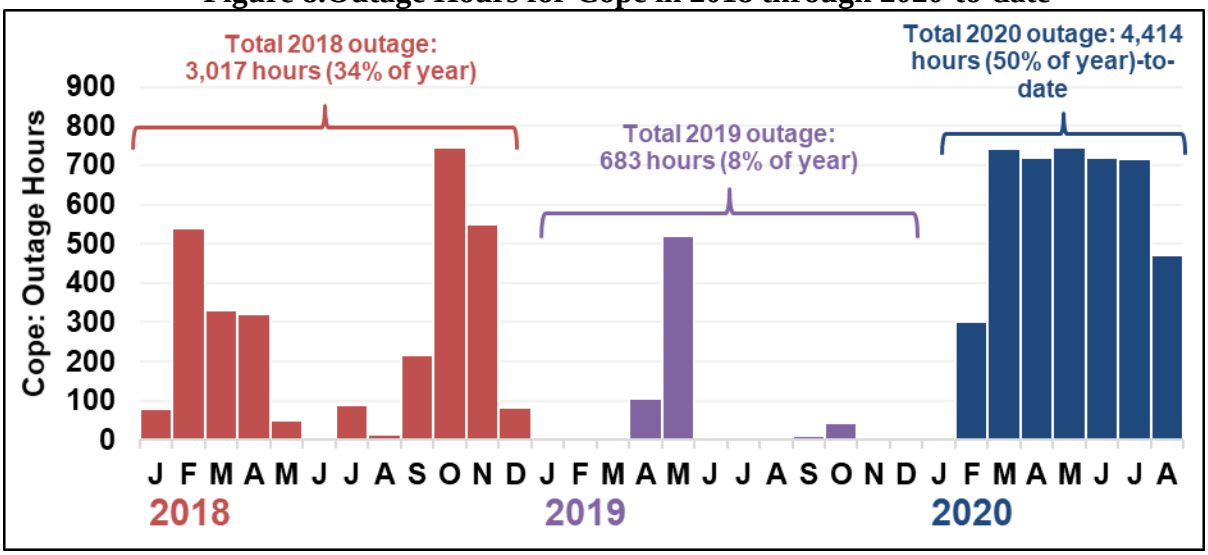
ELECTRONICALLY FILED - 2020 November 12 8:57 AM - SCPSC - Docket # 2020-125-E - Page 13 of 39

Figure 7. Outage Hours for Williams in 2018 through 2020-to-date



Source: SC PSC No. 2006-192-E. January 2018 - August 2020. Dominion Energy South Carolina, Incorporated's (f/k/a South Carolina Electric & Gas Company) Information Related to Fuel Costs Filed Pursuant to Order Number 79-21, Docket Number 18,362. Submitted by Dominion Energy South Carolina. Available at: https://dms.psc.sc.gov/Web/Dockets/Detail/96397

Figure 8.Outage Hours for Cope in 2018 through 2020-to-date



Source: SC PSC No. 2006-192-E. January 2018 - August 2020. Dominion Energy South Carolina, Incorporated's (f/k/a South Carolina Electric & Gas Company) Information Related to Fuel Costs Filed Pursuant to Order Number 79-21, Docket Number 18,362. Submitted by Dominion Energy South Carolina. Available at: https://dms.psc.sc.gov/Web/Dockets/Detail/96397

Q: What caused the current outage at Wateree 2?

A: [redacted]

[redacted]

ELECTRONICALLY FILED - 2020 November 12 8:57 AM - SCPSC - Docket # 2020-125-E - Page 14 of 39

[redacted]

Q: When does DESC expect Wateree 2 will return to full operation?

A: [redacted]

Q: Are Wateree, Williams, and Cope able to reliably provide energy and capacity to serve DESC customers' needs?

A: No. Based on their recent performance—and very high outage rates—Wateree, Williams, and Cope are not reliable sources for meeting customers' energy needs.

Q: What are the implications of your findings regarding the economic performance of the Wateree, Williams, and Cope units?

A: Wateree, Williams, and Cope cost more to run that they generate in revenues. I estimate that together these three plants have lost $1.7 billion since 2012. In addition, DESC's records for the past three years show that these plants are not performing reliably—with units being able and available to run less than half the time in several cases. These plants are uneconomic and they cannot reliably provide capacity at times of peak customer

[10] Exhibit EAS-6, at Slide 16.
[11] Exhibit EAS-6, at Slide 23.
[12] Exhibit EAS-6, at Slide 5.

ELECTRONICALLY FILED - 2020 November 12 8:57 AM - SCPSC - Docket # 2020-125-E - Page 15 of 39

needs. Expenses for uneconomic, unreliable plants are not just and reasonable, and DESC's ratepayers should not have to pay for them in their rates.

Q: Do you expect these revenue loss trends to continue?

A: Yes. Based on my review of DESC's 2020 IRP and its associated modeling files, I expect these revenue losses to continue, [redacted] Overall, I see no future energy market trends that would create advantages for these coal plants making it possible for them to become more economic or more reliable in the future. Rather, many energy market trends suggest a weakening of coal power plant economics in the future: increasing penetration of competing renewable generation will lower market prices and energy revenues; even before the COVID pandemic load growth was flattening across the United States due to customers choosing appliances and lighting that are more efficient and therefore less expensive to operate, creating more competition among generating resources; and coal's lack of flexibility (it cannot turn on and off quickly, adapting to customer demand) makes it ill-suited to work together with low-cost modern resources like renewables, demand response, batteries, and virtual power plants.

Section 4 of my testimony addresses the forward looking economic analysis of the DESC coal plants.

3. DESC's CAPITAL EXPENSES FOR WATEREE, WILLIAMS AND COPE SHOULD BE DISALLOWED.

ELECTRONICALLY FILED - 2020 November 12 8:57 AM - SCPSC - Docket # 2020-125-E - Page 16 of 39

Q: What capital costs does DESC claim since its last rate case for investments in its generation system related to safety, reliability, and efficiency?

A: According to the testimony of Iris N. Griffin, DESC has incurred $878 million in capital costs to its generation system since its last rate case.[13]

Q: Does the $878 million in generation system investments include capital expenses for DESC's Wateree, Williams, and Cope coal plants?

A: Yes. Capital expenses for DESC's Wateree, Williams, and Cope coal plants make up almost half of the $878 million generation system investments, totaling $411 million.[14]

Q: What capital costs has DESC incurred for its Wateree, Williams, and Cope coal plants between 2012 and 2019?

A: DESC spent $411 million[15] in capital costs for its Wateree, Williams, and Cope coal plants between 2012 and 2019:

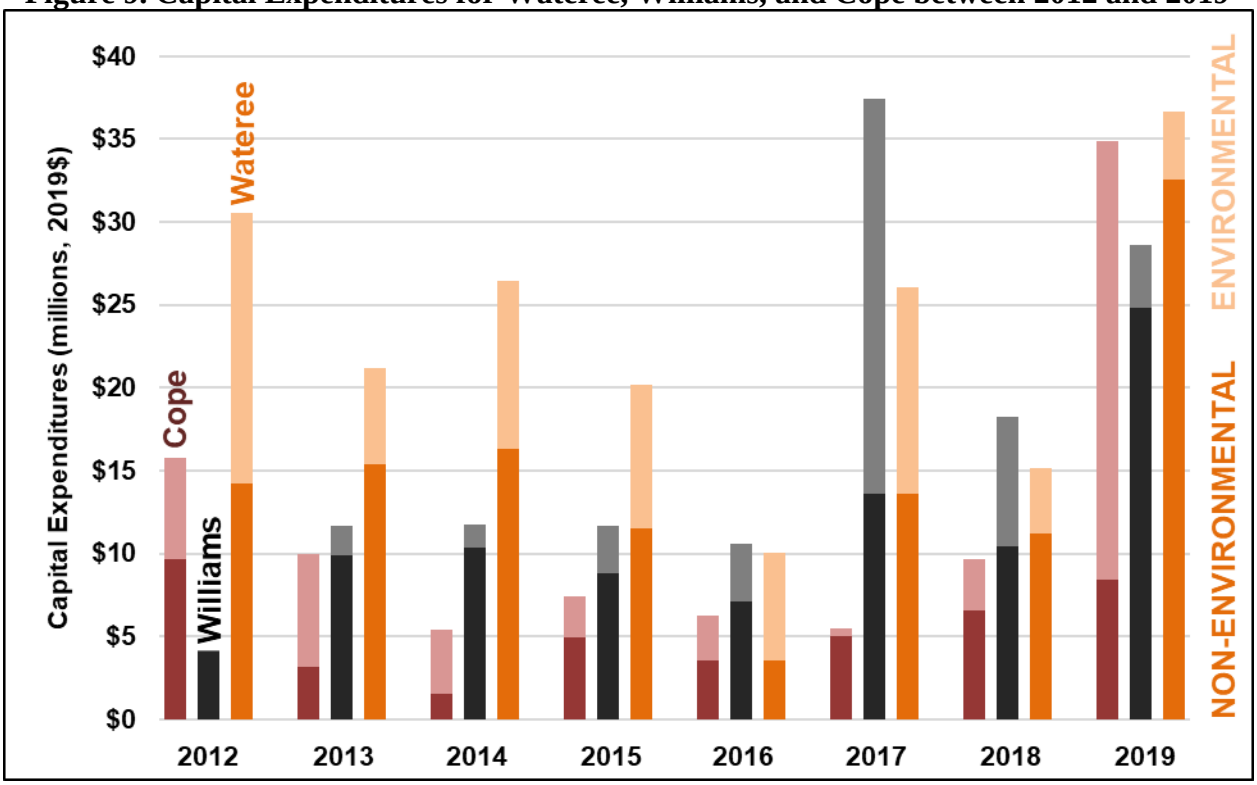
- $182 million for Wateree,
- $134 million for Williams, and
- $95 million for Cope.[16]

DESC attributes approximately 40 percent (or $165 million) of the $411 million in capital costs to environmental expenses (see Figure 9).

[13] *See* Direct Testimony of Iris N. Griffin at page 19, lines 9-14.
[14] *See* DESC Response to Sierra Club 3-2, Attachment "Sierra Club 3-2.xlsx," attached as Exhibit EAS-7.
[15] Converted to 2019 dollars using CPI-U.
[16] *See* Exhibit EAS-4.

ELECTRONICALLY FILED - 2020 November 12 8:57 AM - SCPSC - Docket # 2020-125-E - Page 17 of 39

Figure 9. Capital Expenditures for Wateree, Williams, and Cope between 2012 and 2019



Source: DESC Response to Sierra Club 1-11 (Attachment "1-11 j,k response.xlsx"), and DESC Response to Sierra Club 2-8 (Attachment "2-8 j,k response.xlsx")

Q: Is DESC seeking to recover the $411 million in capital expenses for Wateree, Williams and Cope plants in this rate case?

A: Yes. DESC is asking for recovery of the $411 million ($165 million for environmental and $246 million for non-environmental) in capital expenses for its Wateree, Williams, and Cope coal plants, which have been uneconomic at least since 2012.

Q: Should DESC be able to recover capital expenses for plants, like Wateree, Williams, and Cope that are not economic?

A: No. In my opinion, requiring customers to pay for capital expenditures on uneconomic plants is not just or reasonable, especially when there are less expensive alternative resources. I understand "just and reasonable" utility expenses to be the product of careful, considered investment and operation decisions on the part of the utility with the clear

ELECTRONICALLY FILED - 2020 November 12 8:57 AM - SCPSC - Docket # 2020-125-E - Page 18 of 39

goal of affecting two outcomes: (1) reliable electric service to meet customer needs (maintaining the required reserve margin above expected peak demand); and (2) the lowest possible costs to customers. Wateree, Williams, and Cope do not appear to have helped DESC address either goal; indeed, they seem to have hampered it. Their recent past expenses, therefore, are not just and reasonable.

In future years, these plants will require additional capital investments to comply with environmental regulation and rising O&M costs and will likely continue to lose money due to increasing penetration of competing renewables, which will lower market prices and, consequently, the energy revenues earned by DESC.

DESC has not conducted a retirement analysis to demonstrate that continued investment in its coal-fired units is a just and reasonable decision; therefore it should not require ratepayers, especially in the current economic climate, to pay for capital expenditures intended to prolong the life of units that provide no economic value to customers.

4. FORWARD-LOOKING ECONOMICS ANALYSIS OF THE DESC COAL UNITS

Q: [redacted]

A: [redacted],

[redacted]

ELECTRONICALLY FILED - 2020 November 12 8:57 AM - SCPSC - Docket # 2020-125-E - Page 19 of 39

[redacted]

[redacted] (see CONFIDENTIAL Table 4) .[17]

CONFIDENTIAL Table 4.
Projected Costs and Revenue for Wateree and Williams

[redacted]

Source: DESC Response to Sierra Club 1-28, Attachment "DESC2M_0CO_BG (CONFIDENTIAL).xlsm" and DESC Response to Sierra Club 1-29(b), "PROSYM Outputs" data for 2020 IRP (Resource Plan 2, Medium DSM, $0 CO2, Base Gas)

CONFIDENTIAL Figure 10.
Wateree Historical and Projected Cost versus Revenue[18]

[redacted]

Source: Historical: DESC Response to Sierra Club 1-11 (Attachments "1-11 j,k response.xlsx", "Sierra Club 1-11 response g, h, i,.xlsx", and "1-11 a, c, d, e, f.xlsx"), Projected: DESC Response to Sierra Club 1-28, Attachment "DESC2M_0CO_BG (CONFIDENTIAL).xlsm" and DESC Response to Sierra Club 1-29(b), "PROSYM Outputs" data for 2020 IRP (Resource Plan 2, Medium DSM, $0 CO2, Base Gas)

[17] DESC Response to Sierra Club 1-28, Attachment "DESC2M_0CO_BG (CONFIDENTIAL).xlsm" is attached as Exhibit EAS-8. DESC response to Sierra Club 1-29(b), "PROSYM Outputs" data contains 460 individual files and can be made available to the Commission and other parties upon request.

[18] *See* Exhibits EAS-3, EAS-4, EAS-5 and CONFIDENTIAL EAS-8. "Start Costs" typically refer to the operational cost of "cycling" a coal plant, that is, changing the load level in response to system load requirements.

ELECTRONICALLY FILED - 2020 November 12 8:57 AM - SCPSC - Docket # 2020-125-E - Page 20 of 39

CONFIDENTIAL Figure 11.
Williams Historical and Projected Cost versus Revenue[19]

[redacted]

Source: Historical: DESC Response to Sierra Club 1-11, Attachments "1-11 j,k response.xlsx", "Sierra Club 1-11 response g, h, i,.xlsx", and "1-11 a, c, d, e, f.xlsx"), Projected: DESC Response to Sierra Club 1-28, Attachment "DESC2M_0CO_BG (CONFIDENTIAL).xlsm" and DESC Response to Sierra Club 1-29(b), "PROSYM Outputs" data for 2020 IRP (Resource Plan 2, Medium DSM, $0 CO2, Base Gas)

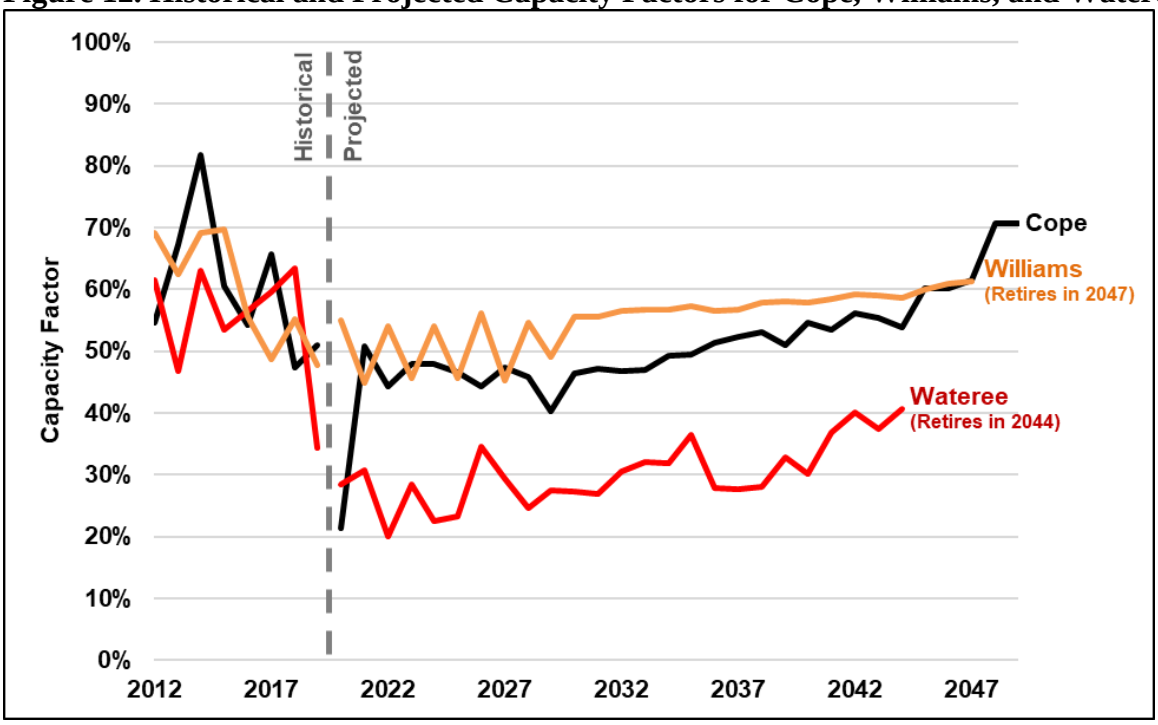
DESC also assumed in its "least-cost" Resource Plan 2—in which Wateree continues operating until 2044 and Williams until 2047—that these coal plants will operate more in the future than they have in the recent past. DESC assumes that Wateree's capacity factor increases from 34 to 41 percent from 2019 to 2044 and Williams' capacity factor increases from 48 to 61 percent from 2019 to 2047 (see Figure 12 below). [redacted]

[19] *See id.*

ELECTRONICALLY FILED - 2020 November 12 8:57 AM - SCPSC - Docket # 2020-125-E - Page 21 of 39

[redacted] (see Confidential Figure 11, above).

Figure 12. Historical and Projected Capacity Factors for Cope, Williams, and Wateree



Source: DESC Response to Sierra Club 1-29(b), "PROSYM Outputs" data for 2020 IRP (Resource Plan 2, Medium DSM, $0 CO2, Base Gas)

Q: [redacted]

A: [redacted] (see CONFIDENTIAL Figure 13 below).

ELECTRONICALLY FILED - 2020 November 12 8:57 AM - SCPSC - Docket # 2020-125-E - Page 22 of 39

CONFIDENTIAL Figure 13. Cope Historical and Projected Cost versus Revenue[20]

[redacted]

Source: DESC Response to Sierra Club 2-8, Attachments "2-8 j,k response.xlsx", "Sierra Club 2-8 response g, h, i, l, m, n.xlsx", and "2-8 a, c, d, e, f.xlsx"), Projected: DESC Response to Sierra Club 1-28, Attachment "DESC2M_0CO_BG (CONFIDENTIAL).xlsm" and DESC Response to Sierra Club 1-29(b), "PROSYM Outputs" data for 2020 IRP (Resource Plan 2, Medium DSM, $0 CO2, Base Gas)

Q: [redacted]

A: [redacted]

DESC needed to assume both that Cope's capacity factor would more than triple (an increase of 50 percentage points) from 21 percent in 2020 up to 71 percent in 2049, and assume that Cope will fire an increasing share of gas over time: from 15 percent in 2020 up to 25 percent in 2049.[21]

[20] *See* Exhibits EAS-3 and EAS-4; Exhibit EAS-8. *See also* DESC response to Sierra Club 1-29(b), "PROSYM Outputs," which contains 460 individual files and can be made available to the Commission and other parties upon request.

[21] Based on "Station Fuel Use Extended Report" in DESC's Response to Sierra Club 1-29(b), "PROSYM Outputs" data for 2020 IRP (Resource Plan 2, Medium DSM, $0 CO2, Base Gas), which can be made available to the Commission and other parties upon request.

ELECTRONICALLY FILED - 2020 November 12 8:57 AM - SCPSC - Docket # 2020-125-E - Page 23 of 39

Q: Are DESC's assumptions regarding changes in future performance at the Wateree, Williams, and Cope plants reasonable?

A: No. These assumptions are not reasonable without some specific, well-founded justification, which DESC has not provided. All three plants' capacity factors have shrunk over the past decade, but DESC—without explanation—shows them rising dramatically in the future. It is not at all clear why DESC would choose to dispatch these uneconomic plants more in future years.

DESC also assumes that Cope will increase the share of gas that it fires in future years. This assumption seems plausible considering the relative affordability of gas generation, but it still requires explanation: Why isn't Cope modeled as running entirely on gas in the future? Are there technical limitations that prevent this or economic reasons that make this preferable? DESC should explain its assumptions and findings in detail to promote third-party review, critical feedback, and the best possible planning decisions for its customers to avoid unnecessary capital expenses.

Q: [redacted]

A: [redacted]

- [redacted]
- [redacted]

ELECTRONICALLY FILED - 2020 November 12 8:57 AM - SCPSC - Docket # 2020-125-E - Page 24 of 39

- [redacted][22]

Q: Does DESC expect future capital costs for the Wateree, Williams, and Cope plants?

A: Yes. According to the Excel revenue requirements modeling used in the Company's 2020 IRP, DESC expects future capital costs for the Wateree, Williams, and Cope plants (see CONFIDENTIAL Figure 14). This modeling accounts for two classes of capital expenditures: (1) "Generation Capital", and (2) "Owning Costs" (i.e., New Generation Capital).[23]

The "Owning Costs" are capital investments at Wateree and Williams to install Effluent Limitation Guidelines (ELG) mitigation equipment in 2026.

[22] *See* Exhibit EAS-8. *See also* DESC Response to Sierra Club 1-29(b), "PROSYM Outputs" data for 2020 IRP (Resource Plan 2, Medium DSM, $0 CO2, Base Gas), which can be made available upon request due to its voluminous size.

[23] *See* Exhibit EAS-8.

ELECTRONICALLY FILED - 2020 November 12 8:57 AM - SCPSC - Docket # 2020-125-E - Page 25 of 39

CONFIDENTIAL Figure 14.
Capital Expenditures for Wateree, Williams, and Cope between 2020 and 2028

[redacted]

Source: DESC Response to Sierra Club 1-28, Attachment "DESC2M_0CO_BG (CONFIDENTIAL).xlsm."

Q: Has DESC stated that the Wateree and Williams coal plants will require additional investments to comply with final, proposed, or possible environmental regulations?

A: Yes, the 2020 IRP "Owning Costs" represent an additional total investment of $228.5 million (including financing costs) to comply with environmental regulations in the future. In the Company's response to Staff Set 2-26 in the 2020 IRP, Case No. 2019-266-E, DESC states that its 2020 IRP modeling assumes capital investments at Wateree and Williams in 2026 to install Effluent Limitation Guidelines (ELG) mitigation equipment:

> In resource plans RP1, RP2, RP4, RP5, RP6, RP7, it was assumed that capital dollars were spent at Wateree and Williams Stations to install ELG mitigation equipment in 2026. The estimations of capital costs were $101.7M at Wateree Station for flue-gas desulfurization (FGD) wastewater treatment and $126.8M at Williams Station for bottom ash transport water treatment and FGD wastewater

ELECTRONICALLY FILED - 2020 November 12 8:57 AM - SCPSC - Docket # 2020-125-E - Page 26 of 39

treatment. In addition, it was assumed that fixed O&M increased $3.33M/year at Wateree Station and $4.16M/year at Williams Station beginning in 2026 because of the installed ELG mitigation equipment.[24]

Q: Did DESC give a different answer in this rate case with regards to whether Williams and Wateree would require additional investment to comply with final, proposed or possible future environmental regulations?

A: Yes. In the Company's response to Sierra Club 1-19, DESC claims that the Wateree and Williams coal plants are in full compliance with environmental regulations:

> Williams and Wateree coal plants are in full compliance with new source review provisions, coal combustion residuals, effluent limitation guidelines, national ambient air quality standards, cooling water intake standards, the cross-state air pollution rule, the mercury and air toxics standards, regional haze, and carbon dioxide emissions. Neither location is operating under a consent decree.
>
> DESC cannot predict the Capital and O&M budgets that will be necessary for technology installations required to meet environmental regulatory requirements that have not yet been determined for any DESC facilities. Final technology needs are determined after SCDHEC (or other regulatory authority) completes a determination for each of the affected facilities.
>
> …
>
> DESC has not made plans for additional capital investment in either Williams or Wateree to comply with final, proposed, or possible future environmental regulations…[25]

[24] *See* DESC Response to Staff 2-26 in DESC's 2020 IRP, Case No. 2019-266-E, attached as Exhibit EAS-9.
[25] *See* DESC Response to Sierra Club 1-19, attached as Exhibit EAS-10

ELECTRONICALLY FILED - 2020 November 12 8:57 AM - SCPSC - Docket # 2020-125-E - Page 27 of 39

Q: Did the Sierra Club ask DESC to clear up this discrepancy between the two cases?

A: Yes. In its response to Sierra Club 3-3, DESC states that the Company has not determined its strategy for compliance in light of the final reconsidered ELG rule:

> The final reconsidered ELG rule was published on October 13, 2020 and becomes effective on December 14, 2020. The compliance dates will likely be determined over the next two years. The Company has not yet determined its strategy for compliance with the reconsidered rule and is evaluating the cost and schedule estimates in light of the rule issued after reconsideration.[26]

Q: Are these future "Owning Costs" (or ELG costs) for the Wateree and Williams coal plants avoidable and should they be considered in a future retirement analysis?

A: Yes. The $228.5 million associated with ELG compliance for the Wateree and Williams coal plants are avoidable if DESC retires Wateree and Williams prior to the deadline to comply with the ELG rule.[27] Allowing recovery of Wateree, Williams, and Cope's past capital expenses lays the groundwork for the Company to request reimbursement for ELG costs and other future capital expenses for these uneconomic plants. DESC's request for recovery of these capital expenses should be denied, future recovery should be refused or capped, and DESC should be required to prepare a retirement analysis of these plants subject to third-party review.

Q: In addition to ELG costs, how much does DESC plan to invest in Wateree, Williams and Cope going forward?

A: Between 2020 and 2049, DESC plans to invest an additional [redacted] (in net present value terms, which is discounted to reflect financing the total amount today) in Wateree, Williams and Cope in addition to its planned ELG investment:

[26] *See* DESC Response to Sierra Club 3-3, attached as Exhibit EAS-11.
[27] *See* Exhibit EAS-9.

ELECTRONICALLY FILED - 2020 November 12 8:57 AM - SCPSC - Docket # 2020-125-E - Page 28 of 39

- [redacted] for Wateree,
- [redacted] for Williams, and
- [redacted] costs for Cope.[28]

Q: How did DESC come up with the capital budget projections used in its revenue requirements model?

A: DESC claims to have used a combination of capital cost budgets for 2020 through 2025, when available, as the basis for the capital budget projections on its revenue requirements model. When asked for additional information on the Company's capital cost forecasts, DESC stated:

> For plants where Mr. Neely had only a 2021 projection he assumed the 2020 expenditures were the same as the 2021 projection. He used that value growing at 2.8% for years 2022 and beyond. For plants where Mr. Neely had 2020-2025 projections, he averaged the 2021-2025 values and used this value as the annual projection of expenditures in years 2026 and beyond growing at 2.8%.[29]

Q: What is the source for DESC's capital cost budgets for 2020 through 2025?

A: It is unclear what the source of DESC's capital cost budgets are for 2020 through 2025. While DESC has provided documents showing their projected budget values, they have offered no explanation of the origins of the budget values. Instead, the Company states that for some plants it assumed that a single year could provide a proxy for future (or past) values, and for other plants an average over five years should be taken as a proxy. Examination of the values provided shows budget values that differ greatly from year to year, calling this methodology into question.[30]

[28] *See* Exhibit EAS-8.
[29] *See* Sierra Club Discovery Request 4-4, attached as Exhibit EAS-12.
[30] *See* Exhibit EAS-12 (Sierra Club request 4-4, Exhibit 1)

ELECTRONICALLY FILED - 2020 November 12 8:57 AM - SCPSC - Docket # 2020-125-E - Page 29 of 39

Q: Are new capital investments in uneconomic coal plants—Wateree, Williams, and Cope—just and reasonable?

A: No. In my opinion, new capital investments in uneconomic plants cannot be considered either just or reasonable. Asking ratepayers to throw good money after bad is not just, and continuing to invest in plants when there is no expectation that they will become economic is not reasonable. DESC has other resource options that will provide reliable service at less cost to its customers. The Commission should deny or cap new expenses until DESC can demonstrate that the continued investment is just and reasonable, and until DESC has performed a retirement analysis of these plants.

5. DESC NEEDS TO CONDUCT A RETIREMENT ANALYSIS BEFORE INVESTING MORE MONEY INTO ITS COAL PLANTS

Q: Are resource planning issues and coal unit retirement dates relevant to this rate case proceeding?

A: Yes. Resource planning issues and coal unit retirement dates are essential considerations in this rate case. DESC proposes to continue to recover coal unit capital expenses, which are only justified as long as they are necessary to keep the coal units operating through just and reasonable retirement dates. The Company is also proposing to recover annual coal unit operating expenses, which—again—are only justified as long as it is just and reasonable for DESC to keep its coal units online rather than retiring them. As discussed in more detail below, DESC has failed to perform an economic evaluation of its coal units and has not demonstrated that it is just and reasonable to burden ratepayers with the cost of continued investment in and operation of these generators.

ELECTRONICALLY FILED - 2020 November 12 8:57 AM - SCPSC - Docket # 2020-125-E - Page 30 of 39

Q: What are the important characteristics of a coal unit retirement analysis?

A: Power plant retirement analysis includes all costs and benefits associated with near- and mid-term retirement dates. In this type of analysis, continued operation of coal is compared to an optimized replacement resource portfolio including both supply and demand resources, rather than a single resource. The costs of replacement resources in that portfolio should be informed by an RFP so that real-world conditions and market prices are part of the analysis. In the replacement scenario, coal retirement and reclamation costs should be considered only to the extent that these same costs are included at a later date in the delayed retirement scenario. Job and community impacts of retirement should be considered only to the extent that employment and other local impacts are considered evenhandedly across both the continued operations and replacement scenarios: both job losses and job gains must be considered.

Q: Did DESC prepare a retirement analysis in conducting its 2020 IRP or in this rate case?

A: No. DESC did not conduct any retirement analysis in its 2020 IRP or in this rate case for the Williams, Wateree or Cope Units, although the Company claims—without analysis—that continuing to run a unit is typically more economic than retiring it.[31]

DESC's recent "retire or replace" analysis of Wateree 1 and 2 is a partial attempt at a retirement analysis.[32] DESC has included a pre-determined set of replacement resources limited to gas CCs and ICTs. DESC neither compared continued operation to an optimized replacement portfolio nor developed that portfolio's costs using an RFP to gain

[31] Rebuttal testimony of Eric Bell, Docket No. 2019-226-E, at 22, available at https://dms.psc.sc.gov/Attachments/Matter/0798ce1c-6e76-4846-870c-67e5f2f1baff

[32] See Exhibit EAS-6.

ELECTRONICALLY FILED - 2020 November 12 8:57 AM - SCPSC - Docket # 2020-125-E - Page 31 of 39

insight into current market conditions. Nonetheless, in this analysis, the scenarios that maintain Wateree in operation the longest are the most expensive.

Q: Outside of an IRP, when should a utility conduct retirement analyses?

A: Utilities should conduct retirement analysis before any major capital investments.

Q: What are the implications for this rate case of DESC's lack of retirement analyses?

A: DESC assumes that it is cost-effective for the Company's ratepayers to continue to pay to operate the coal units through the 2040s for Williams and Wateree and 2070s for Cope without actually performing any type of economic assessment. DESC has provided no justification for continuing to invest in its coal units, and thus no basis for asking its customers to pay for capital expenditures associated with continued operation.

Q: Should DESC conduct a retirement analysis of its coal units?

A: Yes, DESC should conduct a retirement analysis of its coal units instead of assuming that continuing to run these units is in its customers' best interest. As I have discussed above in this testimony:

- Wateree, Williams, and Cope have been uneconomic over the last eight years;
- [redacted]
- These plants' capacity factors have fallen considerably over the past eight years and DESC offers no rationale for assuming they will not continue to fall; and
- Energy market conditions have a poor outlook for coal: competitive renewables, less growth for electric demand, and a premium placed on flexibility that coal cannot provide.

ELECTRONICALLY FILED - 2020 November 12 8:57 AM - SCPSC - Docket # 2020-125-E - Page 32 of 39

Q: When should DESC conduct a retirement analysis of its coal units?

A: DESC should conduct a retirement analysis of its coal units as soon as possible: before committing customers to payment for their past capital expenses (which are needed to keep these uneconomic and unreliable plants running in future years) and before committing customers to any new capital expenses (for example, ELG investments).

Q: Have recent electric market trends affected the economics of coal units in the United States?

A: Yes. Recent electric market trends have affected the economics of U.S. coal units. These trends include:

- Falling investment costs for wind, solar and batteries;
- Flattening (and, with the COVID pandemic, falling) growth projections for customer electric use;
- A trend towards adoption of inexpensive flexible resources (renewables, batteries, demand response, and virtual power plants) that work best when combined with other flexible resources, and not with legacy resources like coal that cannot ramp up and down quickly.

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

A: Yes. These market changes all pose greater risk to coal plant dispatch and coincide with dramatic reductions in coal plants' capacity factors.

Q: Are there any other important risks to future coal plant operations?

ELECTRONICALLY FILED - 2020 November 12 8:57 AM - SCPSC - Docket # 2020-125-E - Page 33 of 39

A: Yes. Under a Biden administration there is a very high likelihood that federal environmental regulations delayed, weakened or removed under the previous administration will be replaced and strengthened. In the current (and expected future) market environment that favors renewables and demand-side measures, these environmental regulations need not increase costs to customers, but they do not bode well for the continued operation and rate-basing of legacy coal plants.

Q: Have other utilities performed retirement analysis as part of their integrated assessment planning or in response to market conditions?

A: Yes, citing only a few cases that have come to my attention in the past (this list is in no way meant to be comprehensive), retirement analysis is a common and well-accepted practice in IRP planning (see Table 5, below). For example, NIPSCO determined in its 2018 IRP, using an all-source request for proposals and optimization modeling, that the least-cost plan for customers included immediate retirement of some coal units and retirement of all coal plants by 2028.[33]

[33] Northern Indiana Public Service Company LLC. October 31, 2018. *Integrated Resource Plan.* IURC Cause No. 45160. Available at: https://www.nipsco.com/docs/librariesprovider11/rates-and-tariffs/irp/2018-nipsco-irp.pdf?sfvrsn=15

ELECTRONICALLY FILED - 2020 November 12 8:57 AM - SCPSC - Docket # 2020-125-E - Page 34 of 39

Table 5. Examples of other recent IRPs with retirement analysis

Utility	Location	Proceeding
NIPSCO	IN	IURC Cause No. 45160
Idaho Power	ID, OR	ID: Case No. IPC-E-19-19 OR: Docket No. LC 74
PacifiCorp	CA, OR, UT, WA, WY, ID	WA: Filing No. UE-180259
PREPA	PR	CEPR-AP-2018-0001
Xcel Energy (only one alternative retirement year is tested for each unit)	MI, MN, ND, SD, WI	Northern States Power Company MN Docket No. E002/RP-19-368

Sources: (1) Northern Indiana Public Service Company LLC. October 31, 2018. Integrated Resource Plan. IURC Cause No. 45160. Available at: https://www.nipsco.com/docs/librariesprovider11/rates-and-tariffs/irp/2018-nipsco-irp.pdf?sfvrsn=15;
(2) Idaho Power. 2019. Integrated Resource Plan. ID Case No. IPC-E-19-19, OR Docket No. LC 74. Available at: https://docs.idahopower.com/pdfs/AboutUs/PlanningForFuture/irp/2019/2019_IRP.pdf;
(3) PacifiCorp. 2019. 2019 Integrated Resource Plan. WA Filing No. UE-180259. Available at: https://www.pacificorp.com/content/dam/pcorp/documents/en/pacificorp/energy/integrated-resource-plan/2019_IRP_Volume_I.pdf;
(4) Siemens Industry. 2019. Puerto Rico Integrated Resource Plan 2018-2019. Prepared for Puerto Rico Electric Power Authority. CEPR-AP-2018-0001. Available at: https://aeepr.com/es-pr/QuienesSomos/Ley57/Plan%20Integrado%20de%20Recursos/IRP2019%20-%20Ex%201.00%20-%20Main%20Report%20%20REV2%2006072019.pdf; and
(5) Xcel Energy. 2019. Upper Midwest Integrated Resource Plan 2020-2034. Northern States Power Company MN Docket No. E002/RP-19-368. Available at: https://www.xcelenergy.com/staticfiles/xe-responsive/Company/Rates%20&%20Regulations/The-Resource-Plan-No-Appendices.pdf

The Indiana Utility Regulatory Commission's (IURC) 2018 Director's Report—reviewing all IRPs submitted in 2018—noted that "Across all of NIPSCO's retirement and replacement analysis, all bundles were available for selection on equal footing with the various supply-side options that were evaluated."[34] NIPSCO's retirement analysis included its own scorecard process, separate from that of its replacement analysis, with factors that included cost, risk, and employee impacts. The IURC Director referred to

[34] Borum, B. 2019. *Draft Director's Report for the 2018 Integrated Resource Plan*. On behalf of the Indiana Utility Regulatory Commission. Available at: https://www.in.gov/iurc/files/NIPSCO%27s%202018%20Draft%20Director%27s%20Report%209-23-19.pdf, p.18

ELECTRONICALLY FILED - 2020 November 12 8:57 AM - SCPSC - Docket # 2020-125-E - Page 35 of 39

NIPSCO's combined RFP and retirement/replacement IRP modeling as "a solid foundation for future IRPs and RFPs."[35]

Q: Have any other utility commissions commented on the need to perform a thorough retirement analysis to correctly identify a least-cost resource portfolio?

A: Yes, the North Carolina Utilities Commission, in reference to Duke Energy Carolinas', LLC, and Duke Energy Progress' 2018 IRPs, chided Duke for failing to consider early retirement of its coal plants:

> In their 2018 IRPs DEC and DEP contemplate that their remaining coal-fired generating plants will continue in use until they have been fully depreciated. However, today's capacity factors for these plants are substantially lower than the historical capacity factors of the plants. It does not appear from the information in the IRPs that DEC and DEP have fully considered early retirement of any of these coal plants by replacing their contributions with other alternative generation resources or with energy efficiency (EE) and demand-side management (DSM) resources. As a result, the Commission determines that it should require Duke to provide an analysis showing whether continuing to operate each of its existing coal-fired units is the least cost alternative compared to other supply-side and demand-side resource options, or fulfills some other purpose that cannot be achieved in a different manner.
>
> To address the issue of economic retirement of aging coal plants, in the 2020 IRPs DEC and DEP shall include an analysis that removes any assumption that their coal-fired generating units will remain in the resource portfolio until they are fully depreciated. Instead, the utilities shall model the continued operation of these plants under least cost principles, including by way of competition with alternative new resources. In this exercise the full costs of disposal of coal combustion wastes shall be included in making any comparison with alternative

[35] *See id.* at p.25

ELECTRONICALLY FILED - 2020 November 12 8:57 AM - SCPSC - Docket # 2020-125-E - Page 36 of 39

resources. If such analysis concludes that continued operation of the utilities' existing coal-fired units until they are fully depreciated is the least cost resource alternative, then the utilities 2020 IRPs shall separately model an alternative scenario premised on advanced retirement of one or more of such units and shall include in that alternative scenario an analysis of the difference in cost from the base case and preferred case scenarios.[36]

Q: Why does least-cost resource planning—including retirement analysis—require an accurate depiction of the entire electric system?

A: Optimization modeling to identify a least-cost resource portfolio through retirements and additions depends on accurate modeling of the entire DESC system. Retirement analysis includes consideration of the system's peak and annual needs, and lower-cost resources that can better meet these needs. Retirement analysis must begin with (among other considerations): accurate credit assigned to intermittent resources on peak and well-supported forecasts of future peak load that include seasonal timing, energy efficiency potential, and the potential for load flexibility resources, such as batteries, demand response, and virtual power plants to reliably lower peak. Incorrectly estimating or forecasting any of the characteristics of the DESC system can result in IRP modeling that incorrectly awards advantages to coal and other legacy generating resources, and a preferred resource plan that is not least cost for customers.

Q: Is it important that DESC perform retirement analysis prior to investing more money in the Wateree, Williams, and Cope plants?

A: Yes. It is critical that DESC perform retirement analysis prior to investing more money in its coal plants. Only retirement analysis can determine whether or not these are good (just

[36] State of North Carolina Utilities Commission. 2019. Order Accepting Integrated Resource Plans and REPS Compliance Plans, Scheduling Oral Argument, and Requiring Additional Analyses. Docket No. E-100, Sub 157. Available at: https://starw1.ncuc.net/NCUC/ViewFile.aspx?Id=143d85de-b1e7-4622-b612-5a8c77e909d4 p.90

ELECTRONICALLY FILED - 2020 November 12 8:57 AM - SCPSC - Docket # 2020-125-E - Page 37 of 39

and reasonable) investments. To spend more money on these plants without conducting this analysis seems reckless. Customers should not be required to pay to keep uneconomic plants running when there are better, more affordable, and more reliable options.

RECOMMENDATIONS FOR THE COMMISSION

Q: Please summarize your recommendations for the Commission.

A: I recommend that the Commission disallow the $411 million in past spending on capital projects incurred and requested in this rate case proceeding for the Wateree, Williams, and Cope coal plants, totaling $246 million for non-environmental expenditures and $165 million for environmental expenditures. These expenses were incurred to keep these plants running in future years, [redacted] Investments made in plants that have been uneconomic [redacted] cannot be just and reasonable.

I also recommend that the Commission place a cap on future capital expenditures intended to prolong the lives of the Williams, Wateree and Cope coal units as generating assets, at least until DESC conducts an analysis showing whether continuing to operate each of its existing coal-fired units is the least-cost alternative compared to other supply-side and demand-side resource options. The Commission should require DESC to seek approval of any expenditure that exceeds that cap before that expenditure can be recovered from ratepayers. The Georgia Public Service Commission recently applied

ELECTRONICALLY FILED - 2020 November 12 8:57 AM - SCPSC - Docket # 2020-125-E - Page 38 of 39

such a cap to capital spending at the Georgia Power's Bowen plant in the recent 2019 IRP proceeding.[37]

Q: Does this conclude your testimony?

A: Yes.

[37] In Re: Georgia Power Company's 2019 Integrated Resource Plan, Docket No. 42310, Georgia Public Service Commission, Order Adopting Stipulation as Amended at 26 (July 29, 2019), available at https://psc.ga.gov/search/facts-document/?documentId=177908.

ELECTRONICALLY FILED - 2020 November 12 8:57 AM - SCPSC - Docket # 2020-125-E - Page 39 of 39