# INTEGRATED RESOURCE PLAN
# 2022 UPDATE

Dominion Energy South Carolina, Inc.

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## I. INTRODUCTION

Dominion Energy South Carolina, Inc. ("DESC" or the "Company") operates an electric utility system that serves more than 771,000 customers in South Carolina. Every three years, DESC files an Integrated Resource Plan ("IRP") with the Public Service Commission of South Carolina (the "Commission") to allow public review of the Company's plans for meeting customers' demands most effectively over a long-term planning horizon. These IRPs provide alternative plans for balancing costs to customers, environmental risks, carbon emissions, and generation diversity as DESC fulfills its commitment to provide customers with energy services that are safe, reliable, affordable and sustainable. DESC updates these IRPs annually. This update (the "2022 IRP Update" or the "Update") is the second annual update to DESC's Modified 2020 IRP.

As part of its goal of creating a cleaner energy future for its customers, Dominion Energy, Inc. is working to end reliance on coal as a fuel for generation across all its companies if that can be done in a safe, reliable and affordable manner. It is also committed to achieving net-zero carbon ("$CO_2$") emissions by 2050.

DESC is proud of its work to date in reducing carbon emissions by retiring coal plants and adding solar and high-efficiency natural-gas fired generation while remaining focused on reliability and affordability. Between 2005 and 2022, DESC has substantially reduced its $CO_2$ emissions while fully offsetting the carbon impacts of a growing service territory during that 17-year period. Its commitments to a cleaner energy future have played an important role in DESC's evaluation of the plans presented in this 2022 IRP Update which evaluates plans deploying a wide range of technologies to meet customers' needs, including solar, battery, offshore wind ("OSW"), high-efficiency gas-fired generation and small modular nuclear reactors ("SMRs").

### A. The Role of an IRP

DESC's IRPs and IRP updates inform regulators and stakeholders about DESC's current resource planning and serve to foster regulatory consensus around the generation procurement or retirement decisions that must be made in the short-term. IRPs and IRP updates, however, are based on forecasts of load growth, fuel prices, environmental constraints and technology costs which are all changing from year to year. They are, therefore, snapshots in time based on what is known and foreseeable when they are prepared and do not reflect fixed decisions to pursue any specific action or project. Additionally, this 2022 IRP Update is being filed amidst significant disruptions in global commodity markets and supply chains across the economy, as well as significant federal tax policy changes which adds to the likelihood of future changes.

### B. The Current IRP and this Update

The IRP statute[1] requires utilities to file a full IRP every third year with annual updates between those filings. The Company's current IRP is the Modified 2020 IRP which the Commission accepted as meeting statutory requirements on June 18, 2021.[2] On July 28, 2022, the Commission accepted the Company's 2021 IRP Update.[3]

This Update is the last of two annual updates to the Modified 2020 IRP and will be operative for approximately four and a half months. DESC will file its 2023 IRP by January 30, 2023, which is a month earlier than the statutory deadline.[4]

***Appendix A*** cross references the sections of this 2022 IRP Update to the requirements of the IRP statute and applicable Commission mandates.

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[1] S.C. Code Ann. § 58-37-40.
[2] See Orders 2020-832 and 2021-429.

[3] See Commission Directive of July 28, 2022, entered in Docket No. 2021-9-E.
[4].DESC agreed to advance the filing of the 2023 IRP to support the Commission's schedule of regulatory proceedings for that year. See Order No. 2022-594.

### C. Resource Optimization

This 2022 IRP Update reflects the first use of resource optimization modeling to construct potential build plans ("Build Plans") for new generation assets. In doing so, DESC used Energy Exemplar's PLEXOS modeling software, which selects the optimum type and timing of generation resources to add to the electric system under alternative market scenarios ("Market Scenarios")[5] unless specific constraints are imposed. In prior IRPs, the Company constructed several resource portfolios to represent alternative approaches to meeting future resource needs and modeled the costs and other attributes of those resource portfolios across multiple future Market Scenarios. Under resource optimization, the model itself selects resources to most efficiently meet a given Market Scenario or set of constraints.

### D. The Updated Preferred Plan

In the Modified 2020 IRP, the Company identified Resource Plan 8 as its preferred resource plan which assumed that the Williams Station coal unit ("Williams") could be retired in 2028. Resource Plan 8 predated DESC's use of resource optimization modeling and the 2022 Coal Plants Retirement Study Report (the "Coal Plants Retirement Study" or "Study") which found that 2030 was the earliest feasible retirement date for Williams. The Commission mandated the Company to undertake both resource optimization and the Coal Plants Retirement Study.[6]

This Update includes a new Build Plan that updates Resource Plan 8 by mandating that Williams be retired in late 2030 and optimizing the resources selected to replace it. The new

[5] In one scenario, the Carbon Constrained Scenario, the PLEXOS model was not able to complete optimization based on the complexities of the scenario. The PLEXOS model did generate a linear solution which does not reflect the discrete sizes in which specific generation resources can be deployed but was unable to complete the task of converting the linear solution into an integer solution which reflects those size increments. In response, DESC used the linear solutions to create a reasonable Build Plan manually based on the linear solution. Since the Build Plan was based in part of the results of the optimization function, DESC still refers to this as an optimized Build Plan.

[6] Order No. 2020-832, Docket No. 2019-226-E (December 23, 2020).

version of Resource Plan 8 is the Williams 2030 Reference Build Plan. PLEXOS optimized this Build Plan using the new set of generation resources that are available for selection in this 2022 IRP Update, including multiple additional solar and battery options, and also used updated costs for those resources and other inputs. The resulting Williams 2030 Reference Build Plan is the Company's preferred plan. For comparative purposes, DESC also modeled Resource Plan 8's specific schedule of resource additions under current inputs and assumptions after modifying it to reflect Williams being retired in 2030. That build plan is RP8.

**E. The 2023 IRP**

DESC will file its 2023 IRP by January 30, 2023, which will further refine these results and update the underlying modeling presented here. Among other things, the 2023 IRP will reflect a new demand-side management ("DSM") potential study (the "2023 DSM Potential Study") which will include potential new Demand Response ("DR") programs based on the roll out of advance metering infrastructure ("AMI") and a new reserve margin policy based on a probabilistic loss of load methodology.

Because of the short time between the filing of this 2022 IRP Update and the 2023 IRP, it may not be possible for DESC to incorporate comments that the South Carolina Office of Regulatory Staff ("ORS") and stakeholders (the "Stakeholders") may file concerning this Update in the 2023 IRP. Work will be far along on the 2023 IRP before ORS and Stakeholder reviews of this Update are completed and Commission acceptance of it is granted. However, DESC continues to meet with ORS and Stakeholders to receive comments on the methodology and inputs used in this Update and will continue to review and consider comments and suggestions carefully. Furthermore, the 2023 IRP proceedings will provide Stakeholders the opportunity to raise any matters that cannot be properly considered until that time.

## II. EXECUTIVE SUMMARY AND KEY FINDINGS

### A. The Twenty-Four Cases

In preparing this 2022 IRP Update, DESC modeled ***twenty-four cases*** by evaluating twelve Build Plans across nine different Market Scenarios. These twenty-four cases modeled variations in load growth forecasts, fossil fuel costs, potential carbon costs, aggressive investment in non-emitting resources, and cases delaying or accelerating the retirement of Williams. The six most likely and representative Build Plans (the "Core Build Plans") were modeled across the three most likely Market Scenarios (the "Core Market Scenario") resulting in ***eighteen Core Cases***. The other six non-Core Build Plans served as sensitivity cases (the "Sensitivity Cases") to assess how Build Plans might vary under other sets of market conditions and to satisfy specific statutory and regulatory requirements.

DESC designed two of the Core Build Plans (the Zero Carbon Cost Build Plan and the Carbon Constrained Build Plan) specifically to assess the costs and benefits of carbon reduction. The Carbon Constrained Build Plan targeted an 80% reduction in carbon emissions in stages by 2050 with the understanding that DESC would offset remaining emissions by other means. As a point of comparison, the Zero Carbon Cost Build Plan assumed that no cost would be imposed on carbon emissions and that supportive policies would make fossil fuel abundant and at low cost.[7]

**Table 1** below presents the twenty-four cases, with the eighteen Core Cases in blue and the Sensitivity Cases in orange.

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[7] This case was chosen to test the performance of Build Plans against such a scenario and is not an endorsement of such results as a policy matter.

**Table 1: The Twenty-Four Cases**[8]

| Case | Fuel | $CO_2$ Price | Load Forecast | DSM | Williams Retirement |
|---|---|---|---|---|---|
| **Reference Market Scenario** | | | | | |
| **RP8 Build Plan** | Base | Med | Base | High | 2030 |
| **Williams 2047 Reference Build Plan** | Base | Med | Base | High | 2047 |
| **Williams 2030 Reference Build Plan** | Base | Med | Base | High | 2030 |
| **High Fossil Fuel Prices Build Plan** | Base | Med | Base | High | 2030 |
| **Zero Carbon Cost Build Plan** | Base | Med | Base | High | 2047 |
| **Carbon Constrained Build Plan** | Base | Med | Base | High | 2030 |
| **High Fossil Fuel Prices Market Scenario** | | | | | |
| **RP8 Build Plan** | High | Med | Base | High | 2030 |
| **Williams 2047 Reference Build Plan** | High | Med | Base | High | 2047 |
| **Williams 2030 Reference Build Plan** | High | Med | Base | High | 2030 |
| **High Fossil Fuel Prices Build Plan** | High | Med | Base | High | 2030 |
| **Zero Carbon Cost Build Plan** | High | Med | Base | High | 2047 |
| **Carbon Constrained Build Plan** | High | Med | Base | High | 2030 |
| **Zero Carbon Cost Market Scenario** | | | | | |
| **RP8 Build Plan** | Base | Zero | Base | High | 2030 |
| **Williams 2047 Reference Build Plan** | Base | Zero | Base | High | 2047 |
| **Williams 2030 Reference Build Plan** | Base | Zero | Base | High | 2030 |
| **High Fossil Fuel Prices Build Plan** | Base | Zero | Base | High | 2030 |
| **Zero Carbon Cost Build Plan** | Base | Zero | Base | High | 2047 |
| **Carbon Constrained Build Plan** | Base | Zero | Base | High | 2030 |
| **Sensitivity Cases** | | | | | |
| **High $CO_2$ Price Build Plan** | Base | High | Base | High | 2030 |
| **Low Regulation Build Plan** | Low | Zero | Base | High | 2030 |
| **Stagflation Build Plan** | High | Zero | Low | High | 2030 |
| **Aggressive Regulation Build Plan** | High | High | High | High | 2030 |
| **Medium DSM Build Plan** | Base | Zero | Base | Medium | 2030 |
| **Low DSM Build Plan** | Base | Zero | Base | Low | 2030 |

## B. The Core Analysis

Analysis of the eighteen Core Cases (the "Core Analysis") showed that the Williams 2030 Reference Build Plan, which is the recalibrated and optimized preferred resource plan from the Modified 2020 IRP, remains the preferred plan under this Update. Specifically, the Core Analysis showed:

[8] PLEXOS optimized the RP8 Build Plan, the Williams 2047 Reference Build Plan, the Williams 2030 Reference Build Plan and the Carbon Constrained Build Plans using Fuel Costs, $CO_2$ Prices, Load Forecasts and DSM results contained in the Reference Market Scenario. PLEXOS optimized the other eight Build Plans using the Market Scenario whose name corresponds with that Build Plan, *i.e.,* the High Fossil Fuel Prices Build Plan is optimized based on the High Fossil Fuel Prices Market Scenario, the Zero Carbon Cost Build Plan is optimized based on the Zero Carbon Cost Market Scenario, etc.

A. Under reference conditions and compared to optimizing the Williams retirement date in 2047, retiring Williams early under the Williams 2030 Reference Build Plan would increase costs by only 0.5%,[9] while achieving a reduction of between 15 and 31 million tons (5.5% to 11.6%) in cumulative carbon emissions through 2051.

B. Across the eighteen Core Cases, the Williams 2047 Reference Build Plan had the lowest or the second lowest cost but delayed Williams' retirement by 17 years.[10]

C. Implementing the RP8 Build Plan would cost between 6.0% and 6.9% more than implementing the Williams 2030 Reference Build Plan and between 6.8% and 8.2% more than the Williams 2047 Reference Build Plan. This is because the RP8 Build Plan delays the Williams retirement by two years and includes update costs and options for replacement capacity.

D. The cost of implementing the Carbon Constrained Build Plan was the highest cost of all six Build Plans under the Core Analysis. Its cost was 18.4% to 22.9% higher than

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[9] Net present value ("NPV") over 30 years.

[10] The PLEXOS model uses a computationally intensive process for formulating an optimized resource plan. Each year that the system requires a resource addition is a decision point that creates potential paths forward that branch off like the branches of a tree. If there are eighteen potential resources that can be selected, each decision point will generate eighteen individual branches. Each of those eighteen branches will generate eighteen additional branches when the next decision point is reached, and so on until the end of the planning horizon or until that path becomes so uneconomical that the software abandons it.

Optimizing retirements are particularly complex since they posit a decision point each year, specifically the decision to retire the resource or not. Modeling the decision to retire in each year requires modeling the cost of each of the replacement options as a separate branch of the decision tree. This level of complexity can result in optimized Build Plans that are subject to variation and anomalous results, such as Build Plans that score marginally lower than other Build Plans in the Market Scenario for which they were optimized. Ideally, a Build Plan should always be the lowest cost in the Market Scenario for which it is optimized.

For that reason, when optimizing retirement dates, DESC asked PLEXOS first to determine the optimized retirement date for the resource, then re-ran the program to determine the optimized Build Plan to support retirement at that date. This simplified the calculation and improved the quality of the results. Nonetheless, in some limited cases, the Build Plan that was optimized for a particular Market Scenario had a slightly higher NPV than a Build Plan optimized for a different Market Scenario. In such cases, the difference was small and the validity of the overall analysis was not called into question.

implementing the Williams 2030 Reference Build Plan. But the Carbon Constrained Build Plan produces an 84.9% reduction in $CO_2$ emissions from 2005 levels which is the greatest reduction of all the Core Build Plans. It also achieved the lowest fuel cost.

E. The cost difference between the Zero Carbon Cost Build Plan, which assumes no carbon cost on generation,[11] and the Williams 2030 Reference Build Plan is 1% or less, indicating relatively small additional cost to customers from pursuing the Williams 2030 Reference Build Plan if carbon taxes do not materialize.

### C. Technologies Considered

Within the limitations of the PLEXOS modeling software,[12] eighteen generation resources were considered including utility and third-party solar resources, utility and third-party solar paired with battery resources, two configurations of stand-alone grid battery capacity, five configurations of gas-fired generation, OSW and SMRs.

### D. Technologies Selected

Collectively, the Core Build Plans are heavily weighted toward non-emitting capacity (solar, solar plus battery, battery capacity, OSW and SMRs) with between 66% and 87% of the capacity added during the 30-year planning horizon being non-emitting resources. The highly constrained Carbon Constrained Build Plan had the second highest percentage of non-emitting resources at 86% and was the only Build Plan in which OSW and SMRs were selected.

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[11] This is an assumption for sensitivity purposes and does not imply that DESC believes that it is likely that carbon emissions will be cost free over the 30-year planning horizon.

[12] In certain cases, to allow the model to resolve its calculations, DESC limited the resources that could be selected by removing some that were clearly not cost effective within that Market Scenario. For example, at today's cost, SMRs were clearly not cost effective in Build Plans other that the Carbon Constrained Build Plan.

### E. Battery Storage

Battery storage, both paired with solar and stand-alone, emerged as a major contributor in each of the Core Build Plans with battery capacity representing between 15% and 26% of the resources added over the planning horizon.

### F. Shared Resources

The modeling of these cases does not reflect the potential for new generation resources being shared with other regional utilities in response to future statewide energy needs. Relevant options will be evaluated as these needs are determined.

### G. The Six Sensitivity Cases

In addition to the Core Analysis, DESC modeled six additional Market Scenarios as Sensitivity Cases that fulfill requirements of the IRP statute and Commission mandates.[13] The six Sensitivity Cases assume varying levels of $CO_2$ costs, environmental regulation, economic and load growth, and DSM effectiveness and confirm the representative nature of the Core Cases.

### H. Reliability

The reliability metric scores each Build Plan based on its contribution to the system's black start and fast start capability, the geographical diversity of generation and the proximity of generation to load centers. The Aggressive Environmental Regulation Build Plan scored highest of all twelve build plans, followed by the Low DSM Build Plan. This result was due principally to the relatively high amount of combustion turbine ("CT") capacity added to the system under those plans. The Carbon Constrained Build Plan scored lowest reflecting the relatively small amount of CT natural gas fired capacity it utilizes. Solar and solar plus battery contributed positively to

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[13] S.C. Code Ann. § 58-37-40.

reliability scores but the volume of such capacity was not sufficient to offset the larger positive effects of the CT capacity added under other Build Plans.

### I. Generation Diversity

All Build Plans envision at least 43% of 2050 generation being solar or solar plus battery-related. Because the Build Plans strongly favor solar and solar plus battery generation, generation diversity is inversely proportional to the amount of these renewable resources added.

### J. Rate Impacts

Rate impacts are measured by the compound annual growth rate ("CAGR") for a typical residential customers' bill (1,000 kWh/month) over the 30-year planning horizon. For the six Core Build Plans, the CAGRs are between 1.69% and 2.34% under the Reference Market Scenario. Under all Market Scenarios considered in the Core Analysis, the Zero Carbon Cost Build Plan was least expensive for customers. The Carbon Constrained Build Plan was most expensive, except under the High Fuel Market Scenario in which case RP8 was the most expensive and the Carbon Constrained Build Plan was second. Under the Reference Market Scenario, at the end of the 30-year planning horizon, the generation component of rates would have increased by 29% under the Williams 2030 Reference Build Plan compared to 37% under the Carbon Constrained Case, and 26% under the Williams 2047 Reference Build Plan.

### K. Safety and Operations

The safety and operations section of this Update indicates that in 2021 DESC continued to operate its system in a safe and reliable manner and continues to invest in generation, transmission and distribution projects and improvements.

## III. KEY DEVELOPMENTS SINCE THE 2021 UPDATE

### A. Implementation of the Resource Optimization Model

In compliance with Order No. 2020-832, and in consultation with Stakeholders, DESC has implemented Energy Exemplar's PLEXOS modeling software to perform resource optimization modeling. DESC limited its use of PLEXOS to certain components of the modeling done in preparing the 2021 IRP Update and used the PLEXOS resource optimization feature in preparing the Coal Plants Retirement Study. But this is the first time DESC has used PLEXOS's resource optimization capability in the IRP process.

In past IRPs, DESC created a pre-determined set of resource plans representing a range of different generation technologies to meet customers' future electricity needs. Using its PROSYM model, it modeled those predetermined resource plans under a range of possible future market conditions and calculated the cost to customers, carbon emissions, fuel mix and renewable energy generation of each plan under each set of market conditions. In this Update, DESC used the PLEXOS model to create optimized Build Plans that identify the lowest cost option for customers under specific Market Scenarios which DESC created in consultation with Stakeholders. Each Market Scenario defines a set of possible future conditions on the system and DESC created two variations on the Market Scenarios by imposing specific constraints ($CO_2$ targets or coal plant retirement dates) on them. Under resource optimization, Build Plans are not predetermined but are outputs of the modeling process.

### B. Stakeholder Process Update

Since 2020, DESC has used Charles River Associates ("CRA") to design and facilitate its IRP Stakeholder Advisory Group process. CRA has broad national experience in designing and facilitating these processes. The IRP Stakeholder Advisory Group[14] has met nine times since 2020. These Stakeholder interactions have provided meaningful information to inform the IRP process and allowed a collaborative exchange of information and perspectives.

In the Modified 2020 IRP docket, DESC reported to the Commission on the structure of the Stakeholder process and provided agendas, presentation materials, minutes and follow up response to questions and suggestions for Sessions I-VI. Since that time Sessions VII-VIIIA were held on March 24, 2022, June 8, 2022, and July 26, 2022.

- During Session VII, the Company and Stakeholders discussed, among other topics, preliminary findings of the Coal Plants Retirement Study, Stakeholder reliability data and information, and planning for the 2022 IRP Update.
- During Session VIII, the Company and Stakeholders discussed, among other topics, the development of the 2022 IRP Update.
- DESC convened Session VIII-A in response to Stakeholder feedback requesting additional consultation regarding how DESC could model DSM as a resource in future IRPs. The Company invited Ms. Anna Sommer, representing SACE and CCL, to present material on modeling DSM to the broader Stakeholder Advisory

[14] Stakeholder meetings are open to interested parties. The thirteen invited members of the IRP Stakeholder Advisory Group are:
- Office of Regulatory Staff
- SC Energy Office
- Coastal Conservation League
- SC Small Business Chamber of Commerce
- SC Office of Economic Opportunity
- SC Energy Users Committee
- SC Community Action Partnership
- Southern Alliance for Clean Energy
- Johnson Development Associates, Inc.
- South Carolina Solar Business Alliance
- Sierra Club
- AARP South Carolina
- Walmart, Inc.

Group. In addition, the Company presented market research conducted by its consultant on how DSM resources have been modelled by other utilities in the Southeast region.

Copies of the agendas, presentation materials, minutes and follow up response to questions and suggestions were provided to the Commission by filing in this docket dated September 12, 2022.

### C. DSM Updates

As required by Commission Order No. 2020-832, the Company is conducting the 2023 DSM Potential Study to inform the 2023 IRP. This study will include a comprehensive evaluation of the cost-effectiveness and achievability of DSM portfolios reaching annual demand reduction levels of 1%, 1.25%, 1.5%, 1.75% and 2.0%. DESC will include results of the 2023 DSM Potential Study as inputs to the 2023 IRP modeling.

In consultation with the stakeholders comprising the Energy Efficiency Advisory Group ("EEAG"), DESC selected ICF as its third-party consultant to conduct the Potential Study, and Opinion Dynamics Corporation ("ODC") to undertake the market assessment on which the Potential Study will be based. Between 2021 and September of 2022, DESC held five EEAG meetings to share progress reports on the 2023 DSM Potential Study and solicit input from EEAG members. The results of the 2023 DSM Potential Study are expected to be available later in 2022 to support modeling for the 2023 IRP.

### D. Peaking Generation Replacements

In 2021, DESC made a formal proposal to the Commission in Docket 2021-93-E to retire thirteen end-of-life and increasingly difficult to maintain natural gas-fired Combustion Turbine ("CT") units and a natural gas-fired steam unit and replace them with modern generation resources. Despite their age and conditions, these units have played an important role in maintaining grid reliability and providing DESC with the ability if needed to restart the grid after blackouts. In November 2021, the Company entered into a Partial Settlement Agreement in Docket 2021-93-E ("Partial Settlement") which the Commission approved in Order No. 2022-27.

***The Hardeeville, Bushy Park, Parr, and Coit Retirements and the Bushy Park and Parr Replacements***

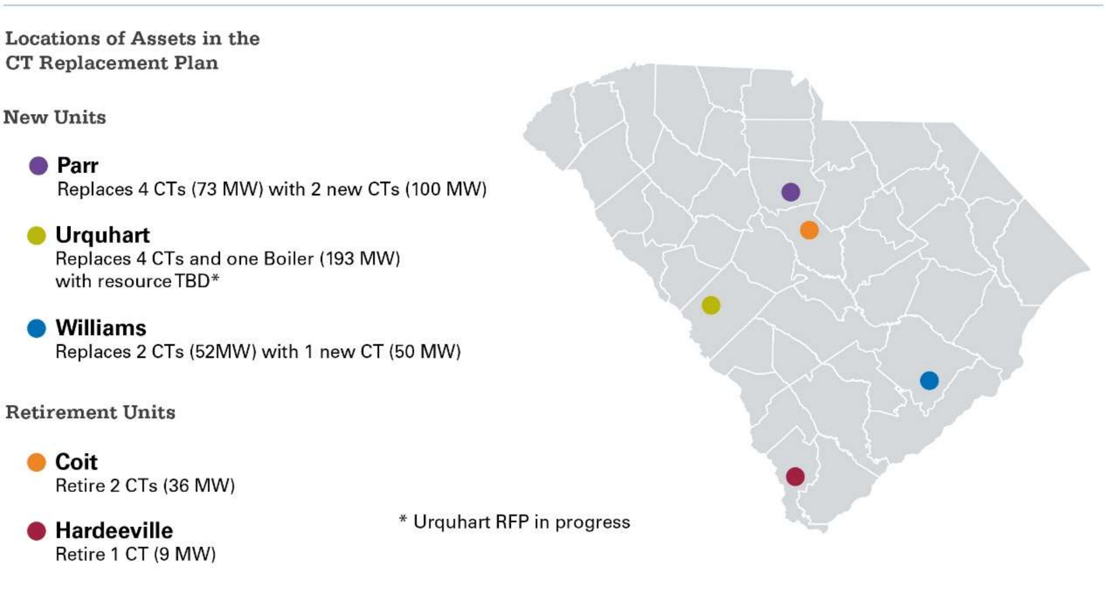
In accord with the Partial Settlement, the Commission found that DESC does not require additional authorization to proceed with replacing six CT units at two sites (Bushy Park/Williams and Parr) with three modern aeroderivative CT units. The Company has executed an equipment supply agreement with General Electric International ("GE") and an Engineering, Procurement, and Construction ("EPC") contract with Burns & McDonnell for construction of the Bushy Park and Parr replacement units. The Company anticipates the Bushy Park unit entering commercial service in the second quarter of 2024 and the Parr units entering service in the second quarter of 2025. Detailed engineering and major equipment manufacturing is underway for both sites. DESC retired the Hardeeville simple cycle CT unit effective March 31, 2022, and plans to retire the Bushy Park simple cycle CT units on September 30, 2022, to support demolition activities ahead of the construction of the replacement unit at that site and anticipates retiring the Parr units on March 31, 2023, to support their demolition and construction activities at those sites.

***Urquhart Replacements***

Under the Partial Settlement, DESC agreed to conduct its first-of-its-kind (for DESC) Request for Proposals ("RFP") to include all sources for the replacement of the capacity and blackstart capability from the four existing CTs and one natural gas-fired conventional steam unit at the Urquhart Station site ("Urquhart RFP"). CRA facilitated the process to obtain stakeholder input into the design of the Urquhart RFP through five stakeholder meeting sessions. On August 11, 2022, DESC issued the Urquhart RFP and final proposals are currently due December 21,

2022. CRA is serving as Independent Evaluator for the Urquhart RFP and will facilitate the selection of bid proposals on behalf of DESC. DESC's Power Generation group will participate as a bidder.

**Figure 1: Location of Proposed Combustion Turbine Retirements and Replacements**




### E. Combined Cycle Uprates

As described in more detail in 2021 IRP Update, DESC negotiated long-term services agreements for its combined cycle units that include hardware upgrades and advanced gas path ("AGP") upgrades that extend the maintenance intervals for turbine components, lower fuel consumption, and increase net generation output. Contractors are performing these upgrades as the units are taken off-line for scheduled maintenance.

Jasper Unit 1 was overhauled and upgraded in Spring 2022, Jasper Unit 2 in Fall 2021, and Jasper Unit 3 in Spring 2021. The upgrades have met their contractual guarantees and will extend the operating periods between future overhaul cycles and reduce fuel consumption. Collectively, they will also provide approximately 123 MW of net additional winter capacity and almost 83 MW of net additional summer capacity to the system. The additional capacity from these upgrades has been modeled in this 2022 IRP Update.

The Columbia Energy Center units are planned to be overhauled and upgraded in late 2022 and 2023. In addition, ultra-low sulfur fuel oil firing capability will be restored to one of the CTs that form part of the Columbia Energy Center units as part of the overhaul and enhancing resiliency when natural gas supplies are limited.

**Figure 2: A Jasper Station Turbine Awaiting Installation after Maintenance and Upgrade**


### F. Wateree Unit 2 Generator Stator Repairs and Return to Service

In May 2022, DESC successfully replaced the generator stator mid-section for Wateree Station coal unit ("Wateree") Unit 2 with no safety or environmental issues. The unit was available to serve customers during the 2022 summer peak period.

**Figure 3: The New Wateree Unit Two Generator Awaiting Recoupling to the Steam Turbine**


### G. Southeast Energy Exchange Market

On February 12, 2021, DESC and nearly 20 other utilities filed for FERC authorization to form a Southeast Energy Exchange Market ("SEEM") to provide an automated, intra-hour trading platform that will allow electric utilities in the Southeast to buy and sell sub-hourly energy and deliver it using unused transmission capacity with no charge except for losses. These utilities collectively own approximately 160,000 MW of generating capacity and serve about 640 Terawatt hours ("TWh") of energy across ten balancing authority areas and two time zones. Transactions in 15-minute intervals will be priced at the midpoint between the offer price and bid price creating value for customers on both sides of the transaction. The anticipated start date for live trading within SEEM is the fourth quarter of 2022.

### H. The Infrastructure Investment and Jobs Act ("IIJA")

On November 15, 2021, President Biden signed the Infrastructure Investment and Jobs Act ("IIJA"), which seeks to build a national network of electric vehicle ("EV") chargers; upgrade power infrastructure to deliver clean, reliable energy across the country; deploy cutting-edge energy technology to support a zero-carbon future; and make infrastructure resilient against the impacts of climate change, cyber-attacks, and extreme weather events. To support these goals, the IIJA provides multiple funding opportunities some of which will be directly available to utilities, and some will be based on joint utility/governmental projects, such as electrification of school buses and other governmental fleets.

The Company is assessing opportunities for accessing IIJA's funding, much of which is awarded on a competitive basis and in many cases will involve negotiating project agreements with state and local governments. DESC intends to actively identify specific projects benefiting its service area and participate in as many opportunities as it can that align with its operations and provide benefits to its customers. DESC's process of identifying and pursuing IIJA funding opportunities will continue over the programs' five-year time horizon.

**I. The Inflation Reduction Act of 2022**

In August 2022, Congress passed the Inflation Reduction Act ("IRA") which includes provisions that support the continued development of renewable and energy storage resources. The IRA includes $369 billion for climate and clean energy provisions including increased tax credits for new build solar, storage, nuclear, and wind capacity. The Company is actively reviewing the provisions of the IRA and will incorporate its provisions in future filings where appropriate.

**J. Offshore Wind**

On August 13, 2021, the United States Bureau of Ocean Energy Management ("BOEM") awarded leases to two OSW sites totaling 110,092 acres in the Carolina Long Bay lease area. The tracts are in waters offshore of Wilmington, North Carolina, and immediately adjacent to the South Carolina border. When developed, the two tracts are expected to provide over 1,300 MW of wind energy capacity. Globally, installed OSW represents some 35,300 MW of installed capacity the majority of which is in Northern Europe. OSW has the advantage of generally higher capacity factors than solar generation (approximately 40% vs. 20% for solar) and can be available at night and during widespread storm events when solar is not. US OSW costs are falling as the domestic supply chain is expanding with major projects underway in the Middle Atlantic states and New England.

BOEM has identified an extensive set of OSW call areas off the South Carolina coast between Little River and Charleston. BOEM is conducting detailed mapping and environmental baseline studies of these areas in consultation with the South Carolina Intergovernmental Renewable Energy Task Force, which is made up of representatives from federal, state, local, and tribal governments. Specific lease sites have not been identified and no timetable for leasing has been announced. For planning purposes, DESC has assumed OSW could be added as a resource beginning in December 2040.

### K. Small Modular Reactors

Nuclear generation provides a reliable, carbon-free complement to renewable energy generation. SMRs are technologically innovative designs that are emerging as an alternative to traditional, site-built nuclear power stations. Individual SMRs can be as small as 50 MW or as large as 300 MW. They will be fabricated in a controlled factory environment as modules, or for smaller sized units as largely completed reactors, and delivered to the installation site for integration with other plant systems including turbine generator sets, cooling water systems and substations.

SMRs will incorporate advanced passive safety features that ensure safe shut-down in all foreseeable circumstances without the need for operator action or a source of emergency power. In addition to minimizing safety risks, this design approach reduces the number and complexity of plant systems and the amount of equipment required in the plant.

SMRs are non-emitting resources that are designed to deliver capacity to customers reliably day in and day out and without the weather-related intermittency that limits most renewable resources. For that reason, SMRs will not require battery or gas-fired back up to support system reliability. They are also being designed to be dispatchable so that system operators can ramp their output up and down with response times comparable to natural gas-fired combined cycle facilities. The manufacturing of standardized reactors in a controlled factory setting is expected to reduce the cost and schedule risk of deploying SMRs and because of their size and enhanced safety profile, SMRs can be located on sites that would not support traditional nuclear units, including retired coal plant sites, brownfield industrial sites, remote industrial areas that are difficult to access, and sites closer to electric demand centers than was possible with prior technology. The small size of individual SMRs allows them to be scalable in relatively small increments.

On July 28, 2022, the United States Nuclear Regulatory Commission ("NRC") announced it was instructing staff to issue the final rule granting the first US certification for an SMR design, the NuScale SMR design. Some eighteen other companies are working on SMRs and other designs are expected to be approved over the next several years. The first NuScale unit is expected to go on-line at the Department of Energy's Idaho National Laboratory in 2029.

The Company anticipates SMRs could be a feasible supply-side resource as soon as the 2030s. The Company has included SMRs as a supply-side option starting in 2040 and has included two pairs of SMRs in the Carbon Constrained Build Plan. Some light-water SMR designs, like the NuScale reactor, utilize current nuclear fuel technologies with an available supply chain and their commercial availability may be even sooner.

The Company will monitor the development of this technology carefully. It expects the costs and lead-times for SMRs may evolve rapidly as manufacturing begins.

### L. Coal Plants Retirement Study

On May 16, 2022, DESC submitted the Coal Plants Retirement Study in Docket No. 2021-192-E to advise the Commission and Stakeholders on an appropriate procedural schedule to retire Williams and Wateree and identify any relevant statutory and regulatory deadlines, especially those related to environmental compliance at those units. Stakeholders filed comments on June 27, 2022, and DESC filed responsive comments on July 18, 2022.

#### 1. The Initial Transmission Impact Analysis

To support the study, DESC's Electric Transmission Planning Department performed a Transmission Impact Analysis ("TIA") to identify and estimate costs and schedules for the transmission system upgrades required to maintain grid reliability after the retirements. As a starting point for the analysis, this initial 2021 TIA assumed that DESC retired both plants on or before 2028. In January of 2022, DESC completed the TIA and filed it with the Commission.

To support the analysis, and in consultation with Stakeholders, DESC identified five representative replacement options to be evaluated in the TIA. Under each option, the TIA found that DESC will need to construct significant transmission system upgrades to maintain system reliability and that the most complex and expensive transmission upgrades are those required to support retiring Williams. Due to geography and the location of transmission and other generation resources, the upgrades to support the retirement of Wateree are less extensive. Nevertheless, DESC estimates at this time that retiring Wateree will require an estimated 344 MW of replacement capacity to maintain system reliability.

The five retirement cases guiding the 2021 TIA Analysis were:

- Case 1:
  - Retire Wateree in 2025
  - Add a 200 MW battery Energy Storage System ("ESS") and 200 MW PV solar generation at Wateree
  - Contract for 200 MW off-system purchased power beginning late in 2025

- Retire Williams in 2028
  - Build a 534 MW 1X1 CC at Jasper
  - Add a 200MW ESS and 200 MW PV solar generation at DESC's former Canadys Station
- Case 2:
  - Retire Wateree and Williams in 2028
  - Build a 534 MW 1X1 CC at Jasper
  - Build 523 MW 2X0 pair of frame CTs at Jasper
- Case 3:
  - Retire Wateree and Williams in 2028
  - Build a 534 MW 1X1 CC at DESC's former Canadys Station
  - Build 523 MW 2X0 pair of frame CTs at DESC's former Canadys Station
- Case 4:
  - Retire Wateree and Williams in 2028
  - Build a 534MW 1X1 CC at DESC's former Canadys Station
  - Add a 200 MW ESS and 200 MW PV solar generation at Wateree
  - Contract for 400 MW off-system purchased power
- Case 5:
  - Retire Wateree and Williams in 2028
  - Contract for 1,100 MW off-system long-term power purchase
- All Cases:
  - Add 117 MW winter rating dual-fuel aeroderivative CTs, incrementally, as needed, at the Williams Station site to maintain system reliability or to economically overcome transmission system contingencies

From a transmission standpoint, the least expensive and lowest risk of the five options evaluated involved siting gas-fired generation forty miles north of Charleston, South Carolina at the site of DESC's retired Canadys Station site ("Canadys"). The TIA indicated that the transmission projects needed to create a path to import permanent replacement power from neighboring utilities would be expensive and time consuming.

Based on information provided in the TIA, DESC determined that retiring Wateree by 2028[15] is a reasonable planning goal. Considering the complexity of the transmission and fuel supply projects required to replace Williams, and the time required to permit, site and construct

[15] The retirement goal for the Wateree is December 31, 2028, and is referred in this IRP Update as 2028. Under other planning conventions, a December retirement date is reported as having occurred in the following year, *i.e., by* 2029 for Wateree. For consistency, this IRP Update references the actual year of retirement even if the retirement occurs on the last day of that year.

those projects, the earliest feasible retirement date for that unit is the end of 2030. Both projected dates assume that the regulatory and legal processes required to authorize, site and construct the replacement generation and supporting transmission and gas supply infrastructure are not unduly delayed.

### 2. Findings of the Coal Plants Retirement Study

The Study supported several high-level conclusions which DESC will continue to evaluate and develop and use to inform modeling in this 2022 IRP Update and the 2023 IRP:

I. Assuming that adequate replacement generation can be obtained, retiring Wateree at the end of 2028 can provide cost benefits to customers by avoiding significant elements of compliance costs associated with the Environmental Protection Agency's ("EPA's") current Steam Electric Power Effluent Limitation Guidelines ("ELGs").

II. Opting not to comply with current ELG requirements at Wateree creates the risk that Wateree would have to be retired from service even if replacement capacity is not yet in place by December 31, 2028. That risk appears reasonable given the costs involved.

III. Retiring Williams is not reasonably feasible before 2030 considering the complexity of siting and constructing the necessary replacement resources including electric transmission and fuel supply.

IV. Setting December 31, 2030, as the earliest feasible retirement date for Williams is appropriate as a "best case" planning goal subject to risk and uncertainty. It includes little, if any, buffer to accommodate regulatory or construction delays or legal challenges to permitting and siting. But with ELG compliance in place, the Williams retirement date will not be compelled by existing environmental regulations. The forced early retirement of Williams due to ELG compliance issues could expose customers to higher costs and risks if there are delays in the critical paths for replacement generation.

### 3. Additional TIA Studies

On July 22, 2022, DESC Resource Planning requested the DESC Transmission Planning Group to conduct another TIA (the "2022 TIA") to study nine additional cases including variations of the cases previously studied under the initial TIA. Three cases assume the retirement of Wateree by the end of 2028 and seek evaluation of replacement resources at the Wateree site and elsewhere. The remaining six cases concern Williams and seek to identify plans to reduce the cost of replacing the energy and reliability services that Williams provides to support the Charleston Metro area. Each of these nine additional cases assume that Williams would be retired on December 31, 2030. The 2022 TIA is expected to be completed in the first quarter of 2023.

The nine retirement cases guiding the 2022 TIA Analysis are:

- ❖ Cases 1-3: Wateree-only retirement cases
- ❖ Case 1:
  - ➢ Retire Wateree in 2028
  - ➢ Replaced with a 375 MW/1,500 MWH 4-hour battery Energy Storage System ("ESS") and a 150 MW-AC PV solar generation at the Wateree site
- ❖ Case 2:
  - ➢ Retire Wateree in 2028
  - ➢ Replacement resources constructed at Urquhart Station site
  - ➢ Build a 351 MW set of aeroderivative simply cycle CTs at Urquhart site by 12/31/2028
- ❖ Case 3:
  - ➢ Retire Wateree in 2028
  - ➢ Purchase off-system capacity and energy for at least two years
  - ➢ Assume PPA remains in place until DESC constructs on-system generation resources to support future retirements and/or load growth
- ❖ Cases 4-6: Assume the ending conditions as a result of Case 1 and retire Williams late in 2030
- ❖ Case 4A and 4B:
  - ➢ Williams is retired in 2030
  - ➢ Case 4A build two heavy-duty frame simple cycle CTs totaling 523 MW and one set of Aeroderivative CTs totaling 234 MW at the Canadys Station site by 12/31/2030
  - ➢ Case 4B build two heavy-duty frame simple cycle CTs totaling 523 MW at the Canadys Station site and one set of Aeroderivative CTs totaling 234 MW at the Williams Station site by 12/31/2030
- ❖ Case 5A, 5B, and 5C:

- Retire Williams in 2030
- Case 5A build a set of simple cycle CTs totaling 757 MW at the Canadys Station site and 100 MW/400 MWH of battery ESS at the Williams Station site by 12/31/2030
- Case 5B build a set of simple cycle CTs totaling 757 MW at the Canadys Station site and 200 MW/800 MWH of battery ESS at the Williams Station site by 12/31/2030
- Case 5C build set of simple cycle CTs totaling 757 MW at the Canadys Station site and 300 MW/1200 MWH of battery ESS at the Williams Station site by 12/31/2030

- Case 6:
  - Retire Williams in 2030
  - Build two heavy-duty frame simple cycle CTs totaling 523 MW and one or a set of Aeroderivative CTs totaling 234 MW at the Canadys Station site by 12/31/2030
  - Assume the existing Williams Station generator converted to a synchronous condenser

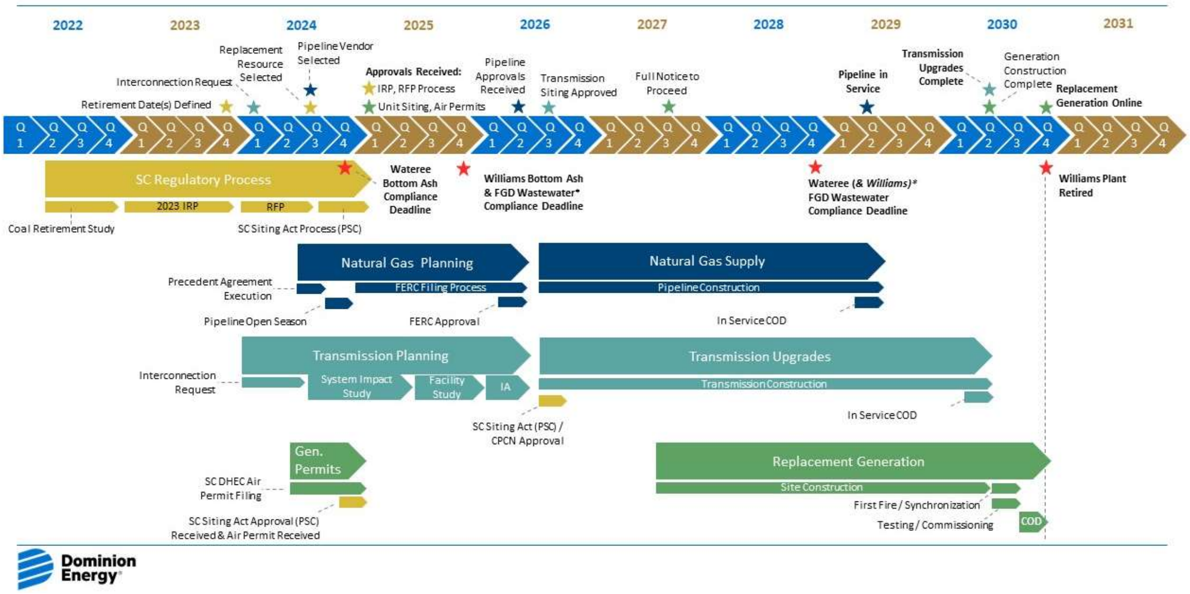
### 4. RFP for Potential Williams and Wateree Capacity Replacement

As indicated in the 2021 IRP Update, DESC plans to issue a non-binding, indicative, all-source RFP to validate prices and market data for the potential replacement options for Williams and Wateree. Due to the pending new TIA request, the uncertainty as to the replacement generation type, timing and siting, and the lengthy stakeholder processes that are anticipated, DESC believes the RFP should be issued based on the preferred plan in DESC's 2023 IRP which it will issue in approximately four and one-half months. Additionally, in accord with the Partial Settlement Agreement entered into in Commission Docket 2021-93-E, the Company is currently conducting an all-source RFP in association with the replacement of the capacity and black start capabilities represented by certain CT and fossil steam units at the Urquhart site. This process has involved extensive consultation with potential bidders. It will continue into early 2023 and provide a robust blueprint in which to follow for the Williams and Wateree replacements.

### 5. Schedule for Replacement

The Coal Plants Retirement Study identified a complex and interrelated series of planning, regulatory and construction activities to replace Wateree and Williams which is illustrated in **Figure 1.** It assumes that permanent replacement capacity for both Williams and Wateree capacity is procured in a single project that requires procuring additional natural gas supplies. Many aspects of this timetable are subject to regulatory review and approval processes with timelines that are outside of DESC's direct control and are subject to significant schedule risks.

**Figure 1: Williams and Wateree Illustrative Planning Schedule**



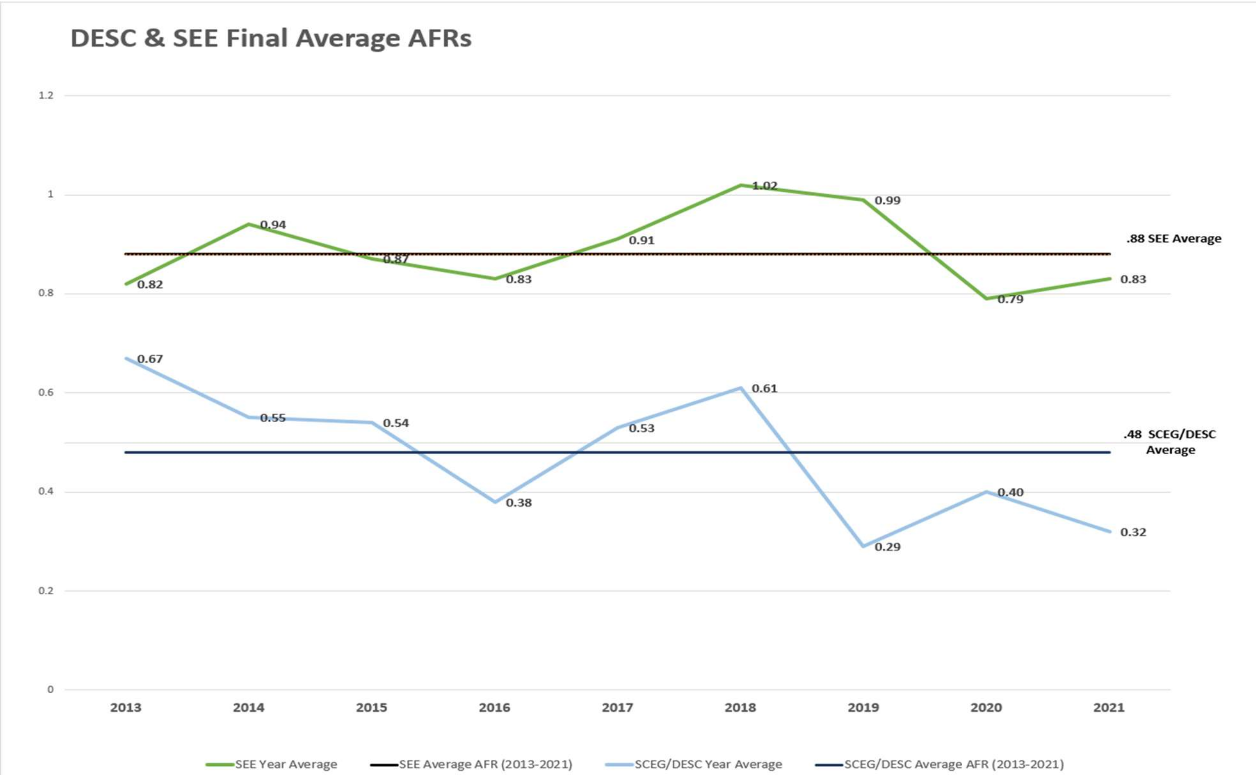

The retirement dates for Wateree and Williams shown here assume that the regulatory and legal processes required to authorize, site and construct the required assets are not unduly delayed by outside parties or otherwise. The greatest risk appears at present to be permitting and construction of required natural gas pipeline capacity by the appropriate FERC-regulated interstate pipeline companies, a process which is ultimately outside of DESC's control and the control of South Carolina regulators.

## IV. OPERATIONS REPORT UPDATE

### A. Safety

Safety, which is the Company's primary core value, is measured through the accident frequency rate ("AFR"). In 2021, the average AFR on DESC's electric system was approximately half the southeastern utility average:

**Accident Frequency Rate**




In 2021, DESC's OSHA recordable incident rate was 0.32. Its days away from work rate ("DART") rate[16] was 0.14, and DART severity rate[17] was 5.10. These are excellent results.

## B. Generation Operating Report Update

### i. Solar and Other Renewable Generation

Since 2019, DESC has connected eight new solar farms and increased its installed solar capacity by approximately 402 megawatts.

[16] DART is the rate of incidents involving days away from work, restricted work activities or job transfers.
[17] Dart severity rate is equal to (the number of work days lost + light duty days lost) x 200,000 / total hours worked.

**Table 2: DESC Utility Scale Solar Resources added in 2020 and 2021**

| PURPA PPAs | Nameplate Capacity (MW-AC) | Actual COD |
|---|---|---|
| **Lily Solar LLC (Allendale County)** | 70.00 | 2/28/2020 |
| **Huntley Solar, LLC (Orangeburg County)** | 75.00 | 4/30/2020 |
| **TWE Bowman Solar Project, LLC (Orangeburg County)** | 74.97 | 5/15/2020 |
| **Midlands Solar LLC (Calhoun County)** | 72.10 | 8/7/2020 |
| **Denmark Solar, LLC (Bamberg County)** | 6.00 | 12/2/2020 |
| **Blackville Solar Farm, LLC (Barnwell County)** | 7.20 | 12/7/2020 |
| **Yemassee Solar, LLC (Hampton County)** | 10.00 | 1/8/2021 |
| **Trask East Solar, LLC (Beaufort County)** | 12.00 | 3/17/2021 |
| **Beulah Solar, LLC (Saluda County)** | 74.97 | 5/9/2022 |

In addition, a third-party developer is building the first utility-scale battery storage project on the DESC system under a purchased power contract ("PPA") with DESC for 73.6 MW of solar generating capacity and a 72 MWh battery designed for a four-hour energy supply duration at 18 MW. The battery charging and discharging is dispatchable and will respond to signals from DESC System Control. All Build Plans modeled in this IRP Update assume that this asset will go into commercial operation in 2022.

In 2021, solar and other renewable generation represented 1,106 MW of installed capacity and produced approximately 9.3% of DESC's energy needs as non-carbon emitting energy.

### ii. Nuclear Operating Report

Since January 1984, DESC has operated the V.C. Summer Nuclear Station safely and efficiently. DESC owns two-thirds of the Summer Station's capacity and the South Carolina Public Service Authority, Santee Cooper, owns the balance.

In 2021, V.C. Summer Station produced approximately 4,665 GWh of non-carbon emitting base-load energy for DESC, representing 20% of DESC's energy needs. Energy produced by V.C. Summer Station during 2021 displaced approximately 4.5 million tons of $CO_2$ that would have been emitted if replaced by fossil resources. The 2021 gross (undivided) generation output from V.C. Summer Station was approximately 7,281 GWh.

In 2021, V.C. Summer Station met or exceeded all Nuclear Regulatory Commission safety and environmental requirements and has received favorable ratings from the Institute of Nuclear Power Operations ("INPO") operational standards assessment. V.C. Summer Station's INPO rating was reaffirmed as "exemplary" on June 15, 2022.

In 2021, V.C. Summer Station's net capacity factor, based on reasonable excludable nuclear system reductions, computed under the provisions of S.C. Code Ann. § 58-27-865, was 102.16%, indicating a high degree of reliability. The 2021 forced outage rate for V.C. Summer Unit 1 was 8.4%. Nuclear generation provided 652 MW of summer capacity and 663 MW of winter capacity to support service to DESC customers (based on DESC's two-thirds share in the capacity of the station).

On November 14, 2021, V.C. Summer Station completed its twenty-sixth scheduled maintenance outage. The total outage duration of 36.5 days was the third shortest refueling outage in the history of the station.

Since the filing of the 2021 IRP Update, DESC filed its notice of intent with the Nuclear Regulatory Commission to file a Subsequent License Renewal ("SLR") application to allow DESC to operate until 2062. The current license expires in 2042.

#### iii. Combined Cycle Gas Plants Operating Report

In 2021, DESC's combined cycle units produced approximately 39.37% of DESC's energy needs. The combined cycle units provide 1,879 MW of capacity in the summer and 2,031 MW of capacity in the winter; these ratings are inclusive of the completed AGP upgrades on the three Jasper Station CT units. DESC's combined cycle units' Forced Outage Rate for 2021 was only 3.06%.

#### iv. Internal Combustion Turbines Operating Report

In 2021, simple cycle CT units produced only approximately 0.26% of DESC's energy needs, reflecting their outdated condition and limited use as peaking generation sources. In 2022, DESC's internal CT units were rated to provide 302 MW of summer season peak capacity summer and 352 MW winter. The Forced Outage Factor or DESC's simple cycle combustion turbines (not counting those mothballed pending retirement) was approximately 3.0%.

DESC officially retired the Hardeeville Combustion Turbine in Jasper County on March 31, 2022. DESC plans to retire the Bushy Park and Parr CT units in 2022 and 2023, respectively, to support demolition activities ahead of the construction and installation of the replacement units at these sites. The Company plans to retire the Coit CT units after the replacement CT unit at Bushy Park enters commercial operation (planned for the third quarter of 2024). The replacement CT units at Parr are planned to enter commercial operation in the second quarter of 2025.

#### v. Fossil-Steam Units Operating Report

In 2021, DESC's fossil steam units provided approximately 27.04% of DESC's energy needs and provide 2,049 MW of summer capacity and 2,055 MW of winter capacity.

The 2021 Forced Outage Rate for all fossil steam units was 22.27% reflecting the fact that Wateree 2 was offline and unavailable for all of 2021. When Wateree 2 is excluded from this calculation, the 2021 forced outage rate for the remaining units was 0.22%.

Attached as **Appendix L** is the Generator Level Performance Data.

#### vi. Hydroelectric-Power Operating Report

In 2021, DESC's hydroelectric plants (including Fairfield Pumped Storage Units) provided approximately 2.69% of DESC's energy needs.

**Fairfield Pumped Storage.** In 2021, Fairfield Pumped Storage returned to the system over 368 GWh of stored energy and provided 576 MW of capacity in both summer and winter. In 2021, the Fairfield Pumped Storage Forced Outage Rate was 0.09%. The remaining hydro units provided 208 MW of capacity in the summer and 224 MW of capacity in the winter.

**Saluda Hydro.** In July of 2009, DESC entered into a Comprehensive Settlement Agreement with the parties to its FERC proceeding to relicense the Saluda Hydro Project (No. 516). DESC is awaiting FERC's decision on the application. The relicensing of the Stevens Creek Project (No. 2535) is under active review by FERC staff.

The Company is in the process of planning and executing a series of major upgrades on the Saluda Hydro units to ensure their continued availability and reliable service. These upgrades include replacement of the penstock headgate assemblies, rewinds and upgrades of the generators, replacement of the turbine runners, and replacement of generator excitation and control systems. The generator step-up transformer units have already been replaced on all five units and are sized to accommodate future planned generator upgrades. As of the summer of 2022, DESC is in the process of rewinding the Saluda Unit 1 generator, which has been in service for over 90 years.

The turbine runner replacements and generator upgrades were agreed to in the Comprehensive Settlement Agreement reached through the Saluda Hydro relicensing process, but these upgrades have been deferred for over a decade pending issuance of the final project license by FERC. The Company has elected to begin proceeding with these upgrades due to the reliability and safety risks from continuing to defer this work and for the environmental benefits they are expected to provide to the Lower Saluda River through enhanced dissolved oxygen. This work should increase the capacity from the Saluda Hydro in both summer and winter seasons. The anticipated capacity contribution of these upgrades is expected to be modeled in the 2023 IRP once a more definitive project schedule has been established for this work.

**Parr Hydro.** As part of the renewed license received in late 2020 for the Parr Hydro Project, the Company plans to upgrade all six of the generating units at the Parr Shoals Hydro facility over the next ten years. Completing these upgrades will enhance the reliability and availability of these units, which have been in service for over a century. Replacing or rewinding the generators and replacing the turbine runners are expected to increase the generating capacity of this facility. The anticipated capacity contribution of these upgrades is expected to be modeled in the 2023 IRP once a more definitive project schedule has been established for this work.

### vii. Environmental and ELG Compliance

Dominion Energy is subject to multiple federal, state and local laws and regulations designed to protect human health and the environment. Significant developments have occurred related to carbon regulations at both the federal and state level since the 2021 Update.

**Federal Carbon Regulation.** On January 19, 2021, the D.C. Circuit Court vacated the Affordable Clean Energy ("ACE") Rule which was the replacement for the Clean Power Plan ("CPP"). The EPA is currently drafting a new set of guidelines to direct how states must regulate greenhouse gas emissions from existing fossil-fuel fired generating units within their borders. According to current EPA guidance, the EPA intends to issue a proposed rule in March 2023, with no timetable for issuance of a final rule at this time.

Both the ACE Rule and the CPP were adopted under Section 111(d) of the Clean Air Act ("CAA"). On June 30, 2022, the U.S. Supreme Court issued a decision in *West Virginia v. EPA* that limits the scope of the EPA's authority to control greenhouse gas emissions from existing power plants under Section 111(d). Absent action from Congress, this decision will impact how greenhouse gas emissions can be regulated at existing power plants by the EPA in future rulemakings. The EPA retains the authority to regulate emissions at the source by proposing mechanisms such as heat rate improvements, but the EPA no longer holds the authority to regulate greenhouse gas emissions from power production by requiring a shift in electricity production from fossil fuel-fired power generation sources to cleaner renewable energy sources.

**Effluent Limitation Guidelines**. On January 20, 2021, President Biden signed Executive Order 13990 directing federal agencies to review rules issued in the prior four years that are, or may be, inconsistent with the President's stated environmental policy. On July 26, 2021, the EPA announced that it is initiating a rulemaking process to determine whether to adopt more stringent limitations than those in the rule finalized in 2020 concerning ELG for steam electric generating units. The agency intends to issue a proposed rule for public comment in the Fall of 2022. The current 2020 rules remain in effect until EPA concludes this new rulemaking activity. The Company is closely monitoring developments in the ELG rulemaking process due to the potential impacts on the Wateree and Williams coal units and existing compliance strategy based around the 2020 rule.

DESC has begun definitive engineering and procurement activities to support construction of the facilities necessary for Williams to comply with the current ELG rule standards by December 31, 2025. The Coal Plants Retirement Study filed in May 2022 determined that for planning purposes it was unreasonable to assume that Williams could be retired before the end of 2030. At Wateree, the Company is on track to achieve compliance with the ash transport water requirements of the ELG rule by December 31, 2024, as required under the Company's Applicability Study that it has filed with the South Carolina Department of Health and Environmental Control ("SC DHEC"). The Company is continuing to conduct early-phase engineering and development efforts for Wateree to comply with the flue gas desulphurization ("FGD") wastewater requirements of the ELG rule under the regulation's Voluntary Incentive Program ("VIP"). Participation in this program provides Wateree with an automatic compliance deadline of December 31, 2028, for FGD wastewater. The Company retains the option to transfer Wateree to an ELG compliance pathway that would require the facility to retire by December 31, 2028, and avoid the need for installation of compliance technologies. Under the ELG rule, the Company must make this election no later than December 31, 2025.

## C. Distribution and Transmission Operating Report Update

### i. Outages and Reliability

The industry benchmark for measuring operational effectiveness in transmission and distribution operations is the number of minutes on average a customer is without power, which is the System Average Interruption Duration Index, or SAIDI score. A lower SAIDI score indicates more reliable transmission and distribution systems. DESC's 2021 SAIDI score was 78.89 minutes which is an historically low level. As reported by the State Energy Office, DESC provided its customers a level of reliability in 2019 that was forty-nine percent better than the other regional investor-owned utilities evaluated by that office.[18]

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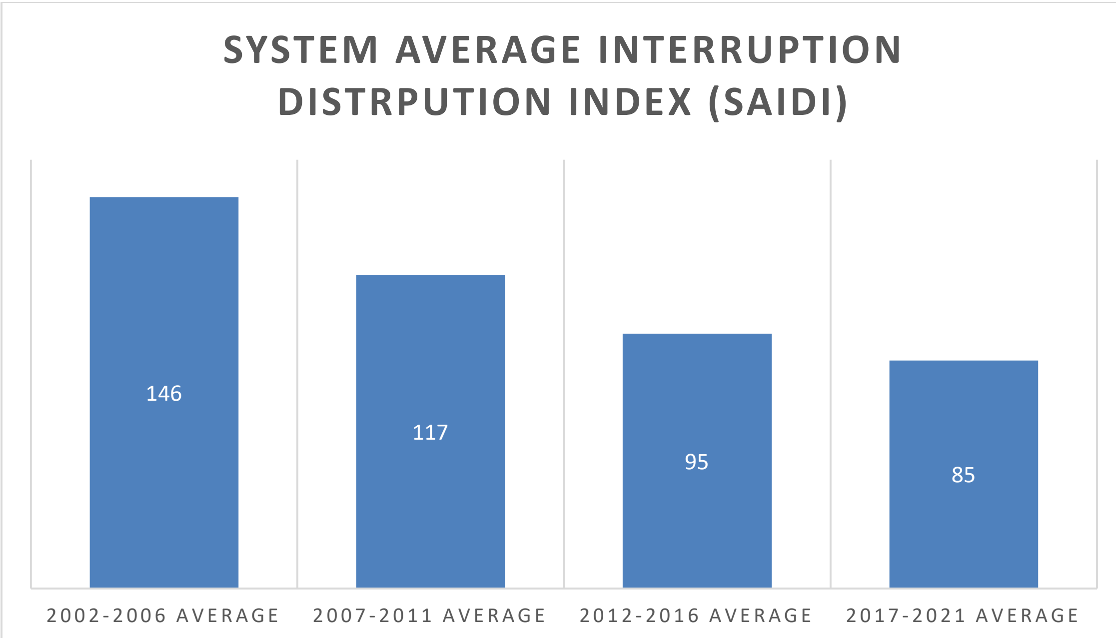
[18] http://energy.sc.gov/node/3065. This is the most current year for which data was reported at the time of writing.

**Figure 4:**




### ii. Storms and Storm Response

The only major storm event to affect DESC's service territory in 2021 was Tropical Storm Elsa which occurred on July 7, 2021, at approximately 11:00 pm. The Tropical Storm impacted a total of 51,644 customers. The peak outage occurred at 5:39 am on July 8, 2021, with 30,179 customers without power. Restoration was largely complete within 24 hours.

**Table 3: Major Storm Outages and Restoration 2014-2021**

| Event | Dates | Total Customers Out | Days to Restore Service |
|---|---|---|---|
| 2014 Winter Storm Pax | 2/12/14-2/19/14 | 151,700 | 7 |
| Hurricane Matthew | 10/7/16-10/16/16 | 313,300 | 9 |
| Hurricane Irma | 9/11/17-9/14/17 | 173,300 | 3 |
| Hurricane Florence | 9/14/2018 | 7,500 | 1 |
| Hurricane Michael | 10/11/18-10/12/18 | 68,800 | 2 |
| Hurricane Dorian | 9/4/19-9/8/19 | 186,400 | 4 |
| April 2020 Tornados | 4/13/2020 | 65,800 | 1 |
| Tropical Storm Elsa | 7/7/21-7/8/21 | 30,179 | 1 |

### iii. Transmission Construction Update

The following new transmission projects were begun or completed in 2021:

i. **Cainhoy-Mt Pleasant 115kV Lines #1 & #2, Rebuild the Horlbeck Creek Crossing (*Completed and in service January 2022*).** DESC rebuilt over three miles of the existing Cainhoy–Mt. Pleasant 115kV Lines #1 and #2, including the Horlbeck Creek crossing, replacing wooden H-frame structures with self-supporting steel structures. This project addressed end of life and reliability issues on these lines.

ii. **Bluffton-Santee 115kV Tie New Transmission Line (*Completion expected December 2022*).** This new 1.5-mile 115kV tie line from DESC's Bluffton Substation to South Carolina Public Service Authority's ("SCPSA") Bluffton Substation was needed to reduce outage durations for planned outages and emergency situations for DESC's Bluffton, Hardeeville, and Pritchardville Substations, as well as provide a secondary source of power to those substations.

iii. **Lake Murray-Harbison 115kV Rebuild and Saluda Hydro-Denny Terrace 115kV Transmission Line Construction (*In service expected December 2022*).** DESC re-terminated the Saluda Hydro – Harbison 115kV line to Lake Murray substation in preparation for the single-pole double-circuit rebuild of the Lake Murray–Harbison 115kV which will add an additional Saluda Hydro–Denny Terrace 115kV line. This project is needed to support system growth in the Irmo, Harbison, Piney Woods Road, and Kingswood areas which require additional 115kV capacity and transmission path to increase reliability.

iv. **Toolebeck-Aiken (SCPSA) 230kV Tie Line and Related Substation Upgrades (*Completed and in service November 2021*).** This project created a 230kV tie line between the Toolebeck 230kV Substation and SCPSA's Aiken Substation. The project also built a fold in to the Toolebeck 230kV substation for the Graniteville #2 – South Augusta Southern Company 230kV tie line (from Urquhart Junction – Toolebeck). This project was required to meet NERC Transmission Planning standards and DESC's Internal Planning Criteria and to relieve congestion in the Aiken area.

v. **Lake Murray-Ward 115kV, Rebuild the 8+ mile Batesburg to Ward Line Section (*Completed and in service July 2021*).** The rebuild of this line was needed to replace aging infrastructure and is one of several projects needed to provide a tie line between the Aiken area and Columbia for power flows. The wooden structures were replaced with galvanized streel structures meeting all modern electric codes and providing increased reliability and resiliency.

vi. **Ward-Stevens Creek 115kV, Rebuild the 24+ mile Ward to Briggs Road Line Section (*Completed and in service May 2022*).** The rebuild of this line was needed to replace aging infrastructure and is one of several projects needed to provide a tie line between the Aiken area and Columbia for power flows. The wooden structures were replaced with galvanized streel structures meeting all modern electric codes and providing increased reliability and resiliency.

vii. **Lake Murray-Gilbert 115kV, Rebuild the 5-mile Lexington Westside to Gilbert Line Section (*Completed and in service January 2022*).** The rebuild of this line was needed to replace aging infrastructure and is one of several projects needed to provide a tie line between the Aiken area and Columbia for transmission system flows. The wooden structures were replaced with galvanized streel structures meeting all modern electric codes and providing increased reliability and resiliency.

viii. **<u>Lake Murray-Gilbert 115kV, Rebuild the 4-mile Lexington Junction to Lexington Westside Line Section (*Completed and in service August 2022*)</u>.** The rebuild of this line was needed to replace aging infrastructure and is one of several projects needed to provide a tie line between the Aiken area and Columbia for transmission system flows. The wooden structures were replaced with galvanized streel structures meeting all modern electric codes and providing increased reliability and resiliency.

ix. **<u>Denny Terrace-Craft Farrow & Denny Terrace-Dentsville Line #1 115kV, Rebuild 5+ mile Denny Terrace to Rader Line Section (*Completed and in service August 2022*)</u>.** The rebuild of this line was needed to replace aging infrastructure. The wooden structures were replaced with galvanized streel structures meeting all modern electric codes and providing increased reliability and resiliency.

x. **<u>Blackville West-Wagener 46kV, Rebuild the 23+ mile Line Section including North to LNG to Perry to Salley to Springfield (*Completed and in service July 2022*)</u>.** The rebuild of this line was needed to replace aging infrastructure. The wooden structures were replaced with galvanized streel structures meeting all modern electric codes and providing increased reliability and resiliency. The line was rebuilt with 1272 aluminum conductor steel reinforced ("ACSR") conductor and 115kV insulation.

xi. **Calhoun County-St Matthews 46kV Rebuild (*In service expected December 2022*).** The rebuild of this 10+ miles line was needed to replace aging infrastructure. The wooden structures were replaced with galvanized steel structures meeting all modern electric codes and providing increased reliability and resiliency. The line was rebuilt with 1272 ACSR conductor and 115kV insulation.

xii. **Park Street 115-13.8kV Substation and Williams Street-Park Street 115kV Construction (*Completed and in service May 2022*).** These are projects to rebuild the Park Street Substation in Columbia and build a new 115kV line between Williams Street and Park Street Substations. These projects were needed for load growth in the downtown Columbia area which requires additional transmission capacity.

xiii. **Cross County 115-23kV Substation and 115kV Transmission Line Tap Construction (*Completed and in service June 2022*).** This is a project to build a new substation in the North Charleston area and was needed due to increased load in the area.

xiv. **May River 115-23kV Substation and 115kV Transmission Line Tap Construction (*In service expected December 2022*).** This project will build the new substation in the Bluffton area and was needed due to increased load in the area.

xv. **Smoaks 115-23kV Substation and 115kV Transmission Line Tap Construction (*Completed and in service July 2022*).** This project will build the new substation in the Smoaks area, between Canadys and Fairfax, and was needed due to increased load in the area and allowed for the retirement of an existing 46-12kV substation.

A report on completed, deferred, and cancelled projects is found in ***Appendix D.***

### iv. AMI Roll Out

Through the end of 2021 a total of 383,063 AMI electric meters have been installed.

As of mid-2022 DESC is approximately 67% complete with AMI meter deployment. However, DESC's primary meter vendor, Itron, has been unable to fulfill DESC's forecasted meters for 2022 due to chip and other supply chain shortages. In May of 2022, Itron notified DESC that shipments through the fourth quarter of 2022 will be delayed and additional meter shipments are not expected in 2022. Itron has not provided a timeline for fulfilling DESC's order. In response, starting in May 2022, DESC reduced the pace of its meter deployment by 70% of the original forecast, targeting approximately 1,900 electric meter installs per week which is the level that DESC can support using current inventory levels. The meter shortage and deployment slowdown has moved the scheduled completion date for AMI roll-out from June 2023 to January 2024. DESC is working closely with Itron to gain insight on any expected shipments and will adjust the meter deployment schedule accordingly.

## V. BUILD PLAN ANALYSIS

Effective resource planning is a necessary part of DESC meeting its primary commitment to safely deliver reliable, affordable, sustainable and increasingly clean energy to its customers. In this 2022 IRP Update, DESC used the PLEXOS resource optimization model to analyze twelve Build Plans and twenty-four Cases to update the findings of the Modified 2020 IRP and confirm the choice of a preferred generation plan.

### A. The Nine Market Scenarios

In consultation with Stakeholders, DESC created nine Market Scenarios each of which reflects an internally consistent narrative about the direction future markets might take in response to environmental policy choices, fuel costs, levels of economic development and load growth and

DSM program results. Collectively, the nine Market Scenarios encompass a broad spectrum of foreseeable future conditions on its electric system. They are described on **Table 4**, below.

**Table 4: The Nine Market Scenarios**

| Scenario | Fuel Price | $CO_2$ Price | Load | DSM | Notes |
|---|---|---|---|---|---|
| **Moderate Electric $CO_2$ Price (Reference Scenario)** | Base | Medium | Base | High | This scenario reflects a middle-of-the-road outlook and the expected values for key market drivers. While there is currently no explicit price on $CO_2$ and the design of future policy is uncertain, DESC includes moderate $CO_2$ pricing in the electric sector as a proxy for future policy that increases the cost of fossil-fired resources. |
| **High Fossil Fuel Prices** | High | Medium | Base | High | This scenario stresses fossil-fueled resources with sustained high gas and coal prices and also represents coal supply and transportation constraints that would result in higher fuel costs. |
| **Zero Carbon Cost** | Base | Zero | Base | High | This scenario tests a middle-of-the-road outlook and expected values for key market drivers under an outlook where no $CO_2$ price is implemented, consistent with current policy. |
| **High $CO_2$ Price** | Base | High | Base | High | Under this scenario, policymakers enact a higher price on electric sector $CO_2$ emissions earlier than under the Reference Case. The price of natural gas remains at or near expected levels, as production gets more costly and lower electric demand is offset by growth in exports and non-electric demand. |
| **Low Regulation** | Low | Zero | Base | High | Under this view, policymakers implement supportive policies in the oil and gas sector that reduce commodity costs from current levels and do not implement market-wide emissions policies. |
| **Stagflation** | High | Zero | Low | High | In this scenario, fuel prices are elevated due to inflationary pressures and supply constraints. Inflation and tight money policy have also resulted in low economic growth and lower loads. |
| **Aggressive Environmental Regulation** | High | High | High | High | Under this view, policymakers enact higher $CO_2$ prices and also limit oil and gas production resulting in more costly natural gas. The higher cost of alternatives leads to an increase in end-use electrification and higher electric loads than in the other scenarios. |
| **Medium DSM** | Base | Zero | Base | Medium | A DSM sensitivity to meet Act No. 62 Requirements |
| **Low DSM** | Base | Zero | Base | Low | A DSM sensitivity to meet Act No. 62 Requirements |

## B. The Twelve Build Plans

DESC created nine of the twelve Build Plans by using PLEXOS to model the nine Market Scenarios directly. DESC created a tenth Build Plan instructing PLEXOS to retire Williams in 2030 rather than allowing PLEXOS to optimize that date in 2047 as it did in the Williams 2047 Reference Build Plan. This created the Williams 2030 Reference Build Plan which closely aligns with the assumptions underlying Resource Plan 8, the preferred plan from the Modified 2020 IRP.

DESC created an eleventh Build Plan by requiring PLEXOS to achieve specific carbon emission reductions in 2040, 2045 and 2050 culminating in an 80% reduction in carbon emissions by 2050. The result is the Carbon Constrained Build Plan which models the cost of an aggressive, utility-driven program to reduce carbon emissions that assumes Williams retires in 2030 but is not motivated by high $CO_2$ prices or high fossil fuel prices which would inject other factors into analysis. [19]

The twelfth Build Plan is an evaluation of Resource Plan 8 using current market inputs. For this analysis, DESC updated Resource Plan 8 to reflect the fact that the Coal Plants Retirement Study found that it was not reasonable to assume that Williams can be retired before the end of 2030. Resource Plan 8 had assumed a 2028 retirement date for Williams. Delaying the assumed retirement date for Williams required changes in the timing and configuration of the resources needed to replace Williams in the early years of the plan. But the RP8 Build Plan generally does not change the specific resource selections made in Resource Plan 8 as presented in the Modified

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[19] The PLEXOS model struggled with the number of factors to be evaluated in optimizing around mandatory levels of carbon emission reductions in 2040, 2045 and 2050. As a result, the Carbon Constrained Build Plan is only partially based on a fully optimized approach. PLEXOS solves for a linear solution first, which does not reflect the MW minimum and maximum size constraints on generation resources. It then converts that linear solution an integer solution that does account for those size constraints. Due to the complexities of the Carbon Constrained Case, the PLEXOS model was unable to complete an integer solution for this Case. To create a build plan for the Carbon Constrained Case, DESC took the linear solution created by PLEXOS and manually created a reasonable build plan for deploying the assets indicated.

2020 IRP and the 2021 IRP Update. With the addition of RP8, DESC evaluated a total of ***twelve Build Plans*** in this 2022 IRP Update.

In preparing Build Plans under these Market Scenarios, DESC informed the PLEXOS model to convert Cope Station ("Cope") to use gas only as a fuel in 2035. DESC remains committed to retiring coal only units by the end of 2030 but decided for planning purposes to assume that Cope remains dual fuel capable until 2035. DESC based this decision on the likely schedule and complexity of assuring natural gas supply in the area where Cope is located as identified in preparing the Coal Plants Retirement Study and reflects the priority of retiring Williams as early feasible as well. DESC will reassess this assumption as more information becomes available.

DESC further informed PLEXOS to retire Wateree as of December 31, 2028, and with three exceptions, to retire Williams as of December 31, 2030. Those three exceptions were the Williams 2047 Reference Build Plan, High Fossil Fuel Prices Build Plan and the Zero Carbon Cost Build Plan. To assess the cost and benefits of the early retirement of Williams, DESC allowed PLEXOS to optimize the Williams retirement date in those plans. In the Williams 2047 Reference Build Plan and the Zero Carbon Cost Build Plan,[20] PLEXOS determined the optimized retirement date for Williams was 2047, which is the end of Williams' useful life. In the High Fossil Fuel Prices Build Plan, PLEXOS optimized the retirement date for Williams in 2030.

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[20] As discussed in footnote 8, above, the PLEXOS model uses a very computationally intensive process for formulating an optimized resource plan. Optimizing retirements dates is particularly complex since they posit a decision point each year and a separate decision tree for each year when a retirement could be possible. For that reason, when optimizing retirement dates, DESC asked PLEXOS first to determine the optimized retirement date for the resource, then re-ran the program to determine the optimized Build Plan to support retirement at that date. This simplified the calculation and improved the quality of the results.

### C. The Six Core Build Plans

From the twelve Build Plans, DESC selected six of the most likely or most representative Build Plans (the "Core Build Plans") for further study and comparative evaluation. The six Core Build Plans include RP8, the Williams 2047 Reference Build Plan, the Williams 2030 Reference Build Plan, the High Fossil Fuel Prices Build Plan, the Zero Carbon Cost Build Plan and the Carbon Constrained Build Plan. The Core Build Plans are all based on the same base load growth assumption which allows their results to be compared on an equal MW-to-MW footing. Their other assumptions are reasonably consistent with the assumptions that underlie the RP8 Build Plan and provide the comparability needed for assessing the updated preferred plan, the Williams 2030 Reference Build Plan. **Table 5** below describes these Build Plans.

**Table 5: The Six Core Build Plans**

| Build Plan | Fuel Price | $CO_2$ Price | Load | DSM | Notes |
|---|---|---|---|---|---|
| **RP8 Build Plan** | Base | Medium | Base | High | This Build Plan is an updated version of RP8 from the Modified 2020 IRP and 2021 Update. It is recalibrated to reflect retirement of Williams in 2030. This is a pre-determined Build Plan that has not been optimized. |
| **Williams 2047 Reference Build Plan** | Base | Medium | Base | High | This Build Plan reflects a middle-of-the-road outlook and the expected values for key market drivers. While there is currently no explicit price on CO2 and the design of future policy is uncertain, DESC includes moderate CO2 pricing in the electric sector as a proxy for future policy that increases the cost of fossil-fired resources. This Build Plan allows the Williams retirement date to be optimized which occurs in 2047. |
| **Williams 2030 Reference Build Plan** | Base | Medium | Base | High | This Build Plan reflects the same assumptions as the Williams 2047 Reference Build Plan but optimizes resources around a fixed 2030 Williams Retirement date. |
| **High Fossil Fuel Prices Build Plan** | High | Medium | Base | High | This Build Plan stresses fossil-fueled resources with sustained high gas and coal prices and also represents coal supply and transportation constraints that would result in higher fuel costs. |
| **Zero Carbon Cost Build Plan** | Base | Zero | Base | High | This Build Plan tests a middle-of-the-road outlook and expected values for key market drivers under an outlook where no $CO_2$ price is implemented, consistent with current policy. |
| **Carbon Constrained Build Plan** | Base | Medium | Base | High | In this Build Plan to the Reference Case, this scenario includes ratchets on annual $CO_2$ beginning in 2040 and continuing in 2045 and 2050. |

### D. The Six Non-Core Build Plans

The six non-Core or Additional Build Plans serve as sensitivities to provide statutorily or Commission mandated information or to measure how Build Plans vary depending on changes in Fuel Cost, $CO_2$ Costs, Load Growth, and DSM effectiveness. **Table 6** below describes these Build Plans.

**Table 6: The Six Additional Build Plans**

| Build Plan | Fuel Price | $CO_2$ Price | Load | DSM | Notes |
|---|---|---|---|---|---|
| **High $CO_2$ Price Build Plan** | Base | High | Base | High | Under this Build Plan, policymakers enact a higher price on electric sector $CO_2$ emissions earlier than under the Reference Case. The price of natural gas remains at or near expected levels, as production gets more costly and lower electric demand is offset by growth in exports and non-electric demand. |
| **Low Regulation Build Plan** | Low | Zero | Base | High | Under this Build Plan, policymakers implement supportive policies in the oil and gas sector that reduce commodity costs from current levels and do not implement market-wide emissions policies. |
| **Stagflation Build Plan** | High | Zero | Low | High | In this Build Plan, fuel prices are elevated due to inflationary pressures and supply constraints. Inflation and tight money policy have also resulted in low economic growth and lower loads. |
| **Aggressive Environmental Regulation Build Plan** | High | High | High | High | Under this Build Plan, policymakers enact higher $CO_2$ prices and also limit oil and gas production resulting in more costly natural gas. The higher cost of alternatives leads to an increase in end-use electrification and higher electric loads than in the other scenarios. |
| **Medium DSM Build Plan** | Base | Zero | Base | Medium | A DSM sensitivity to meet Act No. 62 Requirements. |
| **Low DSM Build Plan** | Base | Zero | Base | Low | A DSM sensitivity to meet Act No. 62 Requirements. |

## E. Resources Available to PLEXOS

In consultation with Stakeholders, DESC identified eighteen generating resources for PLEXOS to call on when optimizing generation plans to meet future demand. These resources included utility and third-party ("PPA") solar resources, utility and third-party solar paired with battery resources, two configurations of stand-alone grid battery capacity, five configurations of gas-fired generation, OSW and SMRs. Of these resources, OSW, Solar plus Storage, Eight Hour Duration Batteries, SMR and four new configurations of CTs and combined cycle units are new to the analysis for the 2022 IRP Update. Solar and Solar plus Storage are modeled as PPA resources in addition to utility-owned resources.

## F. Percentage of Renewable Resources Selected

With the exception of RP8, and the Low Regulation Build Plan, the PLEXOS optimization chose resources that heavily weighted each of the Build Plans toward non-emitting resources. Among the five Core Build Plans excluding RP8, the percentage of non-emitting capacity added is between 72% and 87% of the total capacity added, with each of the Core Build Plans, excluding RP8, adding a minimum of 2,738 MW of Solar, Solar plus Battery and Battery over the 30-year planning horizon. The Carbon Constrained Build Plan adds the greatest amount of non-emitting resources at 6,865 MW. Of the non-Core Build Plans, the Low DSM Build Plan, which has base assumption for fuel and zero $CO_2$ costs, but relatively high load growth adds the least non-emitting resources at 2,775 MW. The RP8 Build Plan adds only 2,813 MW of non-emitting resources, the second lowest of all twelve Build Plans. Williams 2030 Reference Build Plan, which is the revised and updated preferred plan, includes 3,263 MW of non-emitting capacity.

## G. MWs Added by Resource Plans

The net amount of capacity added under each Build Plan varies greatly according to the amount of renewables added. For example, the Carbon Constrained Build Plan which adds the greatest amount of renewables to the system, adds a total of 7,979 MW of capacity, while the other Core Build Plans add between 3,784 MW and 5,820 MW of capacity. This is because the intermittent nature of most renewables requires the PLEXOS model to supplement them with battery storage or dispatchable gas resources to ensure system reliability. In addition, the MW that can be produced annually by intermittent resources, which are limited by daylight and weather, is between approximately 20% (Solar) and 40% (OSW) of the MW that can be produced by dispatchable resources of similar nameplate capacity.

### H. Fossil Fuel Resources Added

While the majority of the resources added in all Build Plans are non-emitting resources, the modeling shows that some level of fossil fuels is also required to support reliability and supply low-cost energy. All of the six Core Build Plans add at least 750 MW of natural gas fired generation.

### I. The Resources Added under Each Build Plan

The timing and nature of resource additions and the resulting capacities and winter reserve margins for each of the 30 years of the model horizon are set forth in the tables attached as **Appendix E & F** to this document.

#### 1. The RP8 Build Plan Resources

The RP8 Build Plan adds a net total of 2,937 MW over the 30-year planning horizon. It adds 75 MW of Solar each year starting in 2026 and double that amount in years 2034, 2039 and 2046 for a total of 2,100 MW of Solar by 2050. It also adds a total of 712.5 MW of new stand-alone Battery storage rated at four-hour discharge. This battery resource has an assumed energy availability ("Energy Availability") of 100% which means it is allowed to use 100% of its capacity to meet day-to-day energy needs with no capacity reserved to supply system capacity needs. This configuration is designated "Battery Grid 4hr 100%." Three hundred MW of this Battery capacity are to be added by 2034. In the first ten years of the planning period, the RP8 Build Plan adds 523 MW of new frame combustion turbines that are built in pairs to reduce procurement and construction costs. These are designated "CT Frame 2x." It also adds 553 MW of new combined cycle ("CC") gas units with a single combustion turbine and a single heat recovery boiler designated "1x1 CC." After year 2036, this Build Plan adds 342 MW of aeroderivative combustion turbines ("Aero CT") to the system.

### 2. The Williams 2047 Reference Build Plan Resources

The Williams 2047 Reference Build Plan adds a net total of 3,035 MW of capacity over the 30-year planning horizon including 750 MW of Solar PPAs in the first eleven years. Between years six and fifteen it also adds 150 MW of new Solar plus Storage and 1,350 MW of new Solar plus Storage PPAs and 750 MW of Battery Storage with Capacity Availability of 30%, 60%, 80% and 100%. After year fifteen, it adds 337.5 MW of Battery Grid 4hr with Energy Availability set at 80% and 100%, two new Aero CT 2x of 234 MW each. and 523 MW of new CT Frame 2x.

### 3. The Williams 2030 Reference Build Plan Resources

The Williams 2030 Reference Build Plan adds a total net of 3,015 MW over the 30-year planning horizon including 750 MW of new Solar PPAs in the first ten years. In the first fifteen years it adds 1,350 MW of new Solar plus Storage PPAs and 150 MW of new Solar plus Storage with 750 MW of Battery Storage with Capacity Availability constraints set at 30%, 40%, 60%, 80% and 100%. After 2035 additional Battery Grid 4hr 100% of 262.5 MW is added by year 2050. Two new CT Frame 2x of 523 MW each are added in years 2031 and 2041.

### 4. High Fossil Fuel Prices Build Plan Resources

In the High Fossil Fuel Prices Build Plan, a total net of 4,526 MW are added to the system over the 30-year planning horizon including 750 MW of new Solar PPAs in the first seven years. In the first fifteen years, 1,350 MW of new Solar plus Storage PPAs and 1,050 MW of new Solar plus Storage are added with 1,200 MW of Battery Storage with Capacity Availability set at 30%, 40%, 60%, 80%, and 100%. Between years 2033 and 2043, 337.5 MW of new Battery Grid 4hr of 80% and 100% Capacity Availability is added, as well as 375 MW of new Solar. In years 2031 and 2044, 523 MW of new CT Frame 2x and 234 MW of new CT Aero 2x are also added, respectively.

### 5. The Zero Carbon Cost Build Plan Resources

The Zero Carbon Cost Build Plan adds a total net of 2,640 MW over the 30-year planning horizon including 750 MW of new Solar PPAs in the first eleven years. In the first fifteen years, the plan adds 1,050 MW of Solar plus Storage PPAs and 150 MW of Solar plus Storage with 600 MW of Battery Storage with Capacity Availability of 80% and 100%. After 2032, 337.5 MW of new Battery Grid 4hr of between 80% and 100% Capacity Availability is added as well as two new CT Frame 2x of 523 MW each.

### 6. The Carbon Constrained Build Plan Resources

The Carbon Constrained Build Plan adds a total net of 6,685 MW over the 30-year planning horizon. In the first nine years, 750 MW of new solar PPAs are added. In the first seventeen years, 375 MW of new Solar is added as well as 1,050 MW of new Solar plus Storage and 1,350 MW of Solar plus Storage PPAs with 1,200 MW of Battery Storage with Capacity Availability constraints set at 30%, 40%, 60%, 80% and 100%. In 2031, 1,114 MW of new 2x1 CC is added. Offshore Wind and SMRs are added beginning in year 2040 accounting for an additional 2,140 MW by year 2049.

## J. The Core Analysis

DESC modeled the six Core Build Plans' performance under three core Market Scenarios (the "Core Market Scenarios") to create eighteen cases ("Core Cases"). The Core Market Scenarios include the Reference Market Scenario, the High Fossil Fuel Prices Market Scenario and the Zero Carbon Cost Market Scenario. All three Core Market Scenarios assume Base Load Growth and a high level of cost-effective DSM. The Reference Market Scenario and the Zero Carbon Cost Market Scenario includes base expectations for Fuel Prices, while the High Fossil Fuel Prices Market Scenario assumes high fuel prices. The Reference Market Scenario and High Fossil Fuel Prices Market Scenario both assume medium expectations for $CO_2$ prices (a price of $12 per ton imposed in 2030 and escalating at 10%), while the Zero Carbon Cost Market Scenario assumes zero $CO_2$ prices. These Core Market Scenarios represent a range of assumptions encompassing the most reasonable and foreseeable future conditions based on regulatory policies, market conditions and information available at this time. Focusing the majority of the analysis on the Core Cases allows DESC to provide meaningful and confident recommendations about the most important elements of the path forward in the Preferred Plan.

The resulting analysis (the "Core Analysis") created eighteen Core Cases for comparative evaluation. These Core Cases encompass Build Plans reflecting base market forecasts, aggressive investment in non-emitting resources, market conditions both favoring and disfavoring continued reliance on fossil fuels and cases delaying or accelerating the retirement of Williams.

### K. The Core Analysis Results

The IRP Statute, Commission Directives or both specify that DESC and the Commission should assess its Build Plans against eight specified metrics:

- Levelized Cost
- $CO_2$ Emissions
- Clean Energy
- Fuel Cost Resiliency
- Generation Diversity
- Reliability Factors
- Mini-Max Regret Analysis
- Cost Range Analysis

In fulfillment of these requirements, DESC has conducted the Core Analysis of the six Core Build Plans to show their relative performance in levelized cost, $CO_2$ emissions, incorporation of clean energy, fuel cost resiliency, generation diversity, reliability factors, mini-max regret factors, and a cost range analysis.

**IRP Evaluation Standards and Metrics**

a. Levelized Cost - Section 58-37-40(C)(2)(b) requires the Commission to consider, in its discretion, whether an IRP appropriately balanced the factor of consumer affordability and least cost. Order No. 2020-832 also required the costs of all candidate resource plans be included.
b. $CO_2$ Emissions - Section 58-37-40(C)(2)(c) requires the Commission to consider, in its discretion, whether an IRP appropriately balanced the factor of compliance with applicable state and federal environmental regulations.
c. Clean Energy - Section 58-37-40(C)(2)(c) requires the Commission to consider, in its discretion, whether an IRP appropriately balanced the factor of compliance with applicable state and federal environmental regulations.
d. Fuel Cost Resiliency - Section 58-37-40(C)(2)(e) requires the Commission to consider, in its discretion, whether an IRP appropriately balanced the factor of commodity price risks, which includes fuel cost resiliency.
e. Generation Diversity - Section 58-37-40(C)(2)(f) requires the Commission to consider, in its discretion, whether an IRP appropriately balanced the factor of diversity of generation supply.
f. Reliability Factors - Section 58-37-40(C)(2)(d) requires the Commission to consider, in its discretion, whether an IRP appropriately balanced the factor of power supply reliability.
g. Mini-Max Regret – Order No. 2020-832 required DESC to implement a Mini-Max regret analyses in the Modified 2020 IRP.
h. Cost Range Analysis - Section 58-37-40(C)(2)(b) requires the Commission to consider, in its discretion, whether an IRP appropriately balanced the factor of consumer affordability and least cost. Order No. 2020-832 also required DESC to implement a Cost Range analysis in the Modified 2020 IRP.

**1. Levelized Cost**

The Levelized Cost metric measures the costs to customers of each of the Core Build Plans based on the thirty-year levelized net present value ("LNPV") of the incremental costs of each Build Plan. The incremental costs include incremental operating costs, capital costs for new generation, incremental costs for ongoing operation and maintenance, and DSM costs.[21] The

[21] Apart from unique events such as early retirements, the incremental costs do not include electric transmission cost apart from generator lead-line construction costs which are included in the costs of constructing new resources. Resource planning at the IRP level is not location-specific so specific transmission costs associated with specific resources cannot be determined. Instead, for resource planning purposes, transmission upgrade costs are assumed to be generally consistent for all Build Plans within each Market Scenario.

following table shows the Levelized Cost Comparison of the Core Build Plans. The Levelized Cost Comparison of all twenty-four cases is attached as **Appendix J**.

**Table 7: Levelized Cost Comparison of the Core Build Plans (30-Year LNPV in Millions)**

| | Core Market Scenarios | | |
|---|---|---|---|
| **Build Plans** | **Reference** | **High Fossil Fuel Prices** | **Zero Carbon Cost[22]** |
| **RP8** | $1,951 | $2,350 | $1,829 |
| **Williams 2047 Reference Build Plan** | $1,812 | $2,190 | $1,679 |
| **Williams 2030 Reference Build Plan** | $1,823 | $2,210 | $1,702 |
| **High Fossil Fuel Prices** | $1,836 | $2,175 | $1,727 |
| **Zero Carbon Cost** | $1,821 | $2,208 | $1,684 |
| **Carbon Constrained** | $2,182 | $2,423 | $2,122 |

This table shows that within any given Market Scenario, the Core Build Plans produce results which are generally consistent in cost. Three of the six Core Build Plans are the generally the most cost-effective across most of the Core Market Scenarios. They are the Williams 2047 Reference Build Plan, Williams 2030 Reference Build Plan, and the Zero Carbon Cost Build Plan. They show less than 2% variation in levelized costs between them.

Williams 2047 Reference Build Plan is the most or second-most cost-effective Build Plan across all three Core Market Scenarios including the Reference Market Scenario which is the most likely set of market conditions that the system will encounter during the coming years. The Carbon

[22] It is anomalous that under the Zero Carbon Cost Market Scenario, the Williams 2047 Reference Build Plan is more cost effective than the Zero Carbon Cost Build Plan which PLEXOS optimized for that Market Scenario. However, the difference is less than 0.3% and within the range of variation that can be expected in optimization modeling of this complexity. See Note 8, above for a fuller description of such variations.

Constrained Build Plan was the most expensive Build Plan of the Core Build Plans, costing between 18.8% and 24.2% more than the Williams 2047 Reference Build Plan.

Both the Zero Carbon Cost Build Plan and Williams 2047 Reference Build Plan are highly comparable in cost and have less than 1% difference across all three Core Market Scenarios. They both retire Williams in 2047. The Williams 2030 Reference Build Plan costs approximately 0.5% to 1.3% more than Williams 2030 Reference Build Plan and 0.1% to 1% more than the Zero Carbon Cost Build Plan but would allow DESC to retire Williams 17 years earlier in 2030.

The following table summarizes rankings of the Core Build Plans under the three Core Market Scenarios. The results are color coded: 1. Green = Least Cost, 2. Blue = Second Lowest Cost, and 6. Orange = Highest Cost.

**Table 8: Levelized Cost Comparison of the Core Build Plans (Rank Order Score)**

| | Core Market Scenarios | | |
|---|---|---|---|
| **Build Plans** | **Reference** | **High Fossil Fuel Prices** | **Zero Carbon Cost** |
| **RP8** | 5 | 5 | 5 |
| **Williams 2047 Reference** | 1 | 2 | 1 |
| **Williams 2030 Reference** | 3 | 4 | 3 |
| **High Fossil Fuel Prices** | 4 | 1 | 4 |
| **Zero Carbon Cost** | 2 | 3 | 2 |
| **Carbon Constrained** | 6 | 6 | 6 |

### 2. $CO_2$ Emissions

DESC required PLEXOS to generate Build Plans that comply with all current environmental regulations on the air emissions of electric generating stations, which are among the most stringent that apply to any industry in the United States. Going forward, the single most important environmental challenge for electric generation will be limiting carbon emissions which are not currently regulated. Carbon emission are a particularly important consideration for DESC's customers and for achieving Dominion Energy's net-zero carbon and methane emissions commitment.

The following table summarizes the $CO_2$ emissions of the Core Build Plans as forecasted at the end of 2050. The table below ranks the six Core Build Plans under each of the three Core Market Scenarios. The scale is 1. Green= Lowest emissions, 2. Blue= Second lowest emissions and 6. Orange= Highest emissions.

**Table 9: 2050 $CO_2$ Emissions (Ktons) Rankings of the Core Build Plans (Rank Order)**

| | Core Market Scenarios | | | | |
|---|---|---|---|---|---|
| **Build Plans** | **Reference** | **High Fossil Fuel Prices** | **Zero Carbon Cost** | **% Reduction from 2005** | **Ranking** |
| **RP8** | 10,331 | 10,342 | 10,342 | 45.6% | 3 |
| **Williams 2047 Reference** | 10,659 | 10,670 | 10,674 | 43.8% | 4 |
| **Williams 2030 Reference** | 10,820 | 10,839 | 10,844 | 43.0% | 5 |
| **High Fossil Fuel Prices** | 9,398 | 9,409 | 9,411 | 50.4% | 2 |
| **Zero Carbon Cost** | 11,160 | 11,198 | 11,174 | 41.1% | 6 |
| **Carbon Constrained** | 2,863 | 2,857 | 2,991 | 84.9% | 1 |

As expected, the Carbon Constrained Build Plan results in the greatest reduction in $CO_2$ emissions in 2050 under all Core Market Scenarios and the Zero Carbon Cost Build Plan has the least. The High Fossil Fuel Prices Build Plan has the second lowest amount of $CO_2$ emissions in 2050, primarily due to the high-efficiency gas units added in the plan. The Williams 2030 Reference Build Plan and Williams 2047 Reference Build Plan are closely aligned in 2050 $CO_2$ emissions (a 0.8% difference in emissions reductions) reflecting variability inherent in the modeling, and differences in the Build Plans made possible by the retirement delay. Williams will be fully retired by 2050 under either Build Plan.

**Table 10: Cumulative 2051 $CO_2$ Emissions (Ktons) Rankings of the Core Build Plans (Rank Order)**

| | Core Market Scenarios | | | |
|---|---|---|---|---|
| **Build Plans** | **Reference** | **High Fossil Fuel Prices** | **Zero Carbon Cost** | **Ranking** |
| **RP8** | 273,220 | 270,981 | 277,343 | 4 |
| **Williams 2047 Reference** | 281,436 | 284,888 | 301,868 | 5 |
| **Williams 2030 Reference** | 266,849 | 264,839 | 270,473 | 3 |
| **High Fossil Fuel Prices** | 240,884 | 238,939 | 244,375 | 2 |
| **Zero Carbon Cost** | 287,339 | 290,712 | 306,545 | 6 |
| **Carbon Constrained** | 174,083 | 171,693 | 178,951 | 1 |

The cumulative reductions in $CO_2$ emissions in 2051 show similar results with the greatest reductions shown under the Carbon Constrained Build Plan where PLEXOS was instructed to obtain an 80% reduction in emissions by 2050 from 2005 levels. The cumulative $CO_2$ emissions for the Core Build Plans in 2051 is generally consistent across the Core Market Scenarios. The Williams 2030 Reference Build Plan shows a significant cumulative reduction in $CO_2$ emissions compared to the Williams 2047 Reference Build Plan as would be expected. A full summary of the 2051 cumulative $CO_2$ emissions for all Twenty-Four cases is attached as **Appendix K**.

### 3. Clean Energy

The Core Build Plans are heavily weighted toward non-emitting capacity (solar, solar plus battery, battery capacity, OSW and SMRs) with between 66% and 87% of the capacity added during the 30-year planning horizon being non-emitting capacity. And all Core Build Plans result in renewables representing a significant amount of generation capacity at the end of the forecast period renewables—between 48% and 61% of total.

The Clean Energy metric compares the Core Build Plans based on how much energy they produced with non-emitting generation over the thirty-year planning horizon, 2022-2051. Clean Energy includes energy generated by nuclear, solar, and hydro facilities. The modeling shows that all build plans produce between 30% and 79% Clean Energy by 2050. But while the percentage of Clean Energy varies by Build Plan, a Build Plan's Clean Energy output does not vary greatly across Market Scenarios because solar, nuclear and hydro generation involve very low fuel cost and economic dispatch assures that the system will use as much low fuel cost energy to meet customers' needs as is possible. The Build Plans with the largest Clean Energy generation in 2050 is the Carbon Constrained Build Plan, at 79%, followed by the High Fossil Fuel Prices Build Plan and Stagflation Build Plan, both at 40%. The Zero Carbon Cost Build Plan, the Low Regulation Build Plan and the Low DSM Build Plan have lowest cumulative Clean Energy generation in 2050 at 30% each. **Table 11** shows the total Clean Energy generated under each Build Plan.

**Table 11: Clean Energy Produced by the Build Plans in 2050 (GWH)**

| Build Plan | Non-Emitting GWH | % Clean Energy |
|---|---|---|
| **RP8** | 9,804 | 31% |
| **Williams 2030 Reference** | 10,232 | 32% |
| **Williams 2047 Reference** | 10,225 | 32% |
| **High Fossil Fuel Prices** | 12,938 | 40% |
| **Zero Carbon Cost** | 9,598 | 30% |
| **Carbon Constrained** | 25,492 | 79% |
| **High $CO_2$ Price** | 11,816 | 37% |
| **Low Regulation** | 9,439 | 30% |
| **Stagflation** | 11,021 | 40% |
| **Aggressive Environmental Regulation** | 12,858 | 36% |
| **Medium DSM** | 11,181 | 35% |
| **Low DSM** | 9,427 | 30% |

### 4. Fuel Cost Resiliency

Each of the Core Build Plans anticipates the addition of a different set of generation resources which will result in a different mix of fuel costs over the planning horizon. The following table evaluates fuel costs as a stand-alone component of cost for the Core Build Plans under the eighteen Core Cases. **Table 12** shows the levelized fuel costs of all Build Plans. The results are color coded: 1. Green = Least Cost, 2. Blue = Second Lowest Cost, and 6. Orange = Highest Cost. Fuel costs are considered along with other costs in the Leveled Cost analysis, so that this analysis is supplemental to it. Although all fuel costs are included, the only fuel prices that change depending upon the Market Scenario are coal and natural gas prices. Nuclear fuel and fuel oil prices are the same in every case.

**Table 12: Fuel Costs for the Core Build Plans (Level Costs in Millions)**

| Build Plans | Core Market Scenarios | | | Ranking |
|---|---|---|---|---|
| | Reference | High Fossil Fuel Prices | Zero Carbon Cost | |
| **RP8** | $756 | $1,141 | $757 | 6 |
| **Williams 2047 Reference** | $736 | $1,101 | $735 | 3 |
| **Williams 2030 Reference** | $747 | $1,122 | $747 | 4 |
| **High Fossil Fuel Prices** | $686 | $1,015 | $687 | 2 |
| **Zero Carbon Cost** | $750 | $1,124 | $749 | 5 |
| **Carbon Constrained** | $554 | $790 | $556 | 1 |

The Carbon Constrained Build Plan produced the lowest fuel costs of the Core Build Plans across all three Core Market Scenarios. This was due to its high percentage of low-fuel cost, non-emitting generation, and greater reliance on combined cycle gas generation compared to less fuel-efficient CT units. RP8 Build Plan had the highest fuel cost due to its low percentage of non-emitting resources and its reliance on less fuel-efficient CTs.

The inputs in the High Fossil Fuel Prices Market Scenario should result in an optimized Build Plan that performs well in a high fossil fuel cost environment. Accordingly, it has the second lowest fuel cost of all the Core Build Plans.

### 5. Generation Diversity

Each of the Core Build Plans proposes a mix of generation resources which will result in a different level of generation diversity in the system. The following chart ranks the generation diversity of each of the Core Build Plans according to the percentage that the generation mix it creates is concentrated in any one type of generation asset. Under this analysis, a plan that leads to a generation system with a single type of generation asset representing 35% of its generation mix would have less generation diversity than a plan where no generation resource type represented more than 25% of its generation mix. The results are color coded: 1. Green = Greatest Diversity, 2. Blue = Second Highest Diversity, and 6. Orange = lowest diversity.

**Table 13: Generation Diversity (Diversity Score and Rank Order)**

| Build Plan | Diversity Score | Rank |
|---|---|---|
| **RP8** | 0.329 | 4 |
| **Williams 2047 Reference** | 0.341 | 5 |
| **Williams 2030 Reference** | 0.342 | 6 |
| **High Fossil Fuel Prices** | 0.409 | 12 |
| **Zero Carbon Cost** | 0.313 | 2 |
| **Carbon Constrained** | 0.344 | 7 |
| **High $CO_2$ Price** | 0.385 | 10 |
| **Low Regulation** | 0.324 | 3 |
| **Stagflation** | 0.389 | 11 |
| **Aggressive Environmental Regulation** | 0.366 | 9 |
| **Medium DSM** | 0.363 | 8 |
| **Low DSM** | 0.303 | 1 |

In each case, the percentage of Solar added drives the diversity score. All Build Plans concentrate at least 30% of system assets in Solar resources. The highest concentration of solar-related resources, 41%, is under the High Fossil Fuel Prices Build Plan where high fossil fuel costs have resulted in minimal natural gas generation being added to the system and is also the lowest diversity score. The highest diversity score goes to the Low DSM Build Plan which results in a Solar concentration of 30%. This reflects the base fuel and $CO_2$ price assumptions and low load growth, leading to less additional generation and less solar being added to the system. The Zero Carbon Cost Build Plan is next with a 31% solar concentration.

The MW of each generation type added by year for each Build Plan is provided in **Appendix F**.

### 6. Reliability Analysis

The IRP Statute[23] mandates consideration of power supply reliability. The PLEXOS model is configured to ensure that all the Build Plans it generates meet a common reliability standard and that the resources included in each Build Plan collectively meet the systems' seasonal peak hour reserve margin, including allowances for forced and scheduled outages and other reliability considerations. In addition, DESC's Transmission Planning group considers coincident peak contribution, energy storage, limited energy storage, dispatchability, and secondary frequency response factors in its annual reliability planning. As a result, all Build Plans are designed with reliability as a priority. No plans are formulated to provide more resources or less resources than are necessary to meet the system reliability criteria.

To provide an additional measure of reliability, and to support comparative evaluation of Build Plans, DESC has also devised a means of scoring the reliability contribution of each generation technology that is included in the Build Plans. To preclude double-counting, and in consultation with Stakeholders, DESC limited the reliability analysis to factors that are not otherwise considered, specifically black start, fast start, geographic diversity, and proximity to load factors.

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[23] S.C. Code Ann. § 58-37-40(C)(2)(d).

**Table 14: Reliability Factors Considered in the Metric**

| Reliability Factor | Able to generate or become a load, shift energy, and complement renewables. |
|---|---|
| **Fast Start** | The unit can respond from an offline condition and serve load in less than 10 minutes. |
| **Geographic Diversity** | The unit can be located in diverse locations and is not restricted by fuel infrastructure. |
| **Proximity to Load** | The unit has a compact footprint and low impact outside of the fence. It can often be sited near load centers. |
| **Black Start** | A generating unit which has the ability to be started without support from the system or is designed to remain energized without connection to the remainder of the system, with the ability to energize a bus, meeting the transmission operator's restoration plan needs for real and reactive power capability, frequency and voltage control, and that has been included in the transmission operator's restoration plan. |

Under this analysis, the reliability contribution of each generation resource is as follows:

**Table 15: Reliability Contributions of Generation Technologies**

| Potential Reliability Attribute | Coal Units | Aero CT | Frame CT | Gas CC | Solar PV | Paired Battery Storage | Stand Alone Battery Storage | SMR | Offshore Wind |
|---|---|---|---|---|---|---|---|---|---|
| **Black Start** | No | Yes | Yes | No | No | No | No | No | No |
| **Fast Start** | No | Yes | Yes | No | No | Yes | Yes | No | No |
| **Geographic Diversity** | No | No | No | No | No | No | Yes | Yes | No |
| **Proximity to Load** | Yes[24] | Yes | Yes | Yes | No | No | Yes | Yes | No |

[24] Williams's location is near a major load center and provides essential reliability attributes in the Charleston metroplex. Wateree is not credited pending completion of the 2022 TIA.

Each Build Plan has been scored based on the MWs that its resources contribute to fast start, geographic diversity, proximity to load, and black start. The score is based on the raw MW contribution and is not adjusted for abundance or scarcity of the attribute contributed on the system. The results show that all Build Plans make a positive contribution to system reliability.

**Table 16: Reliability Scores**

| Build Plan | Total Change in RF (MW equivalent) | Rank |
|---|---|---|
| RP8 | 4,733 | **10** |
| Williams 2047 Reference | 5,351 | **8** |
| Williams 2030 Reference | 5,501 | **7** |
| High Fossil Fuel Prices | 6,326 | **4** |
| Zero Carbon Price | 5,276 | **9** |
| Carbon Constrained | 2,400 | **12** |
| High $CO_2$ Price | 5,726 | **6** |
| Low Regulation | 6,095 | **5** |
| Stagflation | 3,932 | **11** |
| Aggressive Environmental Regulation | 9,464 | **1** |
| Medium DSM | 6,620 | **3** |
| Low DSM | 6,657 | **2** |

Under this analysis, the Aggressive Environmental Regulation Build Plan scored highest of all twelve Build Plans, followed by the Low DSM Build Plan. The determining factor was the relatively high amount of CT capacity added under those plans which contribute both black start and fast start capabilities. The Carbon Constrained Build Plan scored lowest. While the Solar and Solar plus Battery it contributed to the system benefitted reliability scores, the volume was not sufficient to allow it to score higher.

### 7. Mini-Max Regret

The Mini-Max Regret metric is an assessment of the potential worst-case cost changes under each Build Plan. The analysis measures the difference in cost between each Core Build Plan and the lowest cost Core Build Plan under that Market Scenario.

In this analysis, the Williams 2047 Reference Build Plan received the best mini-max score with zero regrets across two of the three Core Market Scenarios and the second lowest regrets score in the third. The High Fossil Fuel Prices Build Plan had the lowest regrets in one scenario but relatively high regrets ($24 million and $48 million) in the other two. The Zero Carbon Cost Build Plan had the second lowest regrets score in two Market Scenarios. The Carbon Constrained Build Plan presented the greatest financial risk to customers ($248-$443 million regrets).

**Table 17: 30-Year Levelized NPV Cost ($M) Mini-Max Regret Comparison of the Core Build Plans (Rank Order Score)**

| | Core Market Scenarios | | | | |
|---|---|---|---|---|---|
| **Build Plans** | **Reference** | **High Fossil Fuel Prices** | **Zero Carbon Cost** | **Max Regret** | **Ranking** |
| **RP8** | $139 | $175 | $150 | $175 | 5 |
| **Williams 2047 Reference** | $0 | $14 | $0 | $14 | 1 |
| **Williams 2030 Reference** | $11 | $34 | $23 | $34 | 3 |
| **High Fossil Fuel Prices** | $24 | $0 | $48 | $48 | 4 |
| **Zero Carbon Cost** | $9 | $32 | $5 | $32 | 2 |
| **Carbon Constrained** | $370 | $248 | $443 | $443 | 6 |

### 8. Cost Range Analysis

A Cost Range Analysis calculates spread between the lowest and highest cost for each Build Plan across the three Core Market Scenarios.

**Table 18: Cost Range Analysis (Rank Order and Cost Spread, Minimum to Maximum)**

| Build Plans | Cost Spread | Ranking |
|---|---|---|
| **RP8** | $522 | 5 |
| **Williams 2047 Reference** | $511 | 4 |
| **Williams 2030 Reference** | $508 | 3 |
| **High Fossil Fuel Prices** | $448 | 2 |
| **Zero Carbon Cost** | $524 | 6 |
| **Carbon Constrained** | $301 | 1 |

Using this metric, the two Build Plans with the highest renewables percentages, the Carbon Constrained Build Plan and the High Fossil Fuel Prices Build Plan received the best scores. This reflects the fact that the relatively high percentage of non-emitting resources they add are not subject to changing assumptions concerning $CO_2$ prices or fuel costs and so costs vary little when those assumptions are changed. But given the high capital cost of non-emitting resources, these plans have respectively the highest, and apart from RP8, the second highest cost to customers.

### 9. Core Build Plans Ranked Across All Metrics

The following table presents the ranking of each of the Core Build Plans against all eight metrics required by the Commission.

**Table 19: Rankings of the Core Optimized Plans and RP8 against all Eight Metrics (Rank Order)**

| Risk and Uncertainty - All Scenarios | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Build Plan | 30-Year LNPV | 2050 $CO_2$ Emissions | 2050 Clean Energy | Fuel Costs | Diversity | Reliability | Mini-Max Regret | Cost Range |
| RP8 | 5 | 3 | 5 | 6 | 2 | 5 | 5 | 5 |
| Williams 2047 Reference | 1 | 4 | 3 | 3 | 3 | 3 | 1 | 4 |
| Williams 2030 Reference | 3 | 5 | 4 | 4 | 4 | 2 | 3 | 3 |
| High Fossil Fuel Prices | 4 | 2 | 2 | 2 | 6 | 1 | 4 | 2 |
| Zero Carbon Cost | 2 | 6 | 6 | 5 | 1 | 4 | 2 | 6 |
| Carbon Constrained | 6 | 1 | 1 | 1 | 5 | 6 | 6 | 1 |

The evaluation of the Core Build Plans across these eight metrics provides a systematic and quantitative assessment of the factors relevant to the selection of a preferred resource plan. Each of these metrics has a different value to the analysis. And mathematical calculations can never solely take the place of informed judgment and the appropriate balancing of multiple factors. Nonetheless, these results point to Williams 2030 Reference Build Plan as the most reasonable and prudent plan for DESC to pursue at this time assuming the cost assumptions underlying them are achievable.

Although the Carbon Constrained Plan has the best ratings under $CO_2$ emissions, fuel costs, clean energy, and cost range, it is the most expensive Build Plan with a levelized annual cost to customers of between \$248 million and \$443 million more than the lowest cost plan under each Core Market Scenario. By comparison, three of the six Core Build Plans cost a maximum of \$34 million more than the lowest cost plan under different Market Scenarios. Although the Williams 2030 Reference Build Plan did not receive high scores under most metrics, its score did not vary greatly from the Williams 2047 Reference Build Plan or the Zero Carbon Cost Build Plan which do not envision Williams retiring early.

### L. Insights from Six Sensitivity Cases

In addition to the Core Analysis, DESC also modeled six additional Market Scenarios as Sensitivity Cases. Among other things, these Sensitivity Cases fulfill requirements of the IRP Statute that specific information and analysis be included in each IRP filing.[25] These Sensitivity Cases measure how the Core Build Plans will vary depending on changes in Fuel Cost (Low Fuel Cost as compared to High and Base Fuel costs as modeled in the Core Market Scenarios); Load Growth (Low or High Load Growth as compared to Base Load Growth modeled in the Core Market Scenarios); and DSM (Medium to Low DSM contributions to restraining load growth compared to High DSM modeled in the Core Market Scenarios).

The six Sensitivity Cases result in Build Plans that include between 64% and 87% non-emitting generation being added to the system with Solar Plus Storage and Battery capacity representing between 47% and 69% of the additions. The lowest percentage of non-emitting and battery-related technology is added in the Low DSM Build Plan, which assumes no $CO_2$ costs and base fossil fuel costs. The highest is in the Stagflation Build Plan which assume low load growth, no $CO_2$ costs, and high fossil fuel costs. Under the Sensitivity Cases, all Build Plans result in solar and battery-related resources equal to at least 64% of future additions.

The Sensitivity Cases confirm the representative nature of the Core Cases since the Sensitivity Cases produce Build Plans that are generally aligned with comparable Core Cases despite changes in certain market assumptions. Mapping the costs of the Core Build Plans and the Sensitivity Cases shows a strong correlation between overall system electricity costs and

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[25] S.C. Code Ann. § 58-37-40.

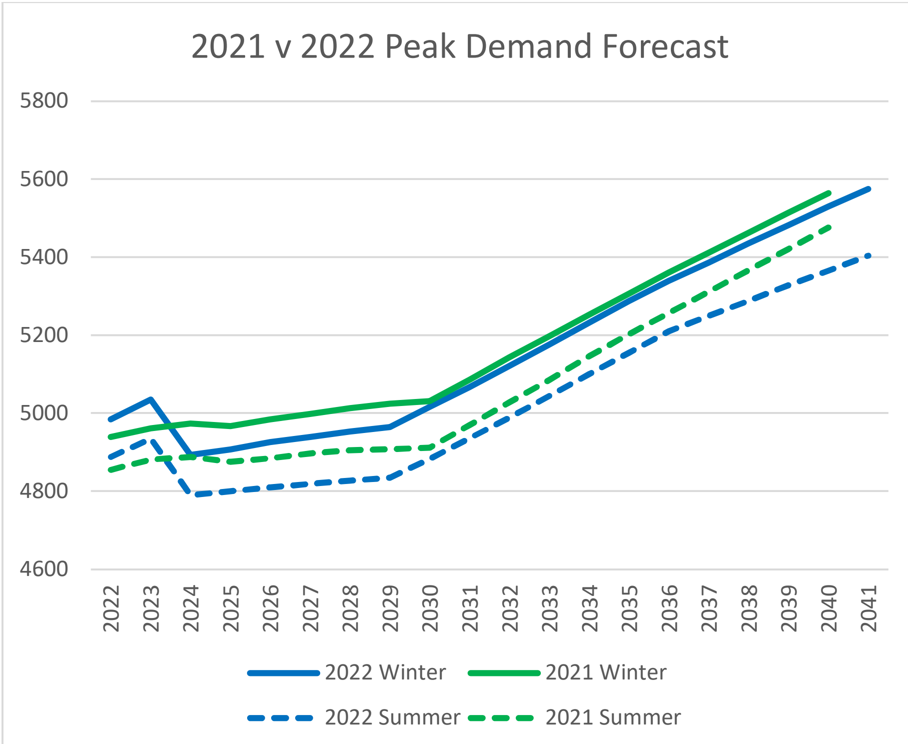
increasing non-emitting additions. Since the model optimizes resources based on market conditions, this correlation demonstrates that fuel costs, $CO_2$ costs, and load growth are the primary drivers for making non-emitting capacity the optimal choice and that non-emitting percentages are high where these costs are high. The Core Build Plans and the Sensitivity Cases also show that under all market conditions a reasonable amount of new natural gas fired generation will be required to support reliability and meet customers' energy needs cost effectively.

## VI. MODELING INPUTS AND ASSUMPTIONS

### A. Load Growth Forecast

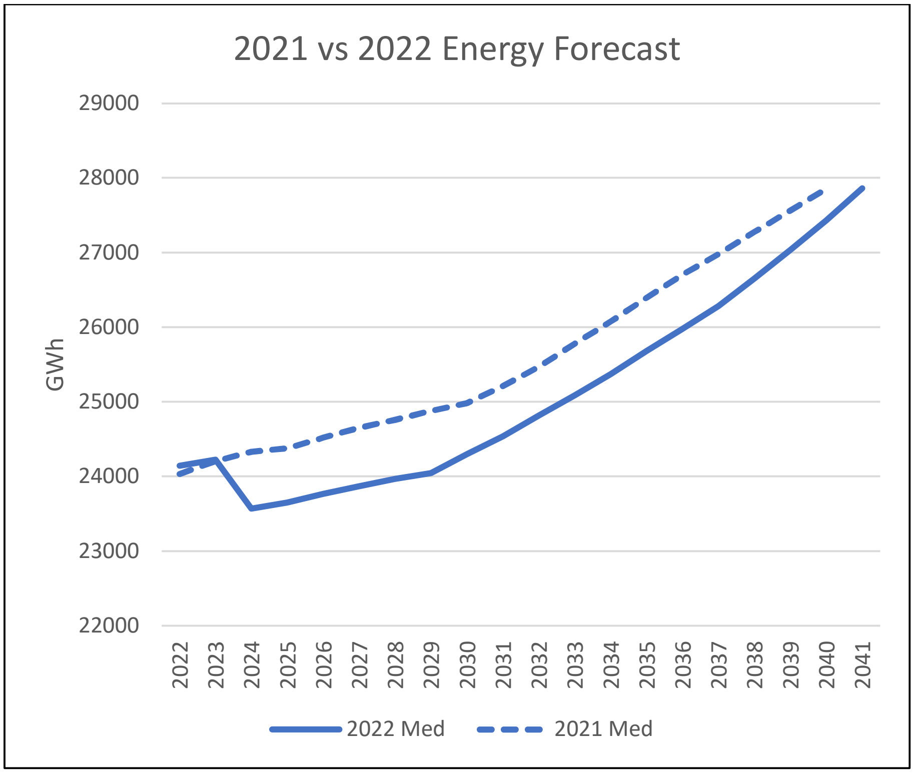
The Base Load Forecast used in this 2022 IRP Update incorporates the Company's 2022 annual Base Load Forecast of customers' future energy and demand needs for the thirty-year planning horizon. It reflects the updated 2022 Guidehouse forecast for expansion in demand for electric vehicles. It anticipates a reduction in peak electric demand in 2024 relative to 2023 due to the expected termination of the Power Supply Agreement with a large wholesale customer. Wholesale energy sales represent about 3.6% of the Company's total sales. The result is modest annualized decrease in the winter peak demand (-0.1%) during the seven-year period following 2022-2029. This reflects a slower growth in demand than was assumed in the 2021 Base Load Forecast.

**Figure 5: Summer and Winter Peak Forecast (MW)**



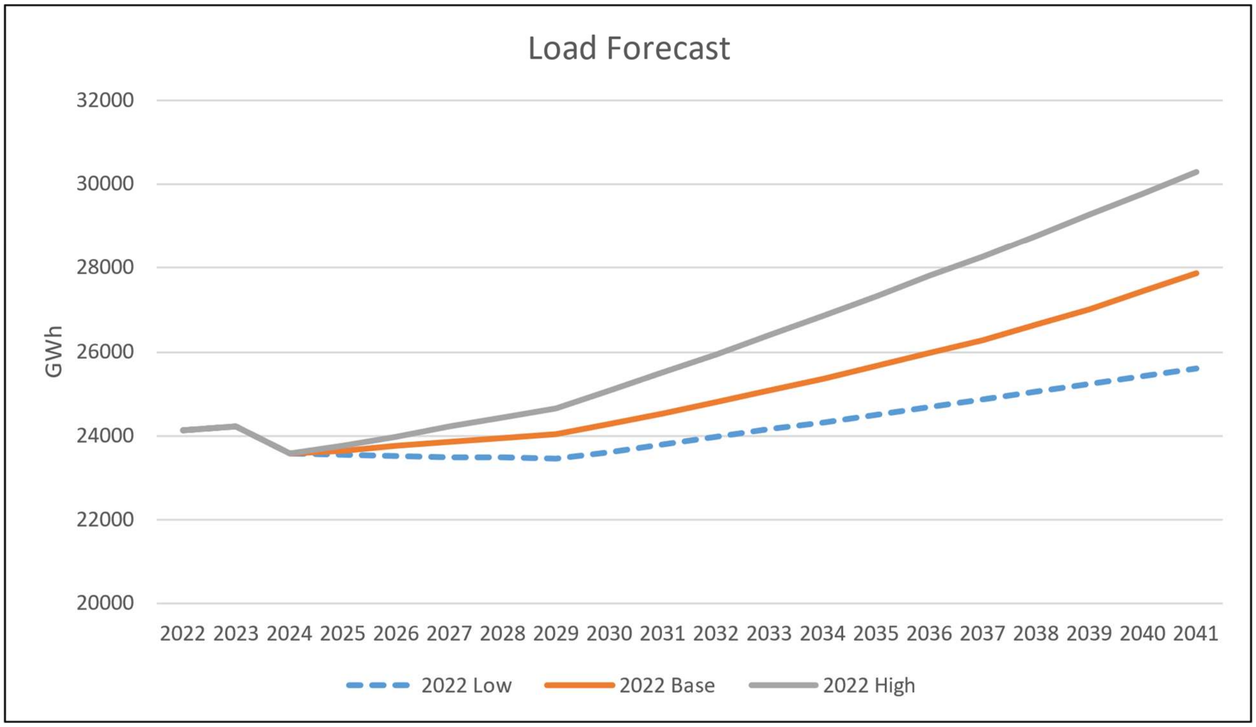

The 2022 energy forecast is also significantly lower than the Base Load Forecast for 2021 and shows a similar dip in energy consumption between 2023 and 2024 driven by the loss of the wholesale customer as mentioned above. But it shows a rate of growth in consumption thereafter that is faster than the growth in demand due to the higher forecast of EV being added. It anticipated that a significant proportion of EV charging will take place in off-peak hours.

**Figure 6: Energy Forecast (GWh)**




Seven of the Market Scenarios incorporate the Base forecast for load growth. The Stagflation Market Scenario models a Low Load Forecast which assumes a 0.5% reduction in annual growth in the Base Load Forecasts. The Aggressive Environmental Regulation Market Scenario adopts a High Load Forecast which assumes a 0.5% increase in growth from the Base Load Forecast.

**Figure 7: Low, Medium and High Load Forecasts**




## B. DSM Assumptions

As required by statute, the PLEXOS model was given multiple assumptions as to the effectiveness of DSM programs to limit load growth.

The High DSM assumption is the expected DSM forecast and assumes that the Company's DSM programs achieve a 1% reduction in annual forecasted load growth (excluding opt-out customers). This is based on the High Case Rapid Assessment conducted in response to Commission directive in 2021 with the goal of achieving at least a 1% reduction in the previous year's retail sales beginning in year 2022. All of DESC's energy and demand values include marginal line losses for DSM.

Seven of the nine Build Plans reflect this base assumption. As a sensitivity, one Build Plan, the Medium DSM Build Plan, assumes that DESC achieves a 0.735% reduction in annual growth in energy consumption. This is based on the levels of demand reductions identified in the 2019

Potential Study which predates the High Case Rapid Assessment. The Low DSM Build Plan assumes that the Company achieves 90% of the DSM levels described in the 2019 Potential Study or a 0.61% reduction in annual growth in energy consumption.

These DSM sensitives are required by statute but for planning purposes are duplicative of the Low, Medium, and High load growth sensitivities which assume higher levels of load variability.

### C. Fuel Price Forecasts

Consistent with Order No. 2020-832, DESC developed three natural gas price forecasts based on the Energy Information Administration ("EIA") 2021 Annual Energy Outlook ("AEO") dated March 2022. There is often a lag between AEO forecasts and more immediate changes in natural gas markets which are often short-term in nature. In keeping with Order No. 2020-832, the Company is relying exclusively on the AEO forecast and not adjusting it to reflect short-term market data.

The base gas price use in this modeling was the AEO 2022 reference case, and is used in five of the Market Scenarios, including the Reference Market Scenario. The high gas price use in this modeling was the AEO 2022 Low Oil and Gas Supply case, and is used in two of the Market Scenarios.[26] This is the highest cost case provided in the AEO and assumed that limited gas supplies results in mean higher prices. The low gas price view was the AEO 2022 High Oil and Gas Supply case which assumes plentiful natural gas supplies and low prices.

[26] https://www.eia.gov/outlooks/aeo/pdf/AEO_Narrative_2021.pdf

**Figure 8: Gas Prices (Henry Hub)**

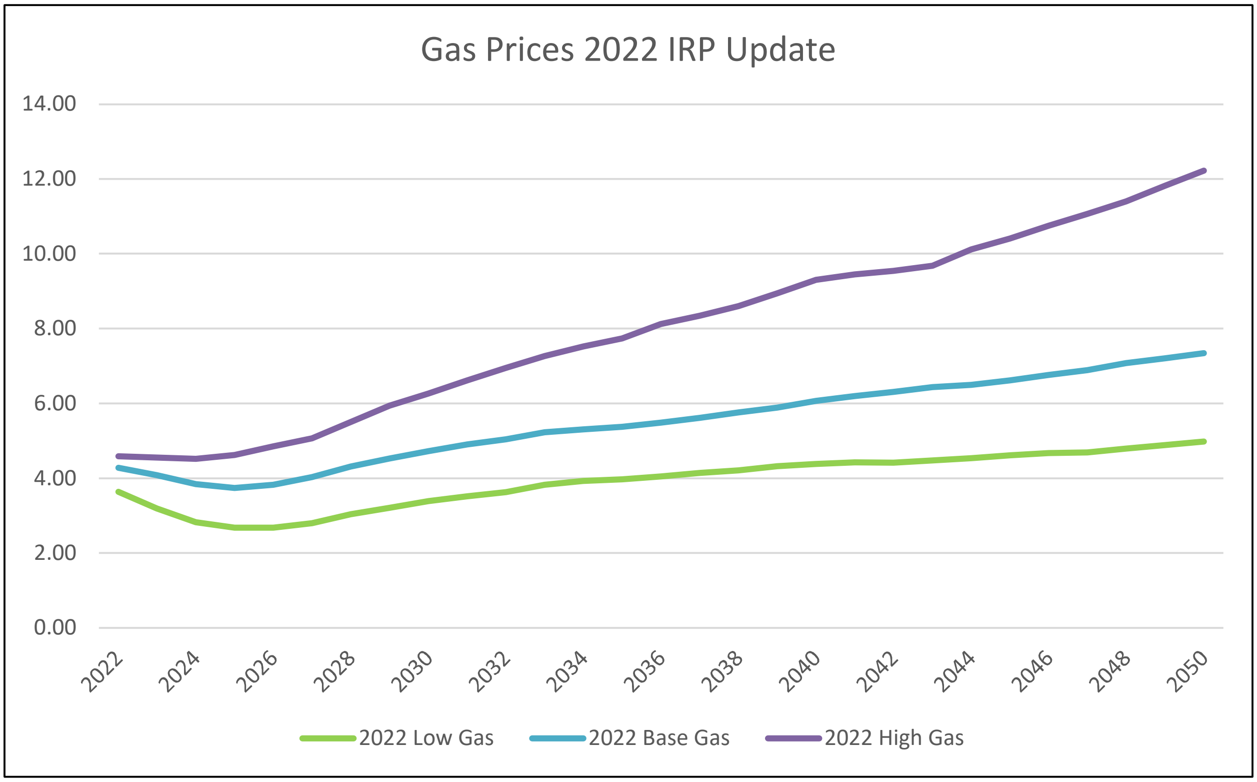
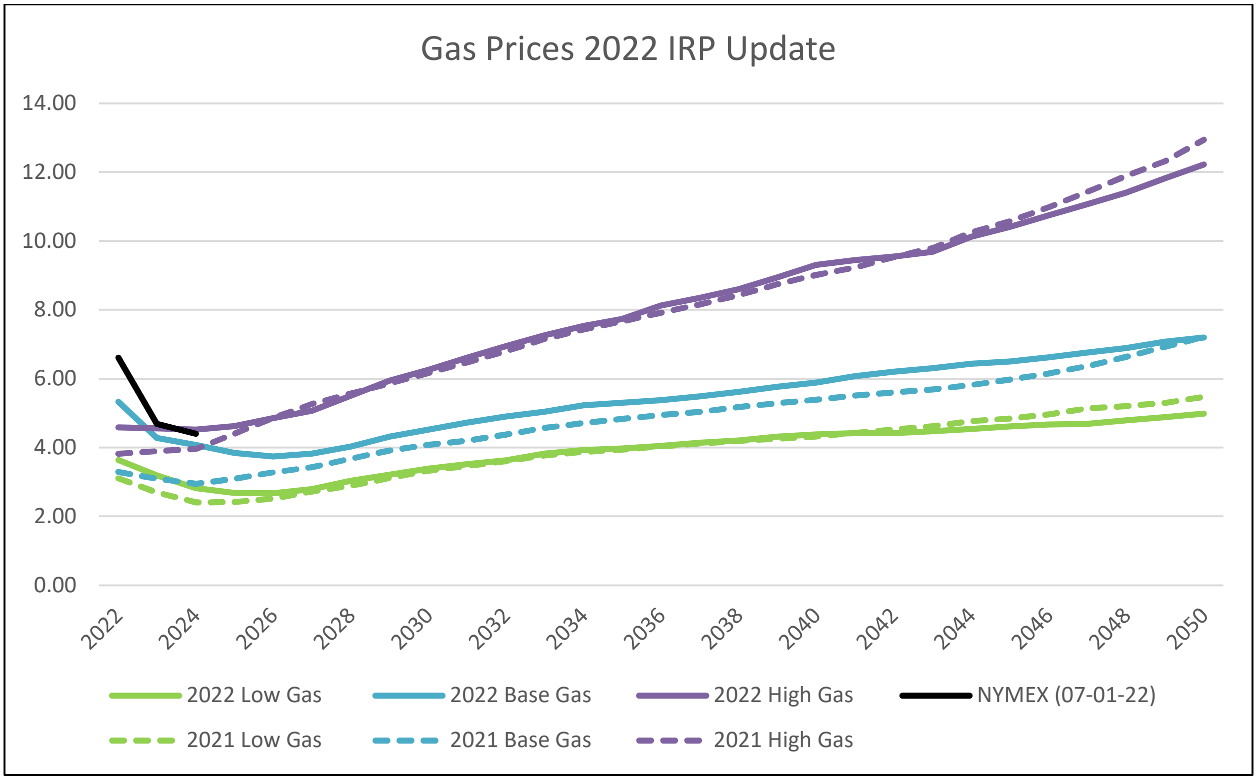
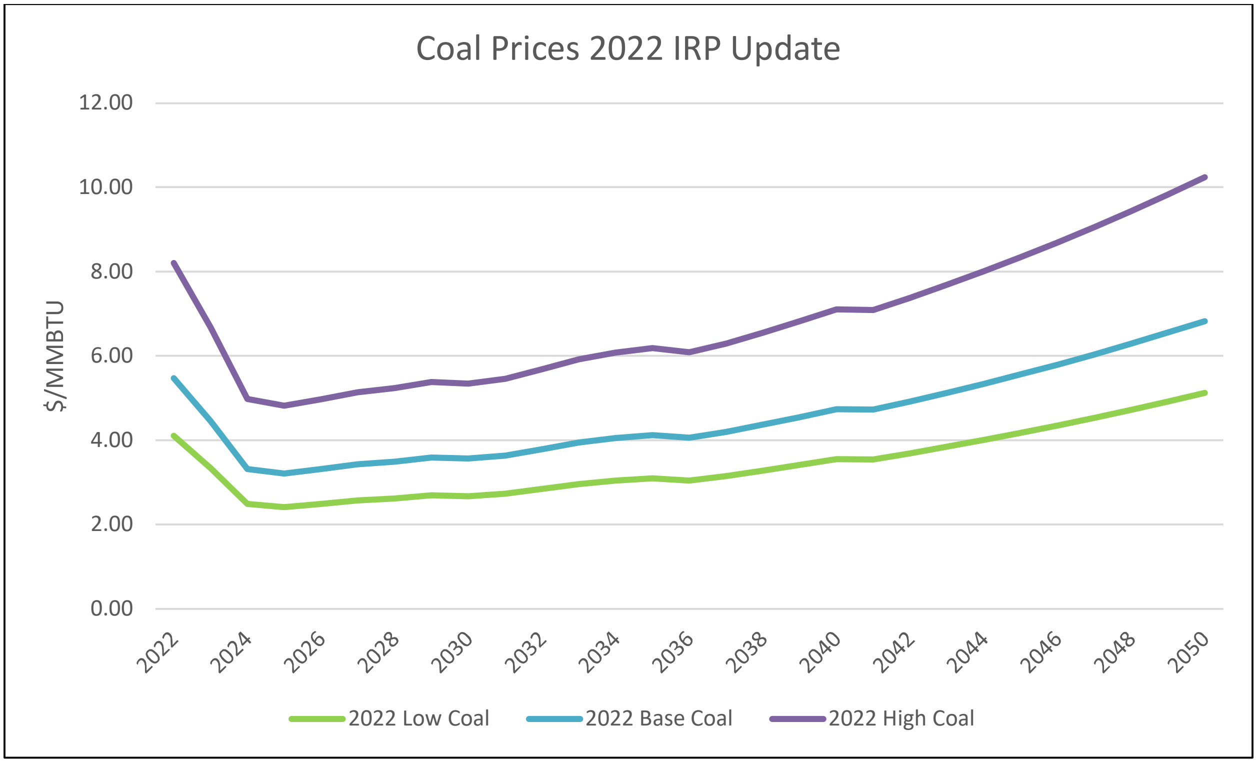


**Figure 9: Natural Gas Price Forecasts**




In response to comments from Stakeholders and ORS, DESC has included coal price sensitivity in this analysis. DESC did so by assuming that the price of coal will vary consistently with the price of natural gas as constraints are imposed on fossil fuel production or are not. Accordingly, fuel price assumptions include high and low price forecasts for both natural gas and coal, with current coal prices adjusted by the same percentage as natural gas prices are adjusted from the reference case.

**Figure 10: Coal Price Forecasts**




**D. $CO_2$ Price Assumptions**

DESC developed three $CO_2$ pricing views for this IRP Update to reflect the wide range of possible emissions pricing pressure that may or may not develop over the coming decades. DESC modeled five Build Plans using the medium $CO_2$ price assumption that a $9.62/Mton $CO_2$ price is imposed starting 2030 then escalates to more than $45/Mton by 2050. This is the IHS "US Power Sector" forecast which was created by a global forecasting company and is widely recognized in the industry. The five Build Plans based on this assumption are the RP8 Build Plan, Williams 2047 Reference Build Plan, Williams 2030 Reference Build Plan Build Plans, the High Fossil Fuel Prices Build Plan and the Carbon Constrained Build Plan.

For the high view of $CO_2$ prices, DESC assumed that $CO_2$ prices would start two years earlier in 2028 and would be 50% higher ($14.43/Mton) than the IHS forecast.[27].The price escalates to $37/Mton by 2040 and $80/Mton by 2050.

Five Build Plans are based on the zero $CO_2$ price assumption that reflects a continuation of current state and federal policies that do not put any explicit price on $CO_2$ emissions. This assumption creates a $CO_2$ sensitivity against which all other Build Plan plans can be evaluated and provides a consistent basis that is unaffected by $CO_2$ cost variables to assess the comparative impact of fuel and load growth variables across these five plans. The five Build Plans that use the zero $CO_2$ cost are the Zero Carbon Cost, Low Regulation, Stagflation, Medium DSM, and Low DSM Build Plans. **Figure 11** below illustrates the three $CO_2$ price trajectories used in this 2022 IRP Update and **Figure 12** illustrates the change in the High and Medium price forecasts from the 2021 IRP Update.

**Figure 11: $CO_2$ Price Forecasts**

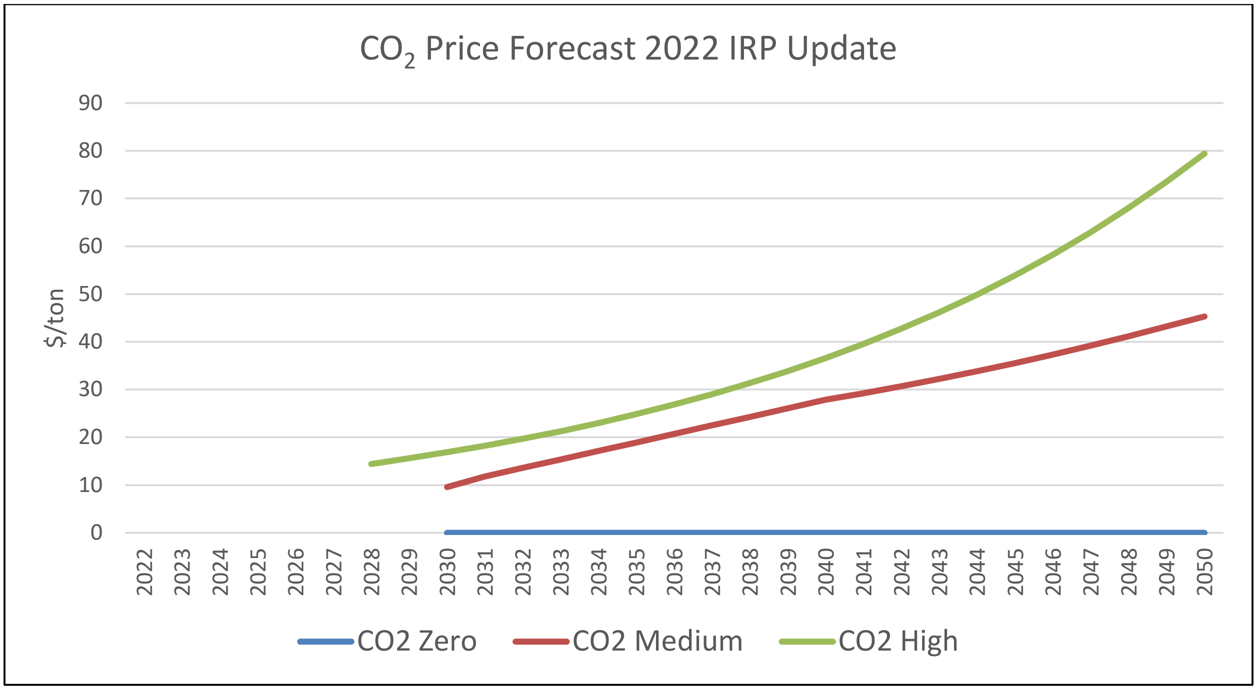
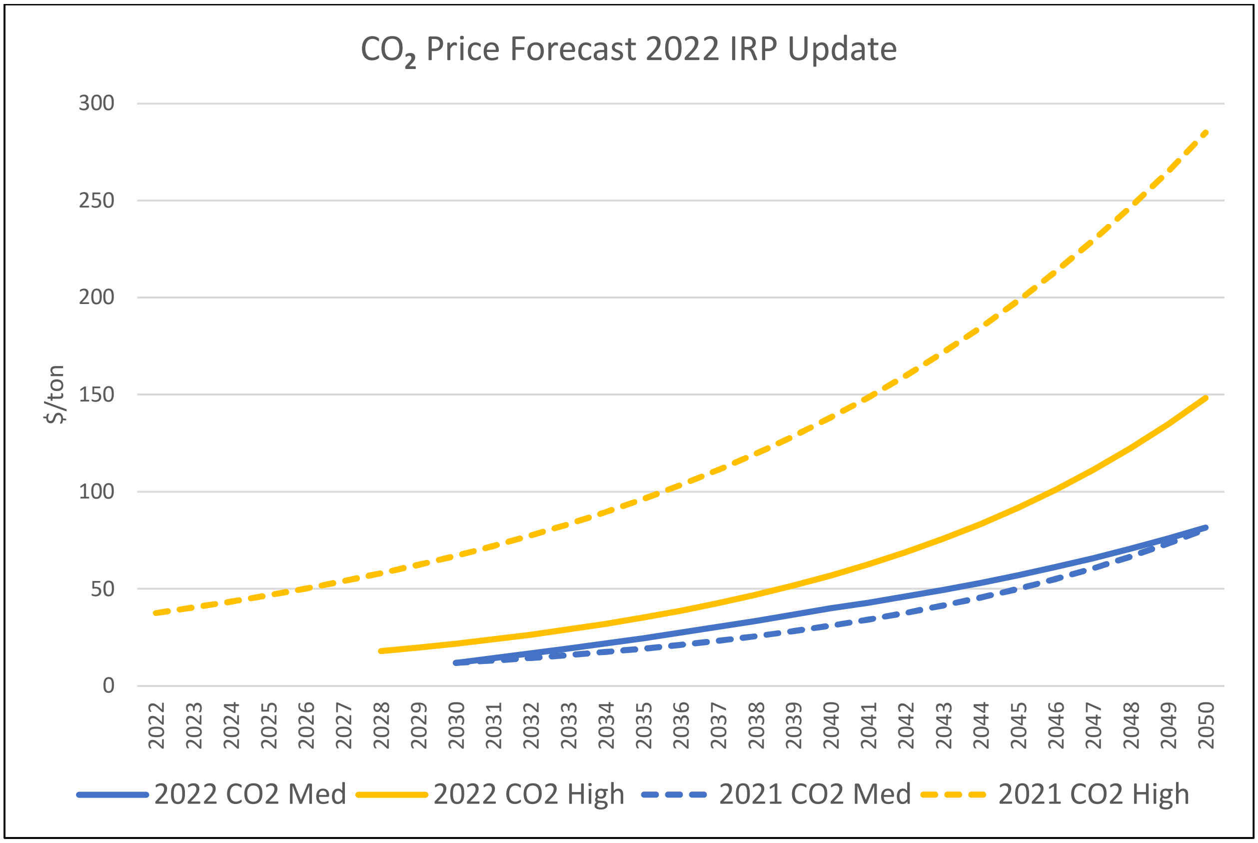


**Figure 12: Change in $CO_2$ Forecast for the Medium and High Cases in the 2021 and 2022 IRP**

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## E. Reserve Margin Requirements

DESC informed the PLEXOS model to maintain a single integrated minimum 21% winter reserve margin and a minimum 14% summer reserve margin. DESC computed these reserve margins by identifying the peak demands placed on the system during the periods of most extreme weather that have occurred in its service territory since the mid-1980s and by updating those peaks for system growth and levels of economic activity. The computation of these reserve margins has not changed since the Modified 2020 IRP. This will be the last time that reserve margins based on this methodology are used. DESC has commissioned a third-party consulting group with broad experience in reserve margin calculations to conduct a probabilistic Reserve Margin and Effective

Load Carrying Capacity ("ELCC") study to be used in the 2023 IRP. The ELCC calculations for this Update are attached as **Appendix C.**

### F. Recently Added or Upgraded Generation Resources

The PLEXOS model includes, as resources already in place or contracted for, 1,108 MW of existing solar PPAs; including a soon to be constructed paired solar and energy storage PPA with a 73.6 MW capacity and an 18 MW four-hour duration battery; full implementation of the CT Plan; and the AGP upgrades at combined-cycle facilities which increase the generating capacity and lower the fuel costs of those units.

### G. Capital and Operating Cost of Resources

The capital costs, escalation in capital cost, operating and maintenance ("O&M") costs and other attributes of each of the eighteen resources available for selection by PLEXOS are listed in **Table 20,** below. These costs have been determined in consultation with Stakeholders. For candidate resources, the capital costs of the resources modeled in each plan have been escalated from 2022 to the year that the generator is installed.

**Table 20: Generation Supply Technology Costs, Escalation and Capacity Units and Supply Technology Characteristics**

| Available Resources | Capital Cost ($2022/kW) | Escalation Rate | Capacity (MW) | Source Of Data |
|---|---|---|---|---|
| New 1x1 Combined Cycle | 1,857 | 1.97% | 553 | Dominion Energy Services - Generation Construction Financial Management & Controls |
| New 2x1 Combined Cycle | 1,437 | 1.97% | 1114 | Dominion Energy Services - Generation Construction Financial Management & Controls |
| New CT Aero 1x | 1,760 | 1.97% | 114 | Dominion Energy Services - Generation Construction Financial Management & Controls |
| New CT Frame 1x | 725 | 1.97% | 262 | Dominion Energy Services - Generation Construction Financial Management & Controls |

| | | | | |
|---|---|---|---|---|
| New CT Frame 2x | 725 | 1.97% | 523 | Dominion Energy Services - Generation Construction Financial Management & Controls |
| New Small Modular Reactor | 6,488 | 1.97% | 275 | Dominion Energy Services - Generation Construction Financial Management & Controls |
| New Solar | 1,226 | Annual escalation per NREL 2022 ATB | 75 | NREL 2022 ATB |
| New Solar PPA | 1,226 | Annual escalation per NREL 2022 ATB | 75 | NREL 2022 ATB |
| New Solar plus Storage | 1,966 | Annual escalation per NREL 2022 ATB | 75 | NREL 2022 ATB |
| New Solar plus Storage PPA | 1,966 | Annual escalation per NREL 2022 ATB | 75 | NREL 2022 ATB |
| New Battery Paired with Solar 4 hour 100% | Cost shown in Solar plus Storage | Escalation shown in Solar plus Storage | 37.5 | NREL 2022 ATB |
| New Battery Paired with Solar 4 hour 80% | Cost shown in Solar plus Storage | Escalation shown in Solar plus Storage | 37.5 | NREL 2022 ATB |
| New Battery Paired with Solar 4 hour 60% | Cost shown in Solar plus Storage | Escalation shown in Solar plus Storage | 37.5 | NREL 2022 ATB |
| New Battery Paired with Solar 4 hour 40% | Cost shown in Solar plus Storage | Escalation shown in Solar plus Storage | 37.5 | NREL 2022 ATB |
| New Battery Paired with Solar 4 hour 30% | Cost shown in Solar plus Storage | Escalation shown in Solar plus Storage | 37.5 | NREL 2022 ATB |
| New Battery 4 hour 100% | 1,387 | Annual escalation per NREL 2022 ATB | 37.5 | NREL 2022 ATB |
| New Battery 8 hour 100% | 2,642 | Annual escalation per NREL 2022 ATB | 37.5 | NREL 2022 ATB |
| New Offshore Wind | 4,323 | Annual escalation per NREL 2022 ATB | 100 | NREL 2022 ATB |

All prices for renewables have been updated with nominal prices calculated from the NREL 2022 ATB. In addition, existing renewables on the DESC system have been updated to include new sources secured through PPAs. As required by Order No. 2020-832, DESC modeled the Solar Investment Tax Credit ("ITC") as provided in the NREL Annual Technology Baseline ("ATB"). For generation coming online in 2022-23 the ITC is 30%, for 2024-2025 the ITC is 26% and for years 2026 and beyond the ITC is 10%.

## VII. THE PREFERRED PLAN

In Order No. 2020-832, the Commission directed DESC to implement resource optimization beginning in the 2022 IRP Update, to study the retirement of the remaining coal units on DESC's system and incorporate the findings of that study into future IRPs filings, beginning with the 2022 IRP Update.

DESC created the Williams 2030 Reference Build Plan as the successor plan to Resource Plan 8 by implementing resource optimization, using the updated inputs and additional resource options considered by PLEXOS, and incorporating the results of the Coal Plants Retirement Study to retire Williams in 2030.

Compared to the RP8 Build Plan, which does not include all of these items, the Williams 2030 Reference Build Plan costs approximately 6% to 6.9% less and adds 10% more non-emitting resources over the planning horizon than the RP8 Build Plan, while maintaining system reliability and resiliency by retiring Williams by December 31, 2030, instead of 2028.

Further refinements to the resource optimization function and planning assumptions will be reflected in the 2023 IRP to select a new preferred plan.

## VIII. FORECAST OF RENEWABLE GENERATION

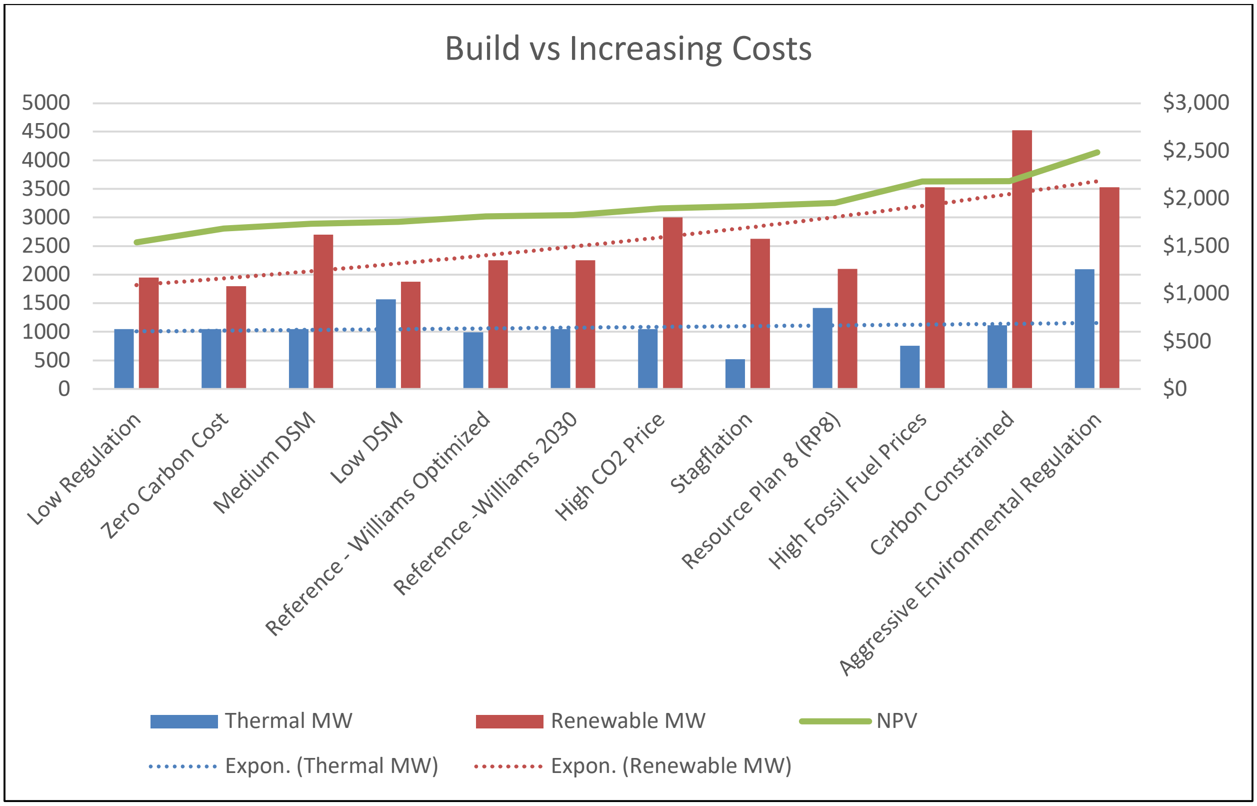
All Core Build Plans include a significant amount of renewables—between 48% and 61% of total generation at the end of the forecast period. The values in the table show the total renewable generation by resource plan by five-year period for the Reference Market Scenario only. Similar data for all twenty-four cases are provided in **Appendix G**.

**Table 21:**

| Energy from Renewable Generation by Five-Year Period (GWh) (Reference Market Scenario) | | | | | | |
|---|---|---|---|---|---|---|
| **Build Plan** | **2022-2026** | **2027-2031** | **2032-2036** | **2037-2041** | **2042-2046** | **2047-2051** |
| **RP8** | 10,727 | 13,043 | 12,617 | 14,185 | 16,377 | 20,549 |
| **Williams 2047 Reference** | 10,573 | 16,092 | 22,513 | 25,713 | 23,634 | 23,634 |
| **Williams 2030 Reference** | 10,573 | 16,248 | 24,990 | 25,745 | 23,634 | 23,634 |
| **High Fossil Fuel Prices** | 10,887 | 20,885 | 31,589 | 38,119 | 36,794 | 36,592 |
| **Zero Carbon Cost** | 10,573 | 15,308 | 22,833 | 22,609 | 20,483 | 20,483 |
| **Carbon Constrained** | 10,573 | 17,818 | 28,748 | 38,626 | 45,687 | 53,601 |

Comparing the NPV of each Build Plan with the amount of renewable resources, there is a high correlation between the increased cost of electricity with the addition of renewable energy resources as shown below in **Figure 13.** This is expected because PLEXOS selects resources based on which resources minimize cost under the given Market Scenario. This indicates that the overall cost of energy, as determined by fuel costs and $CO_2$ costs, is a principal driver of the model choosing renewable energy resources.

**Figure 13:**




## IX. RATE AND BILL IMPACTS

DESC has computed an estimate of the Retail Rate Impact for the Core Build Plans in compliance with Section 58-37-40(C)(2)(b) and Order No. 2020-832. This analysis uses the same incremental cost data used in preparing the Levelized Cost for these Build Plans. Rate impacts were computed using the load growth forecasts and fuel cost forecasts embedded in the relevant Market Scenarios. The analysis then combined that data with data concerning existing rates and cost of service allocators between rate classes. This made it possible to compute the impacts of resource plans on the monthly bill for a typical 1,000 kWh residential customer for each year from 2022 to 2036. The rate impact analysis is not a forecast of future rates, but a calculation for comparative purposes of the incremental dollar impact of each Build Plan on a residential customers' monthly bill, all other things being equal. The analysis does not attempt to model other changes to residential rates or bills.

Both the Levelized Cost metric and Retail Rate Impact analysis measure costs that would be borne by customers. However, they differ because the Levelized Cost metric measures costs over a 30-year period, not fifteen years like the rate impact analysis presented here. In resource planning, 30-year impacts are the more appropriate impacts to be considered in evaluating and ranking resource plans. Long-lived generation assets reduce costs and provide customer benefits over decades. A 30-year period more closely matches the useful lives of most traditional generating assets and ensures that the full cost and benefits of investing in them are captured.

Bill impacts for the typical residential customer for the Core Build Plans are provided in **Table 22** below in dollar terms. The bill impacts are given for the Reference Case. Bill impacts for the remaining twenty-four cases are provided in **Appendix H**.

**Table 22: Residential Bill Impact under Core Build Plans (Reference Market Scenario)**

| Typical Residential Bill @1000 kWh/month under Reference Market Scenario | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Build Plan** | **2022** | **2023** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** | **2030** | **2031** | **2032** | **2033** | **2034** | **2035** | **2036** |
| **RP8** | 132.79 | 134.04 | 128.29 | 128.67 | 136.72 | 138.97 | 141.18 | 144.43 | 150.19 | 160.06 | 166.50 | 170.58 | 173.94 | 178.57 | 182.80 |
| **Williams 2047 Reference** | 132.79 | 134.04 | 128.29 | 128.69 | 136.19 | 137.96 | 140.77 | 139.07 | 144.32 | 146.94 | 153.46 | 157.23 | 159.82 | 164.81 | 168.09 |
| **Williams 2030 Reference** | 132.79 | 134.04 | 128.28 | 128.69 | 136.20 | 137.97 | 140.78 | 139.08 | 144.73 | 150.10 | 156.35 | 160.49 | 162.72 | 168.04 | 170.73 |
| **High Fossil Fuel Prices** | 132.79 | 134.04 | 128.29 | 128.69 | 136.56 | 138.99 | 141.79 | 140.01 | 146.28 | 152.17 | 159.27 | 164.41 | 167.71 | 173.19 | 175.98 |
| **Zero Carbon Cost** | 132.79 | 134.04 | 128.28 | 128.68 | 136.19 | 137.96 | 140.63 | 138.96 | 144.14 | 147.24 | 153.95 | 158.00 | 160.60 | 165.51 | 167.86 |
| **Carbon Constrained** | 132.79 | 134.05 | 128.21 | 128.61 | 136.11 | 138.21 | 141.01 | 139.54 | 145.02 | 161.22 | 168.43 | 172.16 | 175.29 | 179.94 | 183.50 |

The table that follows provides the retail rate impact for the Core Build Plans. Retail rate impacts show the impact on retail rates collectively for all retail customer classes on a dollars/kWh basis. The rate impacts are given for the Reference Case. Rate impacts for the remaining cases are provided in **Appendix I**.

**Table 23: Retail Rate Impact under Core Build Plans (Reference Market Scenario, dollars/kWh)**

| Retail Rate Impacts (dollars/kWh) under Reference Market Scenario | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Build Plan** | **2022** | **2023** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** | **2030** | **2031** | **2032** | **2033** | **2034** | **2035** | **2036** |
| **RP8** | 0.10772 | 0.10782 | 0.10249 | 0.10256 | 0.10881 | 0.1108 | 0.11266 | 0.11561 | 0.1211 | 0.1286 | 0.13437 | 0.13813 | 0.14092 | 0.14533 | 0.14882 |
| **Williams 2047 Reference** | 0.10772 | 0.10782 | 0.10248 | 0.10256 | 0.10845 | 0.11014 | 0.11227 | 0.11138 | 0.11616 | 0.11828 | 0.12396 | 0.12729 | 0.12951 | 0.13411 | 0.13678 |
| **Williams 2030 Reference** | 0.10772 | 0.10782 | 0.10248 | 0.10257 | 0.10847 | 0.11016 | 0.11229 | 0.11140 | 0.11648 | 0.12081 | 0.12608 | 0.12974 | 0.13166 | 0.13645 | 0.13869 |
| **High Fossil Fuel Prices** | 0.10772 | 0.10782 | 0.10249 | 0.10257 | 0.10863 | 0.11059 | 0.11271 | 0.11174 | 0.11723 | 0.12187 | 0.12779 | 0.1321 | 0.13471 | 0.13946 | 0.14145 |
| **Zero Carbon Cost** | 0.10772 | 0.10782 | 0.10248 | 0.10257 | 0.10846 | 0.11015 | 0.11223 | 0.11138 | 0.11618 | 0.11859 | 0.12427 | 0.12781 | 0.13004 | 0.13457 | 0.13678 |
| **Carbon Constrained** | 0.10772 | 0.10784 | 0.10242 | 0.10250 | 0.10839 | 0.11022 | 0.11235 | 0.11169 | 0.11660 | 0.12859 | 0.13462 | 0.13763 | 0.14006 | 0.14398 | 0.14676 |

Under the Core Analysis and focusing on the Reference Case, the annual compound growth rate in a typical customers' monthly bill (1,000 kWh/month) over the 15-year rate impact period would be between 1.69% and 2.34%. with the Zero Carbon Cost Build Plan showing the lowest cost to customers and the Carbon Constrained Build Plan showing the highest. The RP8 Build Plan shows the second highest cost to customers of 2.31%. Under the Reference Market Scenario, at the end of the 15-year rate impact period, the generation component of the typical residential customers' bills would have increased by 29% under the Williams 2030 Reference Build Plan compared to 38% under the Carbon Constrained Case, and 27% under the Williams 2047 Reference Build Plan. As between Market Scenarios, the rates of increase were highest under the High Fossil Fuel Prices Market Scenario (CAGR between 2.09% and 2.77%) and lowest under the

Zero Carbon Cost Market Scenario (CAGR between 1.38% and 2.16%), indicating that assumptions as to fuel prices and $CO_2$ costs will materially impact customers' cost. Under all Market Scenarios considered in the Core Analysis, the Zero Carbon Cost Case was least expensive while the Carbon Constrained Case was most expensive for customers.

[Chart begins on following page]

**Table 24: Compound Annual Growth Rate and Total Chance in a Typical Customers' Bill Under the Core Analysis Due to Generation Costs**

| Market Scenario | Build Plan | CAGR | Total Change |
|---|---|---|---|
| Reference | **RP8** | 2.31% | 26.58% |
| Reference | **Williams 2047 Reference** | 1.70% | 28.57% |
| Reference | **Williams 2030 Reference** | 1.81% | 32.53% |
| Reference | **High Fossil Fuel Prices** | 2.03% | 26.41% |
| Reference | **Zero Carbon Cost** | 1.69% | 38.19% |
| Reference | **Carbon Constrained** | 2.34% | 37.66% |
| | | | |
| High Fossil Fuel Prices | **RP8** | 2.77% | 33.56% |
| High Fossil Fuel Prices | **Williams 2047 Reference** | 2.09% | 36.05% |
| High Fossil Fuel Prices | **Williams 2030 Reference** | 2.22% | 38.75% |
| High Fossil Fuel Prices | **High Fossil Fuel Prices** | 2.37% | 33.50% |
| High Fossil Fuel Prices | **Zero Carbon Cost** | 2.09% | 43.86% |
| High Fossil Fuel Prices | **Carbon Constrained** | 2.63% | 46.61% |
| | | | |
| Zero Carbon Cost | **RP8** | 2.06% | 21.52% |
| Zero Carbon Cost | **Williams 2047 Reference** | 1.40% | 24.57% |
| Zero Carbon Cost | **Williams 2030 Reference** | 1.58% | 28.96% |
| Zero Carbon Cost | **High Fossil Fuel Prices** | 1.83% | 21.21% |
| Zero Carbon Cost | **Zero Carbon Cost** | 1.38% | 34.82% |
| Zero Carbon Cost | **Carbon Constrained** | 2.16% | 33.13% |

## X. THE DYNAMIC NATURE OF RESOURCE PLANNING

Resource planning is conducted throughout the year by the Company for multiple planning and resource procurement purposes. Given the pace of change in customer expectations, technological advances, and environmental policies, it is important that the Company remain flexible with respect to Build Plans and asset procurements, retirements, up-ratings, and improvements. Resource plans will be updated to reflect current needs and the timing when future procurement or retirement decisions are considered based on these needs. The fact that DESC modeled the procurement or retirement of any resource in this 2022 IRP Update does not mean that DESC has made the decision to procure or retire any such resource or that such a decision has been approved by the Commission where such approval is required. These decisions will be presented to the Commission as appropriate at the time they are made or proposed, in accordance with the relevant aspects of the Utility Facility Siting and Environmental Protection Act.

## XI. SHORT-TERM ACTION PLAN UPDATE

### A. Monitoring of Supply Side Decision Points

Going forward, the Company will carefully monitor changes affecting generation including natural gas prices, regulatory and legislative requirements regarding $CO_2$ emissions, the costs of renewable and energy storage technologies, access to fuel supplies and delivery options, changing environmental policies and the emergence of novel generating technologies.

At present, the Company's currently established reserve margins are sufficient to meet customers' capacity needs in the near term. The CT replacement project currently underway will assist the Company in maintaining its reserve margin while planning for the retirement of coal units. The early retirement of Wateree and Williams will accelerate the need to add generation that will likely need to be supported by natural gas transmission capacity. The timeline for accomplishing this consistent with DESC's coal retirement goals is compressed.

In the very near-term, it is in customers' best interest for the Company to:

- Continue to fully engage the IRP Stakeholder Advisory Group in consultations regarding system supply needs and potential coal retirements;

- Continue with its coal unit retirement planning and identification of replacement resources and sites for those resources, refining of its transmission impact analyses, and identifying fuel supply and natural gas pipeline expansion options;

- Continue with the CT modernization plan implementation;

- Continue to refine the PLEXOS resource optimization model for use in the 2023 IRP.

- Complete the 2023 DSM Potential Study to determine maximum achievable demand and energy reductions to be reflected in the 2023 IRP;

- Continue to implement the appropriate changes in its DSM portfolio to increase reductions in sales growth, provide regular updates to the Energy Efficiency Advisory Group; and

- Continue to implement AMI in the face of supply chain disruptions and prepare to implement new demand reduction programs made possible by AMI.

The results of these efforts will help shape the 2023 IRP.

At the core of this short-term action plan is the Company's intention to monitor changing market conditions and state or federal environmental laws and regulations and update its planning to reflect those changes.

### B. Generation Retirement Planning

Since 2002, DESC has closed or repowered eight of its twelve coal units, and has reduced the percentage of coal-based energy it uses to serve its customers from 66% in 2005 to 24% in 2021. After discussions with the stakeholders, retirement studies for Wateree and Williams were completed and filed with Commission on May 16, 2022. The conclusions of the Coal Plants Retirement Study have been incorporated in this 2022 IRP Update.

The specific short-term actions that the Company intends to take in 2023 to accomplish its retirement planning goals are to:

1. **Evaluate retirement plans and recommendation for presentation in the 2023 IRP.**
2. **Complete the second TIA for the Wateree and Williams retirements.**
3. **Identify replacement generation sites and required operating parameters including additional transmission upgrades to support those retirements.**
4. **Determine feasibility of planning assumptions as to retirement dates.**

## C. Peaking Turbine Modernization Program

The inclusion of approximately 1,000 MW of intermittent solar generation on the Company's system and normal operational contingencies has placed additional demands on its aging, outdated fleet of simple cycle combustion turbines.

In November 2021, the Company entered into a Partial Settlement Agreement in Docket 2021-93-E that is allowing the retirement of nine of these CT units to proceed and for their replacements with three modern units at the Bushy Park and Parr sites. In accordance with the Partial Settlement, the Company is proceeding with the Urquhart RFP, which included a collaborative stakeholder process to design the RFP process.

The specific short-term actions that the Company intends to take in 2023 to accomplish its peaking turbine modernization goals are to:

1. **Continue to execute replacement projects contracts for engineering, procurement, and construction of replacement turbines.**
2. **Retire Bushy Park CT units and Parr CT units to support demolition and construction efforts.**
3. **Complete stakeholder process for developing Urquhart RFP.**
4. **Conclude Urquhart RFP and conduct procurement and evaluation of bids.**
5. **DESC and Charles River Associates to provide an update to Commission in Docket 2021-93-E on Urquhart RFP results when completed.**
6. **File for Commission affirmation of like-facilities replacement under the Siting Act, if applicable and if a utility self-bid option is selected from the Urquhart RFP process.**

7. **Proceed to engineering, procurement, and construction of the new units (for a utility self-build) or definitive contracting for third-party resources procured through the Urquhart RFP.**

### D. All-Source Request for Proposals for Future Generation Procurement

The Commission has ordered the Company to develop and implement an all-source procurement plan to inform future IRPs. DESC will use the framework established through the Urquhart RFP. Such RFPs require reasonable specificity concerning the nature and attributes of the resources required, and the timetable for procuring them. The 2023 IRP may identify future all source procurement opportunities to support future resource needs, including support for potential coal unit retirements. The specific short-term actions that the Company intends to take to accomplish the task related to an all-source RFP for replacement capacity for coal retirements are to:

1. **Identify relevant all source procurement opportunities to support future resource needs, including support for potential coal unit retirements in the 2023 IRP to be filed January 30, 2023.**

### E. DSM – Rapid Assessment

At DESC's request, its DSM consultant, ICF, completed the rapid assessment of DSM expansion potential as directed by Order No. 2020-832. This assessment determined that achieving a 1% reduction in demand growth from eligible customers is possible. DESC filed the Rapid Assessment with its Modified 2020 IRP. The Company and ICF continue to implement the plan and modifications have been made in response to the Commission's ruling in the 2021 DSM rate rider review proceeding. The COVID-19 pandemic and vendor staffing challenges have delayed or limited the implementation of certain programs involving on-premises consultations and may affect the achievement of certain goals. Throughout 2022, the EEAG has been provided regular updates through the DSM Stakeholder process regarding the status of the Rapid Assessment activities. These updates include presenting the specific 2022 program challenges that DESC has experienced in meeting the Rapid Assessment forecast that it does not anticipate overcoming this program year.

- The Home Energy Reports expansion to 346,166 homes began in October 2021 with anticipated completion in November 2022. The participation forecast is on track while the energy savings forecast is not likely to be achieved in the first program year as customers have yet to receive reports for an entire year.
- The Municipal LED Lighting Program expansion to ~54,000 units is underway and on track to exceed the current program year forecast.
- The Neighborhood Energy Efficiency Program expansion to 8,710 homes has been impacted by the ongoing effects of the pandemic. DESC's third party implementer reports that it has been unable to maintain consistent and sufficient staffing levels required to complete the installation of energy efficiency measures; lack of consistent field staff supervision has resulted in quality control issues; and kick-off events have been scaled back to address health and safety concerns. This program is not on track to achieve its participation forecast nor energy savings in 2022.
- DESC will continue to execute the above programs and expand resources as practical.

The specific short-term actions that the Company intends to take to implement the DSM Rapid Assessment are to:

1. **Continue executing the above programs during 2022 and 2023.**

### F. The 2023 DSM Potential Study

A new DSM Potential Study to determine the cost-effectiveness and achievability savings levels of 1.25%, 1.5%, 1.75% and 2% is underway and the results will be included in the 2023 IRP.[28].DESC is consulting with the EEAG throughout this process.

In early 2021, the EEAG provided input on both the draft documents for the market assessment and potential study scopes of work and timetable for conducting the potential study. After feedback was received, in consultation with the EEAG Group, DESC selected ODC to complete the market assessment portion of the new potential study and selected ICF, its consultant, as the vendor to initiate the forecasting and modeling portion of the study and evaluation of programs and measures. In late 2021, a kick-off meeting with the EEAG was held to officially start the DSM Potential Study activities. In early 2022, to promote transparency and engagement during the study, DESC retained CRA, the same third-party facilitator used in the IRP process, to manage the EEAG stakeholder process. Since February 2022, DESC has held five EEAG stakeholder meetings with four facilitated by CRA which includes providing agenda topics, documenting feedback, assigning homework, and ensuring potential study updates are shared.

To date, ODC has substantially completed the market study assessment and reported the residential details in April and the non-residential data in June to the EEAG. ICF's modeling analysis is currently underway and the technical and economic results have been shared with the EEAG for review and feedback. Working with ICF, DESC has collaborated with the EEAG to design the potential study, including the following: study scope, energy efficiency measures to be

[28] DESC notes that Order No. 2020-832 provides both a 2022 and 2023 deadline for the comprehensive DSM evaluation. Given that the next full IRP is to be filed in 2023, DESC assumes that the 2023 deadline applies, and the 2022 deadline was misstated. Additionally, to complete a comprehensive DSM evaluation with stakeholder involvement, 2023 is the more practical deadline.

included, definitions for how outcomes will be categorized and load shape recommendations. The EEAG will continue to receive status reports on the progress of the study and will receive a final draft of the 2023 DSM Plan for input prior to the finalization of the proposed study. By the end of 2022, DESC anticipates having two more meetings to provide proposed study details to stakeholders.

The specific short-term actions that the Company intends to take to complete the 2023 DSM Potential Study are to:

1. **Finalize the 2023 DSM Potential Study with Stakeholder input in late 2022.**
2. **Include the results of the 2023 DSM Potential Study in the 2023 IRP filing on January 30, 2023.**
3. **Develop program plans in collaboration with the EEAG.**
4. **Timely report any changes to the Commission on the development of programs plans and provide updates on implementation timeline of new programs/measure within existing programs through Commission filings in 2023.**

### G. The AMI Roll-Out and Residential and Commercial Demand Reduction Programs

As discussed above, the AMI roll-out has been delayed due to supply chain issues related to the meters themselves. The Company expects to have completed the installation of sufficient AMI meters on its system so that the 2023 DSM Potential Study can include new residential and commercial demand reduction programs.

The specific short-term actions that the Company intends to take to accomplish its AMI goals are to:

1. **Complete installation of AMI meters in 2024 if possible considering supply chain issues.**
2. **Collect sufficient data by late 2022 to inform the demand response component of the 2023 DSM Potential Study.**

3. **Include demand response programs in. the 2023 DSM Potential Study to be filed in 2023.**
4. **Petition the Commission to amend tariffs and DSM programs to provide new residential and commercial demand reduction programs in 2023.**
5. **Implement amended tariffs/DSM programs suite upon approval by the Commission by 2024.**

## H. Reevaluate Key PLEXOS Model Assumption and Forecasts

In parallel with implementing the PLEXOS software, the Company has reevaluated key forecasts, assumptions, and inputs to the planning model based on comments received from the IRP Stakeholder Advisory Group. Among the inputs the Company evaluated are its approaches:

- To summer and winter reserve policy;
- To reflect VACAR reserve sharing requirements in its capacity reserve margin calculation;
- To forecast natural gas prices;
- To forecast demand and energy growth on its system; and
- To capacity contribution of PV solar toward the Reserve Margin.

The specific short-term actions that the Company intends to take to accomplish its modeling goals are to:

1. **File the 2023 IRP on January 30, 2023, incorporating changes in inputs and assumptions as reviewed with Stakeholders.**
2. **Complete the probabilistic Reserve Margin and ELCC study by late 2022 to be used in the 2023 IRP.**
3. **Incorporate new DSM and other inputs into the 2023 IRP to be filed January 30, 2023.**

## I. Continue the IRP Stakeholder Advisory Group Process

DESC retained CRA to design and implement a robust stakeholder advisory group process. The advisory group process has been used to consult on the selection and implementation of resource optimization software, on changes to model inputs, forecasts and assumptions, and on changes in DSM assumptions and programs. In the months prior to an IRP filing or update, this process is expected to involve meetings every six to eight weeks to review model inputs and scoping and draft model runs.

The specific short-term actions that the Company intends to take to accomplish its Stakeholder goals are to:

1. **Review the results of the 2022 IRP Update and inputs to the 2023 IRP with the advisory group.**
2. **Incorporate results of consultation in the 2023 IRP filing as practical on January 30, 2023.**
3. **Conduct at least three advisory group meetings in 2023 and 2024 to follow up on the 2023 IRP and prepare for the 2024 and 2025 update.**

## XII. CONCLUSION

In preparing this 2022 IRP Update, DESC used the PLEXOS resource optimization model software to analyze twelve Build Plans and twenty-four Cases to confirm the choice of a preferred generation plan and update the findings of the Modified 2020 IRP and 2021 IRP Update.

The Williams 2030 Reference Build Plan is the updated version of the prior preferred plan, Resource Plan 8. Under the newly implemented resource optimization methodology, Williams 2030 Reference Build Plan scored well under multiple metrics and under multiple scenarios and allows the early retirement of Wateree and Williams with modest additional cost to customers. This 2022 IRP Update affirms this modified and updated version of Resource Plan 8 to be the preferred plan.

This 2022 IRP Update also affirms that DESC continues to operate its electric system in a safe, reliable and efficient manner. A robust and effective stakeholder IRP process has been implemented and additional evaluation is underway to determine timing of coal unit retirements.

The 2023 DSM Potential Study and the probabilistic Reserve Margin and ELCC study will be used in the 2023 IRP which will provide an opportunity for the matters discussed here to be reviewed in detail.

DESC's fundamental objectives remain to protect safety, maintain reliability, and deliver clean, affordable energy to its customers. Achieving these objectives while transitioning to a net-zero carbon future will require investment by the Company, support from the Commission, and coordination and consensus-building across all stakeholder groups.

**APPENDIX LIST**

## Appendix A: Act 62 Requirements and Commission Orders Nos. 2020-832 and 2021-429 Requirements

The details of the IRP requirements under Act No. 62 are shown in the following table along with a reference to each section of the Company's 2022 IRP Update demonstrating compliance:

| Act No. 62 58-37-40 | Requirement | 2022 IRP Update Section |
|---|---|---|
| (B)(1)(a) | a long-term forecast of the utility's sales and peak demand under various reasonable scenarios; | Load Forecasts (pp. 68-71) |
| (B)(1)(b) | the type of generation technology proposed for a generation facility contained in the plan and the proposed capacity of the generation facility, including fuel cost sensitivities under various reasonable scenarios; | Resources Added (p. 48); Fuel Cost Resiliency (p. 58); Appendix E and F |
| (B)(1)(c) | projected energy purchased or produced by the utility from a renewable energy resource; | Percentage of Renewable Resources Selected (p. 47); Forecast of Renewable Generation (p. 80); Appendix G |
| (B)(1)(d) | a summary of the electrical transmission investments planned by the utility; | Transmission Update (p. 35) |
| (B)(1)(e) | several resource portfolios developed with the purpose of fairly evaluating the range of demand-side, supply-side, storage, and other technologies and services available to meet the utility's service obligations. Such portfolios and evaluations must include an evaluation of low, medium, and high cases for the adoption of renewable energy and cogeneration, energy efficiency, and demand response measures, including consideration of the following:<br>(i) customer energy efficiency and demand response programs;<br>(ii) facility retirement assumptions; and<br>(iii) sensitivity analyses related to fuel costs, environmental regulations, and other uncertainties or risks; | Build Plan Analysis (pp.40-68); Modeling Inputs and Assumptions (pp. 68-80) |
| (B)(1)(f) | data regarding the utility's current generation portfolio, including the age, licensing status, and remaining estimated life of operation for each facility in the portfolio; | The information was provided in the Modified 2020 IRP, Generation Operation Report Update (p. 17) and remains accurate with the changes related to the CT replacement plan that are discussed in that section of the report. |
| (B)(1)(g) | plans for meeting current and future capacity needs with the cost estimates for all proposed resource portfolios in the plan; | The Six Core Build Plans (pp. 44); |

| Act No. 62 58-37-40 | Requirement | 2022 IRP Update Section |
|---|---|---|
| | | Levelized Cost (p. 52); Rate and Bill Impacts (pp. 82-86); Appendix H and J |
| (B)(1)(h) | an analysis of the cost and reliability impacts of all reasonable options available to meet projected energy and capacity needs; and | Levelized Cost (p. 52); Reliability (pp. 61-63); Appendix J |
| (B)(1)(i) | a forecast of the utility's peak demand, details regarding the amount of peak demand reduction the utility expects to achieve, and the actions the utility proposes to take in order to achieve that peak demand reduction. | Load Forecasts (pp. 68-71); Demand Side Management Assumptions (pp. 71-72) |
| (B)(2) | An integrated resource plan may include distribution resource plans or integrated system operation plans. | Not included |

The requirements of this 2022 IRP Update pursuant to Orders Nos. 2020-832 and 2021-429 are shown in the following tables along with a reference to each section of the Company's 2022 IRP Update demonstrating compliance:

| Order 2020-832 Page Number | Ordered Requirements | 2022 IRP Update Section |
|---|---|---|
| 16 (Finding of Fact 2) | It is reasonable that, at the time of the filing of Dominion's Modified IRP, Dominion shall be able [to] indicate to the Commission the composition of current and prospective stakeholders [for the IRP Stakeholder Process], and report on any stakeholder meetings that have occurred prior to the filing date. | Stakeholder Process (pp. 11-13) |
| 16 (Finding of Fact 3)<br><br>29 (Commission Conclusion), 92 (Ordering Paragraph 8a.) | It is reasonable require DESC to adopt and implement the use of capacity expansion modeling software starting in the 2022 IRP Update, while requiring input from on [sic.] the selection and implementation of the software, and ensuring that the software meets the transparency requirements of Act 62.<br><br>DESC is required to adopt and implement the use of capacity expansion software starting no later than with the development of the 2022 IRP Update. It is reasonable to require DESC to engage interested parties in this proceeding in a collaborative process to choose a capacity expansion model for the 2022 IRP Update and future IRP proceedings.<br><br>DESC shall negotiate a discounted, project-based licensing fee that permits intervenors the ability to perform their own modeling runs in the same software package as DESC, and to direct DESC to absorb the cost of these licensing fees.<br><br>Contemporaneously with the filing of each future IRP, DESC shall make available, without the need for a data request, the modeling inputs (including the settings) and outputs, assumptions, any post-processing spreadsheets (e.g. to create the revenue requirements) in electronic spreadsheet format, and the model manual. | Resource Optimization (p. 3); Implementation of the Resource Optimization Model (p. 11) |

| Order 2020-832 Page Number | Ordered Requirements | 2022 IRP Update Section |
|---|---|---|
| 17<br>(Finding of Fact 5)<br><br><br><br><br><br><br><br>40<br>(Commission Conclusion) | It is reasonable to require DESC to perform a comprehensive coal retirement analysis to inform development of its 2022 IRP Update and its 2023 IRP and to solicit parties' recommendations on guidelines for performing this analysis through the ongoing IRP Stakeholder Process. Upon completion of the coal retirement study—and targeting the 2023 IRP—DESC shall begin modeling coal retirement as an option in the various scenarios.<br><br>DESC is required to perform comprehensive coal retirement analysis to inform development of its 2022 IRP Update, and to solicit parties' recommendations on guidelines for performing this analysis and approve a set of guidelines prior to DESC's 2022 IRP Update development process via the ongoing IRP Stakeholder Process. | Coal Plants Retirement Study (pp. 21-26) |
| 17<br>(Finding of Fact 6)<br><br><br>44<br>(Commission Conclusion) | DESC is required to include DSM and purchased power as resource options in its 2022 IRP Update and future IRPs<br><br><br>DESC is required to include DSM and purchased power as a resource option in the 2022 IRP Update and future IRPs | Resources Available to PLEXOS, (p. 46); Demand Side Management Assumptions (pp. 71-72) |
| 46<br>(Commission Conclusion) | It is appropriate for DESC, starting with its 2021 IRP Update, to systematically compare resource options for meeting its peaking reserve margin increment, including all available resources, rather than limiting available resources to a narrow subset. | Resource Optimization (p. 3); Implementation of the Resource Optimization Model (p. 11); Build Plan Analysis (pp. 40-68) |
| 18<br>(Finding of Fact 9)<br><br>58<br>(Commission Conclusion) | It is appropriate to require Dominion to work with stakeholders regarding fair inclusion of solar PV's winter capacity value in the 2021 and 2022 IRP Updates. | Reported in the 2021 IRP Update and Stakeholder Meeting minutes filed in the 2020 IRP docket |
| 18-19<br>(Finding of Fact 11)<br><br><br><br><br><br><br><br><br>64 | Cost range and minimax regret analyses are simple, appropriate methodologies that can feasibly be implemented in a Modified 2020 IRP. It is reasonable to require DESC to submit a Modified 2020 IRP including a comparison of candidate resource plans employing simple quantitative risk metrics, including cost ranges and regret scores, as recommended by SCSBA Witness Sercy in his direct and rebuttal testimony. DESC should also consider, with stakeholder input, implementation of more sophisticated risk-adjust metrics in the 2022 IRP Update.<br><br>The Commission will require DESC to implement the cost range and minimax regret analyses in the Modified 2020 IRP and subsequent updates and will consider more refined and sophisticated risk-adjusted metrics in its 2022 IRP Update. | Core Analysis Results (pp. 51-68) |
| 75-76 | The Commission adopts the recommendation in Step 1 of Witness Hill's Late-Filed Exhibit, which directs DESC to conduct a "rapid assessment" of the cost-effectiveness and achievability of ramping up its current | DSM Update (p. 13); DSM Assumptions (pp. |

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|---|---|---|
| | portfolio to achieve at least a 1% level of savings in the years 2022, 2023, and 2024. As outlined in step 2 of that exhibit, DESC must work with the Advisory Group in conducting this "rapid assessment" and must include the results of this "rapid assessment" in its Modified 2020 IRP. The Modified 2020 IRP must also include steps the Company will take to complete the "comprehensive evaluation" discussed below in preparation for including such an evaluation in its 2022 IRP. | 71-72) DSM Rapid Assessment (pp. 90-91) |
| 93 (Ordering Paragraph 9) | Include in its 2022 IRP a full evaluation of the cost-effectiveness and achievability of four higher levels of capacity and energy savings from DSM: 1.25%, 1.5%, 1.75% and 2%, including the consideration of substantive additions and modifications to the Company's existing DSM portfolio and to work with the DSM Advisory Group in developing this analysis and portfolio development. | DSM Update (p. 13); DSM Assumptions (pp. 71-72) DSM Rapid Assessment (pp. 90-91) |
| 20 (Finding of Fact 17) | It is reasonable to require DESC, starting in the 2022 IRP Update, to specifically consider and discuss diversity of its generation supply, and to (a) propose candidate resource plans designed to further diversity its generation supply and (b) include diversity of generation supply in the weighting of candidate resource plans. | Generation Diversity (pp. 59-61) |
| 21 (Finding of Fact 21) | The Proposed IRP does not provide sufficient information for the Commission to evaluate the plan in light of "power supply reliability." It is reasonable to require that DESC include recent generator performance and other reliability data in its Modified 2020 IRP and future IRPs. | Generation Operating Report (pp. 27-34); Distribution (p. 34-40) |
| 21-22 (Finding of Fact 23)<br><br>90<br><br>94 (Ordering Paragraph 11) | It is reasonable to require DESC to include a three-year Action Plan in its Modified 2020 IRP and in future IRPs. The three-year Action Plan should identify and describe the steps DESC will take to implement its IRP during that three-year period. This Action Plan should include a graphical representation of the planned sequence of actions.<br><br>Accordingly, DESC shall include in its Modified 2020 IRP and in future IRPs a three-year Action Plan identifying and describing the steps it will take to implement its IRP during that three-year period, including but not limited to additional analyses, changes to its methodology, issuance of Requests for Proposals, modifications to its DSM portfolio, and applications for new generating facilities under the Siting Act. The Action Plan shall include a graphic representation of the sequencing of its actions. The Action Plan in the Modified 2020 IRP shall include, at a minimum, the DSM Action Plan discussed elsewhere in this Order; the Company's process for selecting a capacity expansion model, in collaboration with stakeholders; the Company's plans to conduct retirement studies required by this Order; as well as any actions related to competitive procurement of renewable energy resources that may be indicated based on the additional production cost modeling that the Commission is requiring in this Order.<br><br>DESC shall include in its Modified 2020 IRP and in future IRPs a three-year Action Plan identifying and describing the steps it will take to implement its IRP during that three-year period, including but not limited to additional analyses, changes to its methodology, issuance of Requests for Proposals, modifications to its DSM portfolio, and applications for new generating facilities under the Siting Act. The Action Plan in the Modified 2020 IRP shall include, at a minimum, the DSM Action Plan discussed elsewhere in this Order; the Company's process for selecting a | Short Term Action Plan Update (pp. 87-95) |

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|---|---|---|
| | capacity expansion model, in collaboration with stakeholders; the Company's plans to conduct retirement studies required by this Order; as well as any actions related to competitive procurement of renewable energy resources that may be indicated based on the additional production cost modeling that the Commission is requiring in this Order. | |
| 34, 50, 52 (Commission Conclusion) | DESC Shall be required to document how it is or is not prudent to take advantage of the solar ITC or implement a plant to take advantage of the solar ITC. This documentation shall be required beginning with its 2022 IRP Update. | Capital and Operating Costs of Resources (p. 80); and Provided in the 2021 IRP Update |
| 52<br><br>90 (Ordering Paragraph 6.b.ii) | Dominion shall work with stakeholders regarding fair inclusion of solar PV's winter capacity value in the 2022 IRP Update.<br><br>For battery storage PPAs, use the NREL ATB's low storage cost case (including capital and fixed O&M 13 costs) with the same 22% ITC safe harbor assumptions employed for solar PV PPAs. | Completed in the 2021 IRP Update and carried forward here |
| 58<br><br>90 (Ordering Paragraph 6.b.iii) | In its Modified 2020 IRP, DESC shall calculate the current ELCC capacity value for solar based on the current level of operational solar on DESC's system, and DESC shall apply that value in its modeling of PV resources.<br><br>Correct the incremental flexible solar PPA capacity value assumptions to reflect the ELCC value specific to the existing system penetration level of incremental flexible solar PV. | Completed in the Modified 2020 IRP and carried forward here |
| 71<br><br>90 (Ordering Paragraph 6.b.vii) | The Commission will therefore direct DESC, in its Modified 2020 IRP and future updates, to use the AEO high $CO_2$ case described by Mr. Sercy in place of DESC's \$25 $CO_2$ case, in the revised cost analysis. . . .The Commission finds that it is prudent for Dominion to add at least one additional lower carbon option to the 2022 IRP Update for modeling incorporating additional solar and storage opportunities.<br><br>Re-run its production cost modeling using the AEO low, reference, and high gas prices described by SCSBA Witness Sercy in his direct testimony, and using the AEO High $CO_2$ case, also as detailed in Mr. Sercy's direct testimony. | $CO_2$ Price Assumptions (p. 75-77) |
| 81 | For that reason, the Commission adopts Witness Sommer's recommendation that DESC be required to calculate the rate and bill impacts of its various portfolios in the IRP, rather than just a levelized NPV of revenue requirements. DESC must include such an evaluation in its Modified 2020 IRP and in future IRPs and IRP Updates. | Rate and Bill Impacts (p. 82-86) |
| 81 | DESC is directed to revise its 2020 IRP to include further analysis and consideration for how state or federal environmental regulations, including the Coal Combustion Residuals rule, the Steam Electric Power Generating Effluent Guidelines and Standards, National Ambient Air Quality Standards, and current and potential future greenhouse gas-related rules, might affect DESC's generating units and resource choices. | Environmental and ELG Compliance (pp. 32-34) |

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|---|---|---|
| 88 | In addition to the Action Plan, Dominion shall explain how the IRP is integrated into other planning at the company by subdivision, division, and department within the Company. | Reported in the 2020 Modified IRP; no change |
| 92<br>(Ordering Paragraph 8 b-i) | Starting in its 2022 IRP Update:<br>b. DESC shall develop a wide but plausible range of load forecasts, and ensure that cost modeling captures each resource plan's capabilities to adapt to load that diverges from the base forecast, as suggested by SCSBA Witness Sercy.<br><br>c. Use wide but plausible range of gas price projections form AEO or another public, credible fundamental gas supply-demand model, as suggested by SCSBA Witness Sercy.<br><br>d. Use wide but plausible zero/medium/high CO2 cost projections from AEO or other public sources, as suggested by SCSBA Witness Sercy.<br><br>e. Include additional candidate resource plans including DSM and purchased power as resource options that are incorporated into candidate resource plans and evaluated across multiple scenarios.<br><br>f. Include candidate resource plans to meet the Company's full peaking reserve margin target, and determine in its resource plan analysis what type of resources best meet the peaking increment.<br><br>g. DESC should also consider, with stakeholder input, implementation of more sophisticated risk-adjusted metrics appropriate to consider sensitivities including but not limited to natural gas price risk, carbon price risk, and load forecast risk.<br><br>h. Specifically consider and discuss diversity of its generation supply, propose candidate resource plans designed to further diversify its generation supply; and include contribution to diversity of generation supply in the evaluation of candidate resource plans.<br><br>i. Incorporate the conclusions from the comprehensive coal retirement analysis. | Load Growth Forecast (p.68-71); The Core Analysis (p. 50-51); The Core Analysis Results (pp. 51-67); Modeling Inputs and Assumptions (pp. 68-80) |
| 93-94<br>(Ordering Paragraph 10) | In its 2020 Modified IRP, 2021 IRP Update, and subsequent annual Updates prepared pursuant to S.C. Code Ann. § 58-37-41(D)(1), DESC shall update its planning assumptions relating to the energy and demand forecast, commodity fuel price inputs, renewable energy forecast, energy efficiency and demand-side management forecasts, and changes to projected retirement dates of existing units. | Modeling Inputs and Assumptions (pp. 68-80) |

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|---|---|---|
| 18 (Order Paragraph 3) | DESC is ordered to provide substantive details of the CT Plan and include the CT Plan in its revised modeling. | The Peaking Replacement Plan (pp. 13-15) |
| 18 (Order Paragraph 4) | DESC shall include resource plans that represent "the range of demand-side, supply-side, storage, and other technologies and services available" to meet the utility's obligations. DESC shall also include "plans for | The Twelve Build Plans (pp. 42-43); Rate and Bill Impacts (pp. 82-86) |

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|---|---|---|
| | meeting current and future capacity needs with cost estimates for all proposed resource portfolios in the plan." | |
| 18-19 (Order Paragraph 5) | DESC is ordered to adjust its Reliability Factors consistent with Appendix A of the filed "Joint Comments of South Carolina Coastal Conservation League, Southern Alliance for Clean Energy, Carolinas Clean Energy Business Alliance and Sierra Club." DESC is required to adhere to Order No. 2020-832 in its application of the approved Minimax regrets and cost range analyses, as well as the plan selection criteria required by the Commission in its 2021 IRP Update as well as in all future IRPs. In its 2021 IRP Update as well as in all future IRPs, DESC shall use Dr. Sercy's Minimax Regrets and Cost Range methodologies in addition to using the "average ranking" approach in order to provide information related to risk using these various approaches. | The Core Analysis Results (pp. 51-67) |
| 19 (Ordering Paragraph 8) | DESC is also ordered to include load forecasts and the integration of Energy Efficiency impacts with its stakeholders as part of the 2021 IRP Update. DESC is also required to present realistic and levelized DSM costs in all future IRPs starting with the 2021 IRP Update. | DSM Update (p. 13); DSM Assumptions (pp. 71-72) DSM Rapid Assessment (pp. 90-91) |
| 19 (Ordering Paragraph 9) | DESC is directed to use marginal line losses in the calculation of avoided costs and in the translation of energy savings from the Market Potential Study to energy savings in future IRP modeling beginning with the 2021 IRP Update. | Completed in the 2021 IRP Update and carried forward here; DSM Assumptions (pp. 71-72) |
| 20 (Ordering Paragraph 10) | DESC is required to use "cost effective, reasonable and achievable" as the standard going forward for evaluating the potential for higher savings portfolios in future IRPs and updates beginning with the 2021 IRP Update. | DSM Update (p. 13); DSM Assumptions (pp. 71-72) DSM Rapid Assessment (pp. 90-91) |

## Appendix B: Glossary of Abbreviations and Table of Key Terms

| Table of Abbreviations | |
|---|---|
| **Abbreviation** | **Name** |
| ACE | Affordable Clean Energy |
| ACSR | Aluminum Conductor Steel Reinforced |
| AEO | Annual Energy Outlook |
| Aero | Aeroderivtative Natural Gas-Fired Combustion Turbine Generating Unit |
| AFR | Accident Frequency Rate |
| AGP | Advanced Gas Path |
| AMI | Advance Metering Infrastructure |
| ATB | Annual Technology Baseline |
| BAA | Balancing Authority Area |
| BOEM | Bureau of Ocean Energy Management |
| CAA | Clean Air Act |
| CAGR | Compound Annual Growth Rate |
| CC | Combined Cycle Power Plant |
| COD | Commercial Operation Date |
| $CO_2$ | Carbon Dioxide |
| CPP | Clean Power Plan |
| CRA | Charles River Associates |
| CT | Combustion Turbine |
| DART | Days Away from Work Rate |
| DR | Demand Response |
| DSM | Demand Side Management |
| EE | Energy Efficiency |
| EEAG | Energy Efficiency Advisory Group |
| EIA | Energy Information Administration |
| ELCC | Effective Load Carrying Capacity |
| ELG | Effluent Limitation Guidelines |
| EPA | Environmental Protection Agency |
| EPC | Engineering, Procurement, and Construction |
| ESS | Energy Storage System |
| EV | Electric Vehicle |
| FERC | Federal Energy Regulatory Commission |

| | |
|---|---|
| FGD | Flue Gas Desulphurization |
| FOR | Forced Outage Rate |
| GWh | Gigawatt Hour |
| GHG | Greenhouse Gas |
| ICT | Internal Combustion Turbine |
| IIJA | Infrastructure Investment and Jobs Act |
| INPO | Institute of Nuclear Power Operations |
| IRA | Inflation Reduction Act of 2022 |
| Ktons | Thousand Tons |
| kV | Kilovolt |
| kW | Kilowatt |
| kWh | Kilowatt Hour |
| LED | Light-emitting Diode |
| LNPV | Levelized Net Present Value |
| MMBtu | Metric Million British Thermal Unit |
| MW | Megawatt |
| MW-ac | Megawatt, Alternating Current |
| MWh | Megawatt Hour |
| NEEP | Neighborhood Energy Efficiency Program |
| NERC | North American Electric Reliability Corporation |
| NPV | Net Present Value |
| NRC | Nuclear Regulatory Commission |
| NREL | National Renewable Energy Laboratory |
| ODC | Opinion Dynamics Corporation |
| O&M | Operation and Maintenance |
| ORS | South Carolina Office of Regulatory Staff |
| OSW | Offshore Wind |
| PPA | Power Purchase Agreement |
| PURPA | Public Utility Regulatory Policies Act of 1978 |
| PV | Photovoltaic |
| RF | Reliability Factor |
| RFP | Request for Proposal |
| SAIDI | System Average Interruption Duration Index |
| SCPSA | South Carolina Public Service Authority |
| SEE | Southeastern Electric Exchange |

| | |
|---|---|
| SEEM | Southeast Energy Exchange Market |
| SLR | Subsequent License Renewal |
| SMR | Small Modular Reactor |
| STAP | Short-Term Action Plan |
| TIA | Transmission Impact Analysis |
| TWh | Terawatt hour |
| VACAR | Virginia-Carolinas Regional Reliability Group or Region |
| VIP | Voluntary Incentive Program |

**Table of Key Terms**

| **Term** | **Definition** |
|---|---|
| Build Plan | A collection of resources used to meet customers' future energy needs. |
| Market Scenario | An outlook and expected values for key market drivers. |
| Resource Optimization | PLEXOS' selection of resources to most efficiently meet a given customers' future energy needs under a specific Market Scenario or set of constraints. |
| Cases | Build Plans evaluated across one or more Market Scenarios. |
| Core Build Plans | A selection representing the six most likely or representative Build Plans. |
| Core Market Scenarios | The three most likely or representative Market Scenarios. |
| Eighteen Core Cases | The six Core Build Plans modeled across the three most likely Market Scenarios. |
| Sensitivity Cases | The six non-Core Build Plans. |

## Appendix C: Effective Load Carrying Capacity Calculations

### Background

In Order No. 2020-832 in Docket No. 2019-226-E the Public Service Commission of South Carolina required the Company to update its calculation of an ELCC capacity value for solar of 11.8%. The order stated the following:

*In Order No. 2020-244, the Commission ordered DESC to apply an ELCC value of 11.8% based on existing levels of solar on the DESC system at that time. In its Modified 2020 IRP, DESC shall calculate the current ELCC capacity value for solar based on the current level of operational solar on DESC's system, and DESC shall apply that value in its modeling of PV resources.*

The calculation of the 11.8% ELCC value was presented in direct testimony in Docket No. 2019-184-E in Table 3b on page 10. The link to access this testimony is:

https://dms.psc.sc.gov/Attachments/Matter/f5f9bb34-d3e8-4db7-9ca5-e949ad51e70a

Table 3b from the testimony showing the ELCC calculation of 11.8% is reproduced below:

| ELCC Results | | | | |
|---|---|---|---|---|
| Step | Case | Description | Capacity | LOLH |
| 1 | Base | 500 MW Solar | 5,125 MW | 2.86 |
| 2 | Change | 1,000 MW Solar | 5,125 MW | 2.13 |
| 3 | Adjusted | 1,000 MW Solar | 5,066 MW | 2.86 |
| | | ELCC Value | 59 MW | 11.8% |

This calculation assumes that there is 500 MWs of solar capacity already existing on the system and that the ELCC methodology is being used to place a capacity value on an additional 500 MWs of solar capacity. The ELCC methodology assigns a capacity value by equating reliability as measured by a reliability index in a before and after situation. The reliability index used here is the Loss of Load Hours ("LOLH") index and the before and after situation is with and without the incremental 500 MWs of solar capacity. In Step 1 in the table the base is shown already having 500 MW of solar and 5,125 MW of capacity with a LOLH index of 2.86 hours per year of expected capacity shortfall. In Step 2 the impact of adding another 500 MWs of solar is shown. The LOLH index decreases to 2.13 implying an increase in reliability. The goal of Step 3 is to return the LOLH index back to the base setting of 2.86 hours by either increasing the system loads or equivalently decreasing the system capacity. Since there are 8,760 hours of system loads, it is easier to simply reduce the system capacity which is what is done here. In Step 3 then the system capacity is reduced by 59 MWs which decreases system reliability to the point where the LOLH index returns to the base level of 2.86 hours. Therefore, the ELCC capacity value of the additional 500 MWs is 59 MWs of firm capacity because the two changes to the system produce equal changes in system reliability as measured by the LOLH index.

**Updated ELCC Calculation**

In the context of the Company's Modified 2020 IRP, the system already includes 973 MWs of solar capacity and the ELCC methodology will be used to place a capacity value on an additional 400 MWs of solar which is a part of one or more of the potential resource plans under study. The following table shows the results of the 3-step ELCC evaluation process.

| **ELCC Results** | | | | |
|---|---|---|---|---|
| Step | Case | Description | Capacity | LOLH |
| 1 | Base | 973 MW Solar | 5,067 MW | 2.86 |
| 2 | Change | 1,373 MW Solar | 5,067 MW | 2.63 |
| 3 | Adjusted | 1,373 MW Solar | 5,050 MW | 2.86 |
| | | ELCC Value | 17 MW | 4% |

The table shows that when adding 400 MWs of solar capacity to the existing 973 MWs producing a total of 1,373 MWs of solar capacity, the system becomes more reliable as indicated by the decrease in the LOLH index to 2.63 hours. In Step 3 the system capacity is decreased by 17 MWs thereby decreasing reliability and bringing the LOLH index back to the base level of 2.86 hours. Therefore, the ELCC capacity value of the incremental 400 MWs of solar capacity is 17 MWs or about 4% of solar nameplate.

For future IRPS, DESC has commissioned a third-party consulting group, with broad experience in reserve margin calculations, to conduct a probabilistic Reserve Margin and ELCC study. The on-going Reserve Margin Study will calculate ELCC values for Solar, Solar with Storage and Storage.

## Appendix D: Report on Completed, Deferred, and Cancelled Transmission Projects

| Planned Project | Tentative Completion Date | Status Update | Explanation |
|---|---|---|---|
| **Church Creek – Faber Place 230kV & 115kV: Rebuild the Ashley River Crossing** | May-21 | In Service Nov-20 | |
| **Graniteville #2 – Toolebeck 115kV: Upgrade to 1272** | May-21 | In Service May-21 | In Service date of April 2022 also applicable due to related switch modifications |
| **Williams Street – Park Street 115kV: Construct** | Jun-21 | In Service May-22 | |
| **Saluda Hydro – Denny Terrace & Lake Murray – Harbison** | Oct-21 | Delayed to Completion Dec-22 | Delayed due to permitting and substation outage constraints |
| **Queensboro – Ft Johnson 115kV Tap** | Dec-21 | Delayed to Completion Dec-23 | Delayed due to permits |
| **Bluffton – (SCPSA) Santee 115kV Tie Line Construct** | Dec-21 | Delayed to Completion Dec-22 | Delayed due to load constraints |
| **Canadys 230kV: Add Back–to–Back Bus Tie Breakers** | Dec-21 | In Service April-21 | |
| **Canadys 230kV Sub: Reterminate Various Lines** | Dec-21 | In Service April-21 | |
| **Emory 230kV Distribution Sub: Construct** | Dec-21 | Delayed to Completion Dec-23 | Delayed due to time required to acquire substation site |
| **Graniteville #2 – South Augusta 230kV : Urq Jct – Toolbeck 230kV Fold In** | Dec-21 | In Service Oct-21 | |
| **Toolebeck Substation: Add three 230kV Terminals** | Dec-21 | In Service Nov-21 | |
| **Toolebeck – Aiken 230kV Tie: Construct** | Dec-21 | In Service Nov-21 | |
| **Cainhoy – Mt. Pleasant 115kV #1 and #2 (Horlbeck Creek Crossing)** | Dec-21 | In Service Jan-22 | |

| | | | |
|---|---|---|---|
| **Queensboro – Johns Island 115kV Tie: Rebuild River and Marsh Crossing** | Dec-21 | Delayed to Completion Dec-22 | Delayed due to permitting |
| **Edenwood Substation: Replace Switch House** | Jun-22 | In Service May-22 | |
| **Burton – Yemassee 115kV #2 Line Rebuild as Double Circuit** | Dec-22 | On Schedule | |
| **Church Creek – Queensboro 115kV: Stono River Crossing** | Dec-22 | Delayed to Completion Dec-23 | Delayed due to permitting |
| **Denny Terrace – Crafts Farrow & Denny Terrace – Dentsville Line #1 115kV Rebuild** | Dec-22 | In Service Aug-22 | |
| **Wateree – Hopkins 230kV Line #2: Rebuild** | Dec-22 | Delayed to Completion Dec-23 | Delayed due to budget constraints |
| **Columbia Industrial Park – Kendrick 115kV & Columbia Industrial Park – Ft. Jackson #2 115kV: Rebuild** | Dec-22 | Canceled | Anticipated load did not develop |
| **Okatie – Bluffton 115kV: Rebuild** | Dec-23 | Delayed to Completion Dec-24 | Delayed due to capital budget constraints |
| **Denny Terrace Substation: Replace Switch House** | Dec-23 | In Service Expected June-23 | |
| **Hopkins – Square D – Eastover 115kV: Rebuild** | Dec-23 | On Schedule | |
| **Burton – St Helena 115kV: Rebuild Burton – Frogmore Transmission Section and Frogmore Distribution – St Helena** | Dec-23 | Delayed to Completion Dec-25 | Delayed due to capital budget constraints |
| **VCS1 – Denny Terrace 230kV & VCS1 – Pineland 230kV: Rebuild Double Circuit Section and Single Circuit Sections** | Dec-23 | Delayed to Completion Dec-26 | Double circuit section In Service July 2022, single circuit sections delayed due to capital budget constraints |
| **Wateree – Hopkins 230kV Line #1: Rebuild** | Dec-23 | Delayed to Completion Dec-26 | Delayed due to capital budget constraints |
| **Coit – Gills Creek 115kV Line: Construct** | Dec-24 | On Schedule | |

| | | | |
|---|---|---|---|
| **Union Pier 115–13.8kV Sub: Tap Construct** | Dec-24 | Delayed to Completion Dec-25 | Delayed due to property developer |
| **Cainhoy – Hamlin 115kV: Rebuild Line and Cainhoy – Hamlin 115kV #2: Construct New 115kV Line** | Dec-24 | On Schedule | |
| **Hopkins – CIP 230kV: Rebuild** | Dec-24 | On Schedule | |
| **Faber Place – Bayfront 115kV: Rebuild North Bridge Terrace to Bayfront Section** | Dec-24 | Delayed to Completion Dec-25 | Delayed due to capital budget constraints |
| **Wateree – Killian 230kV: Rebuild** | Dec-25 | Delayed to Completion Dec-28 | Delayed due to capital budget constraints |
| **Canadys – Ritter 115kV: Rebuild as 230/115kV Double Circuit** | Jun-26 | On Schedule | |
| **Riverport 230–115kV Sub and the Jasper – Yemassee Fold In** | Dec-26 | In Service Expected Dec-24 | System Planning requested 2024 if possible for reliability |
| **Ritter – Yemassee 230kV and 115kV Transmission System Expansion** | Jun-27 | In Service Expected Jun-26 | System Planning requested 2026 if possible for reliability |
| **Clements Ferry 115–23kV Sub: Construct; Jack Primus–Cainhoy 115kV with Clements Ferry Tap Construct** | Dec-27 | On Schedule | |
| **Thomas Island – Jack Primus 115kV New Transmission Line** | Completion Reported in IRP 2021 Update | In Service Feb-20 | |
| **Summerville – Pepperhill 230kV New Transmission Line** | Completion Reported in IRP 2021 Update | In Service Dec-20 | |
| **Church Creek – St. Andrews 115kV Replace Poles on the Greenway** | Completion Reported in IRP 2021 Update | In Service Jan-21 | |
| **Blackville West-Wagener 46kV, Rebuild the 23+ mile Line section including North to LNG to Perry to Salley to Springfield** | Completion Reported in IRP 2021 Update | In Service Jul-22 | |
| **Calhoun County-St Matthews 46kV Rebuild** | Completion Reported in | In Service Expected Dec-22 | |

| | | | |
|---|---|---|---|
| | IRP 2021 Update | | |
| **Cross County 115-23kV Substation and 115kV Transmission Line Tap Construction** | Completion Reported in IRP 2021 Update | In Service Jun-22 | |
| **May River 115-23kV Substation and 115kV Transmission Line Tap Construction** | Completion Reported in IRP 2021 Update | In Service Expected Dec-22 | |
| **Smoaks 115-23kV Substation and 115kV Transmission Line Tap Construction** | Completion Reported in IRP 2021 Update | In Service Jul-22 | |
| **Stevens Creek – Briggs Rd 115kV New Tie** | Completion Reported in IRP 2021 Update | In Service Nov-20 | |
| **Trenton – Briggs Rd 115kV Line** | Dec-21 | In Service Sept-21 | |
| **Ward – Stevens Creek 115kV: Ward – Trenton Section Rebuild** | Dec-22 | In Service May-22 | |
| **Batesburg – Ward 115kV Line** | Dec-21 | In Service Jul-21 | |
| **Batesburg – Gilbert 115kV Rebuild** | Completion Reported in IRP 2021 Update | In Service Feb-21 | |
| **Lex Westside – Gilbert 115kV Line** | Dec-21 | In Service Jan-22 | |
| **Lake Murray-Gilbert 115kV, Rebuild the 4 mile Lexington Junction – Lexington Westside Line section** | Completion Reported in IRP 2022 Update | In Service Aug-22 | |
| **Lake Murray – Gilbert 115kV Line** | Dec-22 | In Service Aug-22 | Combo designation of several projects above |
| **Stevens Creek – Ward – Lake Murray Line and Associated System Hardening Construct** | Mar-23 | In Service Aug-22 | Combo designation of several projects above |

## Appendix E: Timing and Nature of Resource Additions and Resulting Capacities and Reserve Margins

| RP8 Build Plan | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Year** | **Peak (MW)** | **Firm Capacity (MW)** | **Winter Reserve Margin %** | **New Gas (MW)** | **New Solar (MW)** | **New Solar plus Storage (MW)** | **New Storage (MW)** | **New Wind (MW)** | **New SMR (MW)** | **Retirements (MW)** |
| **2022** | 4984 | 6385 | 28.12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2023** | 5035 | 6434 | 27.79 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2024** | 4893 | 6441 | 31.64 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2025** | 4907 | 6434 | 31.12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2026** | 4926 | 6489 | 31.75 | 0 | 75 | 0 | 0 | 0 | 0 | 0 |
| **2027** | 4939 | 6505 | 31.73 | 0 | 75 | 0 | 0 | 0 | 0 | 0 |
| **2028** | 4953 | 6530 | 31.84 | 0 | 75 | 0 | 0 | 0 | 0 | 0 |
| **2029** | 4964 | 6401 | 28.96 | 523 | 75 | 0 | 0 | 0 | 0 | -684 |
| **2030** | 5016 | 6438 | 28.36 | 0 | 75 | 0 | 0 | 0 | 0 | 0 |
| **2031** | 5067 | 6497 | 28.24 | 553 | 75 | 0 | 112.5 | 0 | 0 | -610 |
| **2032** | 5121 | 6495 | 26.83 | 0 | 75 | 0 | 0 | 0 | 0 | 0 |
| **2033** | 5176 | 6508 | 25.74 | 0 | 150 | 0 | 75 | 0 | 0 | 0 |
| **2034** | 5232 | 6621 | 26.55 | 0 | 150 | 0 | 112.5 | 0 | 0 | 0 |
| **2035** | 5287 | 6620 | 25.23 | 0 | 75 | 0 | 0 | 0 | 0 | 0 |
| **2036** | 5339 | 6730 | 26.06 | 114 | 75 | 0 | 0 | 0 | 0 | 0 |
| **2037** | 5386 | 6734 | 25.04 | 0 | 75 | 0 | 0 | 0 | 0 | 0 |
| **2038** | 5435 | 6851 | 26.06 | 114 | 75 | 0 | 0 | 0 | 0 | 0 |
| **2039** | 5482 | 6852 | 25.00 | 0 | 150 | 0 | 0 | 0 | 0 | 0 |
| **2040** | 5529 | 6944 | 25.59 | 114 | 75 | 0 | 0 | 0 | 0 | 0 |
| **2041** | 5575 | 6922 | 24.17 | 0 | 75 | 0 | 0 | 0 | 0 | 0 |
| **2042** | 5624 | 7039 | 25.17 | 0 | 75 | 0 | 112.5 | 0 | 0 | 0 |
| **2043** | 5673 | 7043 | 24.16 | 0 | 75 | 0 | 0 | 0 | 0 | 0 |
| **2044** | 5723 | 7160 | 25.11 | 0 | 75 | 0 | 112.5 | 0 | 0 | 0 |
| **2045** | 5773 | 7164 | 24.10 | 0 | 75 | 0 | 0 | 0 | 0 | 0 |
| **2046** | 5824 | 7246 | 24.43 | 0 | 150 | 0 | 75 | 0 | 0 | 0 |
| **2047** | 5875 | 7363 | 25.34 | 0 | 75 | 0 | 112.5 | 0 | 0 | 0 |
| **2048** | 5927 | 7367 | 24.31 | 0 | 75 | 0 | 0 | 0 | 0 | 0 |
| **2049** | 5979 | 7371 | 23.30 | 0 | 75 | 0 | 0 | 0 | 0 | 0 |
| **2050** | 6031 | 7376 | 22.30 | 0 | 75 | 0 | 0 | 0 | 0 | 0 |
| **2051** | 6084 | 7411 | 21.82 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Williams 2047 Reference Build Plan | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Year** | **Peak (MW)** | **Firm Capacity (MW)** | **Winter Reserve Margin %** | **New Gas (MW)** | **New Solar (MW)** | **New Solar plus Storage (MW)** | **New Storage (MW)** | **New Wind (MW)** | **New SMR (MW)** | **Retirements (MW)** |
| **2022** | 4984 | 6385 | 28.12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2023** | 5035 | 6434 | 27.79 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2024** | 4893 | 6441 | 31.64 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2025** | 4907 | 6434 | 31.12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2026** | 4926 | 6486 | 31.68 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2027** | 4939 | 6499 | 31.60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2028** | 4953 | 6608 | 33.42 | 0 | 150 | 150 | 75 | 0 | 0 | 0 |
| **2029** | 4964 | 6041 | 21.70 | 0 | 150 | 150 | 75 | 0 | 0 | -684 |
| **2030** | 5016 | 6087 | 21.37 | 0 | 300 | 0 | 0 | 0 | 0 | 0 |
| **2031** | 5067 | 6171 | 21.81 | 0 | 75 | 150 | 75 | 0 | 0 | 0 |
| **2032** | 5121 | 6247 | 22.00 | 0 | 0 | 150 | 75 | 0 | 0 | 0 |
| **2033** | 5176 | 6267 | 21.08 | 0 | 75 | 150 | 75 | 0 | 0 | 0 |
| **2034** | 5232 | 6342 | 21.22 | 0 | 0 | 150 | 75 | 0 | 0 | 0 |
| **2035** | 5287 | 6420 | 21.44 | 0 | 0 | 150 | 75 | 0 | 0 | 0 |
| **2036** | 5339 | 6474 | 21.27 | 0 | 0 | 225 | 112.5 | 0 | 0 | 0 |
| **2037** | 5386 | 6530 | 21.24 | 0 | 0 | 225 | 112.5 | 0 | 0 | 0 |
| **2038** | 5435 | 6604 | 21.52 | 0 | 0 | 0 | 75 | 0 | 0 | 0 |
| **2039** | 5482 | 6674 | 21.75 | 0 | 0 | 0 | 75 | 0 | 0 | 0 |
| **2040** | 5529 | 6724 | 21.61 | 0 | 0 | 0 | 75 | 0 | 0 | 0 |
| **2041** | 5575 | 6933 | 24.37 | 234 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2042** | 5624 | 6934 | 23.30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2043** | 5673 | 6935 | 22.25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2044** | 5723 | 7207 | 25.95 | 234 | 0 | 0 | 37.5 | 0 | 0 | 0 |
| **2045** | 5773 | 7268 | 25.91 | 0 | 0 | 0 | 75 | 0 | 0 | 0 |
| **2046** | 5824 | 7269 | 24.83 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2047** | 5875 | 7320 | 24.61 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2048** | 5927 | 7385 | 24.61 | 523 | 0 | 0 | 0 | 0 | 0 | -610 |
| **2049** | 5979 | 7436 | 24.38 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2050** | 6031 | 7437 | 23.33 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2051** | 6084 | 7388 | 21.45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Williams 2030 Reference Build Plan | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Year** | **Peak (MW)** | **Firm Capacity (MW)** | **Winter Reserve Margin %** | **New Gas (MW)** | **New Solar (MW)** | **New Solar plus Storage (MW)** | **New Storage (MW)** | **New Wind (MW)** | **New SMR (MW)** | **Retirements (MW)** |
| **2022** | 4984 | 6385 | 28.12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2023** | 5035 | 6434 | 27.79 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2024** | 4893 | 6441 | 31.64 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2025** | 4907 | 6434 | 31.12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2026** | 4926 | 6486 | 31.68 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2027** | 4939 | 6499 | 31.60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2028** | 4953 | 6608 | 33.42 | 0 | 150 | 150 | 75 | 0 | 0 | 0 |
| **2029** | 4964 | 6041 | 21.70 | 0 | 150 | 150 | 75 | 0 | 0 | -684 |
| **2030** | 5016 | 6162 | 22.86 | 0 | 150 | 150 | 75 | 0 | 0 | 0 |
| **2031** | 5067 | 6164 | 21.65 | 523 | 150 | 150 | 75 | 0 | 0 | -610 |
| **2032** | 5121 | 6246 | 21.97 | 0 | 150 | 150 | 75 | 0 | 0 | 0 |
| **2033** | 5176 | 6295 | 21.63 | 0 | 0 | 225 | 112.5 | 0 | 0 | 0 |
| **2034** | 5232 | 6370 | 21.77 | 0 | 0 | 150 | 75 | 0 | 0 | 0 |
| **2035** | 5287 | 6422 | 21.47 | 0 | 0 | 225 | 112.5 | 0 | 0 | 0 |
| **2036** | 5339 | 6480 | 21.38 | 0 | 0 | 150 | 112.5 | 0 | 0 | 0 |
| **2037** | 5386 | 6519 | 21.04 | 0 | 0 | 0 | 37.5 | 0 | 0 | 0 |
| **2038** | 5435 | 6668 | 22.70 | 0 | 0 | 0 | 150 | 0 | 0 | 0 |
| **2039** | 5482 | 6663 | 21.55 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2040** | 5529 | 7161 | 29.52 | 523 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2041** | 5575 | 7136 | 28.01 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2042** | 5624 | 7137 | 26.91 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2043** | 5673 | 7138 | 25.83 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2044** | 5723 | 7139 | 24.75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2045** | 5773 | 7140 | 23.69 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2046** | 5824 | 7141 | 22.62 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2047** | 5875 | 7192 | 22.42 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2048** | 5927 | 7243 | 22.21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2049** | 5979 | 7244 | 21.16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2050** | 6031 | 7332 | 21.59 | 0 | 0 | 0 | 37.5 | 0 | 0 | 0 |
| **2051** | 6084 | 7383 | 21.37 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| High Fossil Fuel Price Build Plan | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Year** | **Peak (MW)** | **Firm Capacity (MW)** | **Winter Reserve Margin %** | **New Gas (MW)** | **New Solar (MW)** | **New Solar plus Storage (MW)** | **New Storage (MW)** | **New Wind (MW)** | **New SMR (MW)** | **Retirements (MW)** |
| **2022** | 4984 | 6385 | 28.12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2023** | 5035 | 6434 | 27.79 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2024** | 4893 | 6441 | 31.64 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2025** | 4907 | 6434 | 31.12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2026** | 4926 | 6492 | 31.81 | 0 | 150 | 0 | 0 | 0 | 0 | 0 |
| **2027** | 4939 | 6518 | 31.99 | 0 | 300 | 0 | 0 | 0 | 0 | 0 |
| **2028** | 4953 | 6627 | 33.81 | 0 | 150 | 150 | 75 | 0 | 0 | 0 |
| **2029** | 4964 | 6060 | 22.08 | 0 | 150 | 150 | 75 | 0 | 0 | -684 |
| **2030** | 5016 | 6241 | 24.44 | 0 | 0 | 300 | 150 | 0 | 0 | 0 |
| **2031** | 5067 | 6303 | 24.40 | 523 | 0 | 300 | 150 | 0 | 0 | -610 |
| **2032** | 5121 | 6430 | 25.57 | 0 | 0 | 300 | 150 | 0 | 0 | 0 |
| **2033** | 5176 | 6573 | 26.99 | 0 | 0 | 300 | 225 | 0 | 0 | 0 |
| **2034** | 5232 | 6692 | 27.91 | 0 | 0 | 300 | 150 | 0 | 0 | 0 |
| **2035** | 5287 | 6754 | 27.75 | 0 | 0 | 300 | 150 | 0 | 0 | 0 |
| **2036** | 5339 | 6811 | 27.58 | 0 | 0 | 300 | 150 | 0 | 0 | 0 |
| **2037** | 5386 | 6862 | 27.42 | 0 | 300 | 0 | 37.5 | 0 | 0 | 0 |
| **2038** | 5435 | 6902 | 27.01 | 0 | 75 | 0 | 37.5 | 0 | 0 | 0 |
| **2039** | 5482 | 6972 | 27.19 | 0 | 0 | 0 | 75 | 0 | 0 | 0 |
| **2040** | 5529 | 6984 | 26.33 | 0 | 0 | 0 | 37.5 | 0 | 0 | 0 |
| **2041** | 5575 | 6960 | 24.85 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2042** | 5624 | 6961 | 23.78 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2043** | 5673 | 7022 | 23.78 | 0 | 0 | 0 | 75 | 0 | 0 | 0 |
| **2044** | 5723 | 7257 | 26.81 | 234 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2045** | 5773 | 7258 | 25.73 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2046** | 5824 | 7259 | 24.64 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2047** | 5875 | 7460 | 26.98 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2048** | 5927 | 7511 | 26.73 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2049** | 5979 | 7462 | 24.81 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2050** | 6031 | 7463 | 23.75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2051** | 6084 | 7407 | 21.76 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Zero Carbon Cost Build Plan | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Year** | **Peak (MW)** | **Firm Capacity (MW)** | **Winter Reserve Margin %** | **New Gas (MW)** | **New Solar (MW)** | **New Solar plus Storage (MW)** | **New Storage (MW)** | **New Wind (MW)** | **New SMR (MW)** | **Retirements (MW)** |
| **2022** | 4984 | 6385 | 28.12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2023** | 5035 | 6434 | 27.79 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2024** | 4893 | 6441 | 31.64 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2025** | 4907 | 6434 | 31.12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2026** | 4926 | 6486 | 31.68 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2027** | 4939 | 6499 | 31.60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2028** | 4953 | 6605 | 33.36 | 0 | 75 | 150 | 75 | 0 | 0 | 0 |
| **2029** | 4964 | 6037 | 21.63 | 0 | 150 | 150 | 75 | 0 | 0 | -684 |
| **2030** | 5016 | 6081 | 21.24 | 0 | 225 | 0 | 0 | 0 | 0 | 0 |
| **2031** | 5067 | 6198 | 22.33 | 0 | 75 | 225 | 112.5 | 0 | 0 | 0 |
| **2032** | 5121 | 6280 | 22.65 | 0 | 150 | 150 | 75 | 0 | 0 | 0 |
| **2033** | 5176 | 6337 | 22.45 | 0 | 75 | 150 | 112.5 | 0 | 0 | 0 |
| **2034** | 5232 | 6413 | 22.57 | 0 | 0 | 150 | 75 | 0 | 0 | 0 |
| **2035** | 5287 | 6491 | 22.77 | 0 | 0 | 150 | 75 | 0 | 0 | 0 |
| **2036** | 5339 | 6483 | 21.43 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2037** | 5386 | 6554 | 21.70 | 0 | 0 | 75 | 75 | 0 | 0 | 0 |
| **2038** | 5435 | 6592 | 21.29 | 0 | 0 | 0 | 37.5 | 0 | 0 | 0 |
| **2039** | 5482 | 6661 | 21.52 | 0 | 0 | 0 | 75 | 0 | 0 | 0 |
| **2040** | 5529 | 6703 | 21.25 | 0 | 0 | 0 | 75 | 0 | 0 | 0 |
| **2041** | 5575 | 7202 | 29.19 | 523 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2042** | 5624 | 7203 | 28.08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2043** | 5673 | 7204 | 26.99 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2044** | 5723 | 7205 | 25.90 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2045** | 5773 | 7243 | 25.48 | 0 | 0 | 0 | 37.5 | 0 | 0 | 0 |
| **2046** | 5824 | 7244 | 24.39 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2047** | 5875 | 7259 | 23.57 | 523 | 0 | 0 | 0 | 0 | 0 | -610 |
| **2048** | 5927 | 7260 | 22.50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2049** | 5979 | 7311 | 22.29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2050** | 6031 | 7362 | 22.08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2051** | 6084 | 7393 | 21.53 | 0 | 0 | 0 | 37.5 | 0 | 0 | 0 |

| Carbon Constrained Build Plan | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Year** | **Peak (MW)** | **Firm Capacity (MW)** | **Winter Reserve Margin %** | **New Gas (MW)** | **New Solar (MW)** | **New Solar plus Storage (MW)** | **New Storage (MW)** | **New Wind (MW)** | **New SMR (MW)** | **Retirements (MW)** |
| **2022** | 4984 | 6385 | 28.12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2023** | 5035 | 6434 | 27.79 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2024** | 4893 | 6441 | 31.64 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2025** | 4907 | 6434 | 31.12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2026** | 4926 | 6486 | 31.68 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2027** | 4939 | 6505 | 31.73 | 0 | 150 | 0 | 0 | 0 | 0 | 0 |
| **2028** | 4953 | 6614 | 33.55 | 0 | 150 | 150 | 75 | 0 | 0 | 0 |
| **2029** | 4964 | 6047 | 21.83 | 0 | 150 | 150 | 75 | 0 | 0 | -684 |
| **2030** | 5016 | 6169 | 22.99 | 0 | 150 | 150 | 75 | 0 | 0 | 0 |
| **2031** | 5067 | 6761 | 33.44 | 1114 | 150 | 150 | 75 | 0 | 0 | -610 |
| **2032** | 5121 | 6903 | 34.81 | 0 | 0 | 300 | 150 | 0 | 0 | 0 |
| **2033** | 5176 | 6986 | 34.98 | 0 | 0 | 300 | 150 | 0 | 0 | 0 |
| **2034** | 5232 | 7112 | 35.95 | 0 | 0 | 300 | 150 | 0 | 0 | 0 |
| **2035** | 5287 | 7189 | 35.99 | 0 | 0 | 300 | 150 | 0 | 0 | 0 |
| **2036** | 5339 | 7254 | 35.88 | 0 | 0 | 300 | 150 | 0 | 0 | 0 |
| **2037** | 5386 | 7298 | 35.51 | 0 | 150 | 150 | 75 | 0 | 0 | 0 |
| **2038** | 5435 | 7340 | 35.06 | 0 | 150 | 150 | 75 | 0 | 0 | 0 |
| **2039** | 5482 | 7338 | 33.87 | 0 | 75 | 0 | 0 | 0 | 0 | 0 |
| **2040** | 5529 | 7913 | 43.12 | 0 | 0 | 0 | 0 | 100 | 570 | 0 |
| **2041** | 5575 | 7918 | 42.04 | 0 | 0 | 0 | 0 | 100 | 0 | 0 |
| **2042** | 5624 | 7949 | 41.35 | 0 | 0 | 0 | 0 | 100 | 0 | 0 |
| **2043** | 5673 | 8550 | 50.72 | 0 | 0 | 0 | 0 | 100 | 570 | 0 |
| **2044** | 5723 | 8581 | 49.95 | 0 | 0 | 0 | 0 | 100 | 0 | 0 |
| **2045** | 5773 | 8612 | 49.19 | 0 | 0 | 0 | 0 | 100 | 0 | 0 |
| **2046** | 5824 | 8643 | 48.41 | 0 | 0 | 0 | 0 | 100 | 0 | 0 |
| **2047** | 5875 | 8674 | 47.65 | 0 | 0 | 0 | 0 | 100 | 0 | 0 |
| **2048** | 5927 | 8705 | 46.88 | 0 | 0 | 0 | 0 | 100 | 0 | 0 |
| **2049** | 5979 | 8736 | 46.12 | 0 | 0 | 0 | 0 | 100 | 0 | 0 |
| **2050** | 6031 | 8737 | 44.88 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2051** | 6084 | 8738 | 43.63 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| High $CO_2$ Price Build Plan | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Year** | **Peak (MW)** | **Firm Capacity (MW)** | **Winter Reserve Margin %** | **New Gas (MW)** | **New Solar (MW)** | **New Solar plus Storage (MW)** | **New Storage (MW)** | **New Wind (MW)** | **New SMR (MW)** | **Retirements (MW)** |
| **2022** | 4984 | 6385 | 28.12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2023** | 5035 | 6434 | 27.79 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2024** | 4893 | 6441 | 31.64 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2025** | 4907 | 6434 | 31.12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2026** | 4926 | 6486 | 31.68 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2027** | 4939 | 6502 | 31.66 | 0 | 75 | 0 | 0 | 0 | 0 | 0 |
| **2028** | 4953 | 6574 | 32.73 | 0 | 225 | 75 | 37.5 | 0 | 0 | 0 |
| **2029** | 4964 | 6006 | 21.01 | 0 | 150 | 150 | 75 | 0 | 0 | -684 |
| **2030** | 5016 | 6128 | 22.18 | 0 | 150 | 150 | 75 | 0 | 0 | 0 |
| **2031** | 5067 | 6159 | 21.57 | 523 | 75 | 225 | 112.5 | 0 | 0 | -610 |
| **2032** | 5121 | 6238 | 21.82 | 0 | 75 | 150 | 75 | 0 | 0 | 0 |
| **2033** | 5176 | 6288 | 21.49 | 0 | 0 | 225 | 112.5 | 0 | 0 | 0 |
| **2034** | 5232 | 6337 | 21.12 | 0 | 0 | 150 | 75 | 0 | 0 | 0 |
| **2035** | 5287 | 6448 | 21.97 | 0 | 0 | 225 | 112.5 | 0 | 0 | 0 |
| **2036** | 5339 | 6495 | 21.65 | 0 | 0 | 225 | 112.5 | 0 | 0 | 0 |
| **2037** | 5386 | 6547 | 21.56 | 0 | 0 | 150 | 75 | 0 | 0 | 0 |
| **2038** | 5435 | 6612 | 21.67 | 0 | 0 | 225 | 112.5 | 0 | 0 | 0 |
| **2039** | 5482 | 6644 | 21.20 | 0 | 0 | 150 | 75 | 0 | 0 | 0 |
| **2040** | 5529 | 7141 | 29.17 | 523 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2041** | 5575 | 7116 | 27.66 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2042** | 5624 | 7117 | 26.56 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2043** | 5673 | 7118 | 25.49 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2044** | 5723 | 7138 | 24.73 | 0 | 0 | 75 | 37.5 | 0 | 0 | 0 |
| **2045** | 5773 | 7139 | 23.66 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2046** | 5824 | 7140 | 22.60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2047** | 5875 | 7141 | 21.55 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2048** | 5927 | 7192 | 21.34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2049** | 5979 | 7276 | 21.70 | 0 | 0 | 75 | 37.5 | 0 | 0 | 0 |
| **2050** | 6031 | 7327 | 21.49 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2051** | 6084 | 7378 | 21.27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Low Regulation Build Plan | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Year** | **Peak (MW)** | **Firm Capacity (MW)** | **Winter Reserve Margin %** | **New Gas (MW)** | **New Solar (MW)** | **New Solar plus Storage (MW)** | **New Storage (MW)** | **New Wind (MW)** | **New SMR (MW)** | **Retirements (MW)** |
| **2022** | 4984 | 6385 | 28.12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2023** | 5035 | 6434 | 27.79 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2024** | 4893 | 6441 | 31.64 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2025** | 4907 | 6434 | 31.12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2026** | 4926 | 6486 | 31.68 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2027** | 4939 | 6499 | 31.60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2028** | 4953 | 6601 | 33.29 | 0 | 0 | 150 | 75 | 0 | 0 | 0 |
| **2029** | 4964 | 6031 | 21.51 | 0 | 75 | 150 | 75 | 0 | 0 | -684 |
| **2030** | 5016 | 6153 | 22.67 | 0 | 150 | 150 | 75 | 0 | 0 | 0 |
| **2031** | 5067 | 6184 | 22.05 | 523 | 75 | 225 | 112.5 | 0 | 0 | -610 |
| **2032** | 5121 | 6266 | 22.37 | 0 | 150 | 150 | 75 | 0 | 0 | 0 |
| **2033** | 5176 | 6326 | 22.24 | 0 | 150 | 150 | 112.5 | 0 | 0 | 0 |
| **2034** | 5232 | 6402 | 22.36 | 0 | 0 | 150 | 75 | 0 | 0 | 0 |
| **2035** | 5287 | 6469 | 22.36 | 0 | 0 | 75 | 75 | 0 | 0 | 0 |
| **2036** | 5339 | 6532 | 22.35 | 0 | 0 | 75 | 75 | 0 | 0 | 0 |
| **2037** | 5386 | 6570 | 22.00 | 0 | 0 | 0 | 37.5 | 0 | 0 | 0 |
| **2038** | 5435 | 6607 | 21.58 | 0 | 0 | 0 | 37.5 | 0 | 0 | 0 |
| **2039** | 5482 | 6677 | 21.81 | 0 | 0 | 0 | 75 | 0 | 0 | 0 |
| **2040** | 5529 | 7175 | 29.77 | 523 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2041** | 5575 | 7150 | 28.26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2042** | 5624 | 7151 | 27.16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2043** | 5673 | 7152 | 26.08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2044** | 5723 | 7153 | 25.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2045** | 5773 | 7154 | 23.93 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2046** | 5824 | 7155 | 22.86 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2047** | 5875 | 7156 | 21.81 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2048** | 5927 | 7207 | 21.60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2049** | 5979 | 7258 | 21.40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2050** | 6031 | 7359 | 22.03 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2051** | 6084 | 7393 | 21.53 | 0 | 0 | 75 | 37.5 | 0 | 0 | 0 |

| Stagflation Build Plan | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Year** | **Peak (MW)** | **Firm Capacity (MW)** | **Winter Reserve Margin %** | **New Gas (MW)** | **New Solar (MW)** | **New Solar plus Storage (MW)** | **New Storage (MW)** | **New Wind (MW)** | **New SMR (MW)** | **Retirements (MW)** |
| **2022** | 4984 | 6344 | 27.30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2023** | 5035 | 6391 | 26.94 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2024** | 4893 | 6395 | 30.70 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2025** | 4888 | 6384 | 30.61 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2026** | 4884 | 6429 | 31.65 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2027** | 4880 | 6443 | 32.04 | 0 | 300 | 0 | 0 | 0 | 0 | 0 |
| **2028** | 4876 | 6532 | 33.96 | 0 | 150 | 150 | 75 | 0 | 0 | 0 |
| **2029** | 4872 | 5910 | 21.32 | 0 | 150 | 150 | 75 | 0 | 0 | -684 |
| **2030** | 4867 | 6029 | 23.88 | 0 | 150 | 150 | 112.5 | 0 | 0 | 0 |
| **2031** | 4892 | 6016 | 22.98 | 523 | 75 | 150 | 112.5 | 0 | 0 | -610 |
| **2032** | 4917 | 6095 | 23.96 | 0 | 75 | 150 | 75 | 0 | 0 | 0 |
| **2033** | 4942 | 6085 | 23.13 | 0 | 0 | 150 | 75 | 0 | 0 | 0 |
| **2034** | 4967 | 6159 | 24.01 | 0 | 75 | 150 | 112.5 | 0 | 0 | 0 |
| **2035** | 4992 | 6237 | 24.96 | 0 | 0 | 150 | 75 | 0 | 0 | 0 |
| **2036** | 5018 | 6377 | 27.10 | 0 | 150 | 150 | 150 | 0 | 0 | 0 |
| **2037** | 5043 | 6437 | 27.65 | 0 | 150 | 0 | 75 | 0 | 0 | 0 |
| **2038** | 5069 | 6437 | 26.99 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2039** | 5095 | 6431 | 26.24 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2040** | 5120 | 6406 | 25.13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2041** | 5146 | 6381 | 24.02 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2042** | 5172 | 6382 | 23.41 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2043** | 5198 | 6383 | 22.81 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2044** | 5224 | 6384 | 22.22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2045** | 5250 | 6385 | 21.64 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2046** | 5276 | 6386 | 21.06 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2047** | 5303 | 6437 | 21.40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2048** | 5330 | 6488 | 21.74 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2049** | 5357 | 6489 | 21.15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2050** | 5384 | 6540 | 21.49 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2051** | 5411 | 6591 | 21.82 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Aggressive Regulation Build Plan | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Year** | **Peak (MW)** | **Firm Capacity (MW)** | **Winter Reserve Margin %** | **New Gas (MW)** | **New Solar (MW)** | **New Solar plus Storage (MW)** | **New Storage (MW)** | **New Wind (MW)** | **New SMR (MW)** | **Retirements (MW)** |
| **2022** | 4984 | 6385 | 28.12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2023** | 5035 | 6434 | 27.79 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2024** | 4893 | 6441 | 31.64 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2025** | 4937 | 6434 | 30.33 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2026** | 4982 | 6499 | 30.46 | 0 | 300 | 0 | 0 | 0 | 0 | 0 |
| **2027** | 5028 | 6562 | 30.52 | 0 | 225 | 75 | 37.5 | 0 | 0 | 0 |
| **2028** | 5074 | 6671 | 31.48 | 0 | 150 | 150 | 75 | 0 | 0 | 0 |
| **2029** | 5120 | 6687 | 30.61 | 523 | 0 | 300 | 150 | 0 | 0 | -684 |
| **2030** | 5167 | 6838 | 32.36 | 0 | 75 | 225 | 112.5 | 0 | 0 | 0 |
| **2031** | 5245 | 6369 | 21.44 | 0 | 0 | 300 | 150 | 0 | 0 | -610 |
| **2032** | 5324 | 6489 | 21.88 | 0 | 0 | 300 | 150 | 0 | 0 | 0 |
| **2033** | 5405 | 6556 | 21.31 | 0 | 0 | 300 | 150 | 0 | 0 | 0 |
| **2034** | 5486 | 6649 | 21.21 | 0 | 0 | 300 | 150 | 0 | 0 | 0 |
| **2035** | 5569 | 6771 | 21.60 | 0 | 75 | 225 | 187.5 | 0 | 0 | 0 |
| **2036** | 5653 | 6840 | 21.00 | 0 | 150 | 150 | 112.5 | 0 | 0 | 0 |
| **2037** | 5738 | 7370 | 28.45 | 523 | 150 | 0 | 0 | 0 | 0 | 0 |
| **2038** | 5825 | 7430 | 27.56 | 0 | 0 | 0 | 75 | 0 | 0 | 0 |
| **2039** | 5912 | 7425 | 25.59 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2040** | 6002 | 7399 | 23.28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2041** | 6092 | 7393 | 21.36 | 0 | 0 | 75 | 37.5 | 0 | 0 | 0 |
| **2042** | 6186 | 7506 | 21.35 | 0 | 0 | 0 | 112.5 | 0 | 0 | 0 |
| **2043** | 6282 | 8030 | 27.84 | 523 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2044** | 6379 | 8031 | 25.91 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2045** | 6478 | 8032 | 24.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2046** | 6578 | 8033 | 22.13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2047** | 6680 | 8084 | 21.03 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2048** | 6783 | 8223 | 21.23 | 0 | 0 | 0 | 37.5 | 0 | 0 | 0 |
| **2049** | 6888 | 8597 | 24.81 | 523 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2050** | 6995 | 8598 | 22.92 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2051** | 7103 | 8636 | 21.59 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Medium DSM Build Plan | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Year** | **Peak (MW)** | **Firm Capacity (MW)** | **Winter Reserve Margin %** | **New Gas (MW)** | **New Solar (MW)** | **New Solar plus Storage (MW)** | **New Storage (MW)** | **New Wind (MW)** | **New SMR (MW)** | **Retirements (MW)** |
| **2022** | 4984 | 6344 | 27.30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2023** | 5049 | 6392 | 26.61 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2024** | 4922 | 6397 | 29.97 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2025** | 4948 | 6387 | 29.09 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2026** | 4979 | 6435 | 29.26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2027** | 5006 | 6440 | 28.66 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2028** | 5034 | 6450 | 28.14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2029** | 5057 | 6351 | 25.61 | 523 | 225 | 75 | 37.5 | 0 | 0 | -684 |
| **2030** | 5124 | 6378 | 24.49 | 0 | 300 | 0 | 0 | 0 | 0 | 0 |
| **2031** | 5174 | 6342 | 22.58 | 523 | 225 | 75 | 37.5 | 0 | 0 | -610 |
| **2032** | 5229 | 6418 | 22.74 | 0 | 0 | 150 | 75 | 0 | 0 | 0 |
| **2033** | 5284 | 6434 | 21.77 | 0 | 0 | 150 | 75 | 0 | 0 | 0 |
| **2034** | 5340 | 6509 | 21.90 | 0 | 0 | 150 | 75 | 0 | 0 | 0 |
| **2035** | 5395 | 6625 | 22.80 | 0 | 0 | 150 | 112.5 | 0 | 0 | 0 |
| **2036** | 5446 | 6657 | 22.25 | 0 | 0 | 75 | 37.5 | 0 | 0 | 0 |
| **2037** | 5494 | 6699 | 21.94 | 0 | 0 | 75 | 37.5 | 0 | 0 | 0 |
| **2038** | 5543 | 6754 | 21.85 | 0 | 0 | 150 | 75 | 0 | 0 | 0 |
| **2039** | 5589 | 6804 | 21.74 | 0 | 0 | 150 | 75 | 0 | 0 | 0 |
| **2040** | 5637 | 6859 | 21.69 | 0 | 0 | 225 | 112.5 | 0 | 0 | 0 |
| **2041** | 5684 | 6901 | 21.42 | 0 | 0 | 150 | 75 | 0 | 0 | 0 |
| **2042** | 5732 | 6953 | 21.31 | 0 | 0 | 150 | 75 | 0 | 0 | 0 |
| **2043** | 5780 | 7006 | 21.21 | 0 | 0 | 150 | 75 | 0 | 0 | 0 |
| **2044** | 5827 | 7070 | 21.34 | 0 | 0 | 75 | 75 | 0 | 0 | 0 |
| **2045** | 5875 | 7146 | 21.64 | 0 | 0 | 0 | 75 | 0 | 0 | 0 |
| **2046** | 5923 | 7185 | 21.32 | 0 | 0 | 0 | 37.5 | 0 | 0 | 0 |
| **2047** | 5970 | 7236 | 21.22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2048** | 6018 | 7287 | 21.10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2049** | 6066 | 7376 | 21.60 | 0 | 0 | 0 | 37.5 | 0 | 0 | 0 |
| **2050** | 6114 | 7414 | 21.28 | 0 | 0 | 0 | 37.5 | 0 | 0 | 0 |
| **2051** | 6161 | 7465 | 21.18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Low DSM Build Plan | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Year** | **Peak (MW)** | **Firm Capacity (MW)** | **Winter Reserve Margin %** | **New Gas (MW)** | **New Solar (MW)** | **New Solar plus Storage (MW)** | **New Storage (MW)** | **New Wind (MW)** | **New SMR (MW)** | **Retirements (MW)** |
| **2022** | 4984 | 6344 | 27.30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2023** | 5054 | 6391 | 26.46 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2024** | 4930 | 6395 | 29.72 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2025** | 4961 | 6384 | 28.69 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2026** | 4995 | 6429 | 28.72 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2027** | 5024 | 6430 | 28.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2028** | 5054 | 6441 | 27.45 | 0 | 225 | 0 | 0 | 0 | 0 | 0 |
| **2029** | 5080 | 6365 | 25.31 | 523 | 75 | 150 | 75 | 0 | 0 | -684 |
| **2030** | 5151 | 6484 | 25.89 | 0 | 75 | 225 | 112.5 | 0 | 0 | 0 |
| **2031** | 5202 | 6485 | 24.68 | 523 | 150 | 150 | 75 | 0 | 0 | -610 |
| **2032** | 5256 | 6567 | 24.96 | 0 | 150 | 150 | 75 | 0 | 0 | 0 |
| **2033** | 5311 | 6587 | 24.03 | 0 | 75 | 150 | 75 | 0 | 0 | 0 |
| **2034** | 5367 | 6581 | 22.62 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2035** | 5422 | 6577 | 21.32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2036** | 5473 | 6651 | 21.53 | 0 | 0 | 150 | 75 | 0 | 0 | 0 |
| **2037** | 5521 | 6846 | 24.00 | 0 | 0 | 150 | 187.5 | 0 | 0 | 0 |
| **2038** | 5570 | 6845 | 22.91 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2039** | 5616 | 6840 | 21.81 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2040** | 5664 | 6957 | 22.84 | 0 | 0 | 0 | 150 | 0 | 0 | 0 |
| **2041** | 5711 | 6932 | 21.40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2042** | 5759 | 6971 | 21.05 | 0 | 0 | 0 | 37.5 | 0 | 0 | 0 |
| **2043** | 5807 | 7525 | 29.59 | 523 | 0 | 0 | 37.5 | 0 | 0 | 0 |
| **2044** | 5854 | 7526 | 28.57 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2045** | 5902 | 7527 | 27.54 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2046** | 5950 | 7528 | 26.53 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2047** | 5997 | 7529 | 25.55 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2048** | 6045 | 7530 | 24.57 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2049** | 6093 | 7531 | 23.61 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2050** | 6141 | 7532 | 22.66 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2051** | 6188 | 7533 | 21.74 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

## Appendix F: Generation Added by Type for Each Resource Plan by Year

| RP8 Build Plan | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | 1x1 CC | CT Aero 1x | CT Aero 2x | CT Frame 2x | Solar | Battery Grid 4hr 100% | Battery Grid 4hr 80% | Battery Paired 4hr 100% | Battery Paired 4hr 30% | Battery Paired 4hr 40% | Battery Paired 4hr 60% | Battery Paired 4hr 80% |
| 2022 | | | | | | | | | | | | |
| 2023 | | | | | | | | | | | | |
| 2024 | | | | | | | | | | | | |
| 2025 | | | | | | | | | | | | |
| 2026 | | | | | 75 | | | | | | | |
| 2027 | | | | | 75 | | | | | | | |
| 2028 | | | | | 75 | | | | | | | |
| 2029 | | | | 523 | 75 | | | | | | | |
| 2030 | | | | | 75 | | | | | | | |
| 2031 | 553 | | | | 75 | 112.5 | | | | | | |
| 2032 | | | | | 75 | | | | | | | |
| 2033 | | | | | 75 | 75 | | | | | | |
| 2034 | | | | | 150 | 112.5 | | | | | | |
| 2035 | | | | | 75 | | | | | | | |
| 2036 | | 114 | | | 75 | | | | | | | |
| 2037 | | | | | 75 | | | | | | | |
| 2038 | | 114 | | | 75 | | | | | | | |
| 2039 | | | | | 150 | | | | | | | |
| 2040 | | 114 | | | 75 | | | | | | | |
| 2041 | | | | | 75 | | | | | | | |
| 2042 | | | | | 75 | 112.5 | | | | | | |
| 2043 | | | | | 75 | | | | | | | |
| 2044 | | | | | 75 | 112.5 | | | | | | |
| 2045 | | | | | 75 | | | | | | | |
| 2046 | | | | | 150 | 75 | | | | | | |
| 2047 | | | | | 75 | 112.5 | | | | | | |
| 2048 | | | | | 75 | | | | | | | |
| 2049 | | | | | 75 | | | | | | | |
| 2050 | | | | | 75 | | | | | | | |
| 2051 | | | | | | | | | | | | |
| **Total MW** | 553 | 342 | | 523 | 2100 | 712.5 | | | | | | |

| Williams 2047 Reference Build Plan | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Year** | **1x1 CC** | **CT Aero 2x** | **CT Frame 2x** | **Solar** | **Solar PPA** | **Solar plus Storage** | **Solar plus Storage PPA** | **Battery Grid 4hr 100%** | **Battery Grid 4hr 80%** | **Battery Paired 4hr 100%** | **Battery Paired 4hr 30%** | **Battery Paired 4hr 40%** | **Battery Paired 4hr 60%** | **Battery Paired 4hr 80%** |
| 2022 | | | | | | | | | | | | | | |
| 2023 | | | | | | | | | | | | | | |
| 2024 | | | | | | | | | | | | | | |
| 2025 | | | | | | | | | | | | | | |
| 2026 | | | | | | | | | | | | | | |
| 2027 | | | | | | | | | | | | | | |
| 2028 | | | | | 150 | | 150 | | | 75 | | | | |
| 2029 | | | | | 150 | | 150 | | | 75 | | | | |
| 2030 | | | | | 300 | | | | | | | | | |
| 2031 | | | | | 75 | | 150 | | | 75 | | | | |
| 2032 | | | | | | | 150 | | | 75 | | | | |
| 2033 | | | | | 75 | | 150 | | | 75 | | | | |
| 2034 | | | | | | | 150 | | | 75 | | | | |
| 2035 | | | | | | | 150 | | | 75 | | | | |
| 2036 | | | | | | 75 | 150 | | | | 75 | | | 37.5 |
| 2037 | | | | | | 75 | 150 | | | | 75 | | 37.5 | |
| 2038 | | | | | | | | 75 | | | | | | |
| 2039 | | | | | | | | 75 | | | | | | |
| 2040 | | | | | | | | 75 | | | | | | |
| 2041 | | 234 | | | | | | | | | | | | |
| 2042 | | | | | | | | | | | | | | |
| 2043 | | | | | | | | | | | | | | |
| 2044 | | 234 | | | | | | 37.5 | | | | | | |
| 2045 | | | | | | | | | 75 | | | | | |
| 2046 | | | | | | | | | | | | | | |
| 2047 | | | | | | | | | | | | | | |
| 2048 | | | 523 | | | | | | | | | | | |
| 2049 | | | | | | | | | | | | | | |
| 2050 | | | | | | | | | | | | | | |
| 2051 | | | | | | | | | | | | | | |
| **Total MW** | | 468 | 523 | | 750 | 150 | 1350 | 262.5 | 75 | 525 | 150 | | 37.5 | 37.5 |

| Williams 2030 Reference Build Plan | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Year** | **1x1 CC** | **CT Aero 2x** | **CT Frame 2x** | **Solar** | **Solar PPA** | **Solar plus Storage** | **Solar plus Storage PPA** | **Battery Grid 4hr 100%** | **Battery Grid 4hr 80%** | **Battery Paired 4hr 100%** | **Battery Paired 4hr 30%** | **Battery Paired 4hr 40%** | **Battery Paired 4hr 60%** | **Battery Paired 4hr 80%** |
| 2022 | | | | | | | | | | | | | | |
| 2023 | | | | | | | | | | | | | | |
| 2024 | | | | | | | | | | | | | | |
| 2025 | | | | | | | | | | | | | | |
| 2026 | | | | | | | | | | | | | | |
| 2027 | | | | | | | | | | | | | | |
| 2028 | | | | | 150 | | 150 | | 75 | | | | | |
| 2029 | | | | | 150 | | 150 | | 75 | | | | | |
| 2030 | | | | | 150 | | 150 | | 75 | | | | | |
| 2031 | | | 523 | | 150 | | 150 | | 75 | | | | | |
| 2032 | | | | | 150 | | 150 | | 75 | | | | | |
| 2033 | | | | | | 75 | 150 | | 75 | | | | 37.5 | |
| 2034 | | | | | | | 150 | | 75 | | | | | |
| 2035 | | | | | | 75 | 150 | | | 75 | | 37.5 | | |
| 2036 | | | | | | | 150 | 37.5 | | 75 | | | | |
| 2037 | | | | | | | | 37.5 | | | | | | |
| 2038 | | | | | | | | 150 | | | | | | |
| 2039 | | | | | | | | | | | | | | |
| 2040 | | | 523 | | | | | | | | | | | |
| 2041 | | | | | | | | | | | | | | |
| 2042 | | | | | | | | | | | | | | |
| 2043 | | | | | | | | | | | | | | |
| 2044 | | | | | | | | | | | | | | |
| 2045 | | | | | | | | | | | | | | |
| 2046 | | | | | | | | | | | | | | |
| 2047 | | | | | | | | | | | | | | |
| 2048 | | | | | | | | | | | | | | |
| 2049 | | | | | | | | | | | | | | |
| 2050 | | | | | | | | 37.5 | | | | | | |
| 2051 | | | | | | | | | | | | | | |
| **Total MW** | | | 1046 | | 750 | 150 | 1350 | 262.5 | 525 | 150 | | 37.5 | 37.5 | |

| High Fossil Fuel Price Build Plan | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Year** | **1x1 CC** | **CT Aero 2x** | **CT Frame 2x** | **Solar** | **Solar PPA** | **Solar plus Storage** | **Solar plus Storage PPA** | **Battery Grid 4hr 100%** | **Battery Grid 4hr 80%** | **Battery Paired 4hr 100%** | **Battery Paired 4hr 30%** | **Battery Paired 4hr 40%** | **Battery Paired 4hr 60%** | **Battery Paired 4hr 80%** |
| 2022 | | | | | | | | | | | | | | |
| 2023 | | | | | | | | | | | | | | |
| 2024 | | | | | | | | | | | | | | |
| 2025 | | | | | | | | | | | | | | |
| 2026 | | | | | 150 | | | | | | | | | |
| 2027 | | | | | 300 | | | | | | | | | |
| 2028 | | | | | 150 | | 150 | | | 75 | | | | |
| 2029 | | | | | 150 | | 150 | | | 75 | | | | |
| 2030 | | | | | | 150 | 150 | | | 75 | | | | 75 |
| 2031 | | | 523 | | | 150 | 150 | | | 75 | | | | 75 |
| 2032 | | | | | | 150 | 150 | | | 75 | | | 75 | |
| 2033 | | | | | | 150 | 150 | 75 | | 75 | | | 75 | |
| 2034 | | | | | | 150 | 150 | | | 75 | | 37.5 | 37.5 | |
| 2035 | | | | | | 150 | 150 | | | | 75 | 75 | | |
| 2036 | | | | | | 150 | 150 | | | | 75 | 75 | | |
| 2037 | | | | 300 | | | | 37.5 | | | | | | |
| 2038 | | | | 75 | | | | 37.5 | | | | | | |
| 2039 | | | | | | | | 75 | | | | | | |
| 2040 | | | | | | | | 37.5 | | | | | | |
| 2041 | | | | | | | | | | | | | | |
| 2042 | | | | | | | | | | | | | | |
| 2043 | | | | | | | | | 75 | | | | | |
| 2044 | | 234 | | | | | | | | | | | | |
| 2045 | | | | | | | | | | | | | | |
| 2046 | | | | | | | | | | | | | | |
| 2047 | | | | | | | | | | | | | | |
| 2048 | | | | | | | | | | | | | | |
| 2049 | | | | | | | | | | | | | | |
| 2050 | | | | | | | | | | | | | | |
| 2051 | | | | | | | | | | | | | | |
| **Total MW** | | 234 | 523 | 375 | 750 | 1050 | 1350 | 262.5 | 75 | 525 | 150 | 187.5 | 187.5 | 150 |

| Zero Carbon Cost Build Plan | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Year** | 1x1 CC | CT Aero 2x | CT Frame 2x | Solar | Solar PPA | Solar plus Storage | Solar plus Storage PPA | Battery Grid 4hr 100% | Battery Grid 4hr 80% | Battery Paired 4hr 100% | Battery Paired 4hr 30% | Battery Paired 4hr 40% | Battery Paired 4hr 60% | Battery Paired 4hr 80% |
| **2022** | | | | | | | | | | | | | | |
| **2023** | | | | | | | | | | | | | | |
| **2024** | | | | | | | | | | | | | | |
| **2025** | | | | | | | | | | | | | | |
| **2026** | | | | | | | | | | | | | | |
| **2027** | | | | | | | | | | | | | | |
| **2028** | | | | | 75 | | 150 | | | 75 | | | | |
| **2029** | | | | | 150 | | 150 | | | 75 | | | | |
| **2030** | | | | | 225 | | | | | | | | | |
| **2031** | | | | | 75 | 75 | 150 | | | 75 | | | | 37.5 |
| **2032** | | | | | 150 | | 150 | | | 75 | | | | |
| **2033** | | | | | 75 | | 150 | 37.5 | | 75 | | | | |
| **2034** | | | | | | | 150 | | | 75 | | | | |
| **2035** | | | | | | | 150 | | | 75 | | | | |
| **2036** | | | | | | | | | | | | | | |
| **2037** | | | | | | 75 | | 37.5 | | | | | | 37.5 |
| **2038** | | | | | | | | 37.5 | | | | | | |
| **2039** | | | | | | | | 75 | | | | | | |
| **2040** | | | | | | | | 37.5 | 37.5 | | | | | |
| **2041** | | | 523 | | | | | | | | | | | |
| **2042** | | | | | | | | | | | | | | |
| **2043** | | | | | | | | | | | | | | |
| **2044** | | | | | | | | | | | | | | |
| **2045** | | | | | | | | 37.5 | | | | | | |
| **2046** | | | | | | | | | | | | | | |
| **2047** | | | 523 | | | | | | | | | | | |
| **2048** | | | | | | | | | | | | | | |
| **2049** | | | | | | | | | | | | | | |
| **2050** | | | | | | | | | | | | | | |
| **2051** | | | | | | | | | 37.5 | | | | | |
| **Total MW** | | | 1046 | | 750 | 150 | 1050 | 262.5 | 75 | 525 | | | | 75 |

| Carbon Constrained Build Plan | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Year** | 2x1 CC | Offshore Wind | SMR | Solar | Solar PPA | Solar plus Storage | Solar plus Storage PPA | Battery Grid 4hr 100% | Battery Grid 4hr 80% | Battery Paired 4hr 100% | Battery Paired 4hr 30% | Battery Paired 4hr 40% | Battery Paired 4hr 60% | Battery Paired 4hr 80% |
| **2022** | | | | | | | | | | | | | | |
| **2023** | | | | | | | | | | | | | | |
| **2024** | | | | | | | | | | | | | | |
| **2025** | | | | | | | | | | | | | | |
| **2026** | | | | | | | | | | | | | | |
| **2027** | | | | | 150 | | | | | | | | | |
| **2028** | | | | | 150 | | 150 | | | 75 | | | | |
| **2029** | | | | | 150 | | 150 | | | 75 | | | | |
| **2030** | | | | | 150 | | 150 | | | 75 | | | | |
| **2031** | 1114 | | | | 150 | | 150 | | | 75 | | | | |
| **2032** | | | | | | 150 | 150 | | | 75 | | | | 75 |
| **2033** | | | | | | 150 | 150 | | | 75 | | | | 75 |
| **2034** | | | | | | 150 | 150 | | | 75 | | | 75 | |
| **2035** | | | | | | 150 | 150 | | | | 75 | | 75 | |
| **2036** | | | | | | 150 | 150 | | | | 75 | 37.5 | 37.5 | |
| **2037** | | | | 150 | | 150 | | | | | | 75 | | |
| **2038** | | | | 150 | | 150 | | | | | | 75 | | |
| **2039** | | | | 75 | | | | | | | | | | |
| **2040** | | 100 | 570 | | | | | | | | | | | |
| **2041** | | 100 | | | | | | | | | | | | |
| **2042** | | 100 | | | | | | | | | | | | |
| **2043** | | 100 | 570 | | | | | | | | | | | |
| **2044** | | 100 | | | | | | | | | | | | |
| **2045** | | 100 | | | | | | | | | | | | |
| **2046** | | 100 | | | | | | | | | | | | |
| **2047** | | 100 | | | | | | | | | | | | |
| **2048** | | 100 | | | | | | | | | | | | |
| **2049** | | 100 | | | | | | | | | | | | |
| **2050** | | | | | | | | | | | | | | |
| **2051** | | | | | | | | | | | | | | |
| **Total MW** | 1114 | 1000 | 1140 | 375 | 750 | 1050 | 1350 | | | 525 | 150 | 187.5 | 187.5 | 150 |

| High $CO_2$ Price Build Plan | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Year** | 1x1 CC | CT Aero 2x | CT Frame 2x | Solar | Solar PPA | Solar plus Storage | Solar plus Storage PPA | Battery Grid 4hr 100% | Battery Grid 4hr 80% | Battery Paired 4hr 100% | Battery Paired 4hr 30% | Battery Paired 4hr 40% | Battery Paired 4hr 60% | Battery Paired 4hr 80% |
| **2022** | | | | | | | | | | | | | | |
| **2023** | | | | | | | | | | | | | | |
| **2024** | | | | | | | | | | | | | | |
| **2025** | | | | | | | | | | | | | | |
| **2026** | | | | | | | | | | | | | | |
| **2027** | | | | | 75 | | | | | | | | | |
| **2028** | | | | | 225 | | 75 | | | 37.5 | | | | |
| **2029** | | | | | 150 | | 150 | | | 75 | | | | |
| **2030** | | | | | 150 | | 150 | | | 75 | | | | |
| **2031** | | | 523 | | 75 | 75 | 150 | | | 75 | | | | 37.5 |
| **2032** | | | | | 75 | | 150 | | | 75 | | | | |
| **2033** | | | | | | 75 | 150 | | | 75 | | | | 37.5 |
| **2034** | | | | | | | 150 | | | 37.5 | 37.5 | | | |
| **2035** | | | | | | 75 | 150 | | | 75 | | | | 37.5 |
| **2036** | | | | | | 75 | 150 | | | | 75 | | 37.5 | |
| **2037** | | | | | | 150 | | | | | | | 75 | |
| **2038** | | | | | | 150 | 75 | | | | 37.5 | | 75 | |
| **2039** | | | | | | 150 | | | | | | 75 | | |
| **2040** | | | 523 | | | | | | | | | | | |
| **2041** | | | | | | | | | | | | | | |
| **2042** | | | | | | | | | | | | | | |
| **2043** | | | | | | | | | | | | | | |
| **2044** | | | | | | 75 | | | | | | 37.5 | | |
| **2045** | | | | | | | | | | | | | | |
| **2046** | | | | | | | | | | | | | | |
| **2047** | | | | | | | | | | | | | | |
| **2048** | | | | | | | | | | | | | | |
| **2049** | | | | | | 75 | | | | | | | | 37.5 |
| **2050** | | | | | | | | | | | | | | |
| **2051** | | | | | | | | | | | | | | |
| **Total MW** | | | 1046 | | 750 | 900 | 1350 | | | 525 | 150 | 112.5 | 187.5 | 150 |

| Low Regulation Build Plan | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Year** | 1x1 CC | CT Aero 2x | CT Frame 2x | Solar | Solar PPA | Solar plus Storage | Solar plus Storage PPA | Battery Grid 4hr 100% | Battery Grid 4hr 80% | Battery Paired 4hr 100% | Battery Paired 4hr 30% | Battery Paired 4hr 40% | Battery Paired 4hr 60% | Battery Paired 4hr 80% |
| **2022** | | | | | | | | | | | | | | |
| **2023** | | | | | | | | | | | | | | |
| **2024** | | | | | | | | | | | | | | |
| **2025** | | | | | | | | | | | | | | |
| **2026** | | | | | | | | | | | | | | |
| **2027** | | | | | | | | | | | | | | |
| **2028** | | | | | | | 150 | | | 75 | | | | |
| **2029** | | | | | 75 | | 150 | | | 75 | | | | |
| **2030** | | | | | 150 | | 150 | | | 75 | | | | |
| **2031** | | | 523 | | 75 | 75 | 150 | | | 75 | | | 37.5 | |
| **2032** | | | | | 150 | | 150 | | | 75 | | | | |
| **2033** | | | | | 150 | | 150 | 37.5 | | 75 | | | | |
| **2034** | | | | | | | 150 | | | 75 | | | | |
| **2035** | | | | | | 75 | | 37.5 | | | | | 37.5 | |
| **2036** | | | | | | 75 | | 37.5 | | | | | 37.5 | |
| **2037** | | | | | | | | 37.5 | | | | | | |
| **2038** | | | | | | | | 37.5 | | | | | | |
| **2039** | | | | | | | | 75 | | | | | | |
| **2040** | | | 523 | | | | | | | | | | | |
| **2041** | | | | | | | | | | | | | | |
| **2042** | | | | | | | | | | | | | | |
| **2043** | | | | | | | | | | | | | | |
| **2044** | | | | | | | | | | | | | | |
| **2045** | | | | | | | | | | | | | | |
| **2046** | | | | | | | | | | | | | | |
| **2047** | | | | | | | | | | | | | | |
| **2048** | | | | | | | | | | | | | | |
| **2049** | | | | | | | | | | | | | | |
| **2050** | | | | | | | | | | | | | | |
| **2051** | | | | | | 75 | | | | | | | 37.5 | |
| **Total MW** | | | 1046 | | 600 | 300 | 1050 | 262.5 | | 525 | | | 150 | |

| Stagflation Build Plan | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Year** | 1x1 CC | CT Aero 2x | CT Frame 2x | Solar | Solar PPA | Solar plus Storage | Solar plus Storage PPA | Battery Grid 4hr 100% | Battery Grid 4hr 80% | Battery Paired 4hr 100% | Battery Paired 4hr 30% | Battery Paired 4hr 40% | Battery Paired 4hr 60% | Battery Paired 4hr 80% |
| **2022** | | | | | | | | | | | | | | |
| **2023** | | | | | | | | | | | | | | |
| **2024** | | | | | | | | | | | | | | |
| **2025** | | | | | | | | | | | | | | |
| **2026** | | | | | | | | | | | | | | |
| **2027** | | | | | 300 | | | | | | | | | |
| **2028** | | | | | 150 | | 150 | | | 75 | | | | |
| **2029** | | | | | 150 | | 150 | | 37.5 | 37.5 | | | | |
| **2030** | | | | | 75 | 75 | 150 | | | 75 | 37.5 | | | 37.5 |
| **2031** | | | 523 | | | 75 | 150 | | 37.5 | 37.5 | | 37.5 | | |
| **2032** | | | | | 75 | | 150 | | | 75 | | | | |
| **2033** | | | | | | | 150 | | 37.5 | 37.5 | | | | |
| **2034** | | | | | | 75 | 150 | | 37.5 | 37.5 | | | 37.5 | |
| **2035** | | | | | | | 150 | | | 75 | | | | |
| **2036** | | | | | | 150 | 150 | | | 75 | 75 | | | 75 |
| **2037** | | | | | | 150 | | | | | 37.5 | | 37.5 | 37.5 |
| **2038** | | | | | | | | | | | | | | |
| **2039** | | | | | | | | | | | | | | |
| **2040** | | | | | | | | | | | | | | |
| **2041** | | | | | | | | | | | | | | |
| **2042** | | | | | | | | | | | | | | |
| **2043** | | | | | | | | | | | | | | |
| **2044** | | | | | | | | | | | | | | |
| **2045** | | | | | | | | | | | | | | |
| **2046** | | | | | | | | | | | | | | |
| **2047** | | | | | | | | | | | | | | |
| **2048** | | | | | | | | | | | | | | |
| **2049** | | | | | | | | | | | | | | |
| **2050** | | | | | | | | | | | | | | |
| **2051** | | | | | | | | | | | | | | |
| **Total MW** | | | 523 | | 750 | 525 | 1350 | | 150 | 525 | 150 | 37.5 | 75 | 150 |

| Aggressive Regulation Build Plan | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Year** | 1x1 CC | CT Aero 2x | CT Frame 2x | Solar | Solar PPA | Solar plus Storage | Solar plus Storage PPA | Battery Grid 4hr 100% | Battery Grid 4hr 80% | Battery Paired 4hr 100% | Battery Paired 4hr 30% | Battery Paired 4hr 40% | Battery Paired 4hr 60% | Battery Paired 4hr 80% |
| **2022** | | | | | | | | | | | | | | |
| **2023** | | | | | | | | | | | | | | |
| **2024** | | | | | | | | | | | | | | |
| **2025** | | | | | | | | | | | | | | |
| **2026** | | | | | 300 | | | | | | | | | |
| **2027** | | | | | 225 | | 75 | | | 37.5 | | | | |
| **2028** | | | | | 150 | | 150 | | | 75 | | | | |
| **2029** | | | 523 | | | 150 | 150 | | | 75 | | | | 75 |
| **2030** | | | | | 75 | 75 | 150 | | | 75 | | | | 37.5 |
| **2031** | | | | | | 150 | 150 | | | 75 | | | 37.5 | 37.5 |
| **2032** | | | | | | 150 | 150 | | | 75 | | 37.5 | 37.5 | |
| **2033** | | | | | | 150 | 150 | | | 75 | | | 75 | |
| **2034** | | | | | | 150 | 150 | | | 37.5 | 37.5 | 37.5 | 37.5 | |
| **2035** | | | | 75 | | 75 | 150 | 75 | | | 75 | 37.5 | | |
| **2036** | | | | 150 | | 75 | 75 | 37.5 | | | 37.5 | 37.5 | | |
| **2037** | | | 523 | 150 | | | | | | | | | | |
| **2038** | | | | | | | | | 75 | | | | | |
| **2039** | | | | | | | | | | | | | | |
| **2040** | | | | | | | | | | | | | | |
| **2041** | | | | | | 75 | | | | | | 37.5 | | |
| **2042** | | | | | | | | 112.5 | | | | | | |
| **2043** | | | 523 | | | | | | | | | | | |
| **2044** | | | | | | | | | | | | | | |
| **2045** | | | | | | | | | | | | | | |
| **2046** | | | | | | | | | | | | | | |
| **2047** | | | | | | | | | | | | | | |
| **2048** | | | | | | | | 37.5 | | | | | | |
| **2049** | | | 523 | | | | | | | | | | | |
| **2050** | | | | | | | | | | | | | | |
| **2051** | | | | | | | | | | | | | | |
| **Total MW** | | | 2092 | 375 | 750 | 1050 | 1350 | 262.5 | 75 | 525 | 150 | 187.5 | 187.5 | 150 |

| Medium DSM Build Plan | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Year** | 1x1 CC | CT Aero 2x | CT Frame 2x | Solar | Solar PPA | Solar plus Storage | Solar plus Storage PPA | Battery Grid 4hr 100% | Battery Grid 4hr 80% | Battery Paired 4hr 100% | Battery Paired 4hr 30% | Battery Paired 4hr 40% | Battery Paired 4hr 60% | Battery Paired 4hr 80% |
| **2022** | | | | | | | | | | | | | | |
| **2023** | | | | | | | | | | | | | | |
| **2024** | | | | | | | | | | | | | | |
| **2025** | | | | | | | | | | | | | | |
| **2026** | | | | | | | | | | | | | | |
| **2027** | | | | | | | | | | | | | | |
| **2028** | | | | | | | | | | | | | | |
| **2029** | | | 523 | | 225 | | 75 | | | 37.5 | | | | |
| **2030** | | | | | 300 | | | | | | | | | |
| **2031** | | | 523 | | 225 | | 75 | | | 37.5 | | | | |
| **2032** | | | | | | | 150 | | | 75 | | | | |
| **2033** | | | | | | | 150 | | | 75 | | | | |
| **2034** | | | | | | | 150 | | | 75 | | | | |
| **2035** | | | | | | | 150 | 37.5 | | 75 | | | | |
| **2036** | | | | | | | 75 | | | 37.5 | | | | |
| **2037** | | | | | | | 75 | | | 37.5 | | | | |
| **2038** | | | | | | | 150 | | | 37.5 | 37.5 | | | |
| **2039** | | | | | | | 150 | | | 37.5 | 37.5 | | | |
| **2040** | | | | | | 150 | 75 | | | | 37.5 | | | 75 |
| **2041** | | | | | | 150 | | | | | | | | 75 |
| **2042** | | | | | | 150 | | | | | | | 75 | |
| **2043** | | | | | | 150 | | | | | | | 75 | |
| **2044** | | | | | | 75 | | 37.5 | | | | | 37.5 | |
| **2045** | | | | | | | | 75 | | | | | | |
| **2046** | | | | | | | | 37.5 | | | | | | |
| **2047** | | | | | | | | | | | | | | |
| **2048** | | | | | | | | | | | | | | |
| **2049** | | | | | | | | 37.5 | | | | | | |
| **2050** | | | | | | | | 37.5 | | | | | | |
| **2051** | | | | | | | | | | | | | | |
| **Total MW** | | | 1046 | | 750 | 675 | 1275 | 262.5 | | 525 | 112.5 | | 187.5 | 150 |

| Low DSM Build Plan | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Year** | 1x1 CC | CT Aero 2x | CT Frame 2x | Solar | Solar PPA | Solar plus Storage | Solar plus Storage PPA | Battery Grid 4hr 100% | Battery Grid 4hr 80% | Battery Paired 4hr 100% | Battery Paired 4hr 30% | Battery Paired 4hr 40% | Battery Paired 4hr 60% | Battery Paired 4hr 80% |
| **2022** | | | | | | | | | | | | | | |
| **2023** | | | | | | | | | | | | | | |
| **2024** | | | | | | | | | | | | | | |
| **2025** | | | | | | | | | | | | | | |
| **2026** | | | | | | | | | | | | | | |
| **2027** | | | | | | | | | | | | | | |
| **2028** | | | | | 225 | | | | | | | | | |
| **2029** | | | 523 | | 75 | | 150 | | | 75 | | | | |
| **2030** | | | | | 75 | 75 | 150 | | | 75 | | | | 37.5 |
| **2031** | | | 523 | | 150 | | 150 | | | 75 | | | | |
| **2032** | | | | | 150 | | 150 | | | 75 | | | | |
| **2033** | | | | | 75 | | 150 | | | 75 | | | | |
| **2034** | | | | | | | | | | | | | | |
| **2035** | | | | | | | | | | | | | | |
| **2036** | | | | | | | 150 | | | 75 | | | | |
| **2037** | | | | | | | 150 | 112.5 | | 75 | | | | |
| **2038** | | | | | | | | | | | | | | |
| **2039** | | | | | | | | | | | | | | |
| **2040** | | | | | | | | 112.5 | 37.5 | | | | | |
| **2041** | | | | | | | | | | | | | | |
| **2042** | | | | | | | | 37.5 | | | | | | |
| **2043** | | | 523 | | | | | | 37.5 | | | | | |
| **2044** | | | | | | | | | | | | | | |
| **2045** | | | | | | | | | | | | | | |
| **2046** | | | | | | | | | | | | | | |
| **2047** | | | | | | | | | | | | | | |
| **2048** | | | | | | | | | | | | | | |
| **2049** | | | | | | | | | | | | | | |
| **2050** | | | | | | | | | | | | | | |
| **2051** | | | | | | | | | | | | | | |
| **Total MW** | | | 1569 | | 750 | 75 | 1050 | 262.5 | 75 | 525 | | | | 37.5 |

## Appendix G: Energy from Renewable Generation by Five-Year Period for the Twenty-Four Cases

| Energy from Renewable Generation by Five-Year Period (GWh) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Market Scenario** | **Build Plan** | **2022-2026** | **2027-2031** | **2032-2036** | **2037-2041** | **2042-2046** | **2047-2051** |
| **Reference** | RP8 | 10,727 | 13,043 | 12,617 | 14,185 | 16,377 | 20,549 |
| **Reference** | Williams 2047 Reference | 10,573 | 16,248 | 24,990 | 25,745 | 23,634 | 23,634 |
| **Reference** | Williams 2030 Reference | 10,573 | 16,092 | 22,513 | 25,713 | 23,634 | 23,634 |
| **Reference** | High Fossil Fuel Price | 10,887 | 20,885 | 31,589 | 38,119 | 36,794 | 36,592 |
| **Reference** | Zero Carbon Cost | 10,573 | 15,308 | 22,833 | 22,609 | 20,483 | 20,483 |
| **Reference** | Carbon Constrained | 10,573 | 17,818 | 28,748 | 38,626 | 45,687 | 53,601 |
| **High Fossil Fuel Price** | RP8 | 10,727 | 13,044 | 12,617 | 14,185 | 16,377 | 20,549 |
| **High Fossil Fuel Price** | Williams 2047 Reference | 10,573 | 16,250 | 24,998 | 25,744 | 23,634 | 23,634 |
| **High Fossil Fuel Price** | Williams 2030 Reference | 10,573 | 16,093 | 22,512 | 25,705 | 23,634 | 23,634 |
| **High Fossil Fuel Price** | High Fossil Fuel Price | 10,888 | 20,897 | 31,597 | 38,147 | 36,796 | 36,591 |
| **High Fossil Fuel Price** | Zero Carbon Cost | 10,573 | 15,308 | 22,831 | 22,608 | 20,483 | 20,483 |
| **High Fossil Fuel Price** | Carbon Constrained | 10,573 | 17,820 | 28,749 | 38,631 | 45,678 | 53,587 |
| **Zero Carbon Cost** | RP8 | 10,727 | 13,043 | 12,616 | 14,185 | 16,377 | 20,549 |
| **Zero Carbon Cost** | Williams 2047 Reference | 10,573 | 16,243 | 24,974 | 25,740 | 23,634 | 23,634 |
| **Zero Carbon Cost** | Williams 2030 Reference | 11,230 | 16,756 | 23,158 | 26,351 | 24,336 | 24,322 |
| **Zero Carbon Cost** | High Fossil Fuel Price | 10,887 | 20,872 | 31,542 | 38,101 | 36,781 | 36,589 |
| **Zero Carbon Cost** | Zero Carbon Cost | 10,573 | 15,303 | 22,816 | 22,603 | 20,483 | 20,483 |
| **Zero Carbon Cost** | Carbon Constrained | 10,573 | 17,815 | 28,744 | 38,620 | 45,687 | 53,609 |
| ***Sensitivity Case*** | High CO2 Price | 37,167 | 41,101 | 41,095 | 43,490 | 42,821 | 43,601 |
| ***Sensitivity Case*** | Low Regulation | 11,230 | 12,041 | 13,111 | 11,486 | 9,352 | 9,538 |
| ***Sensitivity Case*** | Stagflation | 11,230 | 16,727 | 16,046 | 16,133 | 14,040 | 14,062 |
| ***Sensitivity Case*** | Aggressive Reg | 11,860 | 19,231 | 22,429 | 24,795 | 23,425 | 22,819 |
| ***Sensitivity Case*** | Medium DSM | 10,573 | 13,104 | 13,078 | 10,957 | 14,337 | 14,968 |
| ***Sensitivity Case*** | Low DSM | 10,573 | 13,260 | 13,703 | 10,799 | 8,666 | 8,666 |

## Appendix H: Residential Bill Impacts for the Twenty-Four Cases

| Typical Residential Bill @1000 kWh/month under Reference Market Scenario | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Build Plan** | **2022** | **2023** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** | **2030** | **2031** | **2032** | **2033** | **2034** | **2035** | **2036** |
| RP8 | 132.79 | 134.04 | 128.29 | 128.67 | 136.72 | 138.97 | 141.18 | 144.43 | 150.19 | 160.06 | 166.50 | 170.58 | 173.94 | 178.57 | 182.80 |
| Williams 2047 Reference | 132.79 | 134.04 | 128.29 | 128.69 | 136.19 | 137.96 | 140.77 | 139.07 | 144.32 | 146.94 | 153.46 | 157.23 | 159.82 | 164.81 | 168.09 |
| Williams 2030 Reference | 132.79 | 134.04 | 128.28 | 128.69 | 136.20 | 137.97 | 140.78 | 139.08 | 144.73 | 150.10 | 156.35 | 160.49 | 162.72 | 168.04 | 170.73 |
| High Fuel | 132.79 | 134.04 | 128.29 | 128.69 | 136.56 | 138.99 | 141.79 | 140.01 | 146.28 | 152.17 | 159.27 | 164.41 | 167.71 | 173.19 | 175.98 |
| Zero Carbon Cost | 132.79 | 134.04 | 128.28 | 128.68 | 136.19 | 137.96 | 140.63 | 138.96 | 144.14 | 147.24 | 153.95 | 158.00 | 160.60 | 165.51 | 167.86 |
| Carbon Constrained | 132.79 | 134.05 | 128.21 | 128.61 | 136.11 | 138.21 | 141.01 | 139.54 | 145.02 | 161.22 | 168.43 | 172.16 | 175.29 | 179.94 | 183.50 |

| Typical Residential Bill @1000 kWh/month under High Fossil Fuel Price Market Scenario | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Build Plan** | **2022** | **2023** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** | **2030** | **2031** | **2032** | **2033** | **2034** | **2035** | **2036** |
| RP8 | 132.79 | 134.86 | 129.41 | 130.49 | 139.70 | 142.29 | 144.86 | 149.34 | 155.44 | 165.48 | 173.47 | 178.63 | 182.62 | 188.88 | 194.68 |
| Williams 2047 Reference | 132.79 | 134.85 | 129.41 | 130.49 | 139.25 | 141.48 | 144.31 | 143.63 | 148.81 | 151.67 | 159.41 | 163.92 | 166.95 | 173.15 | 177.35 |
| Williams 2030 Reference | 132.79 | 134.84 | 129.39 | 130.49 | 139.24 | 141.48 | 144.30 | 143.55 | 149.20 | 154.90 | 162.22 | 167.17 | 169.89 | 176.45 | 180.66 |
| High Fuel | 132.79 | 134.93 | 129.58 | 130.64 | 139.58 | 142.05 | 144.90 | 143.88 | 150.24 | 156.22 | 164.56 | 170.36 | 173.83 | 180.12 | 184.25 |
| Zero Carbon Cost | 132.79 | 134.84 | 129.39 | 130.48 | 139.23 | 141.45 | 144.24 | 143.54 | 148.81 | 152.01 | 159.73 | 164.52 | 167.60 | 173.68 | 177.28 |
| Carbon Constrained | 132.79 | 134.91 | 129.59 | 130.74 | 139.52 | 141.85 | 144.68 | 143.71 | 149.35 | 164.81 | 173.24 | 177.94 | 181.21 | 186.76 | 191.03 |

| Typical Residential Bill @1000 kWh/month under Zero Carbon Cost Market Scenario | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Build Plan** | **2022** | **2023** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** | **2030** | **2031** | **2032** | **2033** | **2034** | **2035** | **2036** |
| RP8 | 132.79 | 134.03 | 128.25 | 128.66 | 136.73 | 138.98 | 141.20 | 144.40 | 146.54 | 156.62 | 162.17 | 165.43 | 168.25 | 172.59 | 176.78 |
| Williams 2047 Reference | 132.79 | 134.04 | 128.29 | 128.69 | 136.19 | 137.96 | 140.77 | 139.07 | 140.97 | 143.01 | 148.53 | 151.47 | 153.64 | 158.06 | 161.36 |
| Williams 2030 Reference | 132.79 | 134.04 | 128.28 | 128.69 | 136.20 | 137.97 | 140.77 | 139.08 | 141.35 | 146.78 | 152.32 | 155.75 | 157.48 | 162.74 | 165.42 |
| High Fuel | 132.79 | 134.04 | 128.29 | 128.69 | 136.56 | 138.99 | 141.79 | 140.01 | 143.19 | 149.09 | 155.47 | 160.03 | 162.97 | 168.40 | 171.25 |
| Zero Carbon Cost | 132.79 | 134.04 | 128.28 | 128.68 | 136.19 | 137.95 | 140.62 | 138.95 | 140.71 | 143.20 | 149.04 | 152.26 | 154.53 | 158.81 | 160.96 |
| Carbon Constrained | 132.79 | 134.02 | 128.29 | 128.67 | 136.18 | 138.27 | 141.08 | 139.35 | 141.68 | 158.31 | 164.92 | 168.28 | 171.06 | 175.50 | 179.03 |

| Typical Residential Bill @1000 kWh/month under Sensitivity Cases | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Build Plan** | **2022** | **2023** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** | **2030** | **2031** | **2032** | **2033** | **2034** | **2035** | **2036** |
| High CO2 Price | 132.79 | 134.04 | 128.28 | 128.68 | 136.19 | 138.12 | 146.00 | 144.39 | 147.60 | 152.30 | 158.59 | 162.79 | 164.34 | 169.54 | 172.88 |
| Low Regulation | 132.79 | 133.71 | 127.49 | 127.89 | 135.01 | 136.36 | 138.73 | 136.63 | 138.89 | 144.85 | 150.06 | 153.39 | 155.32 | 159.95 | 161.68 |
| Stagflation | 132.79 | 134.86 | 129.41 | 130.25 | 138.72 | 140.91 | 143.48 | 142.18 | 144.93 | 150.23 | 156.47 | 159.81 | 161.99 | 167.28 | 171.11 |
| Aggressive Regulation | 132.79 | 134.86 | 129.40 | 130.75 | 140.11 | 143.09 | 151.08 | 157.14 | 161.66 | 161.91 | 171.02 | 176.95 | 180.63 | 188.56 | 194.01 |
| Medium DSM | 132.79 | 134.56 | 128.81 | 129.28 | 136.96 | 138.79 | 140.73 | 144.42 | 146.72 | 151.98 | 157.50 | 160.50 | 162.28 | 167.17 | 169.43 |
| Low DSM | 132.79 | 134.69 | 129.04 | 129.56 | 137.31 | 139.17 | 141.55 | 145.27 | 148.38 | 153.84 | 159.43 | 162.44 | 163.73 | 167.75 | 170.35 |

## Appendix I: Retail Rate Impacts for the Twenty-Four Cases

| Retail Rate Impacts (dollars/kWh) under Reference Market Scenario | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Build Plan** | **2022** | **2023** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** | **2030** | **2031** | **2032** | **2033** | **2034** | **2035** | **2036** |
| RP8 | 0.10772 | 0.10782 | 0.10249 | 0.10256 | 0.10881 | 0.1108 | 0.11266 | 0.11561 | 0.1211 | 0.1286 | 0.13437 | 0.13813 | 0.14092 | 0.14533 | 0.14882 |
| Williams 2047 Reference | 0.10772 | 0.10782 | 0.10248 | 0.10256 | 0.10845 | 0.11014 | 0.11227 | 0.11138 | 0.11616 | 0.11828 | 0.12396 | 0.12729 | 0.12951 | 0.13411 | 0.13678 |
| Williams 2030 Reference | 0.10772 | 0.10782 | 0.10248 | 0.10257 | 0.10847 | 0.11016 | 0.11229 | 0.11140 | 0.11648 | 0.12081 | 0.12608 | 0.12974 | 0.13166 | 0.13645 | 0.13869 |
| High Fuel | 0.10772 | 0.10782 | 0.10249 | 0.10257 | 0.10863 | 0.11059 | 0.11271 | 0.11174 | 0.11723 | 0.12187 | 0.12779 | 0.1321 | 0.13471 | 0.13946 | 0.14145 |
| Zero Carbon Cost | 0.10772 | 0.10782 | 0.10248 | 0.10257 | 0.10846 | 0.11015 | 0.11223 | 0.11138 | 0.11618 | 0.11859 | 0.12427 | 0.12781 | 0.13004 | 0.13457 | 0.13678 |
| Carbon Constrained | 0.10772 | 0.10784 | 0.10242 | 0.10250 | 0.10839 | 0.11022 | 0.11235 | 0.11169 | 0.11660 | 0.12859 | 0.13462 | 0.13763 | 0.14006 | 0.14398 | 0.14676 |

| Retail Rate Impacts (dollars/kWh) under High Fossil Fuel Cost Market Scenario | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Build Plan** | **2022** | **2023** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** | **2030** | **2031** | **2032** | **2033** | **2034** | **2035** | **2036** |
| RP8 | 0.10772 | 0.10861 | 0.10356 | 0.10432 | 0.11175 | 0.11406 | 0.11629 | 0.12049 | 0.12638 | 0.13404 | 0.14140 | 0.14627 | 0.14971 | 0.15578 | 0.16090 |
| Williams 2047 Reference | 0.10772 | 0.10860 | 0.10355 | 0.10431 | 0.11147 | 0.11359 | 0.11575 | 0.11589 | 0.12064 | 0.12301 | 0.12995 | 0.13404 | 0.13671 | 0.14256 | 0.14618 |
| Williams 2030 Reference | 0.10772 | 0.10859 | 0.10353 | 0.10432 | 0.11148 | 0.11362 | 0.11577 | 0.11584 | 0.12095 | 0.12561 | 0.13198 | 0.13647 | 0.13889 | 0.14493 | 0.14873 |
| High Fuel | 0.10772 | 0.10867 | 0.10371 | 0.10446 | 0.1116 | 0.11358 | 0.11577 | 0.11556 | 0.12119 | 0.12593 | 0.13313 | 0.13812 | 0.14091 | 0.14647 | 0.14985 |
| Zero Carbon Cost | 0.10772 | 0.10859 | 0.10353 | 0.10431 | 0.11146 | 0.11358 | 0.11579 | 0.11591 | 0.12085 | 0.12337 | 0.13010 | 0.13440 | 0.13712 | 0.14284 | 0.14635 |
| Carbon Constrained | 0.10772 | 0.10865 | 0.10372 | 0.10456 | 0.11175 | 0.11378 | 0.11594 | 0.11578 | 0.12089 | 0.13208 | 0.13936 | 0.14337 | 0.14594 | 0.15078 | 0.1543 |

| Retail Rate Impacts (dollars/kWh) under Zero Carbon Cost Market Scenario | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Build Plan** | **2022** | **2023** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** | **2030** | **2031** | **2032** | **2033** | **2034** | **2035** | **2036** |
| RP8 | 0.10772 | 0.10781 | 0.10245 | 0.10254 | 0.10882 | 0.11081 | 0.11268 | 0.11558 | 0.11745 | 0.12513 | 0.12998 | 0.13290 | 0.13515 | 0.13922 | 0.14267 |
| Williams 2047 Reference | 0.10772 | 0.10782 | 0.10248 | 0.10256 | 0.10845 | 0.11014 | 0.11227 | 0.11138 | 0.11279 | 0.11432 | 0.11898 | 0.12146 | 0.12324 | 0.12724 | 0.12991 |
| Williams 2030 Reference | 0.10772 | 0.10782 | 0.10248 | 0.10257 | 0.10847 | 0.11016 | 0.11229 | 0.11141 | 0.1131 | 0.11745 | 0.12199 | 0.12492 | 0.12632 | 0.131 | 0.13322 |
| High Fuel | 0.10772 | 0.10782 | 0.10249 | 0.10257 | 0.10863 | 0.11059 | 0.11271 | 0.11174 | 0.11413 | 0.11875 | 0.12393 | 0.12765 | 0.12989 | 0.13456 | 0.13662 |
| Zero Carbon Cost | 0.10772 | 0.10782 | 0.10248 | 0.10257 | 0.10847 | 0.11015 | 0.11224 | 0.11139 | 0.11275 | 0.11455 | 0.11934 | 0.12203 | 0.1239 | 0.12776 | 0.12976 |
| Carbon Constrained | 0.10772 | 0.1078 | 0.10249 | 0.10255 | 0.10845 | 0.11026 | 0.11239 | 0.11147 | 0.11321 | 0.12558 | 0.13099 | 0.13363 | 0.1357 | 0.13937 | 0.14213 |

| Retail Rate Impacts (dollars/kWh) under Sensitivity Cases | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Build Plan** | **2022** | **2023** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** | **2030** | **2031** | **2032** | **2033** | **2034** | **2035** | **2036** |
| High CO2 Price | 0.10772 | 0.10782 | 0.10248 | 0.10256 | 0.10846 | 0.11021 | 0.11753 | 0.11671 | 0.11932 | 0.12288 | 0.12827 | 0.13199 | 0.13321 | 0.13788 | 0.14065 |
| Low Regulation | 0.10772 | 0.10749 | 0.10176 | 0.10184 | 0.10734 | 0.10859 | 0.11048 | 0.10927 | 0.11092 | 0.11571 | 0.11992 | 0.12268 | 0.12430 | 0.12858 | 0.12992 |
| Stagflation | 0.10772 | 0.10860 | 0.10354 | 0.10406 | 0.11093 | 0.11262 | 0.11453 | 0.11404 | 0.11611 | 0.12032 | 0.12568 | 0.12871 | 0.13037 | 0.13528 | 0.13836 |
| Aggressive Regulation | 0.10772 | 0.10860 | 0.10353 | 0.10457 | 0.11193 | 0.11435 | 0.12175 | 0.12697 | 0.13085 | 0.13127 | 0.13925 | 0.14454 | 0.14753 | 0.15467 | 0.15934 |
| Medium DSM | 0.10772 | 0.10834 | 0.10301 | 0.10317 | 0.10924 | 0.11098 | 0.11275 | 0.11588 | 0.11769 | 0.12192 | 0.12661 | 0.12929 | 0.13074 | 0.13516 | 0.13717 |
| Low DSM | 0.10772 | 0.10847 | 0.10324 | 0.10345 | 0.10959 | 0.11137 | 0.11329 | 0.11650 | 0.11892 | 0.12330 | 0.12789 | 0.13049 | 0.13173 | 0.13563 | 0.13785 |

## Appendix J: Levelized Cost Comparison for the Twenty-Four Cases ($000)

| Market Scenario | Build Plan | Fuel | CO2 | LNPV |
|---|---|---|---|---|
| **Reference** | RP8 | $756,349 | $121,474 | $1,951,389 |
| **Reference** | Williams 2047 Reference | $735,901 | $126,424 | $1,811,940 |
| **Reference** | Williams 2030 Reference | $746,741 | $119,313 | $1,822,785 |
| **Reference** | High Fossil Fuel Price | $686,124 | $104,805 | $1,835,798 |
| **Reference** | Zero Carbon Cost | $749,866 | $130,343 | $1,820,675 |
| **Reference** | Carbon Constrained | $554,284 | $55,782 | $2,182,046 |
| **High Fossil Fuel Price** | RP8 | $1,140,698 | $121,637 | $2,350,186 |
| **High Fossil Fuel Price** | Williams 2047 Reference | $1,101,105 | $129,373 | $2,189,881 |
| **High Fossil Fuel Price** | Williams 2030 Reference | $1,121,706 | $119,490 | $2,209,950 |
| **High Fossil Fuel Price** | High Fossil Fuel Price | $1,014,506 | $104,998 | $2,175,468 |
| **High Fossil Fuel Price** | Zero Carbon Cost | $1,124,285 | $133,277 | $2,207,712 |
| **High Fossil Fuel Price** | Carbon Constrained | $789,799 | $55,721 | $2,422,968 |
| **Zero Carbon Cost** | RP8 | $757,124 | $0 | $1,828,662 |
| **Zero Carbon Cost** | Williams 2047 Reference | $735,073 | $0 | $1,678,694 |
| **Zero Carbon Cost** | Williams 2030 Reference | $747,476 | $0 | $1,702,032 |
| **Zero Carbon Cost** | High Fossil Fuel Price | $686,768 | $0 | $1,727,167 |
| **Zero Carbon Cost** | Zero Carbon Cost | $749,084 | $0 | $1,683,525 |
| **Zero Carbon Cost** | Carbon Constrained | $556,222 | $0 | $2,122,095 |
| ***Sensitivity Case*** | High CO2 Price | $722,691 | $183,953 | $1,893,231 |
| ***Sensitivity Case*** | Low Regulation | $606,231 | $0 | $1,539,634 |
| ***Sensitivity Case*** | Stagflation | $970,305 | $0 | $1,918,839 |
| ***Sensitivity Case*** | Aggressive Reg | $1,143,264 | $203,382 | $2,485,452 |
| ***Sensitivity Case*** | Medium DSM | $761,926 | $0 | $1,733,309 |
| ***Sensitivity Case*** | Low DSM | $782,660 | $0 | $1,752,145 |

## Appendix K: Summary of $CO_2$ emissions for all Twenty-Four Cases (Ktons)

| Market Scenario | Build Plan | 2050 $CO_2$ Emissions | 2050 Reduction from 2005 $CO_2$ | 2051 Cumulative $CO_2$ |
|---|---|---|---|---|
| **Reference** | RP8 | 10,331 | 45.6% | 273,220 |
| **Reference** | Williams 2047 Reference | 10,659 | 43.8% | 281,436 |
| **Reference** | Williams 2030 Reference | 10,820 | 43% | 266,849 |
| **Reference** | High Fossil Fuel Price | 9,398 | 50.5% | 240,884 |
| **Reference** | Zero Carbon Cost | 11,160 | 41.2% | 287,339 |
| **Reference** | Carbon Constrained | 2,863 | 84.9% | 174,083 |
| **High Fossil Fuel Price** | RP8 | 10,342 | 45.5% | 270,981 |
| **High Fossil Fuel Price** | Williams 2047 Reference | 10,670 | 43.8% | 284,888 |
| **High Fossil Fuel Price** | Williams 2030 Reference | 10,839 | 42.9% | 264,839 |
| **High Fossil Fuel Price** | High Fossil Fuel Price | 9,409 | 50.4% | 238,939 |
| **High Fossil Fuel Price** | Zero Carbon Cost | 11,198 | 41% | 290,712 |
| **High Fossil Fuel Price** | Carbon Constrained | 2,857 | 84.9% | 171,693 |
| **Zero Carbon Cost** | RP8 | 10,342 | 45.5% | 277,343 |
| **Zero Carbon Cost** | Williams 2047 Reference | 10,674 | 43.7% | 301,868 |
| **Zero Carbon Cost** | Williams 2030 Reference | 10,844 | 42.9% | 270,473 |
| **Zero Carbon Cost** | High Fossil Fuel Price | 9,411 | 50.4% | 244,375 |
| **Zero Carbon Cost** | Zero Carbon Cost | 11,174 | 41.1% | 306,545 |
| **Zero Carbon Cost** | Carbon Constrained | 2,991 | 84.2% | 178,951 |
| ***Sensitivity Case*** | High CO2 Price | 9,985 | 47.4% | 253,138 |
| ***Sensitivity Case*** | Low Regulation | 11,253 | 40.7% | 285,775 |
| ***Sensitivity Case*** | Stagflation | 7,999 | 57.8% | 229,874 |
| ***Sensitivity Case*** | Aggressive Reg | 11,480 | 39.5% | 265,658 |
| ***Sensitivity Case*** | Medium DSM | 10,254 | 46.0% | 276,430 |
| ***Sensitivity Case*** | Low DSM | 11,224 | 40.8% | 285,340 |

## Appendix L: Generator Level Performance Data

| Availability factor | | | | | |
|---|---|---|---|---|---|
| Generator | 2017 | 2018 | 2019 | 2020 | 2021 |
| COLUMBIA CT1 | N/A | 87.22% | 90.60% | 78.15% | 86.15% |
| COLUMBIA CT2 | N/A | 82.79% | 88.89% | 77.29% | 72.90% |
| COLUMBIA ST1 | N/A | 87.30% | 91.40% | 80.13% | 88.57% |
| COPE STATION #1 | 91.91% | 77.34% | 92.33% | 47.50% | 92.53% |
| FAIRFIELD PS #1 | 94.52% | 84.18% | 96.44% | 90.53% | 98.65% |
| FAIRFIELD PS #2 | 92.52% | 84.25% | 96.25% | 90.52% | 98.84% |
| FAIRFIELD PS #3 | 94.23% | 89.58% | 97.12% | 88.40% | 99.47% |
| FAIRFIELD PS #4 | 94.34% | 89.96% | 97.06% | 88.11% | 99.40% |
| FAIRFIELD PS #5 | 91.46% | 93.06% | 90.68% | 99.76% | 94.23% |
| FAIRFIELD PS #6 | 88.53% | 92.51% | 89.70% | 99.71% | 94.27% |
| FAIRFIELD PS #7 | 82.63% | 92.99% | 88.39% | 97.58% | 92.41% |
| FAIRFIELD PS #8 | 81.33% | 92.93% | 88.39% | 97.59% | 91.71% |
| HAGOOD GT #4 | 98.72% | 99.83% | 98.70% | 94.76% | 97.37% |
| HAGOOD GT #5 | 84.43% | 92.45% | 96.83% | 99.21% | 80.78% |
| HAGOOD GT #6 | 98.02% | 95.89% | 99.07% | 99.84% | 98.77% |
| JASPER #1 | 96.43% | 88.62% | 91.83% | 92.17% | 86.27% |
| JASPER #2 | 91.64% | 87.91% | 90.83% | 89.49% | 81.71% |
| JASPER #3 | 90.65% | 88.99% | 90.87% | 89.38% | 78.63% |
| JASPER #4 | 98.25% | 90.48% | 92.31% | 94.01% | 88.28% |
| MCMEEKIN #1 | 14.75% | 93.82% | 85.24% | 96.21% | 82.65% |
| MCMEEKIN #2 | 88.15% | 94.02% | 82.58% | 89.98% | 87.90% |
| PARR GT #3 | 87.27% | 98.36% | 87.71% | 99.68% | 97.93% |
| PARR GT #4 | 97.30% | 93.81% | 90.16% | 99.99% | 96.98% |
| SALUDA HYDRO #1 | 84.35% | 61.71% | 93.48% | 68.79% | 98.81% |
| SALUDA HYDRO #2 | 46.15% | 73.99% | 74.94% | 98.06% | 100.00% |
| SALUDA HYDRO #3 | 26.66% | 14.69% | 82.71% | 98.85% | 100.00% |
| SALUDA HYDRO #4 | 84.91% | 98.22% | 79.03% | 95.34% | 94.52% |
| SALUDA HYDRO #5 | 96.76% | 97.96% | 62.60% | 95.58% | 91.25% |
| URQUHART #1 | 88.43% | 82.73% | 92.37% | 87.89% | 96.62% |
| URQUHART #2 | 91.74% | 83.01% | 92.64% | 84.50% | 81.15% |
| URQUHART #3 | 90.65% | 43.25% | 78.61% | 94.63% | 92.13% |
| URQUHART CC #5 | 88.64% | 82.96% | 92.57% | 87.90% | 96.72% |
| URQUHART CC #6 | 92.03% | 83.23% | 92.68% | 87.22% | 81.53% |
| URQUHART GT #4 | 89.04% | 85.13% | 94.33% | 97.98% | 89.85% |
| V.C. SUMMER #1 | 80.81% | 86.07% | 95.92% | 91.11% | 82.33% |
| WATEREE #1 | 79.58% | 91.01% | 61.27% | 73.50% | 81.48% |
| WATEREE #2 | 85.17% | 91.24% | 61.58% | 10.79% | 0.00% |
| WILLIAMS #1 | 63.14% | 83.69% | 74.83% | 84.57% | 72.23% |
| WILLIAMS GT #1 | 96.85% | 93.29% | 76.50% | 0.00% | 0.00% |

| | | | | | |
|---|---|---|---|---|---|
| **WILLIAMS GT #2** | 99.95% | 73.23% | 99.95% | 99.76% | 99.62% |

| **Annual Forced Outage Rate** | | | | | |
|---|---|---|---|---|---|
| **Generator** | **2017** | **2018** | **2019** | **2020** | **2021** |
| **COLUMBIA CT1** | N/A | 0.03% | 0.15% | 0.45% | 8.02% |
| **COLUMBIA CT2** | N/A | 0.71% | 0.78% | 1.25% | 8.01% |
| **COLUMBIA ST1** | N/A | 0.04% | 0.11% | 0.12% | 7.67% |
| **COPE STATION #1** | 2.15% | 3.35% | 0.20% | 1.20% | 0.26% |
| **FAIRFIELD PS #1** | 0.28% | 0.78% | 0.35% | 0.08% | 0.03% |
| **FAIRFIELD PS #2** | 2.33% | 0.21% | 0.55% | 0.08% | 0.00% |
| **FAIRFIELD PS #3** | 0.04% | 0.09% | 0.01% | 0.00% | 0.00% |
| **FAIRFIELD PS #4** | 0.00% | 0.09% | 0.03% | 0.30% | 0.05% |
| **FAIRFIELD PS #5** | 0.00% | 0.20% | 0.00% | 0.00% | 0.04% |
| **FAIRFIELD PS #6** | 0.00% | 0.79% | 1.04% | 0.00% | 0.00% |
| **FAIRFIELD PS #7** | 0.00% | 0.00% | 0.00% | 1.46% | 0.00% |
| **FAIRFIELD PS #8** | 0.18% | 0.09% | 0.00% | 1.46% | 0.00% |
| **HAGOOD GT #4** | 1.07% | 0.03% | 0.06% | 0.12% | 0.16% |
| **HAGOOD GT #5** | 15.57% | 7.55% | 1.14% | 0.12% | 1.11% |
| **HAGOOD GT #6** | 1.89% | 4.11% | 0.03% | 0.07% | 0.90% |
| **JASPER #1** | 0.00% | 0.41% | 0.05% | 0.00% | 0.00% |
| **JASPER #2** | 0.00% | 0.00% | 0.11% | 0.01% | 0.14% |
| **JASPER #3** | 0.00% | 0.00% | 0.08% | 0.02% | 0.03% |
| **JASPER #4** | 0.00% | 0.04% | 0.11% | 0.00% | 0.00% |
| **MCMEEKIN #1** | 0.00% | 0.05% | 3.45% | 0.00% | 0.00% |
| **MCMEEKIN #2** | 0.67% | 0.00% | 0.00% | 2.97% | 0.06% |
| **PARR GT #3** | 0.00% | 1.64% | 2.71% | 0.32% | 0.00% |
| **PARR GT #4** | 0.00% | 6.19% | 0.00% | 0.01% | 0.95% |
| **SALUDA HYDRO #1** | 0.00% | 16.63% | 3.05% | 31.09% | 0.00% |
| **SALUDA HYDRO #2** | 38.20% | 0.23% | 0.00% | 1.79% | 0.00% |
| **SALUDA HYDRO #3** | 58.21% | 79.01% | 0.00% | 0.51% | 0.00% |
| **SALUDA HYDRO #4** | 0.00% | 0.46% | 4.42% | 4.20% | 0.00% |
| **SALUDA HYDRO #5** | 3.24% | 0.98% | 5.82% | 4.35% | 0.00% |
| **URQUHART #1** | 0.06% | 0.35% | 0.40% | 0.28% | 0.80% |
| **URQUHART #2** | 0.21% | 0.34% | 1.89% | 3.43% | 4.33% |
| **URQUHART #3** | 1.13% | 0.39% | 3.56% | 2.43% | 0.01% |
| **URQUHART CC #5** | 0.23% | 0.22% | 0.33% | 0.25% | 0.76% |
| **URQUHART CC #6** | 0.16% | 0.26% | 1.86% | 0.84% | 4.09% |
| **URQUHART GT #4** | 9.52% | 0.51% | 0.48% | 0.37% | 8.93% |
| **V.C. SUMMER #1** | 4.28% | 0.00% | 4.08% | 0.67% | 7.53% |
| **WATEREE #1** | 1.52% | 1.43% | 0.21% | 0.10% | 0.36% |
| **WATEREE #2** | 2.54% | 1.26% | 0.94% | 88.06% | 100.00% |
| **WILLIAMS #1** | 1.14% | 0.16% | 1.81% | 0.11% | 0.08% |

| | | | | | |
|---|---|---|---|---|---|
| **WILLIAMS GT #1** | 0.05% | 0.00% | 23.47% | 100.00% | 0.00% |
| **WILLIAMS GT #2** | 0.05% | 21.14% | 0.02% | 0.24% | 0.01% |

| **Annual Capacity Factor** | | | | | |
|---|---|---|---|---|---|
| **Generator** | **2017** | **2018** | **2019** | **2020** | **2021** |
| **COLUMBIA CT1** | N/A | 59.74% | 79.88% | 68.56% | 76.65% |
| **COLUMBIA CT2** | N/A | 44.96% | 77.69% | 66.19% | 55.17% |
| **COLUMBIA ST1** | N/A | 38.35% | 57.93% | 49.27% | 44.14% |
| **COPE STATION #1** | 65.59% | 47.29% | 50.93% | 26.48% | 43.87% |
| **FAIRFIELD PS #1** | 7.43% | 8.43% | 9.28% | 8.88% | 9.45% |
| **FAIRFIELD PS #2** | 5.12% | 8.52% | 9.43% | 8.36% | 9.06% |
| **FAIRFIELD PS #3** | 6.82% | 8.52% | 9.21% | 8.04% | 4.52% |
| **FAIRFIELD PS #4** | 7.66% | 8.97% | 9.31% | 8.65% | 5.34% |
| **FAIRFIELD PS #5** | 7.22% | 8.59% | 9.43% | 8.28% | 8.36% |
| **FAIRFIELD PS #6** | 6.87% | 8.39% | 9.36% | 8.13% | 6.55% |
| **FAIRFIELD PS #7** | 6.78% | 8.76% | 9.62% | 8.55% | 8.44% |
| **FAIRFIELD PS #8** | 6.36% | 8.73% | 9.49% | 8.65% | 6.68% |
| **HAGOOD GT #4** | 2.29% | 1.92% | 0.91% | 2.10% | 2.25% |
| **HAGOOD GT #5** | 2.14% | 1.65% | 1.41% | 2.13% | 3.01% |
| **HAGOOD GT #6** | 3.75% | 2.58% | 1.69% | 2.63% | 3.71% |
| **JASPER #1** | 83.14% | 73.22% | 72.22% | 74.10% | 69.70% |
| **JASPER #2** | 79.33% | 72.93% | 75.01% | 74.39% | 66.89% |
| **JASPER #3** | 81.93% | 73.29% | 75.19% | 74.27% | 67.17% |
| **JASPER #4** | 63.81% | 54.96% | 57.27% | 58.75% | 52.30% |
| **MCMEEKIN #1** | 0.71% | 29.66% | 35.05% | 45.45% | 40.21% |
| **MCMEEKIN #2** | 30.81% | 25.56% | 33.70% | 47.52% | 43.84% |
| **PARR GT #3** | 0.44% | 1.13% | 0.27% | 0.91% | 0.57% |
| **PARR GT #4** | 0.63% | 1.14% | 0.41% | 0.96% | 0.49% |
| **SALUDA HYDRO #1** | 8.02% | 14.42% | 14.70% | 3.88% | 3.17% |
| **SALUDA HYDRO #2** | 0.23% | 3.30% | 3.63% | 8.32% | 4.13% |
| **SALUDA HYDRO #3** | 0.00% | 8.39% | 13.50% | 24.18% | 12.97% |
| **SALUDA HYDRO #4** | 4.31% | 15.34% | 9.00% | 25.80% | 12.80% |
| **SALUDA HYDRO #5** | 2.63% | 17.44% | 4.28% | 17.76% | 6.65% |
| **URQUHART #1** | 60.32% | 64.41% | 51.01% | 56.88% | 63.71% |
| **URQUHART #2** | 61.45% | 51.94% | 44.97% | 48.21% | 52.40% |
| **URQUHART #3** | 13.08% | 9.58% | 5.45% | 5.61% | 11.16% |
| **URQUHART CC #5** | 47.21% | 52.19% | 41.85% | 46.50% | 52.78% |
| **URQUHART CC #6** | 49.07% | 41.53% | 36.11% | 38.25% | 43.55% |
| **URQUHART GT #4** | 3.26% | 3.93% | 2.56% | 5.16% | 6.84% |
| **V.C. SUMMER #1** | 79.60% | 84.87% | 94.97% | 89.06% | 82.69% |
| **WATEREE #1** | 59.57% | 59.16% | 37.36% | 27.02% | 50.36% |
| **WATEREE #2** | 59.47% | 67.68% | 31.44% | 0.84% | 0.00% |

| | | | | | |
|---|---|---|---|---|---|
| **WILLIAMS #1** | 48.78% | 55.64% | 48.05% | 50.25% | 45.72% |
| **WILLIAMS GT #1** | 0.65% | 0.52% | 0.05% | 0.00% | 0.00% |
| **WILLIAMS GT #2** | 0.42% | 0.47% | 0.10% | 0.07% | 0.05% |