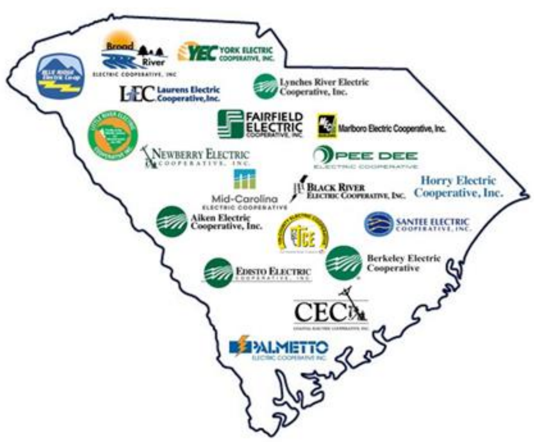
# Integrated Resource Plan

## 2021-2040

Central Electric Power Cooperative, Inc.

A Touchstone Energy® Cooperative



*In accordance with the amendment of The South Carolina Code of Laws, 1976, section 58-37-40 to include electric cooperatives, Central Electric Power Cooperative Inc. (Central) is submitting its Integrated Resource Plan to the South Carolina State Energy Office on behalf of itself and the 20 South Carolina distribution electric cooperatives. The IRP's development included a planning process that was begun in 2019. Central will complete this process every three years, with a review and update in the off years.*

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# 1 Executive Summary

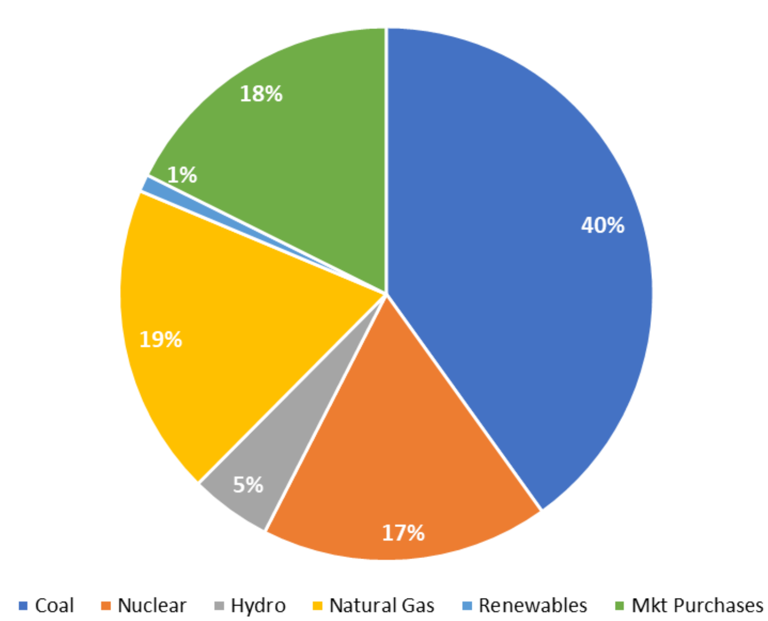
# 1 Executive Summary

## 1.1 Central Electric Power Cooperative, Inc.

Central Electric Power Cooperative, Inc. (Central) is a wholesale electric generation and transmission cooperative (G&T) headquartered in Columbia, South Carolina. Central is owned by the 20 independent, consumer-owned South Carolina distribution electric cooperatives, referred to in this document as member-cooperatives. These member-cooperatives provide retail electric service to their member-owners, located in every county in the State of South Carolina. Central is an IRS Section 501(c)(12) tax-exempt organization that operates on a not-for-profit, cost-of-service basis with the sole purpose of benefiting its member-cooperatives. The core services provided by Central for its member-cooperatives are power supply, transmission, economic development, member and energy services, and finance and billing services.

Central was formed in 1948 by seven South Carolina distribution cooperatives with the purpose of providing wholesale power and transmission aggregation by pooling resources to meet the needs of the cooperatives in a reliable and cost-effective manner. Today, Central and its member-cooperatives own transmission and distribution facilities in all 46 counties in South Carolina, serving electricity to about one-third of the state's population. Central's member-cooperatives serve over 820,000 meters and more than 1.5 million residents over 76,000 miles of power lines covering 70% of South Carolina. Currently, Central provides wholesale power to its member-cooperatives largely through long-term power purchase contracts with the South Carolina Public Service Authority (Santee Cooper), Duke Energy Carolinas LLC (Duke), and the Southeastern Power Administration (SEPA). In 2018, approximately 60% of member-cooperatives' energy needs were met by zero or reduced carbon-emitting resources. The graph below shows the energy mix that Central supplied in 2018.

**Figure 1.1: 2018 Central's Resource Mix**



## 1.2 Cooperative Business Model

In the 1930s, electricity was only available in larger cities and along major transportation routes, leaving 90% of rural homes without electricity. Electric cooperatives were formed by citizens across the U.S. to make electricity available in rural areas and small towns. The organizations were structured as member-owned and not-for-profit businesses. These electric cooperatives filled the void in rural areas where for-profit electric companies were historically reluctant to serve because it was not profitable to serve areas with only a few customers per line mile. Rather than maximizing shareholder value, the primary goal of investor-owned companies, service is the main priority for electric cooperatives because the member-owners are also the users of the product. Every member-owner has the right to participate in the policy-making process by voting on cooperative bylaws and electing members of the governing board. Nationwide, electric cooperatives power over 20 million businesses, homes, schools and farms across 56% of the country's landmass, while serving over 42 million people.

As a cooperative, Central is also owned by its members, which are cooperatives themselves. Central does not provide services to retail consumers. This structure is common across the 900 American distribution electric cooperatives and 60-plus generation and transmission cooperatives.

Central and its member-cooperatives are not-for-profit corporations and are granted federal tax-exempt status provided that 85% or more of their annual revenues are derived from serving member-owners. Central and its member-cooperatives strive to operate at cost but must accumulate capital to build and maintain the electrical system's infrastructure and facilities and to provide other services. All amounts received from member-owners in excess of operating costs and expenses are considered patronage capital and are allocated to each member-owner on a cost-of-service basis. Patronage capital is returned to member-owners in accordance with the cooperative's needs and policies.

Central and its member-cooperatives have access to loans at favorable interest rates through the lending programs of an agency of the U. S. Department of Agriculture — the Rural Utilities Service (RUS). RUS loans help finance the large projects that are necessary to maintain and expand the electric generation, transmission and distribution systems. Access to these loan programs significantly enhance the ability to provide affordable electric service to South Carolina consumers. Central and its member-cooperatives also rely on private-sector sources of financing such as CoBank and the National Rural Utilities Cooperative Finance Corporation.

The homes and businesses powered by Central's member-cooperatives are spread across the state, often in rural areas far from the network transmission lines operated by the local balancing authority. A balancing authority (BA) is an entity that has a legal responsibility for balancing load and generation within an assigned geographic territory, or its balancing authority area (BAA). Central's member-cooperatives are included in the BAAs of Santee Cooper, Duke, and Dominion Energy South Carolina. Central builds transmission lines to connect the substations serving member-cooperatives to the network transmission systems. The economies of scale provided by Central enhance its member-cooperatives' ability to build their systems efficiently while minimizing costs. The transmissions lines that Central builds are referred to as "radial lines" because they connect local substations to the network transmission grid. Central does not own, operate or maintain network transmission lines, nor does Central provide balancing services. Central's board approves construction workplans, which identify all needed radial transmission investments. The current board-approved transmission construction work plan for the 2019-2022 period includes 35 projects with a projected budget of $163.5 million.

## 1.3 Cooperative Principles

The Seven Cooperative Principles, recognized by cooperatives worldwide, provide philosophical guidance to organizations that are organized as cooperatives.

- Open and Voluntary Membership
- Democratic Member Control
- Members' Economic Participation
- Autonomy and Independence
- Education, Training and Information
- Cooperation Among Cooperatives
- Concern for Community

Electric cooperatives work for the sustainable development of their communities through policies and programs accepted by their member-owners. Central and its 20 member-cooperatives sponsor many charities and fundraisers for causes within each respective community (refer to Appendix 8-D for more information).

Central and its member-cooperatives have a long history of working together to offer demand-side management (DSM) programs to member-owners. These programs help member-owners reduce energy use and the member-cooperatives to lower peak demand, thus lowering wholesale power costs for the entire Central system. Currently, Central and its member-cooperatives offer programs that leverage smart home devices that reduce energy use and lower peak demand, on-bill financing options to enable energy efficiency measures and appliance upgrades, rebates to incentivize lighting efficiency upgrades in commercial and industrial facilities, net metering options for renewables, and several other programs that are discussed in the DSM section of this report. Additionally, member-cooperatives offer demand and time-of-use rates that encourage and incentivize their member-owners to use energy off peak, which provides savings to the member-cooperative and its member-owners.

Central and its member-cooperatives strive to drive economic development through investments in their local communities. They partner through the SC Power Team, a cooperative-owned economic development organization that supports the member-cooperatives in promoting, attracting, and retaining businesses and industries. The SC Power Team provides services such as project management, a business retention and expansion program, and industrial park development. It also offers a database for potential investors to search for site-ready locations. Since 2014, the commitment to economic development has led to the creation of nearly 30,000 jobs, $6 billion in capital investment and $30 billion in total economic impact. The expansion of industry not only benefits the local community but also member-owners across the state. This industrial load growth lowers wholesale power costs for the entire electric system and benefits the member-owners directly through lower power bills.

## 1.4 Central's Member-Cooperatives

| Member-cooperatives | Number of Active Accounts | Miles of Lines | Member-owners per Mile | Counties Served |
|---|---|---|---|---|
| Aiken Electric Cooperative | 48,359 | 5,541 | 8.73 | Aiken, Barnwell, Calhoun, Edgefield, Greenwood, Lexington, McCormick, Orangeburg, Saluda |
| Berkeley Electric Cooperative | 108,998 | 5,934 | 18.40 | Berkeley, Dorchester, and Charleston |
| Black River Electric Cooperative | 33,517 | 3,992 | 8.40 | Clarendon, Kershaw, Lee, and Sumter |
| Blue Ridge Electric Cooperative | 67,712 | 7,110 | 9.52 | Anderson, Greenville, Oconee, Pickens, and Spartanburg |
| Broad River Electric Cooperative | 22,241 | 2,662 | 8.35 | Cherokee, Newberry, Spartanburg and Union, SC Cleveland, Polk and Rutherfordton, NC |
| Coastal Electric Cooperative | 11,683 | 1,727 | 6.76 | Bamberg, Colleton, and Dorchester |
| Edisto Electric Cooperative | 20,308 | 3,615 | 5.60 | Allendale, Bamberg, Barnwell, Berkeley, Colleton, Dorchester, Hampton, and Orangeburg |
| Fairfield Electric Cooperative | 30,081 | 3,441 | 8.74 | Fairfield, Chester, Kershaw, Richland, and York |
| Horry Electric Cooperative | 81,919 | 5,375 | 15.20 | Horry |
| Laurens Electric Cooperative | 59,031 | 6,747 | 8.70 | Abbeville, Anderson, Greenville, Laurens, Newberry, Spartanburg, and Union |
| Little River Electric Cooperative | 14,347 | 2,096 | 6.84 | Abbeville, Anderson, Greenwood and McCormick |
| Lynches River Electric Cooperative | 21,301 | 2,900 | 7.30 | Chesterfield, Kershaw, and Lancaster |
| Marlboro Electric Cooperative | 6,474 | 1,088 | 6.00 | Marlboro and Dillon |

| Member-cooperatives | Number of Active Accounts | Miles of Lines | Member-owners per Mile | Counties Served |
|---|---|---|---|---|
| Mid-Carolina Electric Cooperative | 57,383 | 4,352 | 13.18 | Aiken, Lexington, Newberry, Richland, and Saluda |
| Newberry Electric Cooperative | 13,331 | 1,553 | 8.60 | Fairfield, Laurens, Lexington, and Newberry |
| Palmetto Electric Cooperative | 74,677 | 3,365 | 22.00 | Allendale, Beaufort, Hampton, and Jasper |
| Pee Dee Electric Cooperative | 30,145 | 2,806 | 10.85 | Chesterfield, Darlington, Dillon, Florence, Lee, and Marion |
| Santee Electric Cooperative | 43,484 | 5,642 | 7.71 | Clarendon, Florence, Georgetown, and Williamsburg |
| Tri-County Electric Cooperative | 17,697 | 2,720 | 6.51 | Calhoun, Kershaw, Lexington, Orangeburg, Richland, and Sumter |
| York Electric Cooperative | 61,480 | 3,977 | 15.50 | Cherokee, Chester, Lancaster, and York |

# 2 South Carolina Electric Cooperative Service Territories

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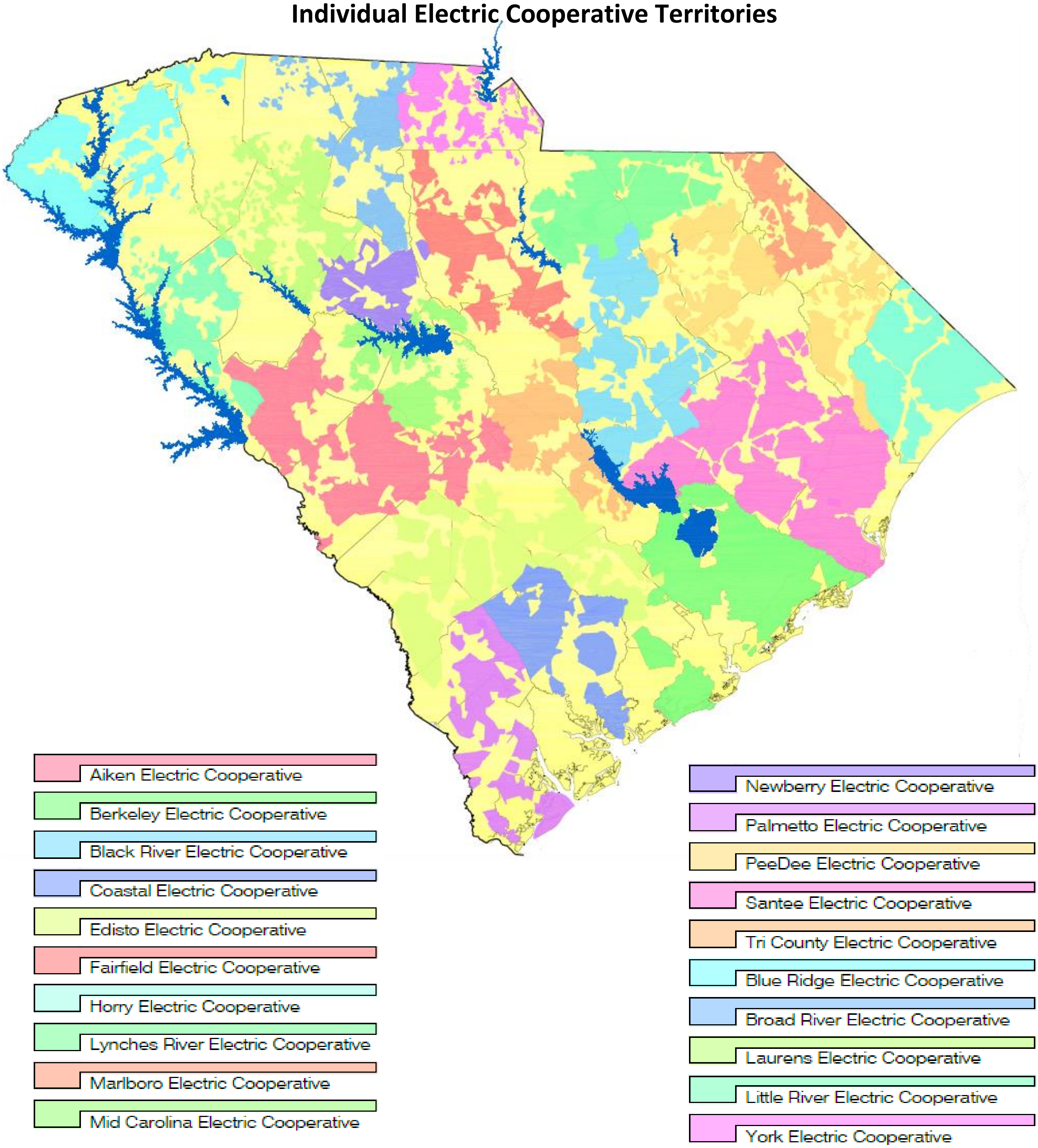
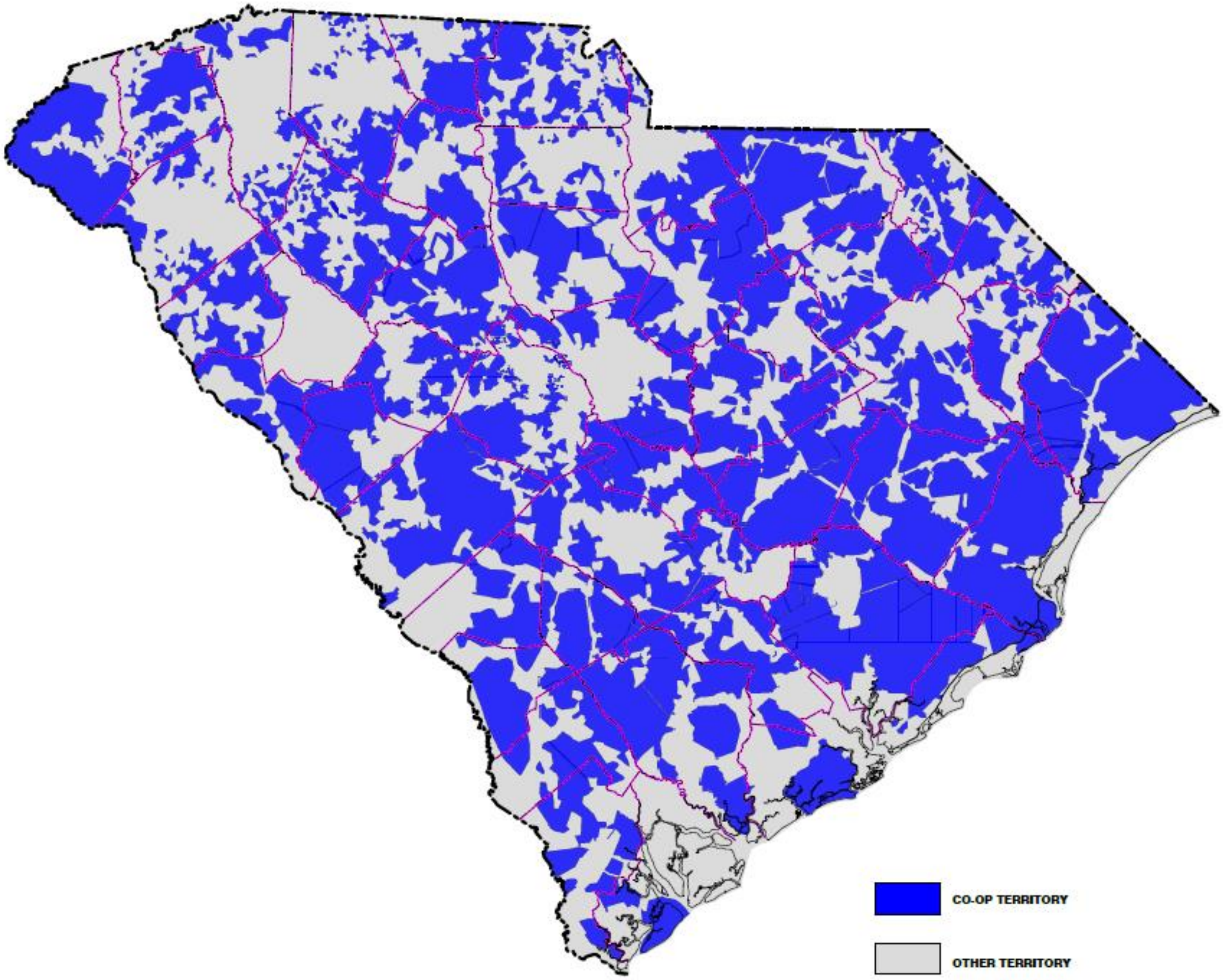
**Individual Electric Cooperative Territories**



## All South Carolina Electric Cooperative Territory



## 2.1 Purpose of the Integrated Resource Plan

Resource planning is an ongoing process at Central and is one of the core responsibilities of the power supply department. By design, Central's integrated resource plan (IRP) is detailed and outlines how Central can meet its long-term forecasted energy consumption and peak demand through a combination of supply-side and demand-side resources. The planning period for Central's IRP is January 1, 2021 – December 31, 2040.

This report provides a comprehensive view of Central's vision, initiatives, and future resource plan to serve the current and growing needs of its member-cooperatives. The IRP is intended to be a working document, used to both guide and communicate Central's long-term power supply and infrastructure investment decisions. The plan embodies the commitment to Central's member-cooperatives to provide reliable power supply in a cost-effective manner.

The provided analysis supporting the plan helps Central, its member-cooperatives, and their member-owners understand the effect of both near-term and long-term resource decisions on member-owner bills and the future reliability of the electric service. Resource planning at Central is a collaborative process among Central and its member-cooperatives. This IRP will not select a specific resource plan for implementation. It will instead serve as a roadmap, assisting Central, its member-cooperatives, and their member-owners as Central moves into the next phase of resource plan development. The Central team has examined various reasonable scenarios to determine a series of resource portfolios designed to minimize both cost and risk.

# 3 Existing Resources

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Central provides wholesale power to its member-cooperatives primarily through a portfolio of contracts. The two primary contracts are with the South Carolina Public Service Authority, a state-owned utility known as Santee Cooper, and Duke Energy Carolinas, LLC (Duke), a subsidiary of Duke Energy Corporation. Central's remaining power-supply resources supplement these contracts. These supplemental resources include backup generators and renewable resources such as solar and hydroelectricity. Central's member-cooperatives receive hydroelectric capacity and energy from the Southeastern Power Administration (SEPA), an entity of the federal government. Central aggregates the power provided under these various contracts to supply the needs of its member-cooperatives. Wholesale costs are aggregated, and each member-cooperative pays the same posted wholesale power rates. Member-cooperatives' wholesale costs will vary based on their size and member composition. Central manages these contracts with the objective of providing reliable power at the lowest possible price.

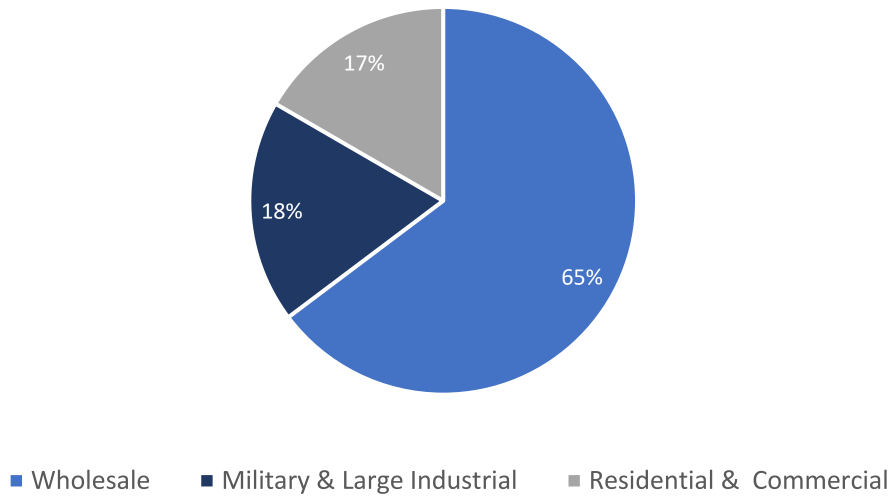
Central's contract with Santee Cooper is commonly called the Coordination Agreement, which is an all-requirements contract. Approximately 76% of the electricity provided by Central to its member-cooperatives flows through the Coordination Agreement. SEPA provides 2% of electricity and the remaining 22% is served by Duke Energy Carolinas. The contract with Duke is referred to as the Duke Power Purchase Agreement (PPA). The Duke PPA is an all-requirements contract for member-cooperative load in Duke's BAA. An all-requirements contract requires the provider to supply the purchaser with all the purchaser's energy needs up to the level of reliability specified in the agreement.

## 3.1 Santee Cooper

The Coordination Agreement is a "bundled" contract for both generation and transmission service provided by Santee Cooper to Central with a contract end date of 2058. This "bundling" of service is allowed due to Santee Cooper's non-jurisdictional status at the Federal Energy Regulatory Commission (FERC) and the fact that amendments to the long-standing Coordination Agreement have not frustrated this legacy treatment, which is beneficial to both Central and Santee Cooper. Central accounts for more than 72% of Santee Cooper's firm demands. Central accounted for approximately 65% of Santee Cooper's energy sales in 2018.

Figure 3-1 illustrates Santee Cooper energy sales by ratepayer class.

**Figure 3-1: 2018 Santee Cooper Energy Sales by Ratepayer Class[1]**




Due to Central's significant share of Santee Cooper's total business, the Coordination Agreement gives Central contractual rights related to resource planning and access to information regarding system operations and fuel purchasing well beyond what is customary in a traditional long term PPA. There are various joint committees between Central and Santee Cooper such as the Joint Planning Committee and the Joint Operating Committee. These committees review and vote on critical matters such as system operations to ensure the combined Central/Santee Cooper system is being planned and operated in a manner consistent with good utility practice.

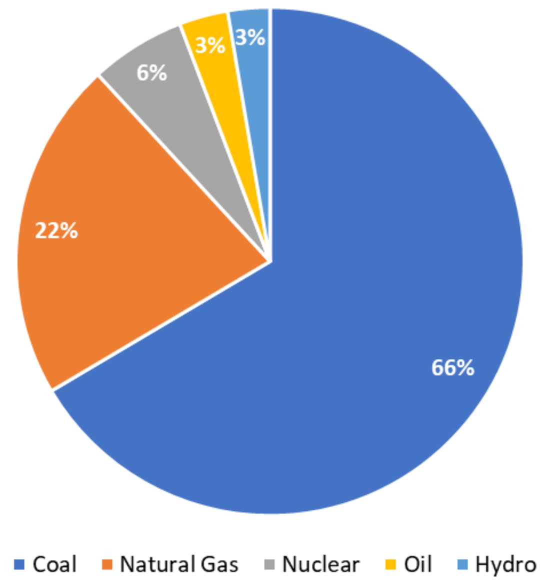
The Coordination Agreement outlines the generation expansion process. Santee Cooper must engage Central throughout the process of creating potential expansion proposals, and Central must opt in to any proposed generation resource; otherwise, Santee Cooper cannot collect capital costs related to the proposed resource in their charges to Central. If Central opts out of Santee Cooper's proposed resource, then Central must secure its own resource for its own pro-rata share of the system shortfall. Central can accomplish this requirement by purchasing capacity from the market, moving load to another regional utility, building new generating units, implementing demand-side management and energy efficiency programs, or some combination thereof.

Santee Cooper's current generation fleet has a mix of coal, nuclear, hydro, and natural gas plants, but the generation fleet is primarily coal-based.

[1] 2018 Santee Cooper Fingertip Facts. Santee Cooper serves four wholesale customers, with Central being the purchaser of almost all of Santee Cooper's wholesale energy.

Figure 3-2 summarizes Santee Cooper's 2018 generation fleet capacity percentage by fuel type.

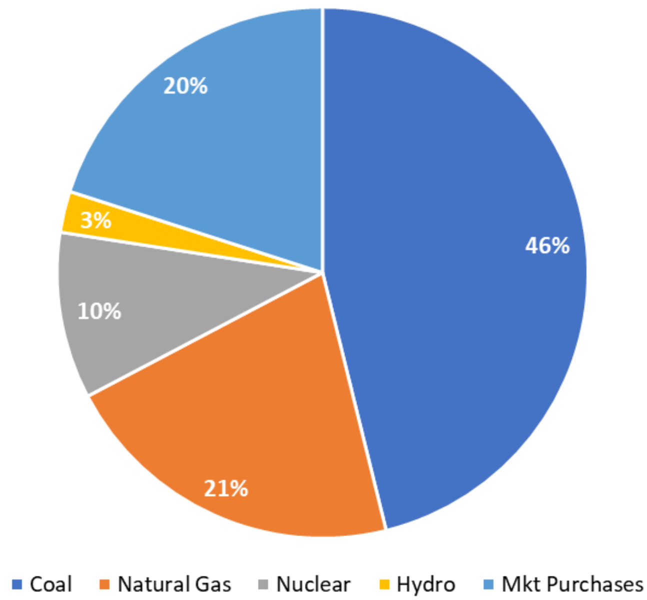
**Figure 3-2: Santee Cooper 2018 Generation Fleet Capacity Percentage by Fuel Type**[2]




[2] 2018 Santee Cooper Integrated Resource Plan

Santee Cooper's actual energy mix is substantially different from its generation fleet capacity. Figure 3-3 shows its 2018 energy mix by fuel type.

**Figure 3-3: Santee Cooper 2018 Energy Mix [3]**




One of the most significant changes in the power industry over the past decade has been a sharp decline in the price of natural gas. Natural gas has shifted from a high-cost fuel to the lowest cost source of fossil fuel generation. Improvements in combustion turbine technologies have further reduced the cost of natural gas-fired generation. For these reasons, natural gas has become the primary source of purchased power in the Southeast, and Santee Cooper has taken advantage of this lower cost purchased power as an alternative to its coal-fired generation when economical.

Santee Cooper announced plans to retire units 3 and 4 at the coal-fired Winyah Generating Station in 2023 and units 1 and 2 in 2027. Winyah Station has been mostly uneconomic to dispatch, and Santee Cooper incurs substantial fixed costs to maintain the station. Those fixed costs can be avoided by retiring those units. Central has strongly urged Santee Cooper to act on these retirements sooner. Doing so would provide the opportunity to add lower-cost generating resources such as solar and natural gas generators. However, Santee Cooper has the final say in planning and operating decisions.

## 3.2 Duke Energy Carolinas, LLC

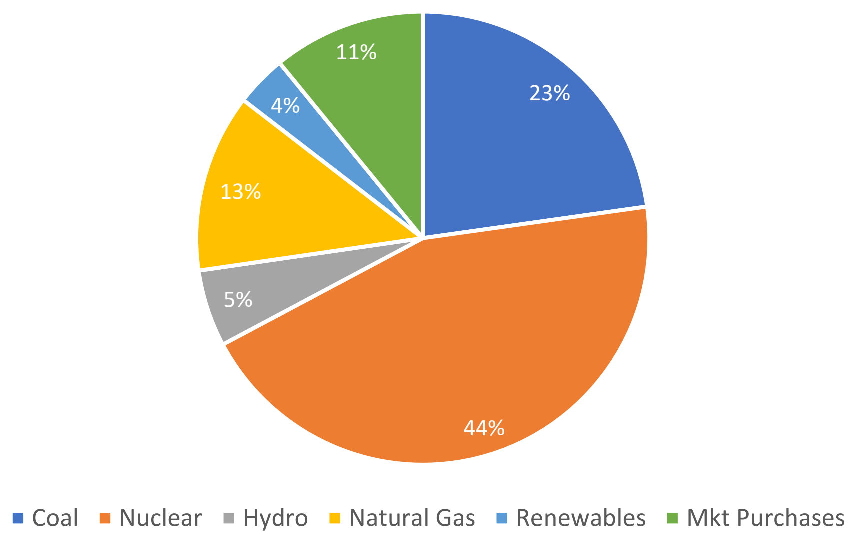
Central's other all-requirements contract with Duke Energy Carolinas, LLC (Duke), is a more traditional PPA, with a contract term through 2030. The PPA is regulated by FERC under a cost-based tariff, and the PPA's terms and rates structure align with FERC's cost-based rate formula methodology.

[3] 2018 Santee Cooper Annual Report

Central has also contracted for a Network Integration Transmission Service Agreement (NITSA) with Duke. The NITSA requires Duke to serve all Central delivery points connected to Duke's transmission system as network load, with no adverse distinction between Central's delivery points and Duke's retail loads. The term of the NITSA remains in effect for as long as Duke provides transmission services as a balancing authority and is independent of the PPA term. If Central does not extend the PPA by 2025, then it will begin ramping down. One third of Central's load currently served by Duke would transition out of the PPA in January 2029, followed by another third in January 2030, with the contract terminated at the end of 2030.

Duke relies heavily on nuclear generation, which accounts for 44% of the energy it produces. In recent years, Duke has retired coal generation and replaced it with natural gas generation, renewable generation, and market purchases. Duke has steadily added solar generation to its system. Market purchases include PPAs with third party solar developers.

**Figure 3-4: Duke Energy Carolinas 2018 Generation Mix by Fuel Type**[4]




Duke Energy Carolinas and Duke Energy Progress have enacted a joint dispatch agreement to jointly use their combined generating fleets to serve their loads. This agreement allows for the non-firm exchange of energy between both companies. The more efficient generation dispatch also benefits Central by minimizing fuel cost.

## 3.3 Southeastern Power Administration

SEPA is a federal power marketing administrator that provides power from hydroelectric dams on the Thurmond, Russell, and Hartwell reservoirs operated by the U. S. Army Corps of Engineers on the Savannah River. The power is sold to electric cooperatives and municipal utilities in the Southeast,

[4] 2018 Duke Energy Carolinas FERC Form 1

including all 20 of Central's member-cooperatives. This low-cost power source reduces member-cooperative costs and lessens Central's capacity and energy requirements from Duke and Santee Cooper. SEPA's power belongs to the member-cooperatives, and SEPA is obligated to provide capacity to member-cooperatives. That capacity is referred to as each cooperative's SEPA allocation; however, the PPAs are contracted directly between SEPA and Central. Central acts as the member-cooperatives' agent, managing the contracts and ensuring that the power benefits the member-cooperatives. SEPA's costs are directly passed through to each member-cooperative based on its SEPA allocation. SEPA currently supplies 200 MW of capacity and associated energy monthly to Central member-cooperatives.

## 3.4 Renewables – Community Solar, Horry County Schools, Savion QF, Volvo Solar

Central's PPAs with Santee Cooper and Duke include limitations on the ability of Central and its member-cooperatives to build renewable generation without incurring penalties. Central and its member-cooperatives are assisting commercial, industrial and residential member-owners throughout the state to access renewable options that meet their needs and benefit the system while minimizing any penalties assessed to Central.

Under the Public Utility Regulatory Policies Act (PURPA) of 1978, Central and other utilities must contract with a third-party renewable developer if its project meets the PURPA criteria to be a Qualified Facility (QF) and if its offer price is less than or equal to the utility's avoided energy cost. This avoided energy cost is specific to each utility but represents the production costs a utility avoids by purchasing energy from the QF provider. Both Santee Cooper's and Duke's contracts with Central acknowledge and account for PURPA-required purchases. Central can transact with these PURPA suppliers, and it can reduce its energy purchases from Santee Cooper and Duke without financial penalties. PURPA law supersedes Central contract limits. If the renewable energy comes from a QF, Central will not be penalized by its power providers for having excess generation.

While solar power provides valuable low-cost energy to Central's member-cooperatives, its inherently intermittent production profile prevents it from significantly reducing Central's capacity purchases. The winter peak occurs early in the morning when solar irradiance is low, so solar production would be minimal at the time of the winter peak. Solar facilities typically are producing during summer peak hours, but Central's summer peak typically occurs as the sun is beginning to set, reducing the capacity value of solar generating facilities.

Below are details of the current and upcoming renewable projects Central and its member-cooperatives have in their resource mix:

### Savion Solar Qualified Facility

The Savion QF projects will consist of two 75 MW (AC) solar sites located in Orangeburg County, and Central will purchase the energy from those sites once they are completed in 2023. Once operational the sites will be capable of producing approximately 250,000 MWh of energy annually. Both sites qualify as PURPA facilities. Utilities must allow access to their transmission system for these QFs. While the Savion sites will produce energy during Central's summer peak period, they will be producing well below their daily peak generation.

## Volvo Solar

As a partial solution to Volvo's corporate goals to procure carbon-free energy for its production facilities, Central has executed a PPA with a solar developer for the output of a project located at Volvo's manufacturing site. These solar arrays have a cumulative nameplate capacity of 6.5 MW (AC) and became operational in March 2020. Volvo is one of the many cooperative member-owners with sustainability goals, and Central is working with its member-cooperatives to help these member-owners achieve their goals.

## Horry County School Solar

Horry Electric Cooperative serves two schools in Horry County with fixed rooftop solar installations that were energized in 2018. Both sites have a combined total of 860 kW (AC) of solar nameplate capacity. Central purchases one-half of the St. James Intermediate and Socastee Elementary schools' generation through a PPA. The remaining generation can be used by the schools to serve their loads, or they can sell a portion of panels' generation back to Horry Electric. Horry Electric compensates those schools with a net metering billing credit, which reduces the schools' monthly electric bill.

## Community Solar

Central's board authorized the construction for up to 5 MW (AC) of community solar available to all of Central's member-cooperatives. Construction on these sites began in 2016, and they are a mixture of ground-mount and canopy configurations. These sites are either owned by Central's member-cooperatives or Central has PPAs with third party solar developers to purchase the energy output. Currently 18 member-cooperatives have access to community solar.

Community solar allows Central's member-cooperatives to offer their member-owners the opportunity to support renewable generation development without the requirement to install those resources on their homes or property. Member-cooperatives can lease the panels to their member-owners. This opens access to solar energy for renters and mobile homeowners, who would not be able to access solar energy under a rooftop ownership business model.

In total, the sites have generated 18 gigawatt-hours (GWh) of energy since 2016, which would equal the production needed to fully supply 15,000 homes with solar energy. By the end of 2020, 4.2 MW (AC) will be online.

Figure 3-5 illustrates the total community solar that each of Central's member-cooperatives has built and/or plans to construct.

**Figure 3-5: Member-Cooperative Solar Breakdown**

| Member-Cooperative | Total kW AC | First In Service Date |
|---|---|---|
| Aiken | 250 | Sept. 2017 |
| Berkeley | 200 | Jan. 2021 |
| Black River | 240 | Jan. 2017 |
| Blue Ridge | 245 | Jul. 2017 |
| Broad River | 270 | Mar. 2017 |
| Coastal | 250 | Jul. 2017 |
| Fairfield | 120 | Dec. 2017 |
| Horry | 240 | Feb. 2017 |
| Laurens | 276 | Aug. 2016 |
| Little River | 240 | Apr. 2017 |
| Lynches River | 240 | Dec. 2017 |
| Marlboro | 165 | Feb. 2017 |
| Newberry | 240 | Apr. 2017 |
| Palmetto | 240 | Jan. 2017 |
| Pee Dee | 240 | Jul. 2017 |
| Santee | 255 | Apr. 2018 |
| Tri-County | 240 | Mar. 2017 |
| York | 240 | Aug. 2016 |
| Total | 4,191 | |
| *Includes completed and planned projects | | |

### Berkeley Electric Cooperative Community Solar + Battery Installation

Berkeley Electric and Central are installing a battery system at Berkeley Electric's community solar site, which is expected to be completed and operational by the end of 2020. Berkeley Electric and Central will be able to use lessons learned from this installation for future solar and battery development. This pilot project will provide an additional load management tool to reduce Central's peak demand.

The battery will be a Tesla lithium-ion battery pack, with a maximum discharge rate (1 hour) of 116 kW (AC) and a total energy rating of 464 kWh. It will charge during low-demand/low-cost hours and discharge during high-load/high-cost hours. The battery will have the dual capability of being charged from the attached solar site or from the electric grid. The attached solar site will have a capacity rating of 120 kW (AC).

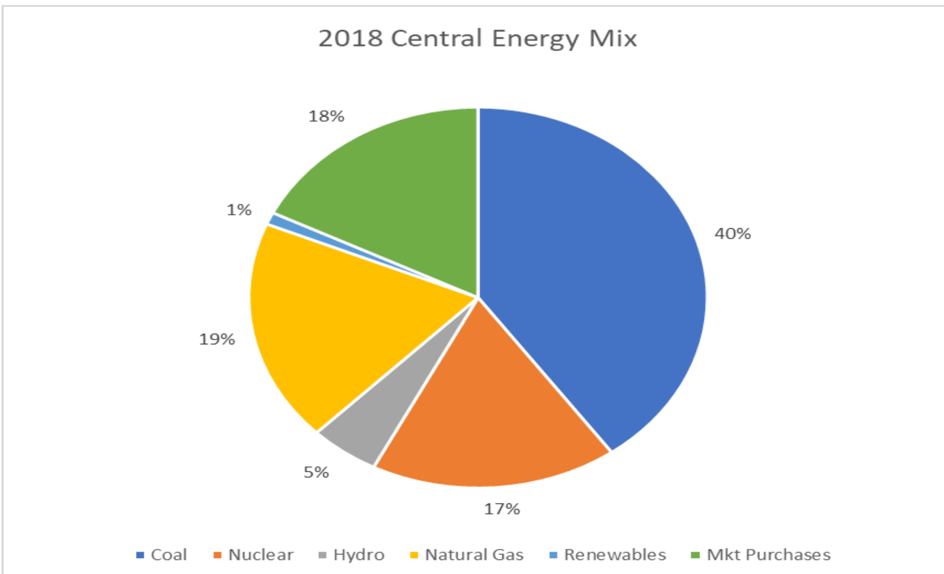
## 3.5 Diesel Generators

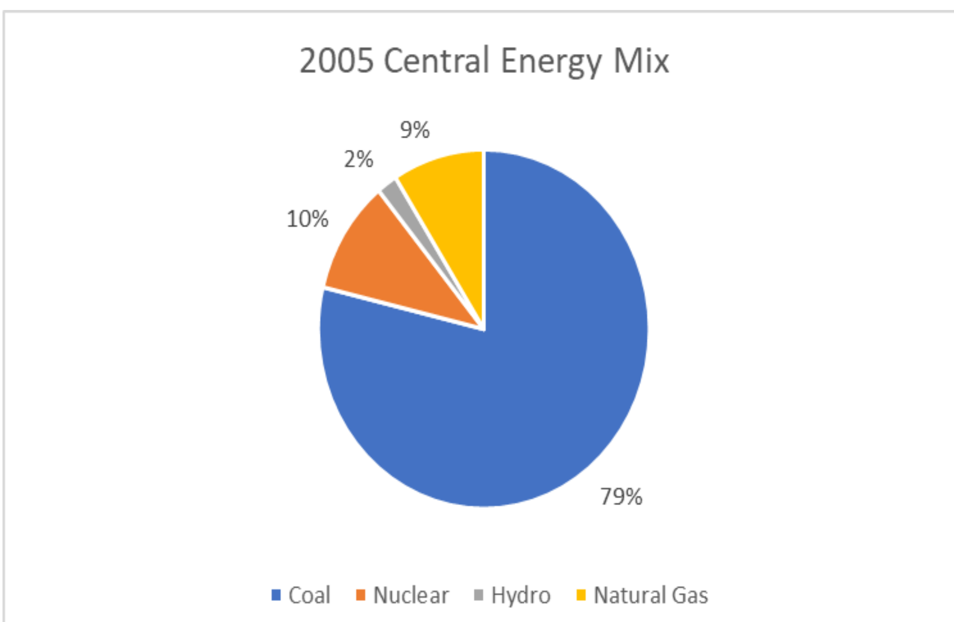
Central purchased six 3 MW diesel generators from Santee Cooper in 2012. Four of the generators are used by Central to reduce Duke's annual coincident peak. The other two generators are connected to Dominion transmission and are used as backup generation for member-cooperatives. These generators are from the General Motors 645F4B series and were placed into service in 1996. They have undergone substantial environmental compliance upgrades, meet current environmental emission standards, and are RICE-NESHAP compliant. Their quick start abilities and high ramp rates make these generators effective peak-shaving resources.

## 3.6 Central's Energy Mix

Combining the production of the various power suppliers listed above with Central's own resources produces the following Central energy mix for 2018.

**Figure 3-6: 2018 Central Energy Mix vs 2005 Central Energy Mix**



In 2018, Central's member-cooperatives received 40% of their energy from coal-fired generation, a reduction by nearly half compared to 2005. Market purchases from other suppliers and natural gas have displaced coal's dominant share of power production over time. Central's coal share of power production will continue to decrease once Central's PPAs with Savion become operational in 2023. This solar production will expand the percentage of renewable energy supplied to Central's member-cooperatives.

# 4 Demand-Side Management

# 4 Demand-Side Management

Demand-side management (DSM) is a broad category of resources whereby Central and its member-cooperatives encourage member-owners to modify consumption of electricity either through various programs or grid-related projects to reduce capacity and/or energy consumption. For the purposes of this IRP, Central categorizes four types of DSM programs:

1) **Energy Efficiency (EE)** – Support of efficient equipment or technology with the objective of reducing overall energy consumption.
2) **Demand Response (DR)** – Programs or tariffs designed to reduce consumption of electricity when the grid is most constrained, or the economic benefits are the greatest. Typically, the objective of DR programs is to shift load rather than reduce the total amount of consumption.
3) **Beneficial Electrification (BE)** – Programs or initiatives that encourage member-owners to transition energy-intensive equipment or processes from fossil fuel to electricity. As the electric grid becomes cleaner, BE measures have the potential to reduce total emissions. If the added load occurs primarily during off-peak periods, BE measures can improve system utilization and place downward pressure on rates.
4) **Renewable Energy (RE)** – Technologies such as behind-the-meter solar photovoltaic arrays reduce the amount of energy that must be supplied by the utility.

Central and its member-cooperatives have pursued various DSM strategies since the 1980s and intend to continue offering member-owner programs over the planning horizon. The base energy and peak demand forecasts discussed in Section 5.2 reflect the impacts of current DSM resources so no adjustments to the load forecast are required. The impact of new DSM programming is not incorporated in the forecast so the expected impacts of EE and DR need to be subtracted from the base forecasts, while BE impacts need to be added to the base forecast, as appropriate, to determine the resource requirements of the system net of projected DSM activity.

Regarding the next three subsections,

- Section 4.1 provides an overview of the type and magnitude of existing DSM resources. This corresponds to a low DSM scenario: given that existing resources are already procured, they represent a minimum level of resources. This scenario is referred to as "Existing"
- Section 4.2 describes the modeling of incremental DSM resources, corresponding to a base or medium DSM scenario. This scenario is referred to as "Business as Usual"
- Section 4.3 explores the impacts of a high DSM scenario where Central and its member-cooperatives increase DSM funding compared to historic levels. This scenario is referred to as "Aggressive"

## 4.1 Existing DSM Resources

Figure 4-1 provides a high-level description of current DSM offerings across the Central system. This list includes offerings with known levels of participation and documented impacts. Member-cooperatives support additional efficiency projects and member services on a case-by-case basis.

### Figure 4-1: Summary of Existing DSM Offerings

| DSM Resource Type | Offering | Description |
|---|---|---|
| DR | Air Conditioning (HVAC) Switches | Direct demand response devices installed on the HVAC unit of homes to reduce cooling load during peak demand events |
| DR | AMI Water Heater Switches | Direct demand response devices on electric water heaters controlled through the AMI network |
| DR | RF Water Heater Switches | Direct demand response devices on electric water heaters controlled through radio signals over a cooperative radio signaling system |
| DR | Smart Thermostats | Wi-Fi connected devices used to adjust the heating or cooling setpoints of homes and to reduce demand during peak demand events |
| DR | Beat the Peak Alerts | Behavioral messages delivered via email, text, and phone that encourage member-owners to reduce demand during peak demand events |
| DR | Pool Pump Switches | Direct demand response devices that interrupt pool pump motor operation during peak demand events |
| DR | Battery Storage | Lithium-ion batteries that store energy during off-peak periods and discharge to the grid during peak demand events |
| DR | Conservation Voltage Reduction (CVR) | Process by which cooperatives reduce voltages at the substation or feeder level during peak hours to lower demand while maintaining minimum service levels |
| EE | Help My House® | Weatherization and HVAC upgrade program with on-bill financing component for participating member-owners |
| EE | Commercial Lighting Rebates | Rebates to encourage the installation of high-efficiency lighting upgrades. Projects may be identified through low/no-cost commercial audits. |
| RE | Solar Photovoltaic | Solar PV arrays installed in residential, commercial, industrial, or community settings. This includes mostly behind-the-meter solar installations. |

### 4.1.1 Future Projections for Existing Programs

Central's current portfolio of DSM programs totals approximately 93 MW of summer capacity and 91 MW of winter capacity. Figure 4-2 shows the existing resources by season and the projected reduction in the existing resources over time. Key drivers of the decrease include:

- Useful life and connectivity of connected devices, switches, and equipment
- Declining productivity of distributed energy resource systems over time. The energy production of solar panels degrades approximately 1% annually.

**Figure 4-2: Existing DSM Resource, by Season**

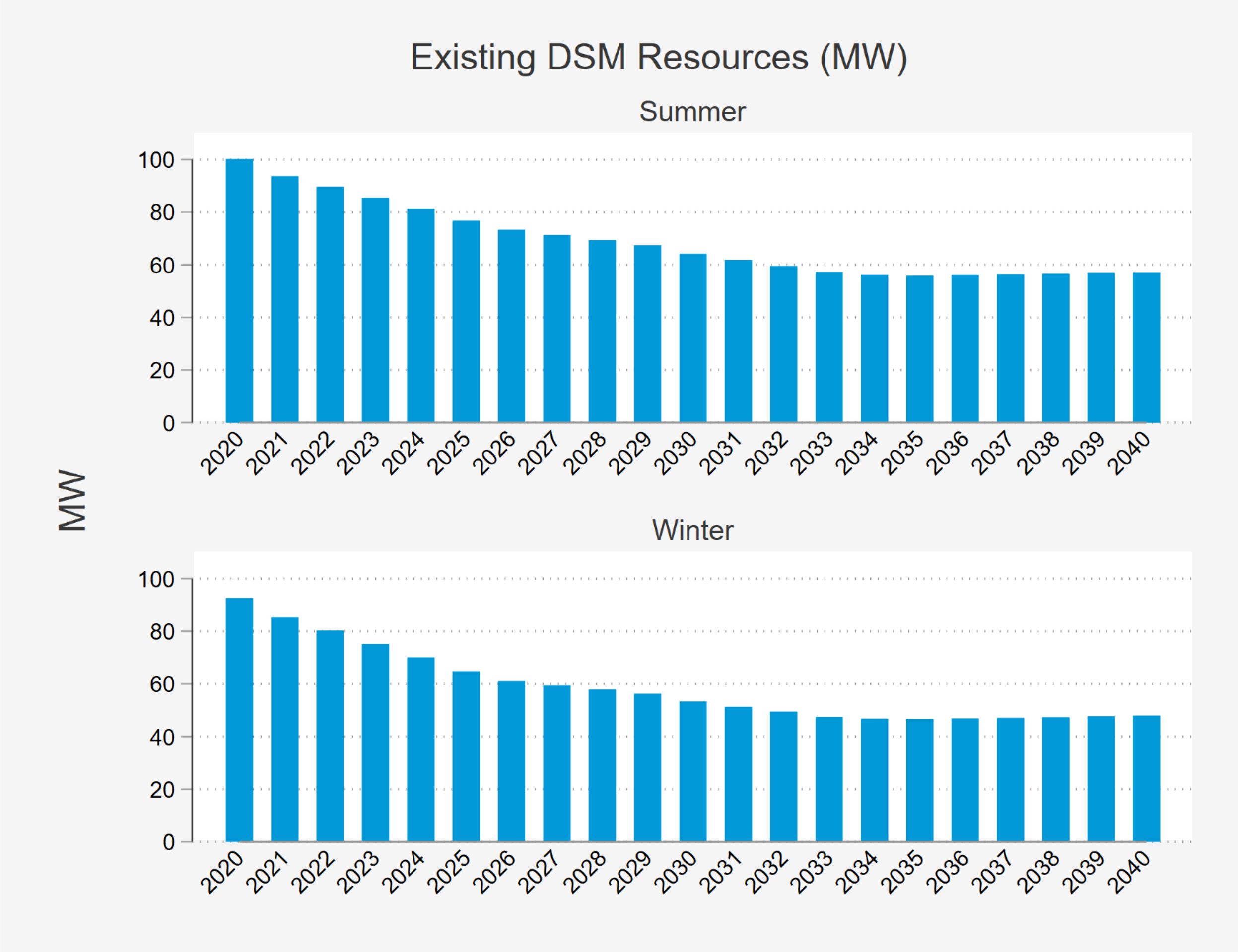
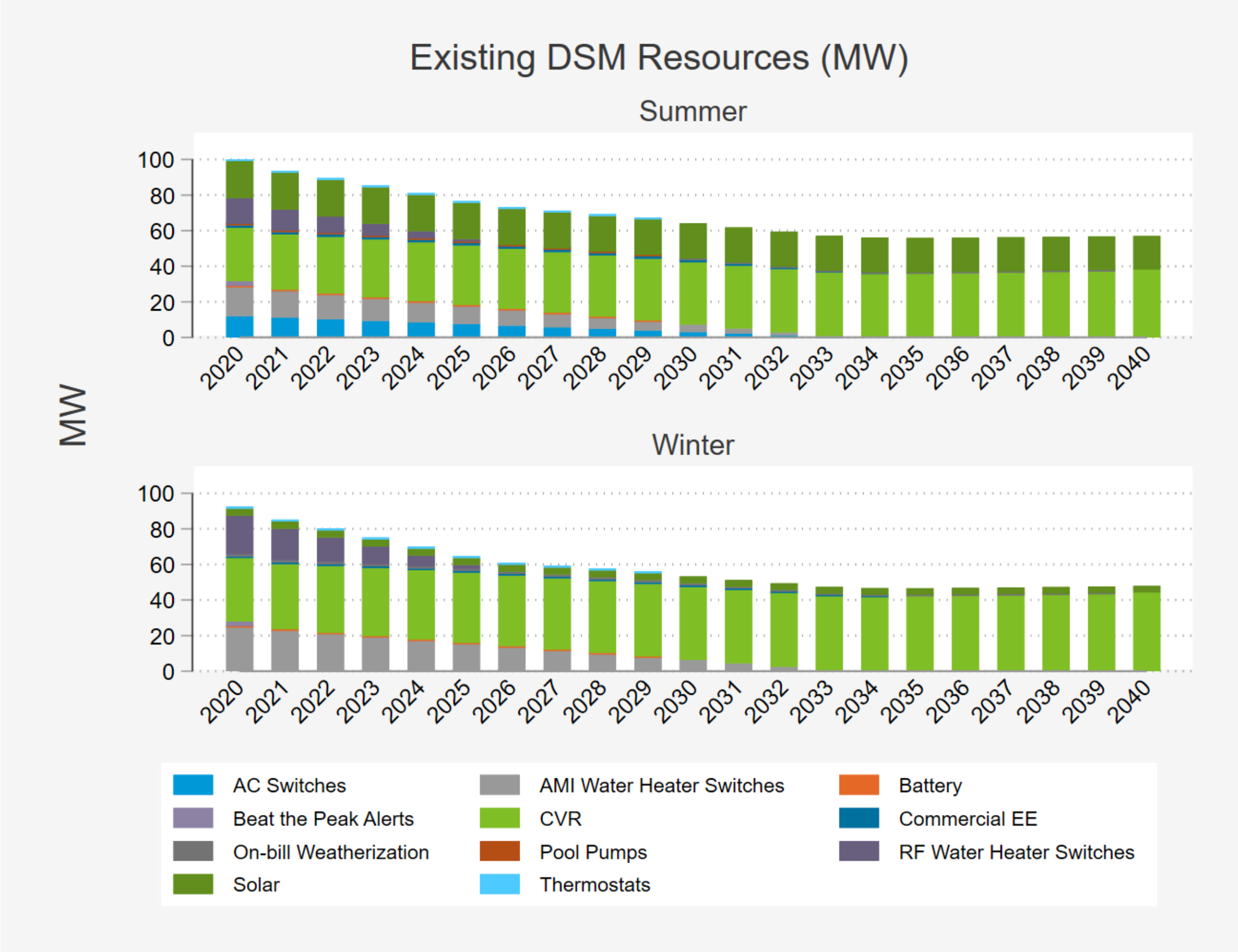



Figure 4-3 below shows the breakdown of existing resources by program. (Detailed tables are available in Appendix A.) Note that some programs are expected to phase out in the next few years as Central redirects investments toward newer technologies. For example, Wi-Fi connected water heaters are being piloted and will replace RF and AMI water heater switches. Similarly, Central and its member-cooperatives will no longer deploy HVAC switches and will instead grow the existing smart thermostat program.

**Figure 4-3: Existing DSM Resources (MW)**

| Season | 2022 | 2025 | 2030 | 2040 |
|---|---|---|---|---|
| Summer | 90 | 77 | 64 | 57 |
| Winter | 80 | 65 | 53 | 48 |

**Figure 4-4: Existing DSM Resources, by Program**




## 4.2 Incremental DSM Modeling

Going forward, Central and its member-cooperatives will continue to invest in DSM programs that bring value to member-cooperatives through decreased energy use and demand. The future DSM portfolio was modeled and forecasted to align with Business as Usual projected budget forecasts. The composition of the future portfolio reflects ongoing programs, pilots, and research initiatives. The following sections describe the framework used to assess portfolio benefit-cost economics, key assumptions, and the resulting economics of the modeled portfolio from multiple perspectives.

### 4.2.1 Economic Modeling Framework

To assess the economics of the future portfolio, Central modeled lifetime benefits and costs for each program over the 20-year IRP timeline using participation forecasts modeled to align with projected budgets. These lifetime benefits and costs were assessed from three perspectives using industry standard benefit-cost tests, namely:

- **Utility Cost Test (UCT):** assesses the system benefits and costs of a DSM program as a resource option based on the costs incurred by the utility (including incentive costs) excluding any costs incurred by the participant
- **Ratepayer Impact Test (RIM):** assesses fairness and equity by measuring what happens to cooperatives' rates due to changes in utility (Central) revenues and operating costs caused by the program
- **Total Resource Cost Test (TRC):** assesses economic efficiency and societal impact by measuring the system benefits and costs of a demand-side management program as a resource option based on the total costs of the program, including both the participants' and the utility's costs.[5]

Figure 4-5 defines the cost and benefit elements included in each test.

**Figure 4-5: Benefit Cost Test Definitions**

| C / B | Economic Element | Description | UCT | RIM | TRC |
|---|---|---|---|---|---|
| C | Utility Measure Costs | *The portion of DSM measure costs paid by the utility. Includes installation and financing, and rebates.* | ✓ | ✓ | |
| C | Incentives | *Incentives paid by the utility accruing to participants, for example, annual participation payments.* | ✓ | ✓ | |
| C | Other Financial or Technical Support Costs | *Payments by utility to trade allies, sales bonuses to contractor staff, etc.* | ✓ | ✓ | ✓ |
| C | Measure Costs | *Full incremental cost of the measure. Indifferent to the funding split between the utility via rebate and the out-of-pocket cost to the participant.* | | | ✓ |
| C | Program Administration Costs | *Management of utility programs and portfolios, including marketing, technical support and administration.* | ✓ | ✓ | ✓ |
| C | Evaluation, Measurement, & Verification | *Analysis to inform design of programs or retrospective assessments.* | ✓ | ✓ | ✓ |
| C | Increased Energy Costs | *Increased generation or purchase of electric energy, varying by season and time of day. Includes line losses.* | | ✓ | |

[5] Though the TRC test includes participant measure costs, it does not fully reflect the economics to the participant because it includes marginal avoided costs (costs to the system) rather than retail resource costs (cost to the end-use consumer). The Participant Cost Test (PCT) can be used to assess economics to the end-use consumer, but, given the system-wide focus of an IRP, this test was not included in the assessment.

| C / B | Economic Element | Description | UCT | RIM | TRC |
|---|---|---|---|---|---|
| C | Increased Generating Capacity Costs | *Cost of increased capacity needs during system peak. Includes line losses.* | | ✓ | |
| C | Increased Transmission Capacity Costs | *Increased investments in Transmission capacity. Includes line losses.* | | ✓ | |
| C | Lost Utility Revenue | *Reduction in retail purchase of energy from a utility as a result of energy use reduction (e. g. indirect incentive)* | | ✓ | |
| B | Avoided Energy Costs | *Avoided generation or purchase of electric energy, varying by season and time of day. Includes line losses.* | ✓ | ✓ | ✓ |
| B | Avoided Generating Capacity Costs | *Value of avoided capacity during system peak. Includes line losses.* | ✓ | ✓ | ✓ |
| B | Avoided Transmission Capacity Costs | *Deferred or eliminated investments in Transmission capacity. Includes line losses.* | ✓ | ✓ | ✓ |
| B | Added Utility Revenue | *Increase in retail purchase of energy from a utility.* | | ✓ | |

The economic assessment entails calculating lifetime net present value of benefits and costs. This requires defining key assumptions for converting costs and benefits for DSM investments made over the 20-year IRP time period.

### 4.2.2 Sensitivities

The avoided cost inputs are a function of current contract terms with Duke and Santee Cooper and the weighting of costs for these two systems. Notably, short range (2021-2029) avoided *capacity* costs (generation plus transmission capacity costs) are higher in the Duke system than in the Santee Cooper system. In contrast, avoided *energy* costs in the Duke system are less than those in the Santee Cooper system. Sensitivities to these assumptions were explored by running two scenarios: one using Duke system costs alone and another using Santee Cooper system costs alone. Economic outcomes for DSM were more beneficial using Duke system avoided costs than when using a blended average or Santee Cooper costs. This is especially true for demand response programs for which the resource benefit is primarily or exclusively avoided capacity. This is also the case, though to a lesser extent, for energy efficiency programs which provide avoided energy and avoided capacity benefits.

Another key assumption to which economic outcomes are sensitive is the treatment of avoided capacity benefits in summer months versus in winter months[6]. A weighting was applied because the DSM portfolio

[6] Summer is defined as April through October, while winter is comprised of the remaining months.

provided capacity benefits in both seasons and because seasonal peaking risk differs by system. Specifically, summer and winter capacity reductions are not additive. To avoid double counting, weights were applied to take the weighted average capacity reductions before applying annual avoided capacity costs. Though the Central system typically peaks in the winter, the Duke portion of the Central system typically peaks in the summer, and, as described above, the avoided costs also differ by system. At a program level this matters because the avoided capacity benefits supplied by a specific DSM measure are a function of the seasonality of the loads being curtailed or otherwise reduced via efficiency improvements. As an example, demand response enabled via smart thermostats produces avoided capacity benefits only when the thermostats control curtailable loads. Households with electric heating and cooling produce both winter and summer avoided capacity benefits. Households with fossil fuel heating do not have electric heating loads that can be curtailed in the winter and, therefore, only produce capacity benefits in the summer. For other measures, seasonality of avoided capacity benefits is more a function of system peak coincidence. Water heating loads are relatively similar year-round. However, water heater use is greatest in the morning, which aligns with the timing of winter system peaks. For the economic analysis, an equal weight was applied to avoided capacity benefits produced in the summer versus in the winter. To assess sensitivity to this assumption, two scenarios were reviewed: one in which only winter demand reduction benefits were included and one in which only summer demand benefits were included.

This sensitivity analysis revealed that the weighting of summer versus winter avoided capacity benefits does not alter the directional economics, largely because the portfolio includes a mix of summer and winter resources across measures and programs. That said, concentrating on the avoided cost of capacity exclusively in the winter worsens economic outcomes because the costs of smart thermostats for dual-fuel households are included without including benefits. Ultimately, the mix of measures in the DSM portfolio, including both summer resources like cooling on smart thermostats and primarily winter resources like water heater demand response, is reflective of the assumption that both winter and summer capacity reductions are valuable.

### 4.2.3 Overview of New Program Archetypes

The development of incremental DSM programs and measures for 2021-2040 was driven by several trends already underway both in South Carolina and across the electric industry at large.

1. **Preference for Smart Devices**: While direct load control of central air conditioners, heat pumps, and electric water heaters is projected to remain a core focus of DSM efforts across the Central system, the types of devices and communication protocols are evolving. In 2017 Central began to pilot smart thermostats for DR purposes and transitioned to a full program in 2018 with active participants at over half of the member-cooperatives. Central is currently piloting two Wi-Fi connected water heater control devices, and this IRP assumes these Wi-Fi enabled devices will replace radio and AMI switches going forward. The preference for smart devices is twofold. First, the smart devices are more attractive to member-cooperatives, which can increase adoption rates among member-owners. Second, the two-way communication capabilities of these devices allow for rapid and accurate impact analysis and increased visibility into the operability of the fleet of load management devices.
2. **Pursuit of Strategic Electrification Opportunities**: Electrification of transportation, space heating, water heating, and agricultural/industrial machinery has seen a sharp increase in policy support

across North America as states and municipalities pursue aggressive climate goals. Unlike EE, DR, and renewables, these offerings are load-building and increase the system requirements. The adoption rate of these technologies is an important consideration for long-term planning, and Central and its member-cooperatives' position is to help guide the member-owners through the conversion to electric equipment and promote technologies where the load shape makes economic sense.

3. **Focus Energy Efficiency Efforts on Equipment that Delivers Peak Demand Reduction**: End uses that drive system peaks, such as HVAC, water heating, and commercial lighting, are most viable for EE programs.

## Figure 4-6: DSM Measures and Descriptions

| DSM Resource Type | Sector(s) | Program Type | Measure | Measure Description |
|---|---|---|---|---|
| Demand Response | Residential, Commercial | On-going | Beat the Peak Alerts | Expansion of current program offering that provides behavioral messaging via email, text, and phone calls encouraging member-owners to shift demand off-peak. |
| Demand Response | Residential | On-going | Smart Thermostat (Dual Fuel) | Expansion of current offering that uses Wi-Fi connected devices to adjust the cooling set points of homes with central electric air conditioning and fossil fuel heat. |
| Demand Response | Residential | On-going | Smart Thermostat (All Electric) | Expansion of current offering that uses Wi-Fi connected devices to adjust the cooling and heating set points of homes with central electric air conditioning and electric heat. |
| Demand Response | Residential | Pilot | Wi-Fi Water Heater Controller | Wi-Fi connected devices used to shift water heating loads off peak during curtailment events. |
| Demand Response | Residential | Pilot | Whole House Generators | Provide financial incentives to homeowners with backup generators to self-generate electricity during curtailment events instead of taking power from the grid. |
| Demand Response | Residential, Commercial | Research | Battery Storage | Financial incentive to homeowners to install a battery backup that can be discharged during peak periods to provide load relief. |
| Demand Response | Residential, Commercial | Pilot | Managed Electric Vehicle Charging | For current EV owners. Direct load control of chargers or price signal to encourage member-owners to charge off-peak. |
| Energy Efficiency | Residential, Commercial | On-going | Audits | Used to identify efficiency and peak-demand saving upgrades within homes or businesses. |
| Energy Efficiency | Commercial | On-going | LED Lighting Upgrades | Rebates for the installation of high-efficiency lamps, fixtures, and control systems in commercial facilities. |
| Energy Efficiency | Commercial | Research | HVAC Upgrades | Rebates for installation of high-efficiency heating, ventilation, and air conditioning units and controls in commercial facilities. |
| Energy Efficiency | Commercial | Research | Cold Storage | Incentives for upgrades to commercial refrigeration equipment and building envelope improvements in cold storage facilities. |
| Energy Efficiency | Residential | On-going | Infiltration Improvements | Expansion of current On-Bill Weatherization offering. Blower door testing is used to identify leaks, and air sealing measures are installed to make the home tighter and thermally efficient. |
| Energy Efficiency | Residential | On-going | Duct Repair | Expansion of current On-Bill Weatherization offering. Duct blaster testing is used to identify air circulation issues, and repairs are made to improve the supply and return of conditioned air to the home. |
| Energy Efficiency | Residential | On-going | HVAC Upgrades | Expansion of current On-Bill Weatherization offering. HVAC contractors identify HVAC issues and repair or upgrade electric systems with new high-efficiency units. |
| Energy Efficiency | Residential, Commercial | Research | Heat Pump Water Heater | Incentivize member-owners who have electric resistance tank water heaters to upgrade to high-efficiency heat pump water heaters. |
| Energy Efficiency | Residential, Commercial | Research | Air Source Heat Pump | Incentivize member-owners with electric space heat to upgrade to high-efficiency air source heat pumps. |
| Energy Efficiency | Residential, Commercial | Research | Geothermal Heat Pump | Incentivize member-owners who have electric space heat to upgrade to high-efficiency ground source heat pumps or to install geothermal units during new construction. |

| DSM Resource Type | Sector(s) | Program Type | Measure | Measure Description |
|---|---|---|---|---|
| Beneficial Electrification | Residential, Commercial | Pilot | Electric Vehicles | Encourage the adoption of EVs in South Carolina through rebates on EV chargers that allow the member-cooperatives to interrupt on peak charging either directly or via tariffs (participation encouraged but not required). Could also include funds for facilitating installation of public charging infrastructure once sufficient EV adoption is achieved. |
| Beneficial Electrification | Residential | On-going | Dual Fuel Heat Pump | Incentivize member-owners with natural gas service to install dual fuel heat pumps, which use the heat pump compressor as the primary heating source and natural gas combustion as auxiliary heat at extreme conditions. |
| Beneficial Electrification | Residential, Commercial | Research | Heat Pump Water Heater | Incentivize member-owners who have fossil fuel water heaters to upgrade to a high-efficiency electric heat pump unit. |
| Beneficial Electrification | Residential, Commercial | Research | Air Source Heat Pump | Incentivize member-owners who have fossil fuel space heat to upgrade to a high-efficiency air source heat pump. |
| Beneficial Electrification | Residential, Commercial | Research | Geothermal Heat Pump | Incentivize member-owners who have fossil fuel heat to upgrade to a high-efficiency ground source heat pump. |
| Beneficial Electrification | Residential, Commercial | Research | Geothermal Heat Pump | Incentivize member-owners who have fossil fuel heat to upgrade to a high-efficiency ground source heat pump. |
| Beneficial Electrification | Commercial | Research | Forklifts and Off-road Vehicles | Encourage commercial accounts to transition from delivered fuel to electric charging and to charge the equipment off peak. |
| Beneficial Electrification | Commercial | Research | Heavy duty machinery | Encourage commercial accounts to transition energy-intense processes from natural gas and delivered fuel to electricity. |
| Beneficial Electrification | Residential, Commercial | Research | Golf carts | Incentivize golf courses and golf communities to adopt electric golf carts and charging infrastructure instead of gasoline. |
| Beneficial Electrification | Residential, Commercial | Research | Outdoor tools | Provide education, awareness, and incentives for adoption of electric lawn and garden tools. |

### 4.2.4 Business as Usual Funding Allocation

Central and the member-cooperatives contribute funding and administrative labor to DSM measures, and some member-cooperatives also administer programs tailored to their local communities. For the economic assessment, the collective DSM budget was assumed to remain at "Business as Usual" levels for the duration of the IRP study period. While estimates of incremental resources include forecasted incremental renewables, the economic assessment only includes budget dollars and resources associated with DR, EE, and BE.

### 4.2.5 Business as Usual Results

Participation and resource forecasts for each program were developed by scaling granular "bottom up" forecasts based on near- to medium-term plans to match these "top down" budget allocations. Forecasts for energy and capacity avoided by these incremental resources are a function of the participation forecasts and the assumptions for per-participant energy and demand impacts as well as useful life for each measure. Impacts and measure-life assumptions are based on a combination of program measurement and validation and industry standards.

Figures 4-7 and 4-8 show cumulative capacity reductions for the forecasted incremental DSM portfolio resources by budget category. The initial increase in resources reflects the increase in funding as the budget is reallocated away from renewables. Most measures have an assumed useful life of 10 to 15 years, so resources stabilize in the early 2030s as existing resources retire and are replaced by newer resources. Note that the vast majority of DSM capacity comes from demand response. Energy efficiency contributes relatively little capacity reduction and electrification contributes only a small increase.

**Figure 4-7: Incremental DSM Capacity Resources (MW) by Budget Category – Business as Usual**

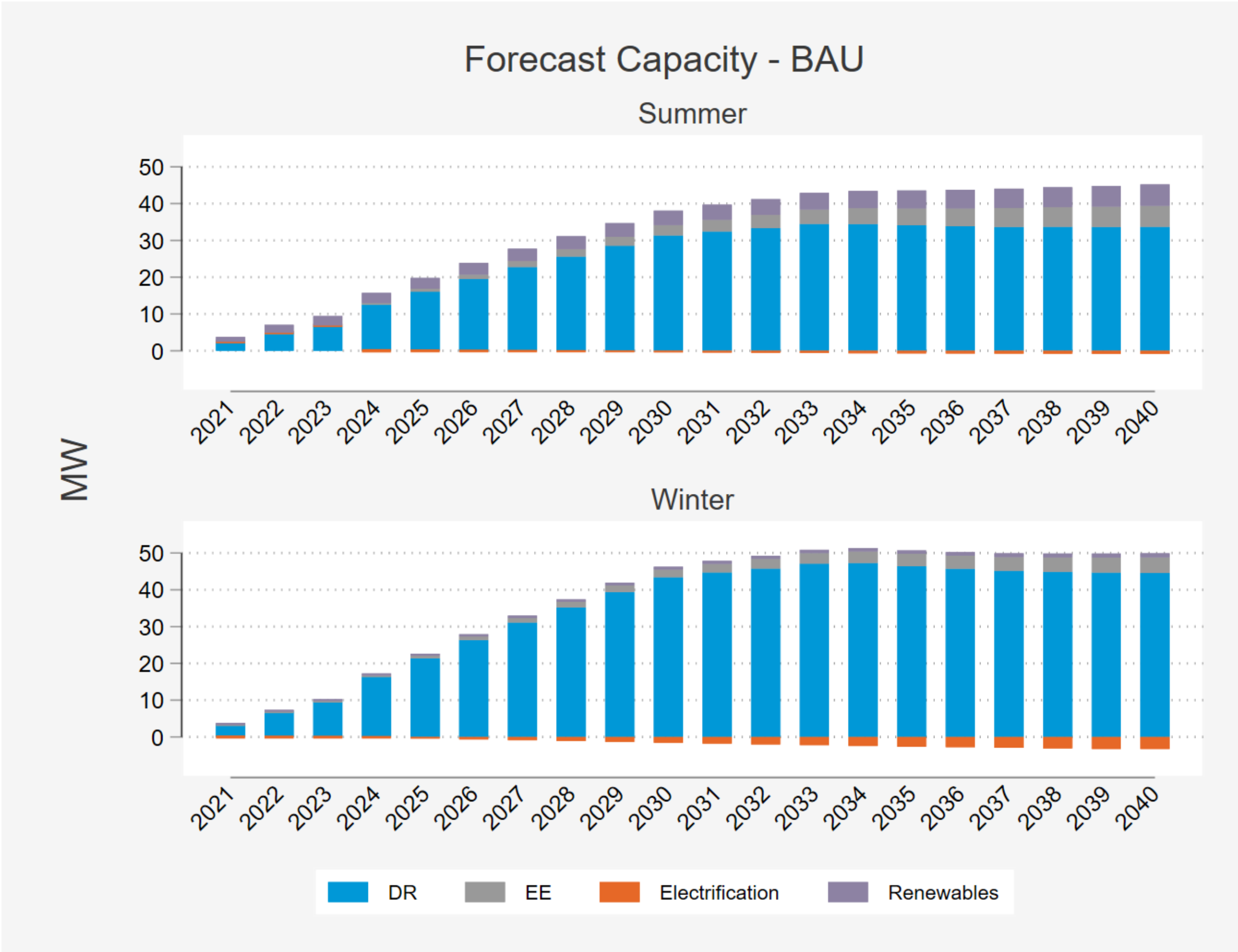



**Figure 4-8: Incremental DSM Capacity Resources (MW) by Budget Category – Business as Usual**

| Resource | 2022 | 2025 | 2030 | 2040 |
|---|---|---|---|---|
| DR | 6 | 19 | 37 | 39 |
| EE | 0 | 1 | 2 | 5 |
| Electrification | 0 | 0 | -1 | -2 |
| Renewables | 1 | 2 | 2 | 3 |
| **Total** | **7** | **21** | **41** | **46** |

Figures 4-9 and 4-10 show cumulative energy reductions for the forecasted incremental DSM portfolio resources. As with capacity, the increase in resources mirrors the allocation of budget to each resource. Notably, energy reductions from energy efficiency (in blue) are partially canceled out by energy increases due to electrification (in gray).

**Figure 4-9: Incremental DSM Energy Resources (GWh) by Budget Category – Business as Usual**

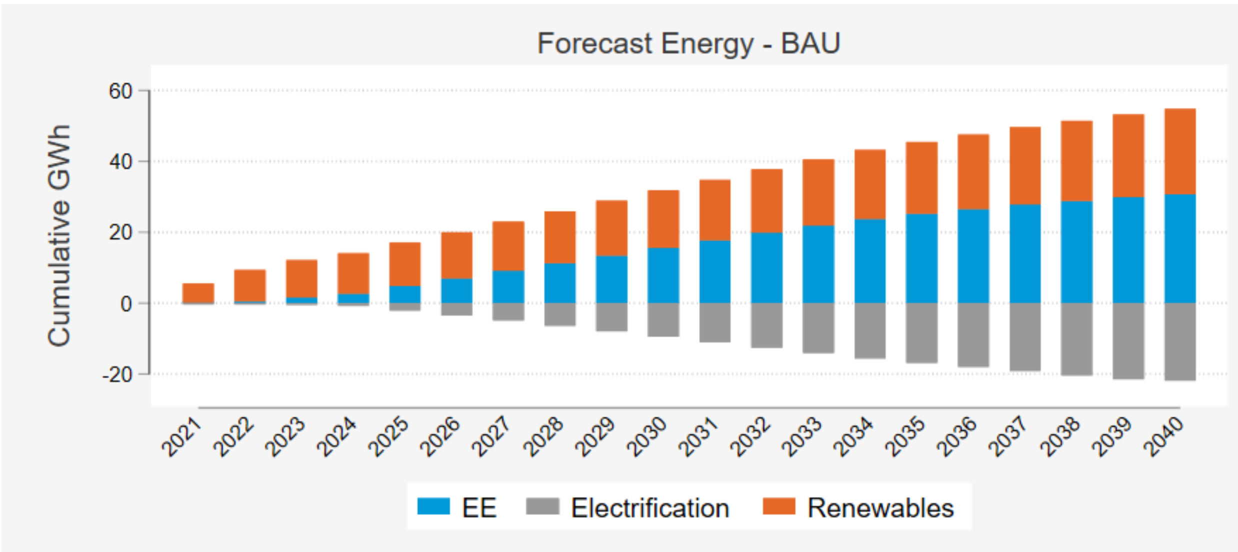



**Figure 4-10: Incremental DSM Energy Resources (GWh) by Budget Category – Business as Usual**

| Resource | 2022 | 2025 | 2030 | 2040 |
|---|---|---|---|---|
| EE | 1 | 5 | 16 | 31 |
| Electrification | 0 | -2 | -10 | -22 |
| Renewables | 9 | 12 | 16 | 24 |
| **Total** | **9** | **15** | **22** | **33** |

Figures 4-11 and 4-12 show the capacity forecast for incremental and existing resources. Note that while existing resources decline over time, this is largely offset by the addition of incremental resources, keeping the overall portfolio roughly at 95 MW across summer and winter.

**Figure 4-11: Existing and Incremental DSM Capacity Forecast (MW) – Business as Usual**

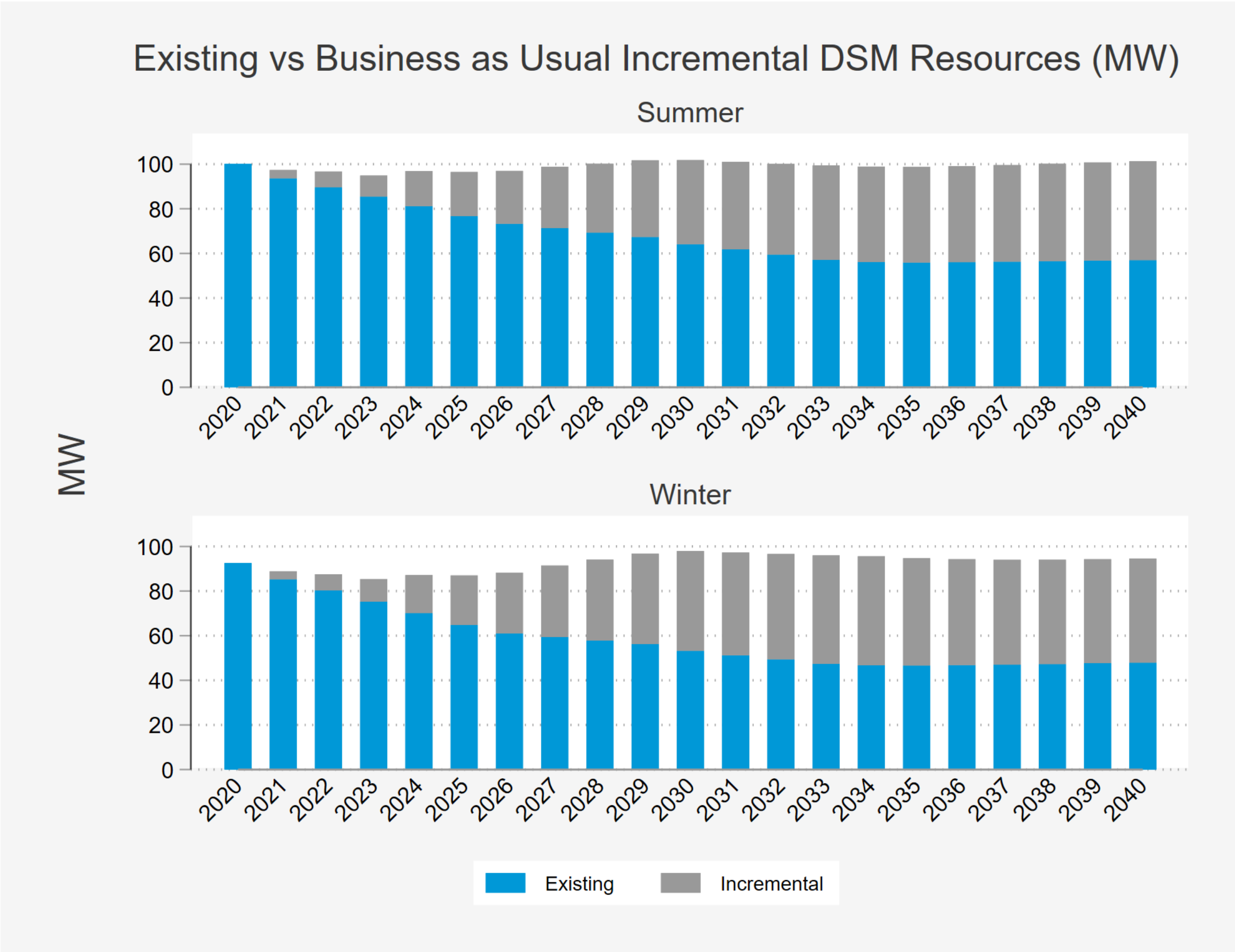



**Figure 4-12: Existing and Incremental DSM Capacity Forecast (MW) – Business as Usual**

| Season | Resource | 2022 | 2025 | 2030 | 2040 |
|---|---|---|---|---|---|
| Summer | Existing | 90 | 77 | 64 | 57 |
| | Incremental | 7 | 20 | 38 | 44 |
| Winter | Existing | 80 | 65 | 53 | 48 |
| | Incremental | 7 | 22 | 45 | 47 |

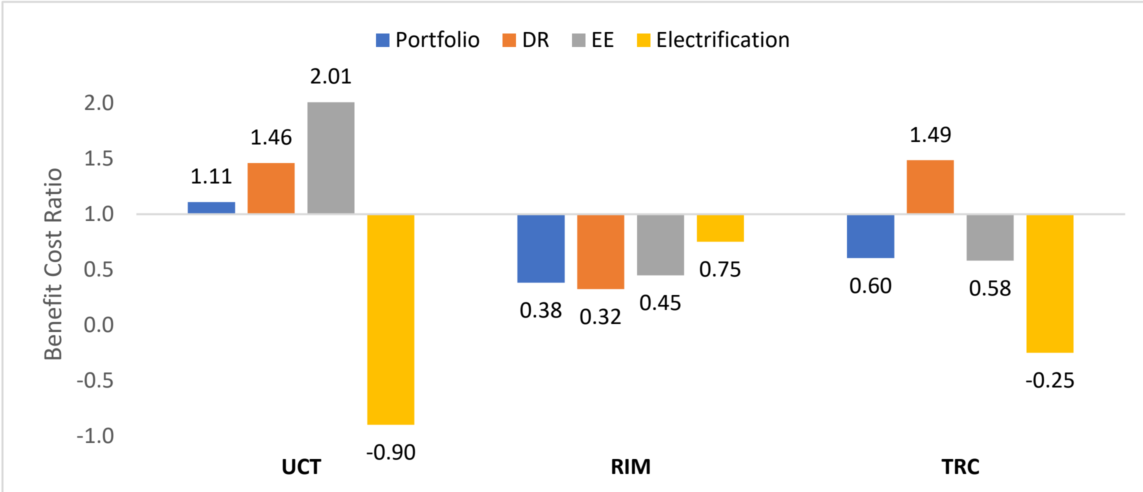
The economic assessment of the Central Business as Usual DSM portfolio evaluated the utility cost perspective (UCT), the ratepayer impact perspective (RIM), which includes the impact of changes to utility revenue, and the total resource perspective (TRC), which includes participant costs. Including these standard cost tests provides a more complete assessment of portfolio economics. This assessment includes lifetime benefits and costs for incremental DSM resources forecasted for 2021 through 2040. Importantly, the assessment focused on electric resources only and did not include fuel costs avoided by participants (which would improve outcomes for electrification) or any estimated reduction of participant utility due to load curtailment (which would decrease outcomes for demand response).

Figure 4-13 shows the benefit-cost ratios from the three perspectives. Outcomes are shown for DR programs, EE programs, beneficial electrification, and for the whole DSM portfolio. Key observations include:

- From the utility perspective, the DSM portfolio is cost-effective (benefit-cost ratio above 1.0) with a benefit-cost ratio of 1.11. DR (benefit-cost ratio of 1.46) and EE (benefit-cost ratio of 2.01) programs are each cost effective, with a combined benefit-cost ratio of 1.56. Electrification programs have a negative benefit-cost ratio (-0.90) because of the increase in energy and capacity (and a reduction in avoided costs) that results from electrification of new end uses. However, electrification also provides valuable benefits in the form of potential emission reductions and new revenue sources that partially offset lost revenue due to DR and EE programs. Importantly, a utility that supplies electricity and gas would recognize avoided fuel costs due to end-use fuel switching. Because Central is an electric-only utility, it experiences electric resource cost increases without commensurate fuel resource cost savings.
- The individual categories and portfolio are not cost-effective from a RIM perspective. This is expected because it considers changes in utility revenue. However, relative to the other budget categories the benefit-cost ratio is highest for electrification due to the increase in energy sales from newly electrified end uses.
- From the TRC perspective only demand response is cost-effective due to the inclusion of the cost of participant measures.[7] This essentially increases the denominator (costs) while keeping the numerator (benefits) constant. Demand response outcomes are very similar to the UCT perspective because all costs are borne by the utility and non-monetary participant impacts are not factored in, though this is sometimes done for this test.

[7] Though the TRC test includes participant measure costs, it does not fully reflect the economics to the participant because it includes marginal avoided costs (costs to the system) rather than retail resource costs (cost to the end-use customer). The Participant Cost Test (PCT) can be used to assess economics to the end-use customer, but, given the system-wide focus of an IRP, this test was not included in the assessment.

**Figure 4-13: Benefit-Cost Ratios for DSM Portfolio Categories**




## 4.3 Aggressive DSM Scenario

As a sensitivity analysis, a second DSM portfolio scenario was also constructed and assessed. The goal of this "Aggressive" scenario is to analyze whether substantial increases to DSM resources would meaningfully impact the overall Central resource mix. The Aggressive scenario was designed to be feasible within the range of neighboring utilities' DSM program spending. The following sections discuss the regional context for DSM, funding assumptions for the Aggressive scenario, resulting resource magnitudes, and economics.

### 4.3.1 Funding Assumptions

For the Aggressive scenario, DSM spending was assumed to ramp up to reach roughly 4.7 times that of the Business as Usual scenario by 2027. To translate this budget scenario into a participation forecast program, administration costs were kept largely fixed, consistent with the assumption that incremental revenue would largely be allocated towards growing participation. Some additional administrative costs were included to cover the likelihood that additional staffing would be needed to support a DSM budget of this magnitude.

To develop forecasts for incremental resources in future years for the Aggressive scenario, the forecasted budget was allocated across the same four key spending categories using the same annual budget shares as applied to the Business as Usual scenario. For incremental renewables, annual additions are assumed to reach an equilibrium of 1 MW of AC capacity per year starting in 2025, compared to 0.5 MW of AC capacity in the Business as Usual scenario. This higher rate of additions is meant to capture conditions generally more favorable to renewables and could include increased marketing, offering of value of solar (VOS) tariffs by additional member-cooperatives, a more favorable VOS tariff, or lower market costs for solar modules.

### 4.3.2 Aggressive Scenario Results

Participation and resource forecasts for each program were developed by scaling granular "bottom up" forecasts based on near-term to medium-term plans to match the "top down" allocations of the

Aggressive budget. Forecasts for energy and capacity avoided by these incremental resources are a function of the participation forecasts and the assumptions for per-participant energy and demand impacts as well as useful life for each measure. Impacts and measure-life assumptions are based on a combination of program measurement and validation and industry standards.

Figures 4-14 and 4-15 show cumulative capacity reductions for the forecasted incremental DSM portfolio resources by budget category. The initial increase in resources reflects a more than four-fold increase in funding as budget is scaled up from Business as Usual levels to Aggressive levels by 2027. Subsequent growth in resources continues for another eight years until equilibrium is reached between retirement of existing resources and replacement by newer resources. Note that the vast majority of DSM capacity comes from demand response. Energy efficiency contributes relatively little capacity reduction and electrification contributes only a small increase.

**Figure 4-14: Incremental DSM Capacity Resources (MW) by Budget Category – Aggressive**

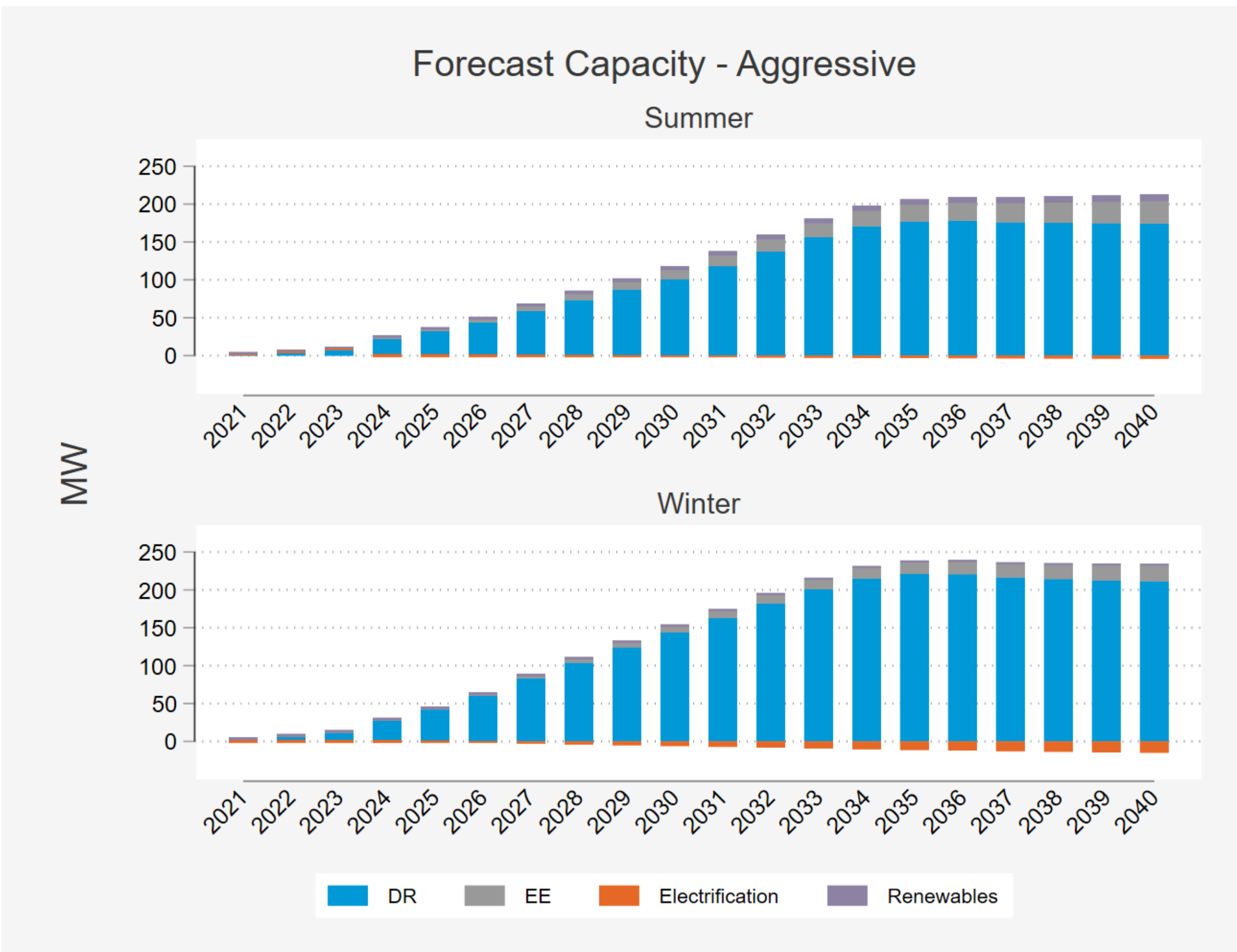


**Figure 4-15: Incremental DSM Capacity Resources (MW) by Budget Category – Aggressive**

| Resource | 2022 | 2025 | 2030 | 2040 |
|---|---|---|---|---|
| DR | 7 | 37 | 122 | 193 |
| EE | 0 | 2 | 10 | 25 |
| Electrification | 0 | -1 | -4 | -10 |
| Renewables | 1 | 2 | 3 | 6 |
| **Total** | **8** | **41** | **132** | **214** |

Figures 4-16 and 4-17 show cumulative energy reductions for the forecasted incremental DSM portfolio resources in the Aggressive scenario. As with capacity, the ramp reflects the timing of budget increases. Notably, energy reductions from energy efficiency (in blue) are partially canceled out by energy increases due to electrification (in grey).

**Figure 4-16: Incremental DSM Energy Resources (GWh) by Budget Category – Aggressive**

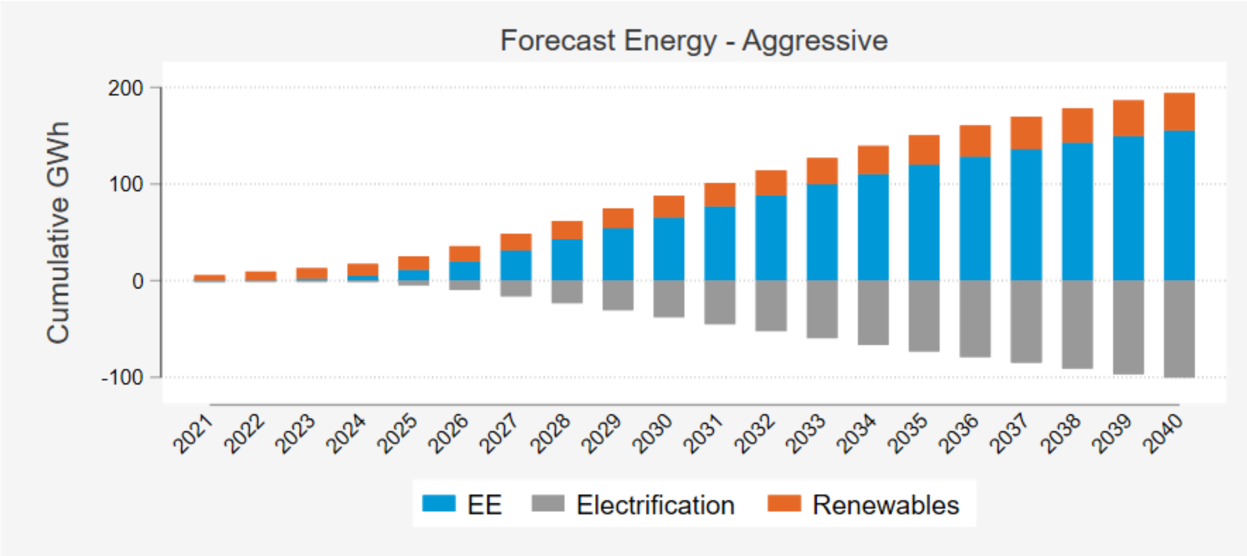



**Figure 4-17: Incremental DSM Energy Resources (GWh) by Budget Category – Aggressive**

| Resource | 2022 | 2025 | 2030 | 2040 |
|---|---|---|---|---|
| EE | 1 | 11 | 66 | 156 |
| Electrification | 0 | -5 | -38 | -100 |
| Renewables | 9 | 14 | 22 | 39 |
| **Total** | **9** | **21** | **50** | **94** |

Figures 4-18 and 4-19 show the capacity forecast for incremental and existing resources for the Aggressive scenario. For the Business as Usual scenario, the full portfolio remained at roughly 90 MW over time, while in the Aggressive scenario the full portfolio reaches about 260 MW of summer resources and 275 MW of winter resources. This includes approximately 205 MW of incremental summer resources and 220 MW of winter resources once resource equilibrium is reached in the mid-2030s.

**Figure 4-18: Existing and Incremental DSM Capacity Forecast (MW) – Aggressive**

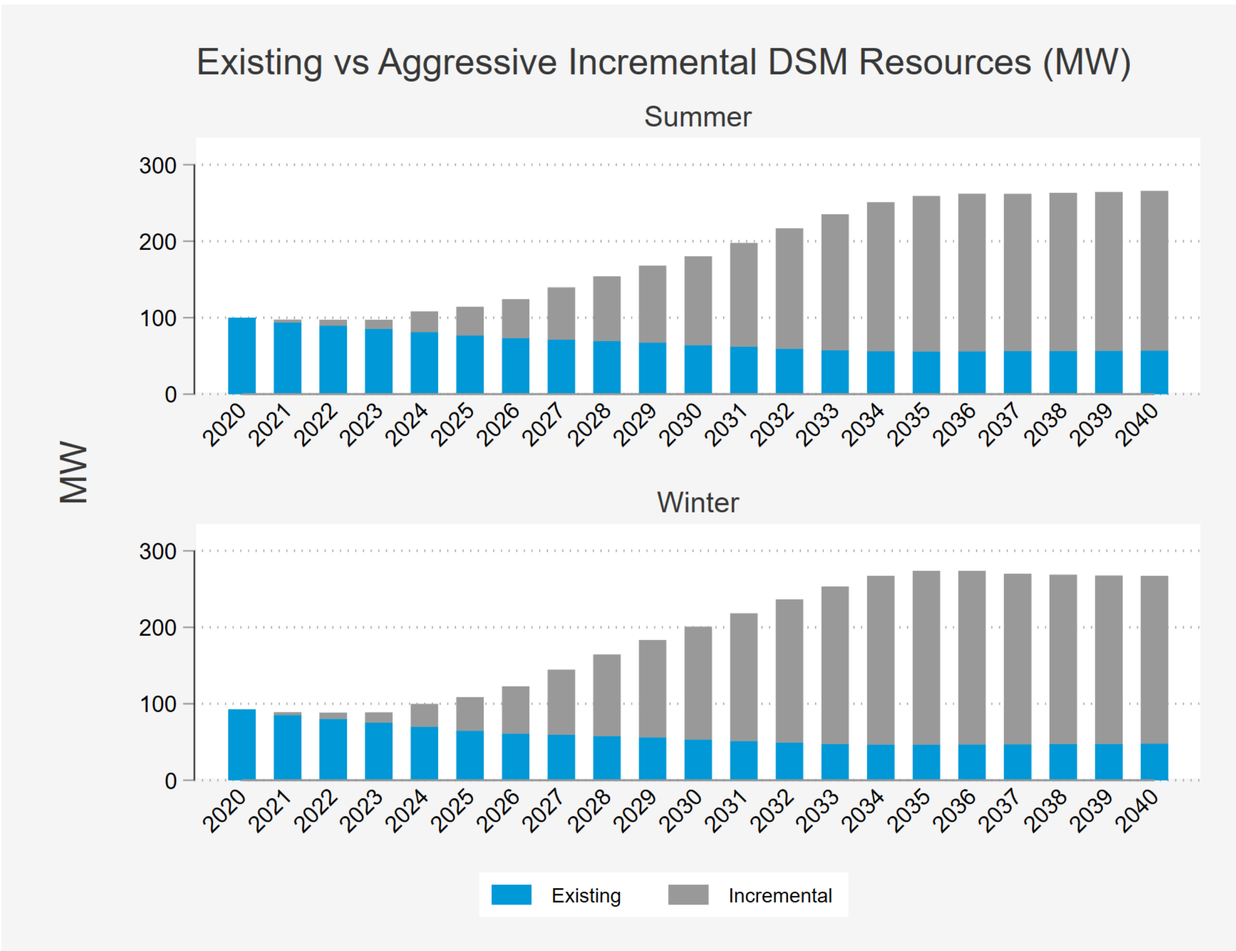



**Figure 4-19: Existing and Incremental DSM Capacity Forecast (MW) – Aggressive**

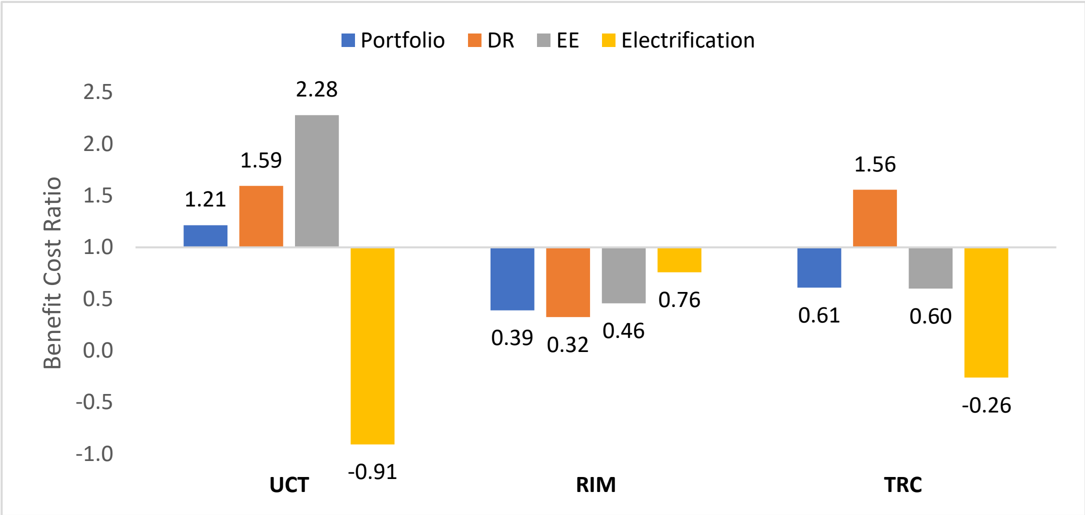
| Season | Resource | 2022 | 2025 | 2030 | 2040 |
|---|---|---|---|---|---|
| Summer | Existing | 90 | 77 | 64 | 57 |
| | Incremental | 8 | 37 | 116 | 209 |
| Winter | Existing | 80 | 65 | 53 | 48 |
| | Incremental | 8 | 44 | 147 | 219 |

First the economic assessment of the Central Aggressive DSM portfolio evaluated the utility cost perspective (UCT), second the economic assessment evaluated the ratepayer impact perspective (RIM)—which includes the impact of changes to utility revenue— third, the total resource perspective (TRC), which includes participant costs. Including these standard cost tests provides a more complete assessment of portfolio economics. This assessment includes lifetime benefits and costs for incremental DSM resources forecasted for 2021 through 2040. Importantly, the assessment focused on electric resources and did not include fuel costs avoided by participants (which would improve outcomes for electrification) or any estimated reduction of participant utility due to load curtailment (which would decrease outcomes for demand response).

Figure 4-20 shows the benefit-cost ratios from the three perspectives for each budget category and for DR programs, EE programs, beneficial electrification, and for the portfolio as a whole. Key observations include:

- The economic outcomes for the Aggressive scenario are directionally similar and slightly more beneficial than under the Business as Usual scenario due to economies of scale from delivering larger programs. Though total costs are higher under the Aggressive scenario, this higher level of budget spending produces some degree of economies of scale.
- The result from the utility perspective is that the DSM portfolio is slightly more cost-effective under the Aggressive scenario (benefit-cost ratio of 1.21) than under the Business as Usual scenario (benefit-cost ratio of 1.11). DR (benefit-cost ratio of 1.59) and EE (benefit-cost ratio of 2.28) programs are each cost-effective. EE is meaningfully more cost-effective under the Business as Usual scenario (2.01). Electrification programs have a negative benefit-cost ratio (-0.91) because of the increase in energy and capacity (and a reduction in avoided costs) that results from electrification of new end uses. However, electrification also provides valuable benefits in the form of new revenue sources, which partially offset lost revenue due to DR and EE programs. Importantly, a dual-fuel utility would recognize avoided fuel costs due to end-use fuel switching. Because Central is an electric-only utility, it experiences electric resource cost increases without commensurate fuel resource cost savings.
- The individual categories and portfolios are not cost effective from a RIM perspective. This is expected because it considers changes in utility revenue. However, relative to the other budget categories, the benefit-cost ratio is highest for electrification due to the increase in energy sales from newly electrified end uses.
- From the TRC perspective, only demand response is cost-effective, due to the inclusion of participant measure costs.[8] This essentially increases the denominator (costs) while keeping the numerator (benefits) constant. Demand response outcomes are very similar to the UCT perspective because all costs are borne by the utility and non-monetary participant impacts are not included.

**Figure 4-20: Benefit-Cost Ratios for DSM Portfolio Categories**



# 5 Load Forecast

# 5 Load Forecast

## 5.1 Methodology

The load forecast is a key input in Central's resource plan. The 2020 Central Load Forecast is the sum of the 20 member-cooperative forecasts through 2040. The peak forecast identifies capacity requirements necessary for the system to maintain reliability. Central completes a load forecast annually for each of its 20 member-cooperatives by allocating member-cooperative loads into classes according to standards set forth in the RUS Form 7. The Form 7 classes are: Residential, Small Commercial, Large Commercial & Industrial, Seasonal, Irrigation, Lighting, and Other load classes.

Residential and Small Commercial classes are forecasted using the industry standard Statistically Adjusted End-Use (SAE) modeling, discussed in more detail later in this section. Residential energy is modeled by forecasting the number of residential member-owners and the average use per member-owner. Due to energy efficiency trends, residential growth comes from new residential member-owners on the system. Similarly, Small Commercial growth is driven by additional member-owners. The Industrial subset of Large Commercial and Industrial is forecasted individually in close consultation with member-cooperatives. The remaining classes (Seasonal, Irrigation, Lighting, and Other) are forecasted using linear trends and historical averages.

Weather sensitive loads are modeled using 30-year rolling temperature averages. The member-cooperatives are each assigned one of the following airport weather stations: Greenville-Spartanburg, Columbia, Savannah, Charleston, or Florence. Peak Heating Degree Days are calculated with a base of 55, and Cooling Degree Days base of 75. Energy forecasts use the Degree Day base of 65 for both heating and cooling. Deviations from the base degree cause increases in the degree days.[9] Degree Days are a forecasting tool used to better analyze the impact of temperature on electric loads. Increases in degree days result in increases in weather related loads, such as heating and air conditioning.

Economic and demographic projections are obtained from IHS Markit, a nationally recognized economic forecasting firm. These are county-level forecasts for South Carolina. Each member-cooperative's economic forecast is based on the counties in its service territory. Below are the projected average annual growth rates of key economic drivers for South Carolina. Economic data for individual member-cooperatives can vary from the state averages due to the economic data of the counties in their service territories.

**Figure 5-1: Average Annual Growth for South Carolina 2020-2040**

| | |
|---|---|
| Gross State Product | 2.0% |
| Real Personal Income | 2.5% |
| Households | 1.0% |

[9] Using a base of 75, an average peak day temperature of 90 will yield a cooling degree day value of 15. Degree-Days are non-negative, so the Heating Degree Day value in this example is 0.

No increase in electric vehicles or behind-the-meter solar penetration is explicitly modeled in the Base forecast. Existing solar and electric vehicles are instead embedded in the Base forecast. Scenario forecasts are explained in Section 6 of this report. The Base Forecast excludes adverse economic and load impacts of the coronavirus (COVID-19) pandemic. Central developed a COVID-19 scenario that sits between the Base and Low Cases. This is explained in more detail in section 5.3.

## 5.2 Base Load Forecast

The SAE modeling methodology combines linear regression analysis with end-use models. It employs end-use data, housing information, weather data, economic data and price projections. It explicitly accounts for future energy efficiencies that may not be included in the load history. The end-use data includes appliance efficiency trends and appliance saturations.

Linear regression analysis calculates the historical relationship between variables by estimating a line-of-best-fit through the sample. In this process, the predictor variables are measured against the dependent variable, and the resulting coefficients quantify the relationship. For example, the forecast uses linear regressions to estimate coefficients between total households in a county and a member-cooperative's residential member-owners. SAE modeling uses the linear regression framework on end-use models to create the energy and peak forecasts. End-use models use appliance stock to forecast retail use. Estimates of household appliances such as electric water heaters, heat pumps, televisions, and refrigerators are used. Commercial end-use models use heating, cooling, floor space, lighting, and refrigeration. The total appliance stock is multiplied by the average electric use of the appliance (use-per). This method requires much data collection—even estimates of the square footage of a house or commercial building—and appliance use analysis to make total energy balance with existing sales. SAE models allow for reasonable end-use estimates to be calibrated to actual load using linear regression. These models depend upon reliable efficiency projections. Central uses energy efficiency projections for the South Atlantic Census Region produced annually by the Energy Information Administration (EIA). Central then customizes the appliance share forecasts using the member-cooperatives' most recent appliance saturation survey results.

Central's member-cooperatives collect appliance saturation surveys from their member-owners every three years. These surveys collect information on home air conditioning type, kitchen appliances, and lighting type. The survey gives Central and its member-cooperatives a clearer understanding of the characteristics of the residential housing stock in member-cooperative service territories, forming the basis for updating current appliance share estimates and forecasts for each member-cooperative. The average-use-per-household forecast is the product of the appliances operated in the household and the efficiency of those appliances. Future efficiency improvements are both naturally occurring, as technology improvements make their way into member-owner households and are based on federal mandates. Efficiency mandates are not immediately adopted, and the EIA makes predictions regarding the rate at which these efficiencies are adopted into the average household.

There are two elements to the load forecast: peaks and energy. Energy, the total amount of electricity consumed over a month, is forecasted as described above. Peaks, the highest electric load level on the system in an hour, are modeled using a combination of SAE and historical averages. Large Industrial peaks are modeled individually using historical peaks. New Large Industrials are projected using future billing estimates provided by the member-cooperative. Non-industrial load is modeled using SAE. Weather-sensitive load is estimated by interacting monthly energy forecasts with average peak-day temperatures. Baseload is not weather sensitive and uses peak fractions to determine the contribution to the monthly peak. Peak fractions are estimates of appliance load during the monthly peak hour. For example, if 15% of electric water heaters are online during the February peak hour, electric water heaters would have a peak fraction of 0.15 in February.

### 5.2.1 Member-Owner Forecasts

Below are the member-owner forecasts for the 20 member-cooperatives. Figure 5-1 shows the number of member-owners served by member-cooperatives, categorized by class designations from the RUS Form 7.

**Figure 5-1: Member-Owner Accounts Forecast by Class**

| Year | Residential | Small Commercial | Large Commercial | Other | Lighting | Irrigation | Seasonal |
|---|---|---|---|---|---|---|---|
| 2020 | 735,885 | 84,537 | 369 | 2,320 | 1,628 | 1,434 | 1,814 |
| 2021 | 746,885 | 85,265 | 369 | 2,320 | 1,628 | 1,437 | 1,814 |
| 2022 | 756,762 | 85,912 | 369 | 2,320 | 1,628 | 1,440 | 1,814 |
| 2023 | 766,176 | 86,536 | 369 | 2,320 | 1,628 | 1,443 | 1,814 |
| 2024 | 775,223 | 87,222 | 369 | 2,320 | 1,628 | 1,446 | 1,814 |
| 2025 | 784,389 | 87,964 | 369 | 2,320 | 1,628 | 1,449 | 1,814 |
| 2026 | 793,604 | 88,722 | 369 | 2,320 | 1,628 | 1,452 | 1,814 |
| 2027 | 802,735 | 89,488 | 369 | 2,320 | 1,628 | 1,455 | 1,814 |
| 2028 | 812,034 | 90,254 | 369 | 2,320 | 1,628 | 1,458 | 1,814 |
| 2029 | 821,436 | 91,062 | 369 | 2,320 | 1,628 | 1,461 | 1,814 |
| 2030 | 830,959 | 91,867 | 369 | 2,320 | 1,628 | 1,464 | 1,814 |
| 2031 | 840,594 | 92,653 | 369 | 2,320 | 1,628 | 1,467 | 1,814 |
| 2032 | 850,256 | 93,479 | 369 | 2,320 | 1,628 | 1,470 | 1,814 |
| 2033 | 859,870 | 94,280 | 369 | 2,320 | 1,628 | 1,473 | 1,814 |
| 2034 | 869,424 | 95,072 | 369 | 2,320 | 1,628 | 1,476 | 1,814 |
| 2035 | 878,987 | 95,855 | 369 | 2,320 | 1,628 | 1,479 | 1,814 |
| 2036 | 888,621 | 96,635 | 369 | 2,320 | 1,628 | 1,482 | 1,814 |
| 2037 | 898,282 | 97,422 | 369 | 2,320 | 1,628 | 1,485 | 1,814 |
| 2038 | 907,993 | 98,212 | 369 | 2,320 | 1,628 | 1,488 | 1,814 |
| 2039 | 917,761 | 99,002 | 369 | 2,320 | 1,628 | 1,491 | 1,814 |
| 2040 | 927,584 | 99,798 | 369 | 2,320 | 1,628 | 1,494 | 1,814 |
| **Growth Rate** | 1.2% | 0.8% | 0.0% | 0.0% | 0.0% | 0.2% | 0.0% |

### 5.2.2 Central Demand and Energy Forecast

Below in Figure 5-2 are the base peak and energy forecasts for Central. These projections are at the generation level, meaning that they include all losses incurred as power flows between the generating stations and the member-owner.

**Figure 5-2: Central Demand and Energy Forecast (MW)**

| Year | Summer Peak | Winter Peak | Energy |
|---|---|---|---|
| 2020 | 3,776 | 4,273 | 19,013,291 |
| 2021 | 3,845 | 4,324 | 19,341,329 |
| 2022 | 3,900 | 4,373 | 19,659,974 |
| 2023 | 3,942 | 4,418 | 19,907,944 |
| 2024 | 3,985 | 4,471 | 20,210,524 |
| 2025 | 4,024 | 4,515 | 20,346,333 |
| 2026 | 4,056 | 4,551 | 20,483,036 |
| 2027 | 4,092 | 4,588 | 20,627,910 |
| 2028 | 4,128 | 4,632 | 20,837,420 |
| 2029 | 4,171 | 4,669 | 20,941,239 |
| 2030 | 4,207 | 4,704 | 21,083,958 |
| 2031 | 4,245 | 4,740 | 21,232,792 |
| 2032 | 4,281 | 4,780 | 21,442,244 |
| 2033 | 4,326 | 4,814 | 21,545,762 |
| 2034 | 4,368 | 4,852 | 21,703,919 |
| 2035 | 4,413 | 4,891 | 21,870,299 |
| 2036 | 4,456 | 4,937 | 22,105,285 |
| 2037 | 4,511 | 4,978 | 22,237,227 |
| 2038 | 4,562 | 5,024 | 22,427,834 |
| 2039 | 4,614 | 5,072 | 22,623,156 |
| 2040 | 4,663 | 5,122 | 22,826,503 |
| Average Annual Growth Rate | 1.0% | 0.9% | 0.9% |

### 5.2.3 DSM and Energy Efficiency in the Base Forecast

The base forecast has over 90 MW of existing DSM. Naturally occurring energy efficiencies are embedded in the base forecast using the EIA's efficiency projections of the South Atlantic Census region. These are based on national efficiency mandates unfolding throughout the forecast period. Current mandates will not be reflected in the average appliance for many years. Further explanation of existing and forecasted DSM is covered in Section 4 of this report.

### 5.2.4 Load Duration Curves

Figure 5-4 is a projected load duration curve for 2020 using normal weather. Load duration curves are created by ranking hourly loads from highest to lowest. This demonstrates the overall shape of the utility's load. The shape of a utility's load helps determine the resource plan. A utility with a relatively flat load shape will prioritize resources differently from a utility with a heavily residential load shape. Residential load tends to have high peaks when member-owners are at home and temperatures are most extreme.

HVAC load is the largest contributor to a home's energy use. This translates into low energy use when temperatures are mild or when the home is unoccupied. Residential energy sales are lowest during the temperate months (March, April, October, and November).

Central's high saturation of residential load makes member-cooperative load sensitive to weather, so a simulation with average weather is used. In Figure 5-3, load duration curves for 2018 (a severe-weather winter) and 2019 (a mild-weather winter) are also included to give a range of weather impacts.

**Figure 5-3: Historical Hourly Load Duration Curves**

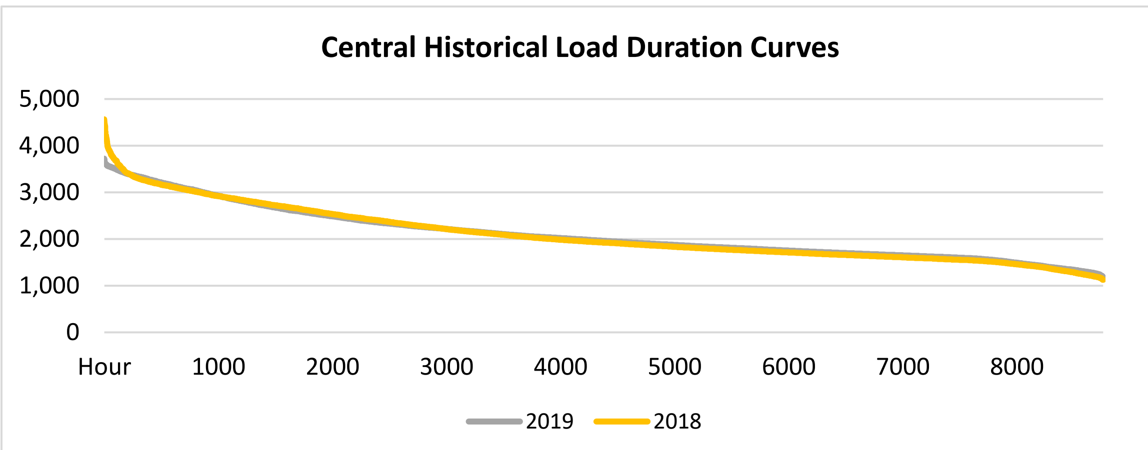
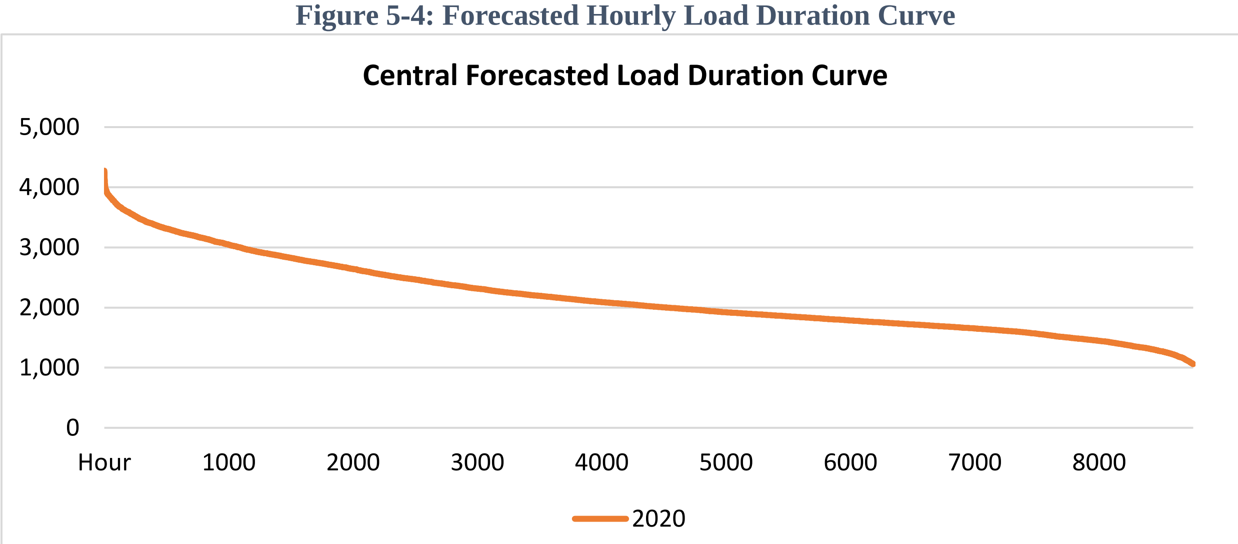



**Figure 5-4: Forecasted Hourly Load Duration Curve**



## 5.3 Load Forecast Scenarios

High and low load growth scenarios are demonstrated below in Figure 5-5. The low-growth scenario uses economic growth that is one standard deviation below the IHS Markit base forecast. (Standard deviation measures the variability of individual values from the average.) The growth rates for all economic and demographic categories are reduced by the standard deviation calculation. For example, a standard deviation estimate of 0.5% and a growth estimate of 1.2% yields 0.7% growth in the low-growth scenario. Residential member-owner forecasts are also one standard deviation below projections. High-growth scenarios are calculated similarly, but one standard deviation is added for economic growth and the member-owner forecasts.

Standard deviations are calculated for each member-cooperative using the years 2000-2019. These estimates assume normal distributions around the base forecast. The base forecast values of the residential member-owner forecasts and economic projections serve as the mean. The range between the high- and low-growth rates represents 68.3% of the possible values.

The low-growth scenarios are approximately 0.5% per year for the period. The low-growth scenario incorporates the negative economic impacts due to COVID-19. Large industrial loads are more sensitive to economic recessions than residential loads, and this reduces energy in the early forecast years. The high-growth scenario estimates a 1.7% annual growth and excludes negative impacts from COVID-19.

The COVID-19 scenario forecasts electric sales using a 30% GDP contraction in the second quarter of 2020. While the third quarter bounces back strongly, it does not assume a V-shaped recovery. Economic output does not return to 2019 levels until 2022.[10] Twenty years of historical data are used in the scenario forecasts. Residential, Small Commercial, and Large Commercial classes are modeled.

[10] IHS Markit COVID Scenario Forecast for South Carolina published in April 2020

**Figure 5-5: Forecasted Scenarios**

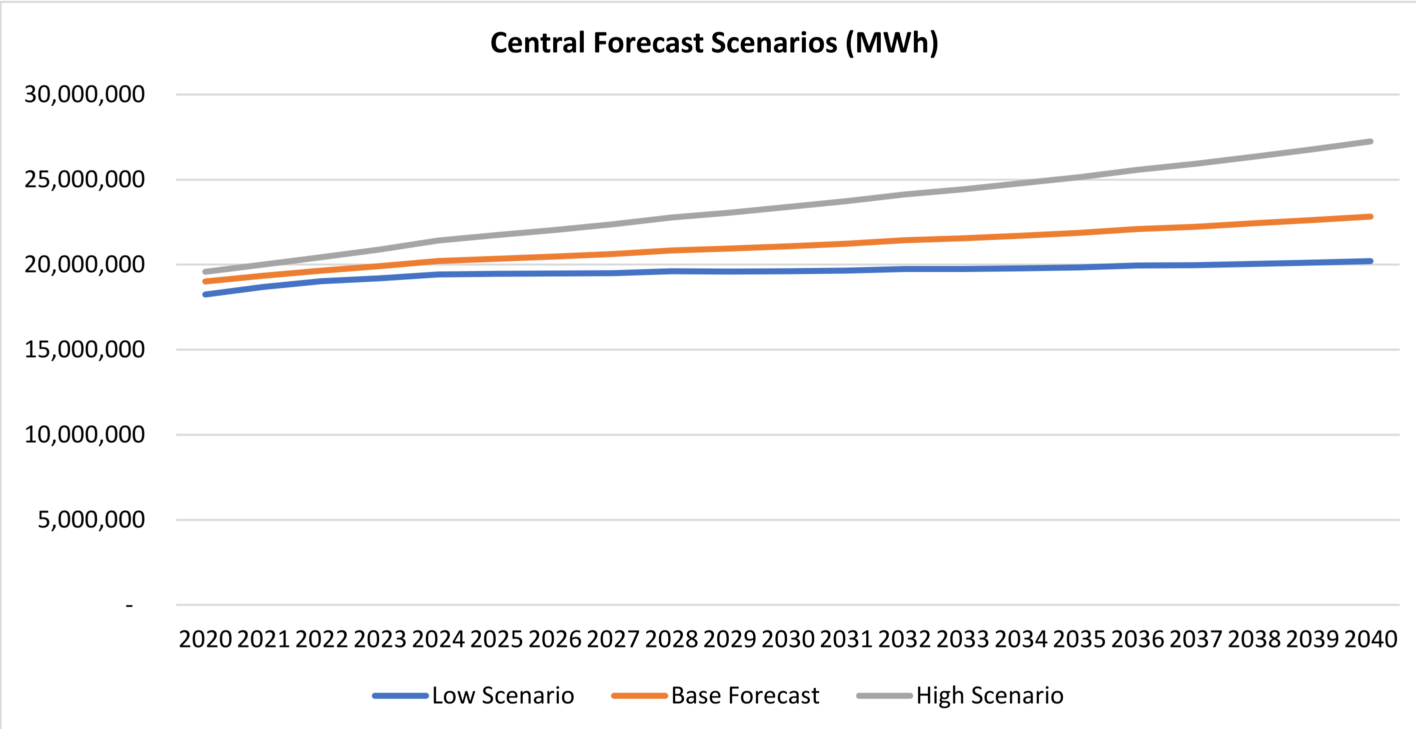



**Figure 5-6: Forecasted Winter Peak Scenarios**

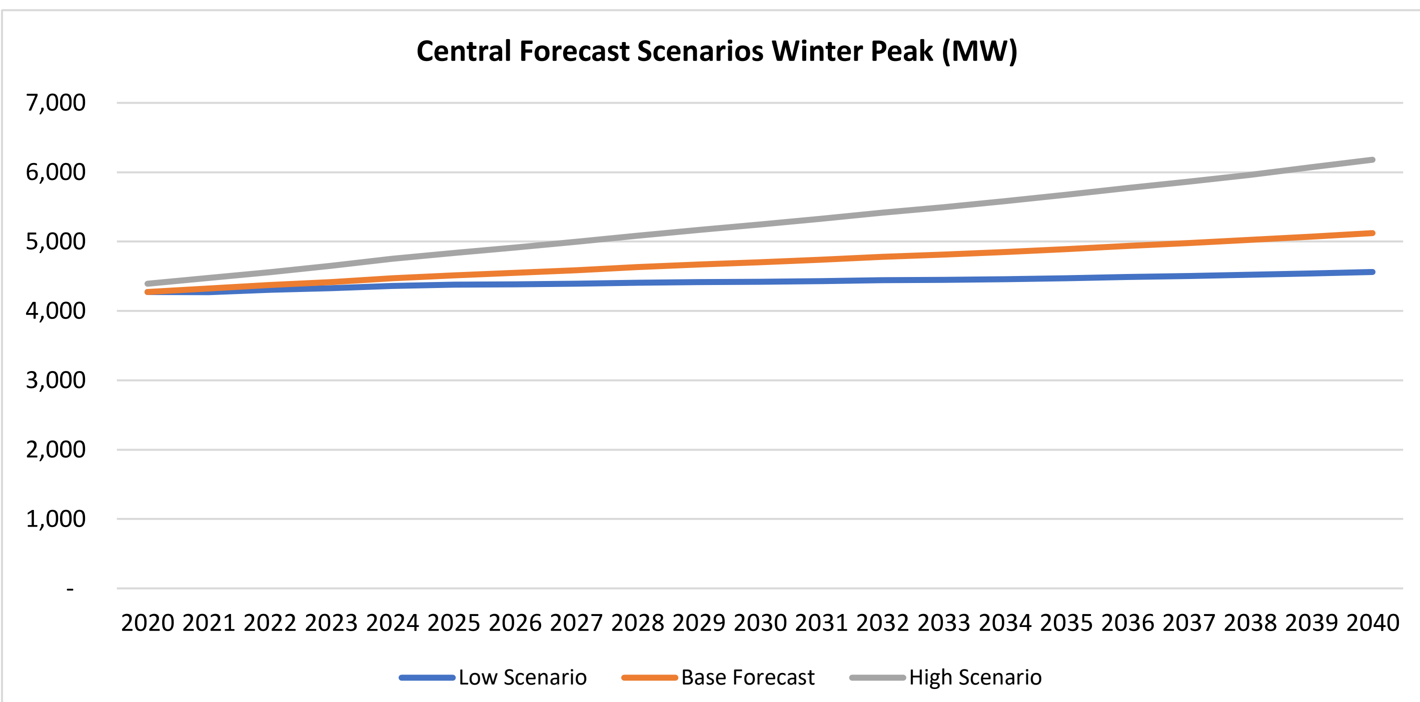
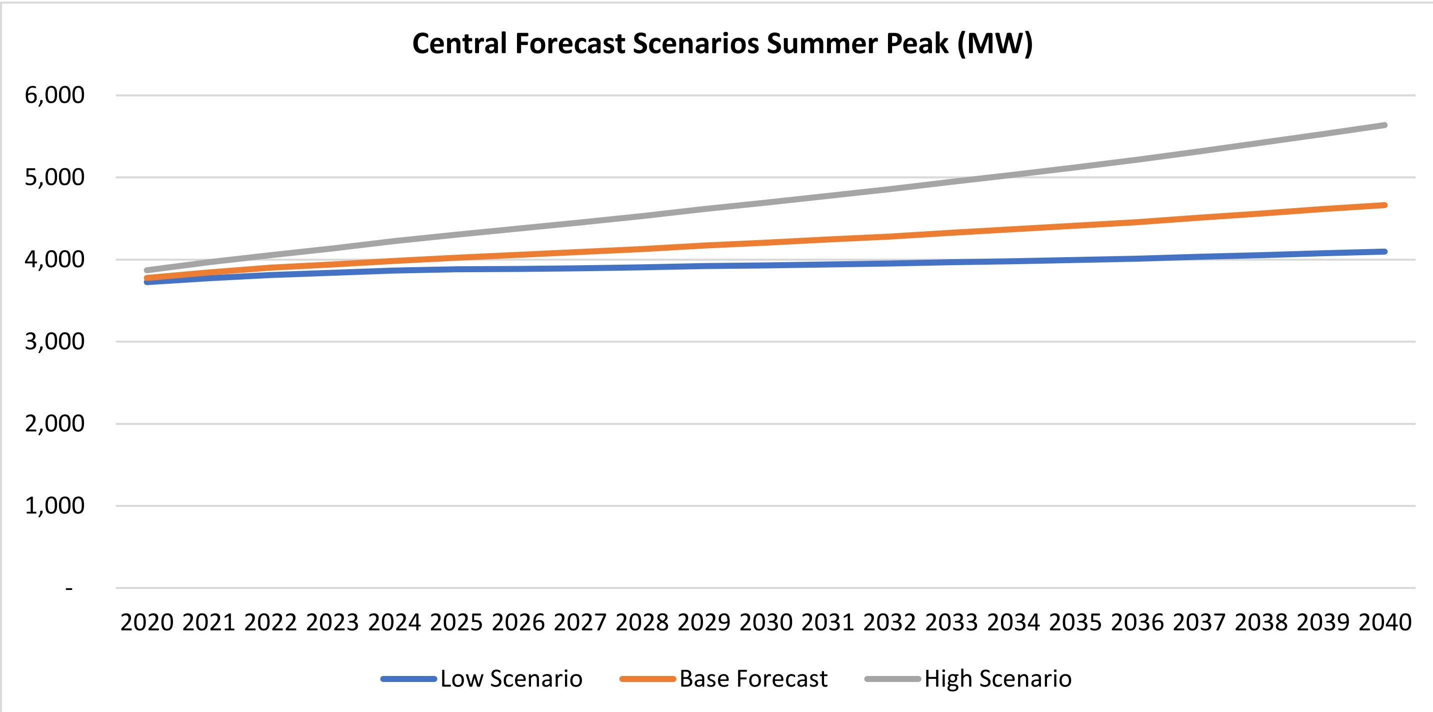


**Figure 5-7: Forecasted Summer Peak Scenarios**



### Figure 5-8: Low Growth Scenario (MW)

| Year | Summer | Winter | Energy |
|---|---|---|---|
| 2020 | 3,725 | 4,273 | 18,246,166 |
| 2021 | 3,774 | 4,271 | 18,687,718 |
| 2022 | 3,813 | 4,307 | 19,027,922 |
| 2023 | 3,841 | 4,328 | 19,191,955 |
| 2024 | 3,867 | 4,361 | 19,431,545 |
| 2025 | 3,881 | 4,378 | 19,462,883 |
| 2026 | 3,886 | 4,383 | 19,479,657 |
| 2027 | 3,895 | 4,391 | 19,507,920 |
| 2028 | 3,905 | 4,407 | 19,605,436 |
| 2029 | 3,919 | 4,414 | 19,590,578 |
| 2030 | 3,929 | 4,421 | 19,619,870 |
| 2031 | 3,940 | 4,428 | 19,653,584 |
| 2032 | 3,951 | 4,442 | 19,750,186 |
| 2033 | 3,966 | 4,448 | 19,738,629 |
| 2034 | 3,980 | 4,459 | 19,784,834 |
| 2035 | 3,996 | 4,472 | 19,836,127 |
| 2036 | 4,012 | 4,491 | 19,955,542 |
| 2037 | 4,034 | 4,504 | 19,971,611 |
| 2038 | 4,054 | 4,521 | 20,044,737 |
| 2039 | 4,076 | 4,541 | 20,121,318 |
| 2040 | 4,097 | 4,562 | 20,211,213 |
| **Growth Rate** | **0.5%** | **0.3%** | **0.5%** |

**Figure 5-9: High Growth Scenario (MW)**

| Year | Summer | Winter | Energy |
|---|---|---|---|
| 2020 | 3,870 | 4,392 | 19,581,735 |
| 2021 | 3,966 | 4,477 | 20,007,320 |
| 2022 | 4,052 | 4,560 | 20,447,938 |
| 2023 | 4,136 | 4,650 | 20,895,318 |
| 2024 | 4,226 | 4,751 | 21,419,959 |
| 2025 | 4,304 | 4,838 | 21,732,361 |
| 2026 | 4,376 | 4,916 | 22,047,666 |
| 2027 | 4,453 | 4,997 | 22,376,481 |
| 2028 | 4,530 | 5,086 | 22,768,481 |
| 2029 | 4,616 | 5,167 | 23,061,601 |
| 2030 | 4,695 | 5,247 | 23,391,400 |
| 2031 | 4,776 | 5,328 | 23,728,526 |
| 2032 | 4,856 | 5,415 | 24,125,119 |
| 2033 | 4,947 | 5,498 | 24,425,917 |
| 2034 | 5,034 | 5,584 | 24,781,428 |
| 2035 | 5,124 | 5,673 | 25,147,546 |
| 2036 | 5,214 | 5,771 | 25,585,885 |
| 2037 | 5,319 | 5,864 | 25,930,037 |
| 2038 | 5,420 | 5,964 | 26,339,956 |
| 2039 | 5,529 | 6,071 | 26,784,762 |
| 2040 | 5,638 | 6,180 | 27,244,789 |
| **Growth Rate** | **1.9%** | **1.7%** | **1.7%** |

### 5.3.1 DSM Penetration Scenarios

These scenarios are referenced in sections 4.2 and 4.3.

### 5.3.2 Renewable and Cogeneration Penetration Scenarios

These scenarios are referenced in Section 4 of this report.

# 6 Resource Plan

# 6 Resource Plan

The portfolio of power supply contracts managed by Central is evolving. To better manage its own power supply needs, Central negotiated changes to the Coordination Agreement in 2013 that effectively give it opt-out rights regarding its own participation in future Santee Cooper generation construction. Further, the pace of technological innovation in the power industry has accelerated, creating a number of powerful trends influencing Central's resource plan.

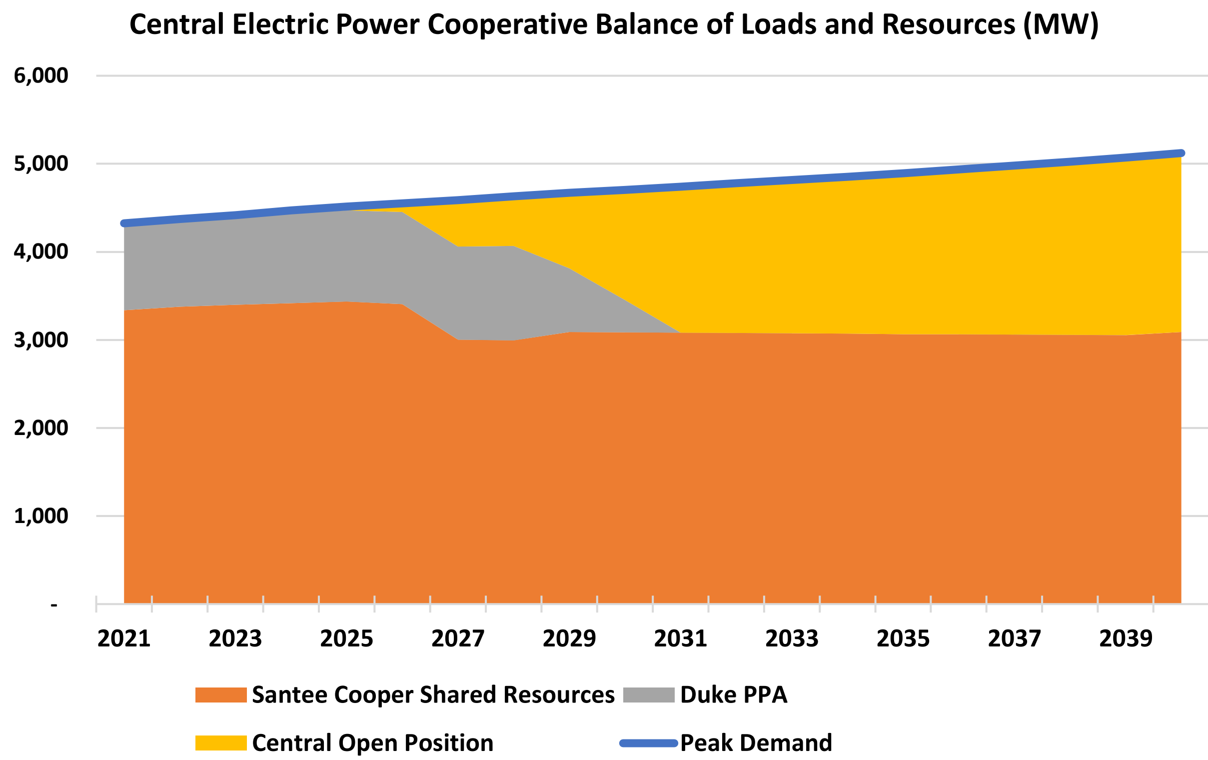
The price of renewable energy has declined rapidly, and energy storage is becoming an increasingly viable source of reliable capacity. The growing affordability of renewable energy and energy storage is leading a shift away from large, central station generation to smaller, distributed energy solutions. At the same time, dramatic increases in the supply of natural gas — as a result of improved hydraulic fracking techniques combined with more efficient combustion turbines — have transformed modern natural gas combined cycle plants into the lowest cost sources of traditional large-scale generation. It is in this environment that Central finds itself with an opportunity to evolve its resource mix into a blend of assets and power supply contracts that reduces the cost burden on cooperative member-owners while improving the sustainability of the resource portfolio.

As noted in previous sections, Central's existing principal wholesale power supply contracts are the Coordination Agreement with Santee Cooper and the Duke PPA. The Duke PPA is scheduled to phase out by the end of 2030, while the Coordination Agreement terminates in 2058. The mix of resources used to serve load in the Santee Cooper BAA, however, is not fixed. Per the Coordination Agreement, whenever a need for new capacity arises, Central and Santee Cooper will jointly develop a new generation expansion plan. This generation expansion plan will produce a set of Proposed Shared Resources. These resources can be large central station generating units, power purchase agreements, renewable resources, and/or demand-side management programs. The board of directors for each company will independently decide whether to opt in to each proposed shared resource in the generation expansion plan. If one party declines to opt in for a resource, then each party must independently develop a resource to provide the combined system with that party's load ratio share of the capacity shortfall that was identified in the generation expansion plan. As Central is currently 72% of the Santee Cooper system's firm demand, Central would be required to provide the combined system with approximately 72% of the identified capacity shortfall if a proposed shared resource is not jointly approved.

Santee Cooper has publicly committed to retiring Winyah Generating Station units 3 and 4 in 2023 and units 1 and 2 in 2027. These retirements will reduce system capacity by 1150 MW (winter), creating a need for new capacity. Central and Santee Cooper will develop a new generation expansion plan to fill the gap left in Santee Cooper's capacity mix caused by the retirement of Winyah Station. It is currently difficult for Central staff to predict the outcome of this joint effort. Consequently, Central's load ratio share of the capacity shortfall will be listed as an open position. As the Duke PPA unwinds between January 2029 and the end of 2030, the load formerly served under that agreement will also be a part of Central's open position.

Central is a winter peaking system, so planning for the winter peak will always be a key driver of Central and its member-cooperatives' capacity needs. In Figure 6-1, Central's balance of loads and resources shows member-cooperatives' winter capacity needs and the expected sources of that capacity, namely Santee Cooper, Duke, and the open position.

**Figure 6-1: Central Electric Balance of Loads and Resources (MW)**




The resource plans detailed in this IRP are designed to fill this open position. Central intends to develop a blended portfolio of demand-side management, renewable resources, conventional central station generation, and power purchase agreements to create a portfolio of resources capable of serving Central's member-cooperatives with reliable, low-cost power. Central's continuing mission will be to manage this portfolio of resources in the best interests of its member-cooperatives.

## 6.1 Southeast Regional Transmission Organization Potential

The adaptation of emerging technology, economic efficiencies, and regulatory initiatives refocuses attention toward achieving more affordable, reliable, safe, and sustainable electricity. Regional transmission organizations (RTOs) and other Independent System Operators (ISOs) operate the transmission delivery network and facilitate the business of buying and selling power. Each market and region has a distinct design and structure through which customer value can be derived. An important function of an RTO is to dispatch generating plants on a lowest cost basis across a wider pool, creating savings for customers.

The majority of the United States' electricity users are serviced by seven ISOs or RTOs, while the Southeast region of the country operates without an organized wholesale electricity marketplace. In recent years, there have been studies and discussions on the impacts of forming one in the Southeast. The formation of an organized marketplace in the Southeast could facilitate greater competition and transparency for energy, capacity, and ancillary services transactions, which could result in net economic savings and fewer concerns with building new generators that become stranded assets.

Recent studies of a Southeast regional market demonstrate cumulative economic savings for the entire Southeast, but the assumptions and conclusions of these reports will need further analysis as part of the South Carolina legislature's recently passed law forming the "Electricity Market Reform Measures Study Committee." This committee will deliver a report in late 2021 describing the committee's assessment of electricity market reform options, the value to consumers of those options, and establishing next steps for the state of South Carolina.

## 6.2 Reliability Considerations

The overarching objective of this IRP is to reliably and economically meet forecasted annual peak demand and energy and to establish reserves above the shortfalls demonstrated in the previous sections. Upon the full retirement of the Winyah Generating Station, Central plans to achieve adequate reserves with the addition of new capacity. Reliability implications differ between a large 2 x 1 combined cycle generator and multiple generators that equal the same capacity. Large generating units within a system can contribute a significant portion of an area's capacity reserves, but load-serving capability diminishes rapidly when a large unit is forced offline or taken out of service. The loss of a single or multiple large unit(s) would reduce reserves in an instant and may potentially compromise reliability. The loss probability of one large unit versus multiple units differs significantly.

### 6.2.1 Planning Reserve Margin

The planning reserve margin (PRM) is a metric that represents the amount of generation capacity available to meet the forecasted load in the planning period. Alternatively stated, planning reserve margin is the percentage difference in projected resource availability over/above the net demand. Projected planning reserve margins can be determined with probabilistic models that measure the uncertainty of resource delivery as compared to net demand. "Net demand" is the total internal demand minus dispatchable, controllable demand used to reduce load. This measurement indicates the capacity available above the uncertainty in demand for the planning horizon. This measurement is capacity-based and does not provide an indication of energy adequacy.

### 6.2.2 Effective Load Carrying Capability

The effective load carrying capability (ELCC) of a generating resource represents its probabilistic capacity contribution as a percentage of its nameplate capacity. Most thermal generators are attributed a high percentage ELCC due to their likely availability to generate when called upon, typical of the unit's capacity and forced outage rate. Solar and wind generators are attributed ELCC based upon their time of delivery due to their variable and intermittent nature. Their contribution to utility peak demand is dependent on the uncontrollable factor of sunshine and wind. ELCC decreases as variable generation increases, the impact to peak demand shifts, and overall reduction diminishes.

### 6.2.3 Probabilistic Loss of Load

Loss of load probability (LOLP) is a metric of resource adequacy that can be calculated with the use of a detailed model that measures the hourly risk of load not being served. The measurement considers hourly projected load and compares it to generation capacity and generation forced outage rate. LOLP measures the risk associated with insufficient generation to meet hourly load requirements. LOLP does not measure the amount of unmet demand or the duration that the demand is not met.

Loss of load expectation (LOLE) is a reliability metric that seeks to determine the amount of capacity needed to operate a reliable system without numerous shortages. LOLE is an annual measure of resource adequacy converted from the product of hourly LOLP. For the calculations of LOLE to be performed, the generators of a given system are analyzed by combining their capacity profiles, scheduled outages, and probability of generator forced outages to determine how many days in a year a shortage could occur. The historically accepted industry target for LOLE is to remain below 1 day in 10 years.

In a survey of load serving entities, North American Electric Reliability Corporation (NERC) observed that most entities in North America performed resource adequacy studies primarily using LOLE. While it has been a matter of judgement between regions and assessment areas as to the methodology used to measure adequacy, the trend is that most recognize that emerging reliability issues may be assessed with probabilistic models. The LOLE of any system can be lowered by managing and reducing forced outages rates. The replacement of larger units, equal in capacity, with smaller, flexible, and reliable generating units will maintain PRM while reducing LOLE. In a wider interconnected system, additional reliability gains can be measured through the accounting of neighboring utility support. Reserve sharing programs serve to minimize loss of load probability resulting in increased reliability.

### 6.2.4 IRP Reserve Margin

As explained above, important measures of reliability are planning reserve margin (PRM) and loss of load expectation (LOLE), and the relationship between them should be noted when assessing system reliability. NERC references 15% and 10% PRM to mostly thermal and mostly hydro-electric systems, respectively, when regional and sub-regional specific margin calculations are not provided. Coupled with probabilistic analysis, the PRM is a standard used by planners to measure adequacy. NERC guidance is provided to SERC Reliability Corporation (SERC) and the other coordinating regions. The individual coordinating regions provide further guidance and/or requirements to the balancing authorities.

Consistent with Santee Cooper’s application of planning reserves, this IRP targets planning reserve margins of 12% and 15% for the winter and summer months, respectively.

## 6.3 Santee Cooper Balancing Authority

If Central declines to opt into a Proposed Shared Resource resulting from the Santee Cooper-led joint generation expansion process, Central is obligated to provide capacity to the Santee Cooper system if existing resources are insufficient to maintain the required reserve margins. Figure 6-2 includes an overview of the existing Coordination Agreement's contractual requirements related to generation resource requirements in the Santee Cooper BAA.

**Figure 6-2: Santee Cooper BAA Capacity Position**

| Santee Cooper BAA Capacity Position (MW) | | | |
|---|---|---|---|
| Year | Base Case | High Load | Low Load |
| 2020 | - | - | - |
| 2021 | - | - | - |
| 2022 | - | - | - |
| 2023 | 12 | 168 | - |
| 2024 | 33 | 208 | - |
| 2025 | 44 | 228 | - |
| 2026 | 99 | 302 | - |
| 2027 | 529 | 774 | 359 |
| 2028 | 566 | 843 | 377 |
| 2029 | 494 | 818 | 294 |
| 2030 | 520 | 877 | 302 |
| 2031 | 547 | 937 | 311 |
| 2032 | 577 | 1,001 | 324 |
| 2033 | 604 | 1,064 | 334 |
| 2034 | 632 | 1,129 | 347 |
| 2035 | 661 | 1,196 | 359 |
| 2036 | 696 | 1,269 | 378 |
| 2037 | 726 | 1,340 | 391 |
| 2038 | 761 | 1,416 | 408 |
| 2039 | 796 | 1,498 | 427 |
| 2040 | 857 | 1,569 | 443 |

## 6.4 Duke Balancing Authority

Central's current all-requirements contract with Duke features a three-year ramp down prior to the contract's end date of December 31, 2030. Figure 6-3 includes an overview of the existing PPA's contractual requirements related to generation resource requirements in the Duke BAA.

**Figure 6-3: Duke BAA Capacity Position**

| Duke BAA Capacity Position | | | | |
|---|---|---|---|---|
| Year | Duke PPA Coverage | Duke BAA Capacity Shortfall | | |
| | | Base Case | High Load | Low Load |
| 2020 | 100% | - | - | - |
| 2021 | 100% | - | - | - |
| 2022 | 100% | - | - | - |
| 2023 | 100% | - | - | - |
| 2024 | 100% | - | - | - |
| 2025 | 100% | - | - | - |
| 2026 | 100% | - | - | - |
| 2027 | 100% | - | - | - |
| 2028 | 100% | - | - | - |
| 2029 | 66.7% | 362 | 384 | 335 |
| 2030 | 33.3% | 731 | 783 | 676 |
| 2031 | - | 1,110 | 1,197 | 1,020 |
| 2032 | - | 1,124 | 1,219 | 1,027 |
| 2033 | - | 1,136 | 1,243 | 1,032 |
| 2034 | - | 1,149 | 1,267 | 1,038 |
| 2035 | - | 1,163 | 1,292 | 1,045 |
| 2036 | - | 1,178 | 1,317 | 1,053 |
| 2037 | - | 1,192 | 1,346 | 1,059 |
| 2038 | - | 1,206 | 1,374 | 1,066 |
| 2039 | - | 1,221 | 1,404 | 1,073 |
| 2040 | - | 1,237 | 1,432 | 1,081 |

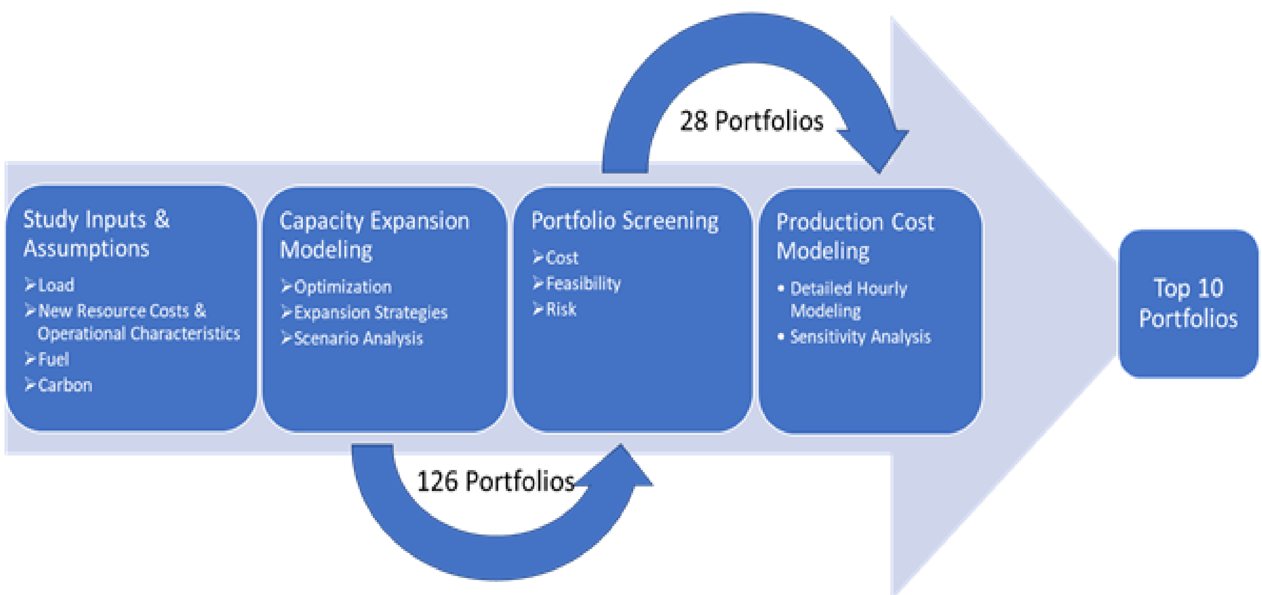
## 6.5 Central Resource Planning Process

Central designed a process for its IRP analyses to determine the most cost-effective resource portfolios for the 20-year study period. The key steps were as follows:

1. Inputs and assumptions were developed that define important variables.
2. Capacity expansion modeling was performed to identify lowest cost portfolios under different sets of resource constraints and with variations in key inputs and assumptions.
3. These portfolios were analyzed and reduced to a meaningful but manageable number for more detailed analysis.
4. Production cost modeling was conducted on the remaining portfolios for detailed cost, operational, and sensitivity analysis.
5. The top 10 portfolios were then selected and represented a diverse set of cost-effective portfolios.

Figure 6-4 is a high-level illustration of these key process steps, which are described in more detail within this section

**Figure 6-4: Central IRP Process**



## 6.6 Study Inputs and Assumptions

The first step in resource planning is to identify study inputs and assumptions with an emphasis on those that impact the cost-effectiveness of resource portfolios. For example, the projected price of natural gas is an important input assumption that affects the cost-effectiveness of potential future resources. Central categorized input assumptions into the following categories:

- New Generation Resources (Cost and Operational Performance)
    - Thermal Generation Options
    - Renewable Generation and Energy Storage Options
- Power Purchase Options
- Electric Transmission Investments
- Load
- Fuel (Commodity Prices and Transportation Costs)
- Renewables Integration
- Demand-Side Management
- Environmental Regulations
- Financial Assumptions

In addition to the base case assumptions for these inputs, the analysis included sensitivities or variations in these input assumptions, such as a high natural gas price and low natural gas price. The sections below highlight the input assumptions used for capacity expansion scenarios and sensitivities.

### 6.6.1 Technical Assessment of New Generation Resources

Technology assumptions for new resources are a critical component of a capacity expansion plan. A typical assessment is comprised of planning-level assumptions for cost (Capital, Operations & Maintenance) and performance characteristics. The assessment for new resources to satisfy future capacity and energy needs in this expansion plan was split into two main technology categories: thermal and renewable. The thermal unit technology assessments were performed for various peaking and combined cycle technologies. Peaking generation is designed to produce power for relatively brief periods of time. Combined cycle generators are baseload generation, which are expected to operate around the clock. The renewable technologies consisted of offshore wind, solar, and battery storage.

### 6.6.2 Thermal Technology

The thermal unit technology assessments were separated into two main groups: peaking and combined cycle technologies. There were six peaking technology assessments and four combined cycle technology assessments.

### 6.6.3 Peaking Technology

Simple cycle gas turbine (SCGT) technology produces power in a gas turbine generator and is typically used for peaking power due to fast load ramp rates and relatively low capital costs. These units have high heat rates compared to combined cycle technologies. Heat rate is a measure of efficiency; it relates the amount of energy (thermal) consumed to the amount of electricity generated. All peaking technology assessed is fueled by natural gas. The assessed technologies are shown in Figure 6-5 with the associated capacity and capital cost.

**Figure 6-5: Thermal Peaking Technology Options**

| Peaking Technology | Capacity (MW) | Capital Cost ($/kW) |
|---|---|---|
| 1x Aeroderivative SCGT | 48 | $1,340 |
| 1x Aeroderivative SCGT | 112 | $1,030 |
| 1x F Class Frame SCGT | 225 | $600 |
| 1 x J Class Frame SCGT[11] | 348 | $520 |
| 1 x J Class Frame SCGT[12] | 368 | $570 |
| Reciprocating Engine (18 MW Engines) | 90 | $1,220 |

- Aeroderivative Gas Turbines – Aeroderivative gas turbine technology is based upon an aircraft jet engine design and is built with high quality materials that allow for increased turbine cycling. The output of commercially available aeroderivative turbines ranges from less than 20 MW to approximately 100 MW in generation capacity. In simple cycle configurations, these machines typically operate more efficiently than larger frame units and exhibit shorter ramp-up and turndown times, making them ideal for peaking and load following applications.
- Frame Gas Turbines – Frame style turbines are industrial engines, more conventional in design, that are typically used in intermediate to baseload applications. Traditionally, frame turbines exhibit slower startup times and ramp rates than aeroderivative models. Conventional start times are commonly 30 minutes for frame turbines, but fast start options allow 10- to 15-minute starts. These turbines typically have higher heat rates than aeroderivative engines, however they are more efficient in the combined cycle operation because exhaust energy is further utilized.
- Reciprocating Engines – The internal combustion reciprocating engine operates on a four-stroke cycle for the conversion of pressure into rotational energy. By design, cooling systems are typically closed-loop radiators, minimizing water consumption. The reciprocating engine technology has quick start up and ramp rate characteristics. Utility scale operations commonly rely on medium speed engines (18 MW).

### 6.6.4 Combined Cycle Technology

The basic principle of the combined cycle gas turbine (CCGT) plant is to use natural gas to produce power in a gas turbine that can be converted to electric power by a coupled generator. Then, the hot exhaust gases from the gas turbine are used to produce steam in a heat recovery steam generator (HRSG). This steam is used to drive a steam turbine and generator to produce electric power. The use of both gas and steam turbine cycles in a single plant to produce electricity results in high conversion efficiencies and low emissions. Additionally, natural gas can be fired in the HRSG to produce additional steam and associated output for peaking load, a process commonly referred to as duct firing. Combined cycle facilities can be designed with multiple combustion turbines connected to a single steam turbine. These technologies are

[11] Emission controls to limit nitrogen oxides (NOx) to 15 parts per million (ppm) reduces capacity (MW).
[12] Higher allowance for NOx of 25 ppm results in higher capacity output.

called 2x1 (two by one) CCGTs to indicate that there are two combustion turbines and one steam turbine. A combined cycle with only one combustion turbine is called a 1x1 CCGT. A 2x1 CCGT has a lower heat rate compared to a 1x1 CCGT, and a 2x1 CCGT can continue operating when one combustion turbine experiences an outage, improving the reliability of the plant.

The assessed technologies are shown below in Figure 6-6 with the associated capacity.

**Figure 6-6: Thermal Combined Cycle Technology Options**

| Combined Cycle Technology | Capacity (MW) | Capital Cost ($/kW) |
|---|---|---|
| 2x1 SGT-800 CCGT – Fired | 191 | 1,760 |
| 1x1 J-Class CCGT – Fired | 655 | 780 |
| 2x1 J-Class CCGT – Unfired | 1,105 | 670 |
| 2x1 J-Class CCGT – Fired | 1,315 | 590 |

### 6.6.5 Renewable Technology

Figure 6-7 shows the renewable technology types studied with the associated capacity and energy where applicable:

**Figure 6-7: Renewable Technology**

| Renewable Technology | Capacity (MW) | Energy (CF % \| MWh) | Capital Cost ($/kW) |
|---|---|---|---|
| Offshore Wind | 500 | 42.6% CF | 4,640 |
| Offshore Wind | 1,000 | 42.6% CF | 4,500 |
| Single Axis Tracking Photovoltaic | 75 | 25.5% CF | $25/MWh |
| Battery Storage – Lithium Ion (4 hr.) | 20 | 80 | 1,450 |
| Battery Storage – Lithium Ion (8 hr.) | 20 | 160 | 2,650 |
| Battery Storage – Lithium Ion (4 hr.) | 50 | 200 | 1,340 |
| Battery Storage – Lithium Ion (8 hr.) | 50 | 400 | 2,300 |
| Battery Storage – Flow Battery (8 hr.) | 20 | 160 | 5,150 |
| Battery Storage – Flow Battery (8 hr.) | 50 | 200 | 1,340 |

*Wind Technology* – Wind turbines convert the kinetic energy of wind into mechanical energy, which can be used to generate electrical energy that is supplied to the grid. Wind turbine energy conversion is a mature technology and is generally grouped into two types of configurations:

- Vertical-axis wind turbines, with the axis of rotation perpendicular to the ground.
- Horizontal-axis wind turbines, with the axis of rotation parallel to the ground.

Over 95% of turbines over 100 kW operate are configured as horizontal axis. Subsystems for either configuration typically include the following: a blade/rotor assembly to convert the energy in the wind to rotational shaft energy; a drive train, usually including a gearbox and a generator; a tower that supports the rotor and drive train; and other equipment, including controls, electrical cables, ground support equipment and interconnection equipment.

Wind turbine capacity is directly related to wind speed and equipment size, particularly to the rotor/blade diameter. The power generated by a turbine is proportional to the cube of the prevailing wind; that is, if the wind speed doubles, the available power will increase by a factor of eight. Because of this relationship, proper siting of turbines at locations with the highest possible average wind speeds is vital. According to the Department of Energy's National Renewable Energy Laboratory (NREL), Class 3 wind areas (average wind speeds of 14.5 mph) are generally considered to have suitable wind resources for wind generation development. South Carolina's offshore areas demonstrate wind speeds above 16.8 mph. Offshore wind typically has more consistent and stronger wind patterns than onshore wind. Utility-scale land-based wind turbines are typically 80 meters to 140 meters in height; onshore wind resources are not suitable in South Carolina as wind speeds average below 14.5 mph. Offshore wind technology is still gaining momentum in America and can often be cost prohibitive while technology and construction advancements continue to catch up with onshore wind.

*Single Axis Tracking Photovoltaic Technology* – The conversion of solar radiation to useful energy in the form of electricity is a mature concept with extensive commercial experience that is developing into a diverse mix of technological designs. PV cells consist of a base material (most commonly silicon), which is manufactured into thin slices and then layered with positively and negatively charged materials. When sunlight strikes the cell, the separation of charged particles generates an electric field that forces current to flow from the negative material to the positive material. This flow of current is captured via wiring connected to an electrode array on one side of the cell and an aluminum back-plate on the other. Approximately 15% of the solar energy incident on the solar cell can be converted to electrical energy by a typical silicon solar cell. As the cell ages, the conversion efficiency degrades at a rate of approximately 2% in the first year and 0.5% per year thereafter. At the end of a typical 30-year period, the conversion efficiency of the cell will be approximately 80% of its initial efficiency. Single axis tracking was utilized in this assessment and is commonly used in utility scale applications. Single axis tracking means that the solar panels are mounted on structures with one axis of rotation. Motors mechanically rotate the panels along the horizon. The panels are oriented north-south, to face east with the sunrise, and track west until sundown.

*Battery Storage* – Electrochemical technology is developing as one of the leading energy storage and load following technologies due to its modularity, ease of installation and operation, and relative design maturity. Two types of energy storage technologies were evaluated in the IRP: lithium-ion batteries (typically short-duration) and flow batteries (long-duration).

- Lithium-ion (Li-ion) batteries contain graphite and metal-oxide electrodes and lithium ions dissolved within an organic electrolyte. The movement of lithium ions during cell charge and discharge generates current. Li-ion battery technology has seen a resurgence of development in recent years due to its high energy density, low self-discharge, and cycling tolerance. Many Li-ion battery manufacturers currently offer 15-year warranties or performance guarantees. Consequently, Li-ion batteries have gained traction in several markets including the utility and automotive industries.

Li-ion battery prices are trending downward, and continued development and investment by manufacturers are expected to further reduce production costs. While there is still a wide range of project cost expectations due to market uncertainty, Li-ion batteries are anticipated to expand their reach into the utility sector.

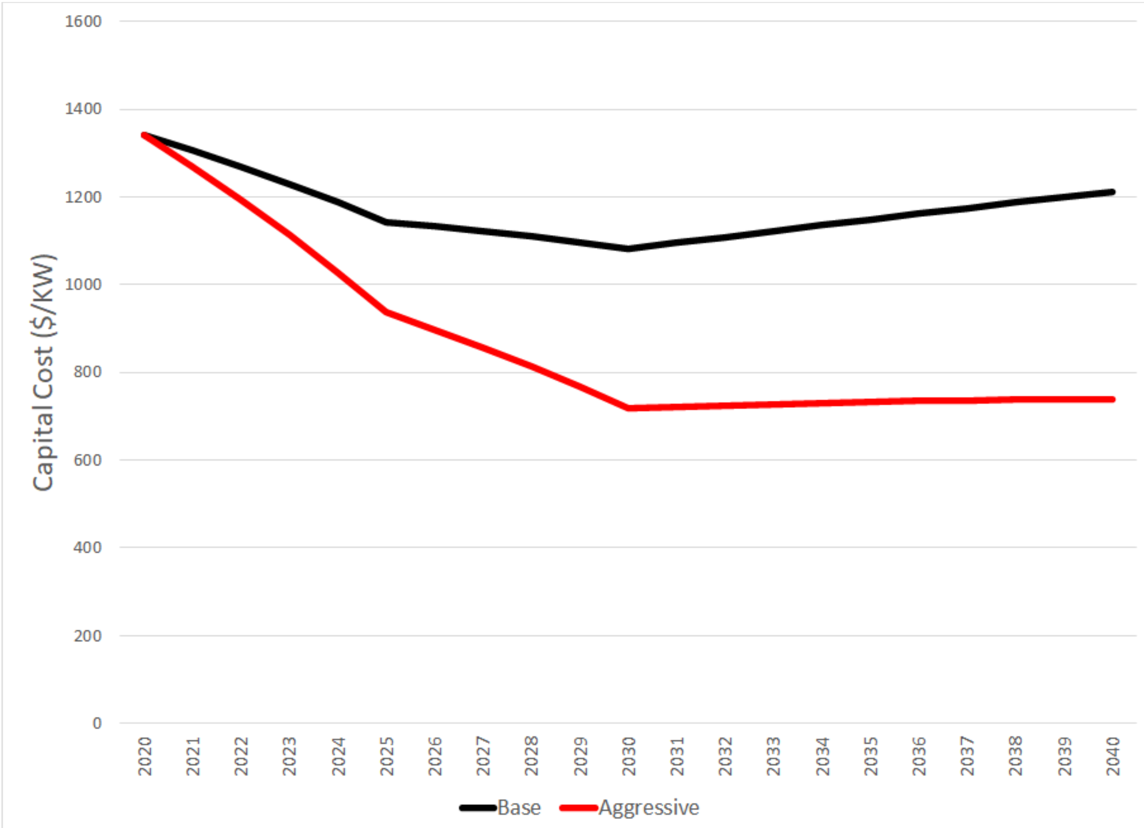
- Flow batteries use an electrode cell stack with externally stored electrolyte material. The flow battery is comprised of positive and negative electrode cell stacks separated by a selectively permeable ion exchange membrane, in which the charge-inducing chemical reaction occurs, and liquid electrolyte storage tanks, which hold the stored energy until discharge is required. Various control and pumped circulation systems complete the flow battery system, in which the cells can be stacked in series to achieve the desired voltage difference.

  The battery is charged as the liquid electrolytes are pumped through the electrode cell stacks, which serve only as a catalyst and transport medium to the ion-inducing chemical reaction. The excess positive ions at the anode are allowed through the ion-selective membrane to maintain electroneutrality at the cathode, which experiences a buildup of negative ions. The charged electrolyte solution is circulated back to storage tanks until the process is allowed to repeat in reverse for discharge as necessary.

  In addition to external electrolyte storage, flow batteries differ from traditional batteries in that energy conversion occurs as a direct result of the reduction-oxidation reactions occurring in the electrolyte solution itself. The electrode is not a component of the electrochemical fuel and does not participate in the chemical reaction. Therefore, the electrodes are not subject to the same deterioration that depletes electrical performance of traditional batteries, resulting in high cycling life of the flow battery. Flow batteries are also scalable such that energy storage capacity is determined by the size of the electrolyte storage tanks, allowing the system to approach its theoretical energy density. Flow batteries are typically less capital intensive than some conventional batteries but require additional installation and operation costs associated with balance of plant equipment.

The key cost elements of a battery system are the inverter, the battery cells, the interconnection, and the installation. The capital costs include engineering, procurement, and construction (EPC) costs plus owner's cost, which reflect recent trends for capacity overbuild to account for short-term degradation. It is also assumed that the system will be co-located with an existing asset or in close proximity to existing infrastructure. Consistent with recent trends, the capital costs of battery storage installations are expected to continue declining through the end of the decade, with installation costs expected to fall approximately 20% by 2030. Figure 6-8 contains indicative Base and Aggressive cost curves applied to battery storage technologies in this analysis.

**Figure 6-8: Battery Storage Cost Projections (50MW-4hr Li-Ion Example)**




### 6.6.6 Power Purchase Agreements (PPAs)

Central solicited and received indicative PPA offers from multiple entities. The PPAs received varied in options from unit contingent power to full-requirement options. The PPA options include the ability to purchase power from existing simple cycle and combined cycle power plants along with options to purchase power from new combined cycle plants. Figure 6-9 shows the PPA associated technologies and nameplate capacity.

**Figure 6-9: Power Purchase Agreements**

| PPA Technology | Capacity (MW) |
|---|---|
| Baseload | 250 – 1000 |
| Peaking | 150 – 250 |
| Full-Requirements | 400 – 1200 |

### 6.6.7 Electric Transmission Investments

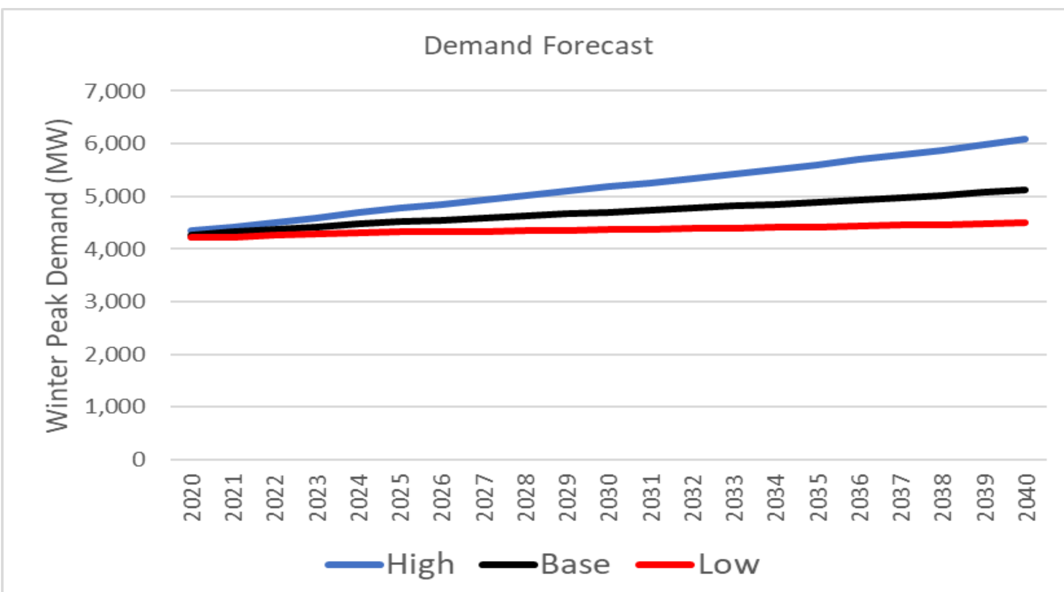
Central has considered several sites for new peaking and combined cycle plants. The exact size and location of new plants and/or power purchase suppliers will dictate any needed electric transmission upgrades. High-level electric transmission studies have been conducted for the potential sites. Absent a definitive site or sites at this point for new generation or power purchases, potential new resource assumptions included only high-level transmission interconnection estimates. For example, all the natural gas combined cycle plants evaluated included an assumption that 10 miles of 230 kW transmission line would need to be built, with a total transmission interconnection cost of $23 million.

### 6.6.8 Load

Due to variations in economic growth, changing consumption patterns, and changing electrification trends, there is uncertainty in future electric load growth. To account for the variations in potential load growth, two load sensitivities were developed in addition to the base load forecast. Section 5 - Load Forecast details the load projections for base, high, and low load growth. The actual capacity surplus and deficiencies are discussed in Sections 6.3 and 6.4.

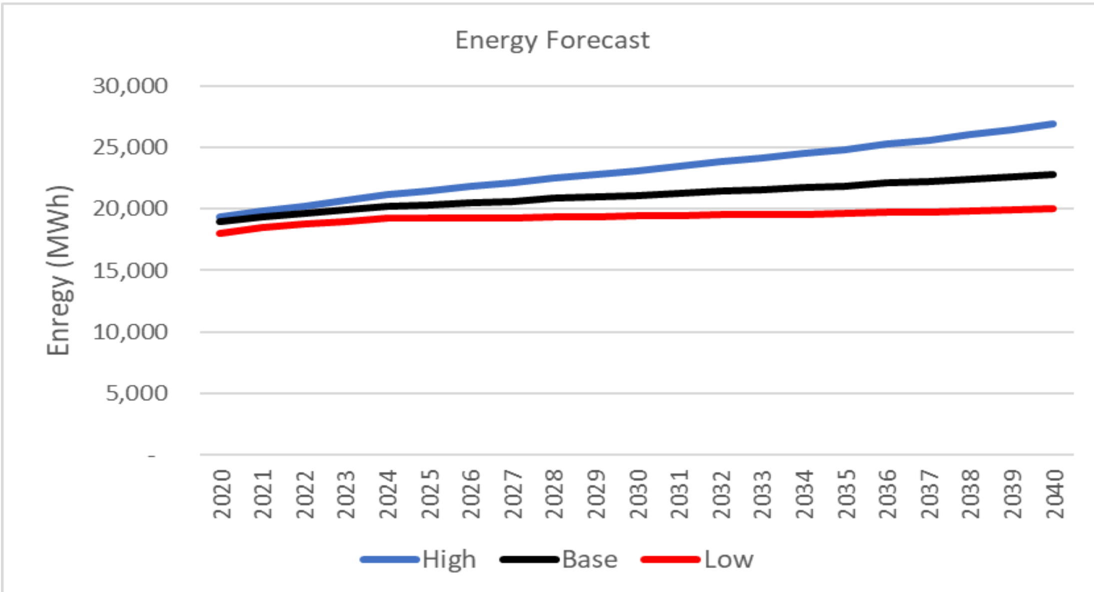
The base load forecast and the high and low sensitivities were developed by Central. All three load forecasts were modeled in Capacity Expansion to create resource portfolios optimized to each load forecast. The peak demand for the base forecast and the high and low sensitivities are shown in Figure 6-10.

**Figure 6-10: Peak Load Growth**



The energy forecast for the base assumptions and high/low sensitivities is shown in Figure 6-11.

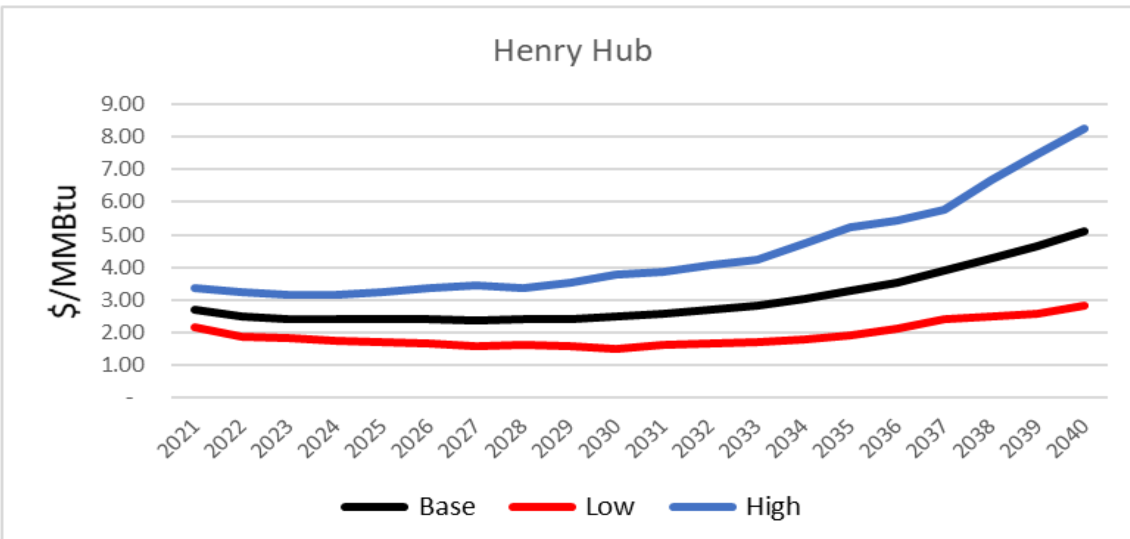
**Figure 6-11: Energy Growth**



### 6.6.9 Fuel

Discussions were held with multiple companies to determine natural gas transportation options including necessary infrastructure requirements and associated pricing. Based upon this information and absent a definitive site for a new gas plant, a high-level assumption for natural gas transportation costs was included in the analysis. New York Mercantile Exchange (NYMEX) Henry Hub was assumed to be the source of the natural gas supply. Historically, natural gas prices have experienced volatility that is often difficult to predict. To account for the volatility that may be present over the study time horizon, two sensitivities were developed beyond the base scenario. Stochastic distributions for the natural gas prices were developed and were used to frame the high and low gas prices sensitivities. Figure 6-12 shows an annual average commodity price that was modeled for the base natural gas forecast and the high and low sensitivities.

**Figure 6-12: Natural Gas Commodity Price Forecast**

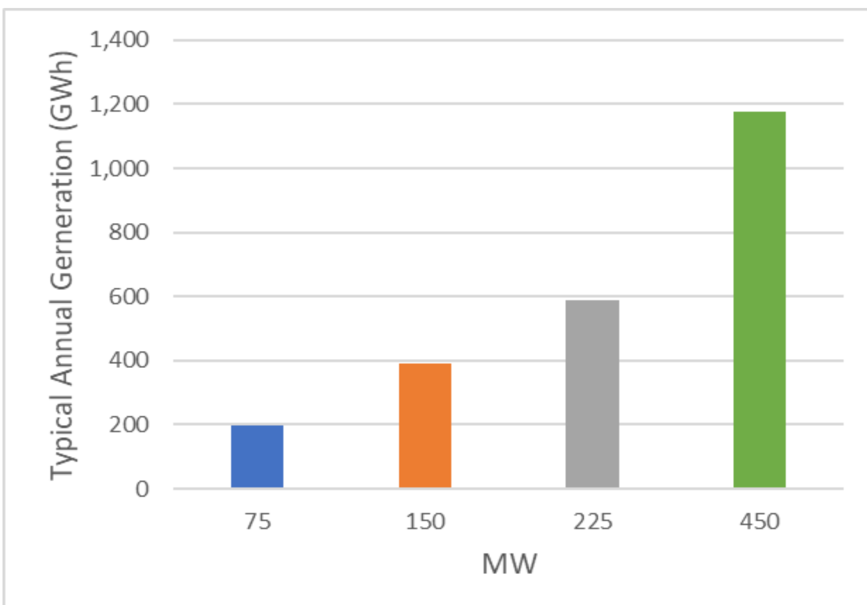


### 6.6.10 Renewables Integration

Renewable energy has been a quickly advancing field and has gathered support due its competitive pricing and lower environmental impact relative to thermal energy generators. With uncertainty surrounding tax laws, technology costs, and effective load carrying capability, two renewable sensitivities were developed beyond the base case. The base case provided the availability to commission up to 225 MW of additional solar during the study period. Integrating solar can be challenging due to its highly intermittent nature, and Santee Cooper and Duke Energy Carolinas would be responsible for managing solar integration as balancing authorities. The costs of integration, however, would be passed on to Central. The high case provided the availability to commission up to 450 MW of additional solar during the study period. The low case provided the availability to commission 150 MW of additional solar during the study period. Central believes that these incremental additions of solar are technically and economically viable. Studies would need to be conducted to ensure grid reliability before incremental solar above these levels can be considered.

Figure 6-13 shows the estimated annual energy generated by solar PV for the high, base, and low cases of 450 MW, 225 MW and 150 MW, respectively. Modeling for solar PV was represented in 75 MW blocks, so generation for 75 MW of solar is also shown.

**Figure 6-13: Incremental Annual Solar Generation Estimate**

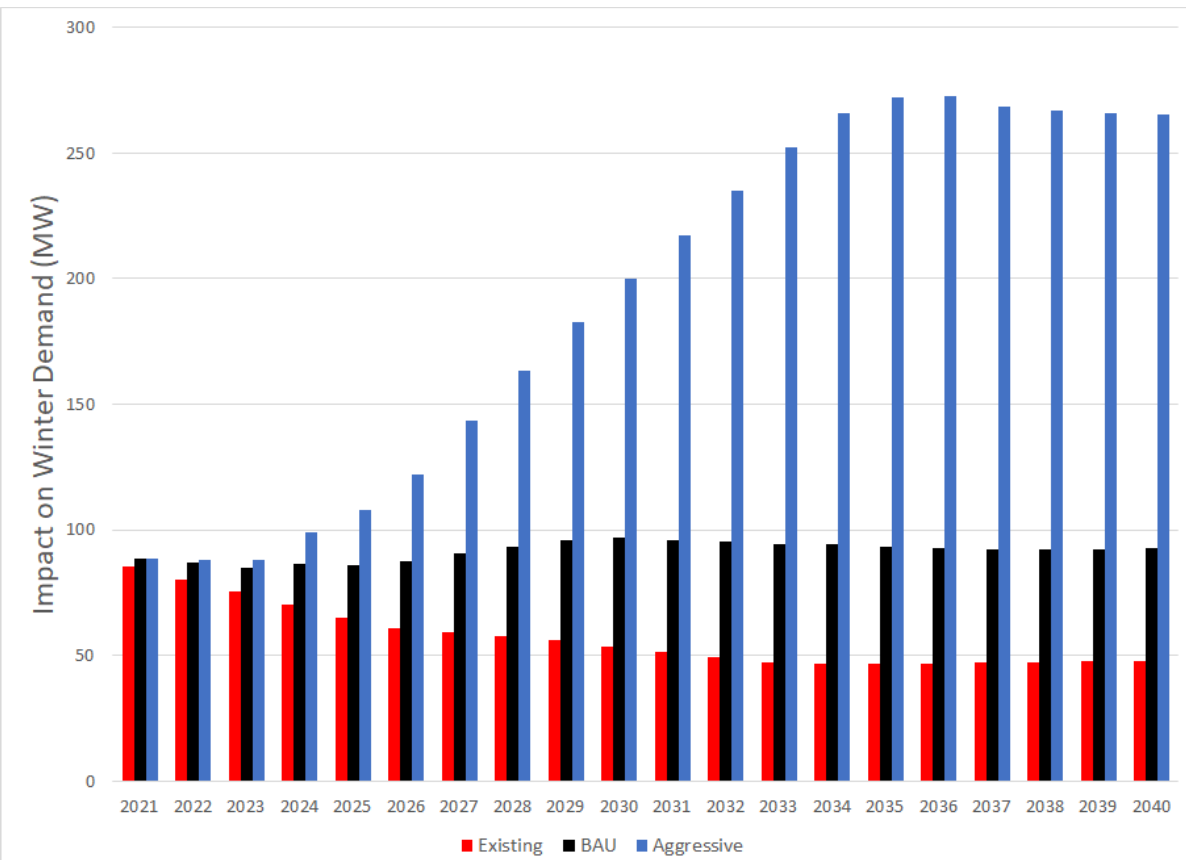


### 6.6.11 Demand-Side Management

Demand-side management allows electric utilities to reduce future energy requirements and peak demand through methods such as time-of-use rates, peak shaving, and smart thermostats. The reduction of future resource needs provides an opportunity for cost savings through avoided generation expansion. The Business as Usual (BAU) DSM forecast includes existing DSM plus continued incremental DSM deployment. The BAU case assumes DSM investments remain similar to current levels and forecasts an incremental addition of approximately 45 MW of DSM capacity resources by the end of the study period.

Given the uncertainty around DSM program savings and costs, two additional DSM sensitivities were evaluated. The Aggressive DSM sensitivity is detailed in Section 4.3. The Aggressive DSM assumption is designed to test the capacity expansion selection process. The Aggressive case assumes increased investments in DSM compared to current levels, and it forecasts an incremental addition of approximately 214 MW of DSM capacity resources by the end of the study period. The Existing DSM forecast shows the impact of no new incremental additions in DSM above existing programs and resources.

**Figure 6-14: Demand-Side Management Forecasts**

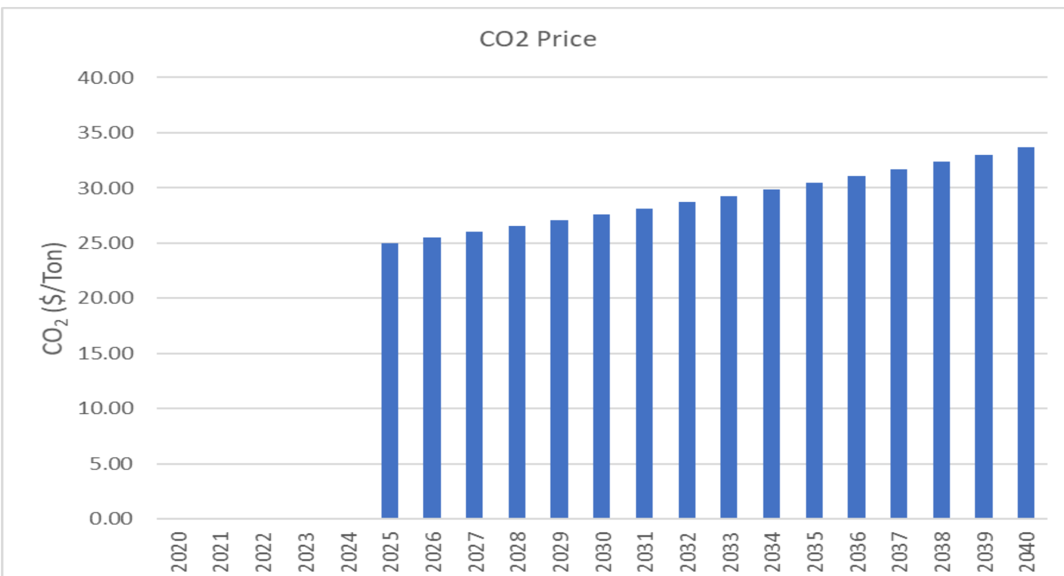


### 6.6.12 Carbon Policy

No comprehensive national regulation of carbon emissions currently exists in the United States, though there have been attempts to enact a federal carbon policy over the years. This included efforts by the U.S. Congress to pass a national cap-and-trade regime, the Environmental Protection Agency's (EPA) regulation of greenhouse gas (GHG) emissions from new and existing power generators culminating in the Affordable Clean Energy rule (ACE rule), and more recently proposals in the U.S. Congress for carbon taxes and comprehensive clean energy targets.

South Carolina does not have a state policy limiting or otherwise placing a price on carbon emissions from power generation. However, the potential remains for enactment of such a policy at the national or state level over the study period. To account for this, a carbon tax sensitivity was created. The carbon tax sensitivity assumed the implementation of a carbon tax starting January 1, 2025. This tax was set at $25 per ton and is consistent with other utility IRPs submitted in South Carolina for 2020. The tax is escalated annually at a general rate of 2.5% through the end of the study period as shown in Figure 6-15.

**Figure 6-15: $CO_2$ Price**




### 6.6.13 Financial Assumptions

The capacity expansion evaluation required baseline assumptions and constraints applicable to Central. The following financial assumptions and parameters were assumed:

- The 20-year study period covers years 2021 through 2040.
- The study results are presented in calendar years.
- The discount rate is assumed to be 3.0%.
- The cost escalation rate assumed for future years is 2.0%.

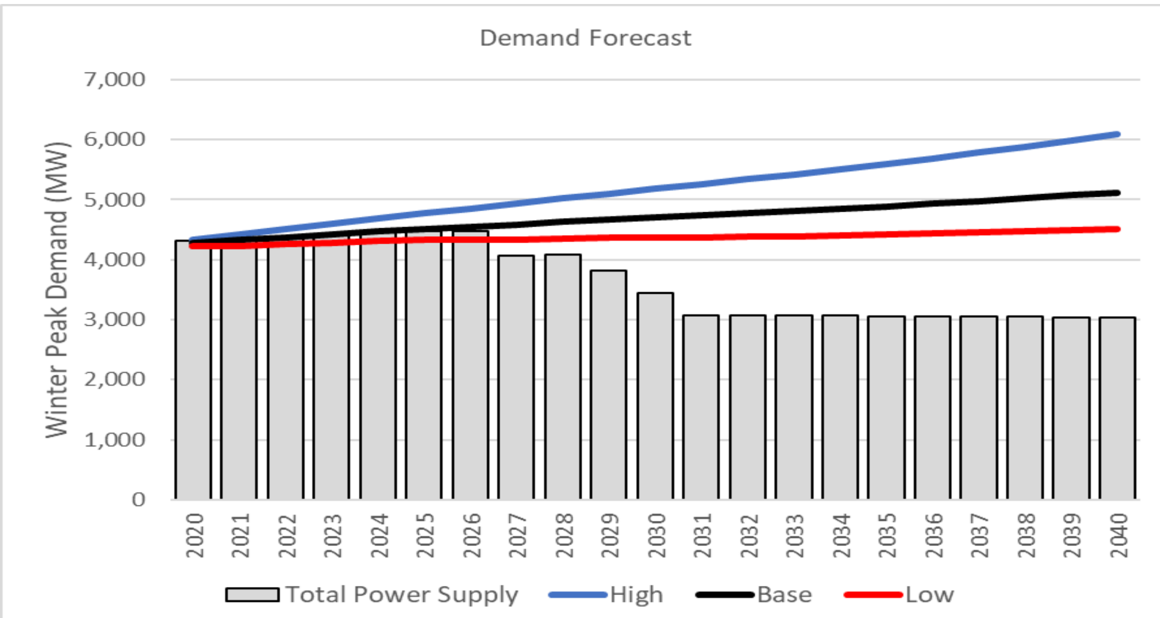
## 6.7 Capacity Expansion Modeling

Once inputs and assumptions are finalized, the next critical step of the IRP process is initiated. The purpose of the capacity expansion modeling process is to identify cost-effective resource portfolios to meet the capacity and energy system requirements.

The complete retirement of the Winyah Generating Station in 2027 results in significant capacity shortfall in the form of an open position for Central in the Santee Cooper balancing authority. The need for capacity and energy is compounded when the Duke PPA expires in 2030. This shortfall of capacity and energy will need to be filled with new generation resource options that could include PPAs.

Figure 6-17 illustrates the magnitude of capacity shortfall to be investigated and planned for in this IRP.

**Figure 6-17: Load Forecast vs Existing Supply**

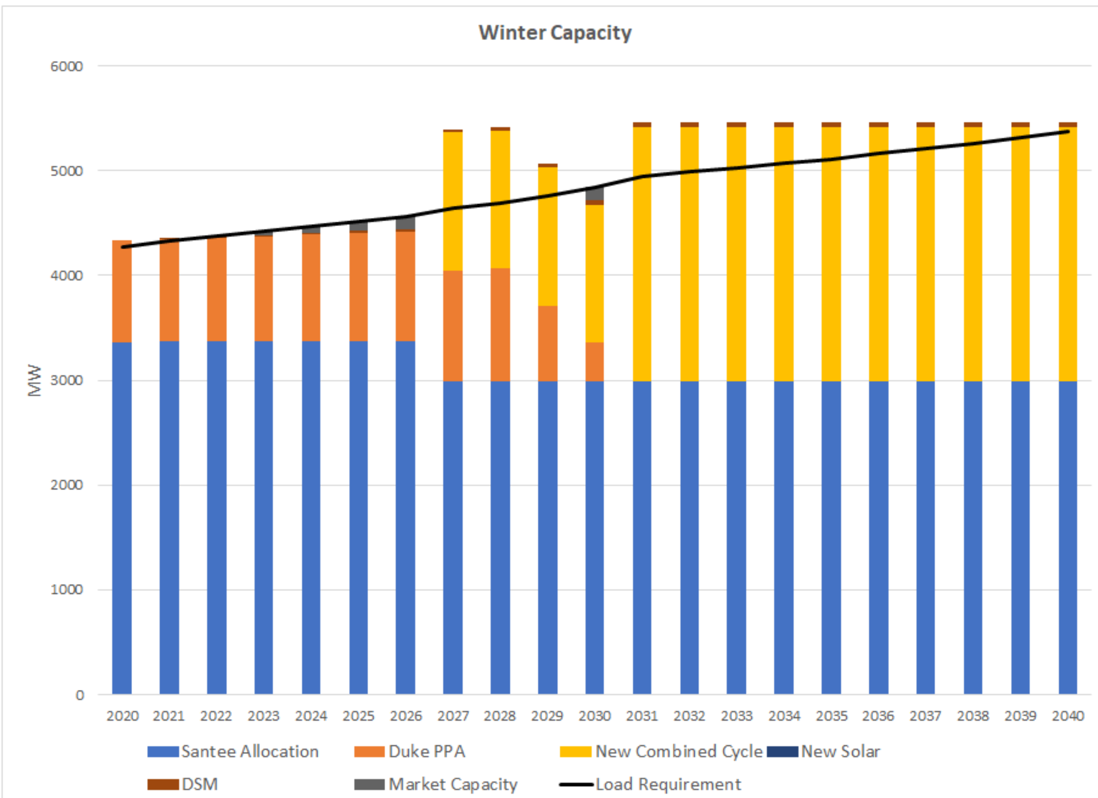



The capacity expansion modeling process utilizes ABB's Capacity Expansion model. The Capacity Expansion model is an energy portfolio management software solution, which, under a given set of assumptions, considers multiple resource combinations to minimize cost over a time horizon while covering all system energy and capacity needs. The model identifies resource portfolios that have the lowest present value of revenue requirements (PVRR) for consumers. PVRR, a proxy for end-user cost, captures the discounted present value of future costs. The costs for new resources, including capital investment and production expenses such as fuel, are estimated in the PVRR for each portfolio. Ongoing costs for existing plants and any credit from off-system sales are included as well.

Initial capacity expansion modeling was performed using base input assumptions and without constraining the types or combinations of resources that could be selected. For example, the model can choose from resources such as large combined cycle units and individual simple cycle combustion turbine units to create a portfolio that minimizes PVRR for a given set of input assumptions. The results demonstrate preference for ownership of two new combined cycle (2x1) plants with the first installation coincident to the Winyah Station retirement in 2027 and the second with the full expiration of the Duke PPA at the end of 2030.

The lowest cost portfolio generated by this modeling has been selected to be used as a reference (reference portfolio) for comparison with all other portfolios generated in the IRP process. The portfolio with two new combined cycle plants has the lowest PVRR with base input assumptions; however, there is significant risk in Central's developing, constructing and owning projects of this magnitude. In addition, this portfolio creates an overbuild of capacity for several years after the combined cycles come online, as shown in the balance of loads and resources for the reference portfolio (shown in Figure 6-19). Capacity overbuild may be cost effective from a PVRR viewpoint (which discounts all future costs to the current year), but PVRR does not recognize the significant initial rate impact of large capital additions. For these reasons, while the portfolio with the large combined cycle plants is the reference portfolio, the IRP analysis will study alternatives with an eye to reducing risk and with consideration of the rate impacts on member-owners.

**Figure 6-19: Balance of Load and Resources - Reference Portfolio**




### 6.7.1 Expansion Strategies

Based upon the results of this unconstrained modeling, four additional expansion strategies were designed for evaluation with capacity expansion modeling. These expansion strategies apply limits on what type of resources the modeling can choose. Here are the five expansion strategies:

1) **Unconstrained Modeling (Unconstrained)** – No constraints. Optimization modeling allows all new generation technology and PPA options included in the technical assessment to be considered.

2) **Partial CC Ownership Strategy (Partial CC)** – The optimization modeling was constrained from selecting full ownership of a combined cycle. Only 50% ownership of a single new 2x1 combined cycle was allowed. Optimization modeling considers the balance of new generation technology and PPA options as shown in the technical assessment.
3) **No CC Ownership Strategy (No CC)** – This case restrains the optimization model from selecting a new combined cycle that is fully or even partially owned by Central. Base load needs must be met with PPAs or other resources included in the technical assessment, such as simple cycle combustion turbines.
4) **Full Requirements PPA & Partial CC Strategy (Full Req & Partial CC)** – The optimization model is forced to select a full requirements PPA to serve all load in the Duke BAA upon expiration of the Duke PPA. Also, this case constrains the model from selecting full ownership of a 2x1 combined cycle and only allows the selection of a single partially owned combined cycle. All other resources included in the technical assessment are available.
5) **Full Requirements PPA & No CC Ownership Strategy (Full Req & No CC)** – The model is forced to select a full requirements PPA to serve all load in the Duke BAA upon the expiration of the Duke PPA. Also, this case does not allow the selection of a combined cycle in the form of ownership. Optimization modeling allows all other new generation technology and PPA options to be considered.

### 6.7.2 Expansion Strategies Modeled with Base Input Assumptions

Capacity expansion modeling was then conducted on each of the four expansion strategy cases using base input assumptions to identify the lowest cost portfolios that conformed to each strategy. A summary of the lowest cost portfolios generated for each expansion strategy is listed below and depicted in Figure 6-21. A chart of the portfolio PVRRs is shown in Figure 6-22.

**Partial CC Ownership Strategy** – The model chooses a PPA that is tied to a new combined cycle in 2027 and elects to build a 2x1 combined cycle that is 50% owned by Central in 2031. Two simple cycle combustion turbines are also built in 2031. The PVRR of this portfolio is 2.0% higher than the reference portfolio.

**No CC Ownership Strategy** – The model chooses a PPA that is tied to a new combined cycle in 2027 and builds a large amount of combustion turbines in 2031. The PVRR of this portfolio is 3.9% higher than the reference portfolio.

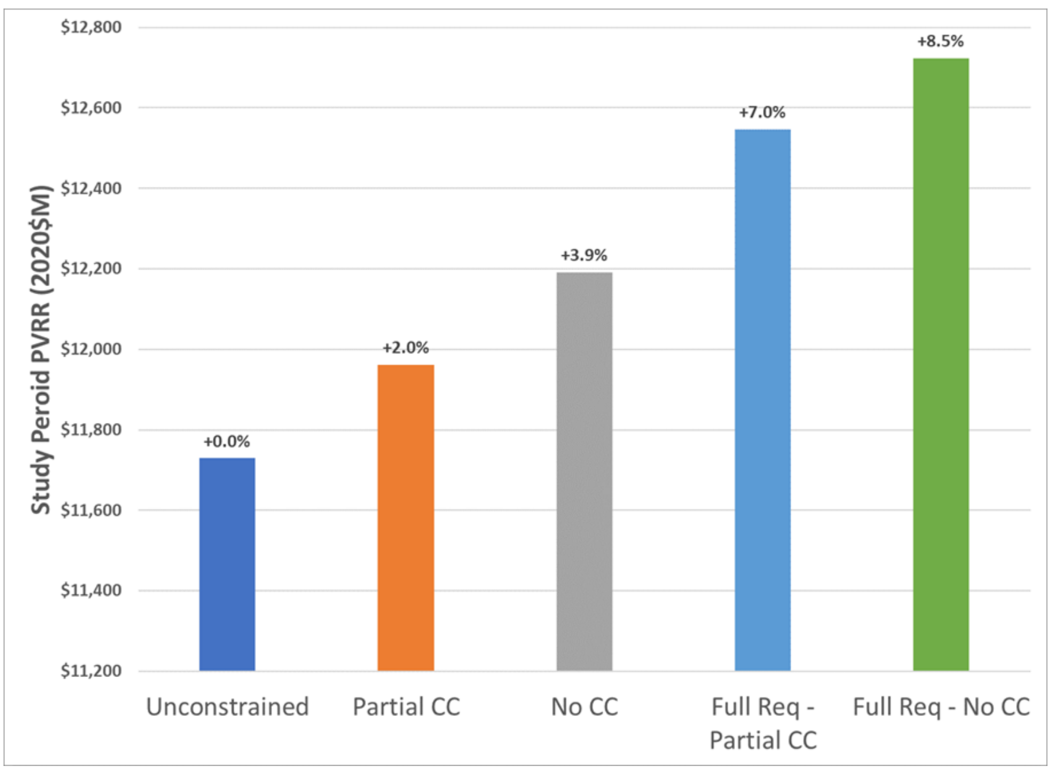
**Full Requirements PPA & Partial CC Strategy** – The model builds a 2x1 combined cycle that is 50% owned by Central in 2027. The full requirements PPA begins in 2029. A simple cycle combustion turbine is built in 2031. The PVRR of this portfolio is 7.1% higher than the reference portfolio.

**Full Requirements PPA & No CC Ownership Strategy** – This portfolio includes a PPA that is tied to a new combined cycle in 2027 and the selection of two simple cycle combustion turbines in 2031. The PVRR of this portfolio is 8.5% higher than the reference portfolio.

**Figure 6-21: Lowest Cost Portfolios Using Base Inputs for each Expansion Strategy**

| | Unconstrained<br>Reference Portfolio | Partial CC | No CC | Full Req - Partial CC | Full Req - No CC |
|---|---|---|---|---|---|
| 2021 | | | | | |
| 2022 | 225 MW Solar | 225 MW Solar | 225 MW Solar | 225 MW Solar | 225 MW Solar |
| 2023 | Market | Market | Market | Market | Market |
| 2024 | Market | Market | Market | Market | Market |
| 2025 | Market | Market | Market | Market | Market |
| 2026 | Market | Market | Market | Market | Market |
| 2027 | 1315 MW CC | PPA-2 CC | PPA-2 CC | 658 MW CC | PPA-2 CC |
| 2028 | | | | | |
| 2029 | | Market | Market | Full Req | Full Req |
| 2030 | Market | Market | Market | | |
| 2031 | 1105 MW CC | 552 MW CC<br>700 MW CT | 1400 MW CT | 350 MW CT<br>Market | 695 MW CT |
| PVRR ($M) | $11,729 | $11,961 | $12,192 | $12,561 | $12,724 |
| Delta | 0.0% | 2.0% | 3.9% | 7.1% | 8.5% |

**Figure 6-22: PVRRs of Lowest Cost Portfolios Using Base Inputs**



### 6.7.3 Scenario Analysis

An important step in the capacity expansion modeling process is to identify low cost portfolios that perform well under a wide range of inputs and assumptions. Central modeled the five expansion strategy cases by varying key inputs and assumptions. The following is a description of key inputs and assumptions that are varied in the scenario analysis.

1) **High Load** – Central load demand is higher than forecasted, approximately 1,000 MW higher than the Base forecast by 2040.
2) **Low Load** – Central load demand is lower than forecasted, approximately 600 MW lower than the Base forecast by 2040.
3) **High Fuel** – Henry Hub natural gas prices remain above the Base price forecast and are slightly higher than $8/MMBtu by 2040.
4) **Low Fuel** – Henry Hub natural gas prices remain below the Base price forecast and level off near $3/MMBtu by 2040.
5) **High Renewables** – Up to 450 MW of solar is built, and the aggressive battery price forecast is used.
6) **Low Renewables** – Solar is limited to 150 MW.
7) **Aggressive DSM** – DSM is incorporated beyond the BAU plan, reaching a total peak reduction of 247 MW by 2040.
8) **Existing DSM** – DSM is incorporated at current levels with no incremental DSM. Total peak reduction falls to just below 50 MW by 2040.
9) **Carbon** – Carbon tax is incorporated for carbon emissions in this scenario. A carbon tax of $25/ton is assumed for 2025 and escalates by 2% each year. The carbon tax for 2040 is approximately $33/ton.

Capacity expansion modeling of all five expansion strategies with each of the scenarios listed above results in 123 unique portfolios.

### 6.7.4 Custom Portfolios

After reviewing the modeling results from the original five expansion strategies and scenario analysis, three custom portfolios were created for further analysis and consideration. One of the custom portfolios included a high level of battery build-out, and the other portfolios included both Aggressive DSM and High Renewables.

## 6.8 Portfolio Screening

In the portfolio screening process, the 126 unique portfolios generated in the portfolio expansion process are narrowed down to a meaningful but manageable number for more detailed analysis in the production cost modeling process. The objective is to find portfolios that perform well in all the tested scenarios, not simply to focus on strong performers in the Base case assumptions. Considerations for advancing portfolios include PVRR, magnitude of potential capital expenditures, risk considerations, and ensuring a diverse set of portfolios. This screening process resulted in 28 portfolios being promoted to the detailed production cost modeling process.

## 6.9 Production Cost Modeling

The 28 portfolios that resulted from the capacity expansion modeling process are then modeled and evaluated in hourly detail. ABB's PROMOD production cost modeling software is used to conduct a more detailed cost and operational analysis of the 28 portfolios. PROMOD simulates hourly regional generation dispatch to meet electricity demand while using the most economical resources. Referred to as security-constrained economic dispatch, the model adheres to reliability constraints for generators and transmission lines in the region.

In capacity expansion modeling, assumptions and resource options are the inputs, and portfolios are the outputs. In production cost modeling, a single set of assumptions and a single portfolio are the inputs. The output is total cost, which is summarized in this report as PVRR. The production cost model is run for each portfolio under each set of assumptions identified in the sensitivity analysis. Production cost modeling allows the evaluation of a single portfolio under a wide range of sets of assumptions for comparison to other portfolios under the same sets of assumptions.

### 6.9.1 Sensitivity Analysis

The 28 selected portfolios are modeled and studied in detail with each portfolio modeled under base input assumptions. Central also performed sensitivity analysis by modeling each portfolio while varying one important input assumption at a time. The seven different sensitivities (sets of input assumptions) are as follows:

- High Load
- Low Load
- High Fuel
- Low Fuel
- Aggressive DSM
- Existing DSM
- Carbon Tax

### 6.9.2 Top 10 Portfolios Selection & Review

The results of the detailed production cost modeling using the base set of input assumptions and seven sensitivities were analyzed to determine the top 10 portfolios. The top 10 portfolios were selected primarily based upon their cost performance across the full range of sensitivities with consideration given to ensuring a diverse set of portfolios was represented. The least cost portfolio remains the reference portfolio, which includes full ownership of two 2x1 combined cycle plants. The second portfolio includes the full ownership of one 2x1 combined cycle. The remaining eight portfolios restrict the addition of a full combined cycle. All remaining eight portfolios include a combination of partial (50%) combined cycle ownership, PPAs and other peaking resources. Four of the 10 portfolios include between 375 MW and 450 MWs of solar and two have significant battery storage additions. The top 10 portfolios ranked from lowest PVRR to highest are shown in Figure 6-43.

**Figure 6-43: Portfolio Ranking**

| Sensitivity | Reference Portfolio | Top 10 Portfolios | | | | | | | | | | Remaining 18 Portfolios |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | #1 | #2 | #3 | #4 | #5 | #6 | #7 | #8 | #9 | #10 | Highest Cost |
| Base Assumptions | $11.4 | $11.5 | $11.6 | $11.6 | $11.6 | $11.6 | $11.7 | $11.7 | $11.7 | $11.7 | $11.8 | |
| HighFuel | $12.5 | $12.7 | $12.6 | $12.7 | $12.8 | $12.8 | $12.7 | $12.8 | $12.8 | $12.8 | $12.8 | |
| LowFuel | $9.7 | $9.7 | $9.7 | $9.7 | $9.7 | $9.7 | $9.8 | $9.7 | $9.7 | $9.9 | $10.0 | |
| AggressiveDSM | $11.4 | $11.5 | $11.5 | $11.6 | $11.6 | $11.6 | $11.6 | $11.6 | $11.7 | $11.7 | $11.7 | |
| ExistingDSM | $11.4 | $11.5 | $11.6 | $11.6 | $11.7 | $11.7 | $11.7 | $11.7 | $11.7 | $11.7 | $11.8 | |
| CarbonCase | $11.5 | $11.7 | $11.8 | $11.8 | $11.9 | $11.9 | $11.9 | $11.9 | $11.9 | $12.0 | $12.0 | |
| HighLoad | $12.9 | $13.1 | $13.5 | $13.4 | $13.5 | $13.5 | $13.3 | $13.2 | $13.5 | $13.3 | $13.7 | |
| LowLoad | $10.5 | $10.6 | $10.6 | $10.6 | $10.7 | $10.7 | $10.7 | $10.7 | $10.7 | $10.8 | $10.8 | |

| Color | |
|---|---|
| Portfolio NPV | Better → Worse |

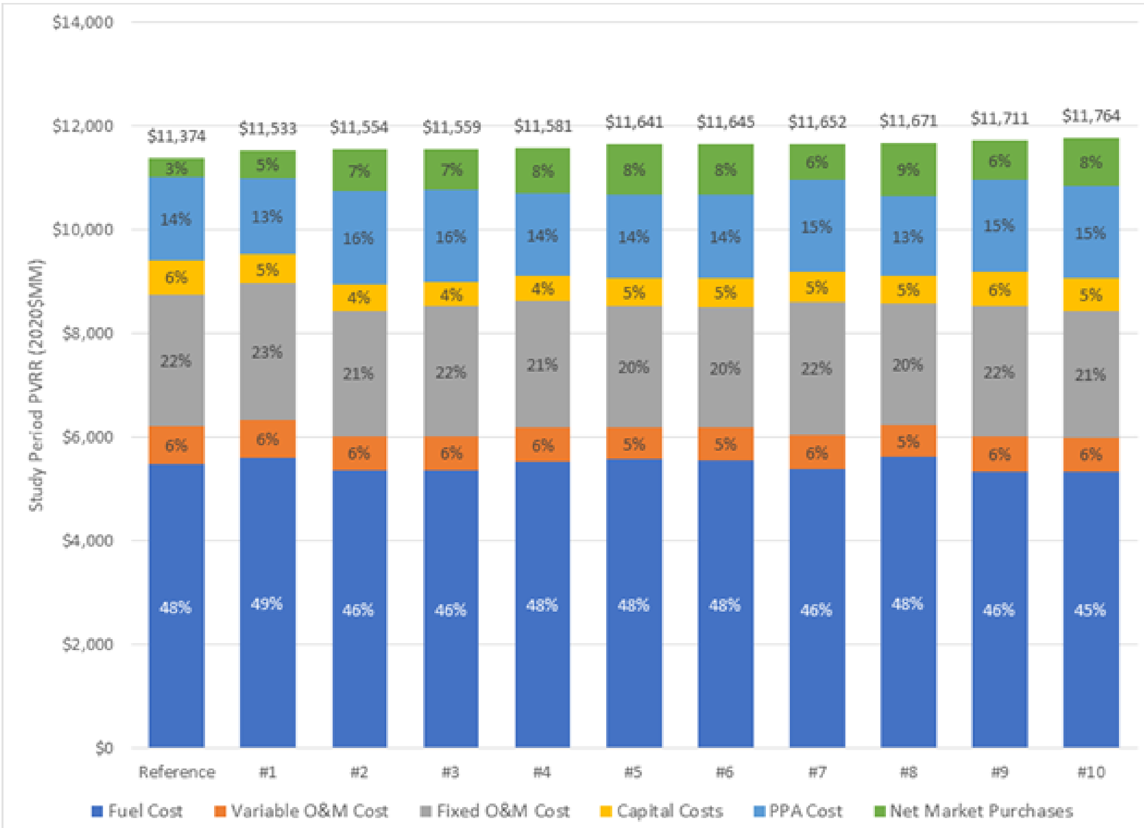
Figure 6-44 shows the resource mix of each of the top 10 portfolios.

**Figure 6-44: Top 10 Portfolios - Comparison**

| Year | Reference Portfolio | Top Ten Portfolios | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | #1 | #2 | #3 | #4 | #5 | #6 | #7 | #8 | #9 | #10 |
| 2021 | | | | | | | | | | | |
| 2022 | 225 MW Solar | 75 MW Solar | 225 MW Solar | 225 MW Solar | 225 MW Solar | 225 MW Solar | 300 MW Solar | 225 MW Solar | 150 MW Solar | 300 MW Solar | 225 MW Solar |
| 2023 | Market | Market | 150 MW Solar<br>Market | Market | Market | Market | 150 MW Solar<br>Market | Market | Market | 150 MW Solar<br>Market | 150 MW Solar<br>Market |
| 2024 | Market | Market | Market | Market | Market | Market | Market | Market | Market | 120 MW BESS | 70 MW BESS |
| 2025 | Market | Market | Market | Market | Market | Market | Market | Market | Market | | 50 MW BESS |
| 2026 | Market | Market | Market | Market | Market | Market | Market | Market | Market | | |
| 2027 | 1315 MW CC | PPA-1 CC | 658 MW CC | 658 MW CC | PPA-1 CC | PPA-1 CC | PPA-2 CC | PPA-2 CC | PPA-1 CC | 658 MW CC | 658 MW CC |
| 2028 | | | | | | | | | | | 50 MW BESS |
| 2029 | | 1105 MW CC | 350 MW CT | PPA-1 CC | 658 MW CC | 659 MW CC | 658 MW CC<br>350 MW CT | 350 MW CT<br>Market | 658 MW CC | PPA-1 CC | 350 MW CT<br>50 MW BESS |
| 2030 | Market | | 350 MW CT | Market | 350 MW CT | Market | | 658 MW CC | Market | 350 MW CT | 100 MW BESS<br>Market |
| 2031 | 1105 MW CC | 350 MW CT | PPA-2 CC | 700 MW CT | 350 MW CT | 700 MW CT | 350 MW CT | 350 MW CT | 350 MW CT<br>Market | 350 MW CT | PPA-2 CC |
| PVRR (2020 $M) | 11,374 | 11,533 | 11,554 | 11,581 | 11,641 | 11,645 | 11,652 | 11,655 | 11,671 | 11,711 | 11,764 |
| % difference | | 1.4% | 1.6% | 1.8% | 2.3% | 2.4% | 2.4% | 2.5% | 2.6% | 3.0% | 3.4% |

Figure 6-45 shows the PVRR for the top 10 portfolios along with a breakdown of the cost components.

**Figure 6-45: Top 10 Portfolios – PVRR Cost Components**



# 7 Conclusion

# 7 Conclusion

Central is using this IRP as a foundation to work with its member-cooperatives to address Central's impending open positions and determine the best path forward. Filling these open positions is an opportunity for Central to support its member-cooperatives in meeting the needs of member-owners for reliable, low-cost electricity and to create a more diversified portfolio. A diversified portfolio allows greater flexibility and opportunities for our members than the existing resource mix. The various resource plans identified in this report provide reliable capacity to meet the needs of member-owners, as identified in the current load forecast.

Beginning in 2023, Central will have an open position resulting from the generating unit retirements at Santee Cooper. The full retirement of Winyah Generating Station by Santee Cooper will create an open position of 529 MW that Central will be required to fill. This IRP assumes that Santee Cooper will retire Winyah in 2023 and 2027 as announced. Central can fill this position by opting into a Santee Cooper Proposed Shared Resource or by independently developing a set of alternative resources. In addition to the 529 MW position in the Santee Cooper BAA, beginning in 2029 Central will have an open position in the Duke BAA. As the Duke PPA ramps down between 2029 and January 2031, Central will need to acquire 1,110 MW of capacity to serve its member-cooperatives' needs in the Duke BAA.

In 2019, Central and its member-cooperatives began evaluating how to best fill its open positions with a reliable and economical resource plan. One hundred twenty-six portfolios were developed and evaluated, and the top 28 were selected for more in-depth analysis. These 28 portfolios were analyzed with detailed production cost modeling to evaluate how they would perform under multiple risk sensitivities. The top 10 portfolios that performed the best under all risk sensitivities were then selected.

Central is a winter peaking system, which typically occurs early in the morning when solar resources are not available. All top 10 portfolios involve investment in natural gas combined cycle capacity to serve peak demand. This capacity can come in the form of full ownership, joint ownership, or power purchase agreements. Natural gas combined cycle generation is both economical and 50% less carbon intensive than coal generation. Battery storage can be used to shift the timing of solar power into hours when demand is highest. Battery storage options are currently more expensive than natural gas options; however, Central will continue to monitor developments in the storage sector.

Central is committed to serving its member-cooperatives by procuring low-cost power for their member-owners. Central and its member-cooperatives must understand and evaluate the risks involved in every portfolio. Many portfolios are dependent upon natural gas fired generation. The future of natural gas prices and delivery is uncertain. Resource plans with high capital investment create the possibility for stranded costs if the environment shifts against that type of generation. Changes in technology can make an existing or planned generating unit less attractive. The development of an organized market in the Southeast could fundamentally alter the economic structure of the electric utility business in South Carolina. Advances in energy storage can reduce the integration costs of intermittent renewable energy. Reductions in the variable integration costs of solar will enable Central and its member-cooperatives the ability to commission solar beyond the levels evaluated in this report.

As a part of the production cost modeling process, varying levels of DSM and renewable implementation were assessed. The results consistently showed that resource portfolios high in DSM, specifically demand response, and renewables outperformed portfolios with lower implementation levels across all evaluated risk scenarios. The analysis in this report indicates that replacing energy purchases from fossil fuel plants with the development of solar energy resources reduces power costs. Although solar provides minimal winter capacity benefit, Central and its member-cooperatives should continue working to expand access for member-owners to low-cost renewable energy.

Central's strength has always been in the diversity of its member-cooperatives and their shared commitment to reliable, low-cost power. Each of the 20 member-cooperatives brings experience, understanding, and resources that produce a system that serves member-owners better than each member-cooperative working independently. Central will use this same philosophy as it builds a system to serve its member-cooperatives in the future.

This IRP is the foundation upon which Central and its member-cooperatives can build a more diversified portfolio to serve the energy needs of the people of South Carolina for years to come. The electric industry is changing, and the portfolio of resources that Central manages will need to evolve as well. A holistic approach that combines renewable energy, demand side management, energy storage, efficient central station generation, and power purchase agreements will likely produce a superior risk-adjusted outcome compared to a portfolio that ignores one of these components.

# 8 Appendices

# 8 Appendices

## A. Glossary of Acronyms

| | |
|---|---|
| AC | alternating current |
| AMI | advanced metering infrastructure |
| BA | balancing authority |
| BAA | balancing authority area |
| BAU | business as usual |
| BC | benefit-cost |
| BE | beneficial electrification |
| BESS | battery energy storage system |
| BLR | balance of loads and resources |
| C&I | commercial and industrial |
| CCGT | combined-cycle gas turbine |
| CFL | compact fluorescent light |
| CVR | conservation voltage reduction |
| DOE | U.S. Department of Energy |
| DR | demand response |
| DSM | demand-side management |
| Duke | Duke Energy Carolinas |
| ECSC | The Electric Cooperatives of South Carolina |
| EE | energy efficiency |
| EESI | Environmental and Energy Study Institute |
| EIA | Energy Information Administration |
| EISA | Energy Independence and Security Act |
| ELCC | effective load carrying capability |
| EPC | engineering, procurement, and construction costs |
| EV | electric vehicle |
| FERC | Federal Energy Regulatory Commission |
| G&T | generation and transmission cooperative |
| GDP | gross domestic product |
| GHG | greenhouse gas |
| GW | gigawatt |
| GWh | gigawatt-hour |
| HRSG | heat recovery steam generator |
| HVAC | heating, ventilation, and air conditioning |
| IOU | investor-owned utility |
| IRP | integrated resource plan |
| ISO | independent system operator |
| kW | kilowatt |
| kWh | kilowatt-hour |
| LED | light-emitting diode |
| Li-ion | lithium ion |
| LOLE | loss of load expectation |
| LOLP | loss of load probability |
| MLOC | member line of credit |
| MW | megawatt |
| MWh | megawatt-hour |
| NERC | North American Electric Reliability Corporation |

| | |
|---|---|
| NESHAP | National Emission Standards for Hazardous Air Pollutants |
| NITSA | Network Integrated Transmission Service Agreement |
| NOx | nitrogen oxides |
| NPV | net present value |
| NREL | National Renewable Energy Laboratory |
| OATT | Open Access Transmission Tariff |
| PPA | power purchase agreement |
| PRM | planning reserve margin |
| PURPA | Public Utility Regulatory Policies Act (1978) |
| PV | photovoltaic |
| PVRR | present value of revenue requirements |
| QF | qualified facility |
| RE | renewable energy |
| RICE | reciprocating internal combustion engine |
| RF | radio frequency |
| RIM | ratepayer impact measurement |
| RTO | regional transmission organization |
| RUS | Rural Utilities Service |
| SAE | statistically adjusted end-use |
| Santee Cooper | South Carolina Public Service Authority |
| SCGT | simple-cycle gas turbine |
| SEEM | Southeast Energy Exchange Market |
| SEPA | Southeastern Power Administration |
| TRC | total resource cost test |
| UCT | utility cost test |
| VOS | value of solar |

## B. Existing Resources

| Season | Resource | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 | 2039 | 2040 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Summer | AC Switches | 12 | 11 | 10 | 9 | 8 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | AMI Water Heater Switches | 17 | 16 | 14 | 13 | 12 | 11 | 9 | 8 | 7 | 5 | 4 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Battery | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Beat the Peak Alerts | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | CVR | 30 | 31 | 32 | 33 | 33 | 34 | 34 | 34 | 34 | 35 | 35 | 35 | 36 | 36 | 36 | 36 | 37 | 37 | 37 | 38 | 38 |
| | Commercial EE | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | On-bill Weatherization | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Pool Pumps | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | RF Water Heater Switches | 14 | 12 | 9 | 7 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Solar | 15 | 15 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 13 | 13 | 13 | 13 | 13 |
| | Thermostats | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Winter | AC Switches | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | AMI Water Heater Switches | 25 | 23 | 21 | 20 | 18 | 16 | 14 | 12 | 10 | 8 | 6 | 4 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Battery | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Beat the Peak Alerts | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | CVR | 36 | 37 | 38 | 38 | 39 | 39 | 40 | 40 | 40 | 41 | 41 | 41 | 42 | 42 | 42 | 43 | 43 | 43 | 44 | 44 | 44 |
| | Commercial EE | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | On-bill Weatherization | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Pool Pumps | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | RF Water Heater Switches | 22 | 18 | 14 | 10 | 6 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Solar | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | Thermostats | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

## C. Balance of Loads and Resources (BLR)

A BLR table identifies the source of a utility's capacity and energy. The demand tables in Appendices C-1 and C-2 show Central's projected seasonal peak demand by year and identify the supplier for each required MW of demand.

### C-1. Winter Demand

| Central Balance of Load and Resources (MW) | | | | | | |
|---|---|---|---|---|---|---|
| Year | Peak Demand | Santee Cooper Shared Resources | Duke Energy Carolinas PPA | SEPA Resources | Central Supplied Resources | Total Capacity |
| **2022** | 4,373 | 3,232 | 938 | 203 | - | 4,373 |
| **2023** | 4,418 | 3,254 | 949 | 203 | 12 | 4,418 |
| **2024** | 4,471 | 3,271 | 963 | 203 | 33 | 4,471 |
| **2025** | 4,515 | 3,293 | 975 | 203 | 44 | 4,515 |
| **2026** | 4,551 | 3,263 | 987 | 203 | 98 | 4,551 |
| **2027** | 4,588 | 2,857 | 999 | 203 | 529 | 4,588 |
| **2028** | 4,632 | 2,850 | 1,014 | 203 | 566 | 4,632 |
| **2029** | 4,669 | 2,947 | 664 | 203 | 856 | 4,669 |
| **2030** | 4,704 | 2,943 | 307 | 203 | 1,251 | 4,704 |
| **2031** | 4,740 | 2,939 | - | 203 | 1,656 | 4,798 |
| **2032** | 4,780 | 2,936 | - | 203 | 1,700 | 4,839 |
| **2033** | 4,814 | 2,931 | - | 203 | 1,740 | 4,873 |
| **2034** | 4,852 | 2,926 | - | 203 | 1,781 | 4,911 |
| **2035** | 4,891 | 2,922 | - | 203 | 1,825 | 4,950 |
| **2036** | 4,937 | 2,920 | - | 203 | 1,873 | 4,996 |
| **2037** | 4,978 | 2,916 | - | 203 | 1,918 | 5,037 |
| **2038** | 5,024 | 2,912 | - | 203 | 1,967 | 5,082 |
| **2039** | 5,072 | 2,911 | - | 203 | 2,017 | 5,131 |
| **2040** | 5,122 | 2,945 | - | 203 | 2,033 | 5,181 |

## C-2. Summer Demand

| Central Balance of Load and Resources (MW) | | | | | | |
|---|---|---|---|---|---|---|
| Year | Peak Demand | Santee Cooper Shared Resources | Duke Energy Carolinas PPA | SEPA Resources | Central Supplied Resources | Total Capacity |
| **2022** | 3,900 | 2,776 | 921 | 203 | - | 3,900 |
| **2023** | 3,942 | 2,795 | 931 | 203 | 12 | 3,942 |
| **2024** | 3,985 | 2,805 | 944 | 203 | 33 | 3,985 |
| **2025** | 4,024 | 2,820 | 956 | 203 | 44 | 4,024 |
| **2026** | 4,056 | 2,789 | 966 | 203 | 98 | 4,056 |
| **2027** | 4,092 | 2,382 | 979 | 203 | 529 | 4,092 |
| **2028** | 4,128 | 2,369 | 990 | 203 | 566 | 4,128 |
| **2029** | 4,171 | 2,471 | 650 | 203 | 848 | 4,171 |
| **2030** | 4,207 | 2,469 | 299 | 203 | 1,236 | 4,207 |
| **2031** | 4,245 | 2,468 | - | 203 | 1,574 | 4,245 |
| **2032** | 4,281 | 2,463 | - | 203 | 1,616 | 4,281 |
| **2033** | 4,326 | 2,466 | - | 203 | 1,657 | 4,326 |
| **2034** | 4,368 | 2,466 | - | 203 | 1,699 | 4,368 |
| **2035** | 4,413 | 2,467 | - | 203 | 1,743 | 4,413 |
| **2036** | 4,456 | 2,462 | - | 203 | 1,791 | 4,456 |
| **2037** | 4,511 | 2,468 | - | 203 | 1,840 | 4,511 |
| **2038** | 4,562 | 2,468 | - | 203 | 1,891 | 4,562 |
| **2039** | 4,614 | 2,468 | - | 203 | 1,943 | 4,614 |
| **2040** | 4,663 | 2,500 | - | 203 | 1,960 | 4,663 |

## D. Community Causes

| Aiken Electric Cooperative | |
|---|---|
| **Volunteer Services / Community Development Initiatives** | Run United |
| | Wire bag packing for Co-op Closet |
| | United Way Agencies |
| | Project Power |
| | Salvation Army Bell Ringing |
| | Aiken Lighting Ceremony |
| | Relay for Life |
| | United Way Family Fun Day |
| | Christmas Caroling – local nursing home |
| **Sponsorships of Charities and Local Organizations** | United Way – School Tools, Corporate Contributions, Annual Fundraisers/Events |
| | Aiken YMCA |
| | NAACP |
| | Special Olympics |
| | CSRA Foundation |
| | Aiken Heart Board |
| | Co-op ministries of North |
| | NRECA Foundation |
| | Alzheimer's Association |
| | Legion Post |
| | Fit 4 School |
| | Education Matters |
| | Aikenites |
| | Red Cross |
| | Rotary Club |
| | MLK Celebration |
| | Scholarship Grants |
| | Axel Adams Foundation |
| | Cinderella Project |
| | Storytime in the Garden |
| | Edgefield County First Steps |
| | Aiken County Veterans |
| | Aiken County PRT |
| | Hankinson's Boxing Gym |
| | Recovery Road |
| | Southeastern Firefighters |
| | TPSA |
| | Golden Harvest Food Bank |
| | Operation Sunscreen for Soldiers |
| | Great Oak Equine Program |
| | SPCA |

| | |
|---|---|
| | Children’s Place |
| | FOTAS |
| | Sarah’s Santa |
| | Valley Empty Stocking Fund |
| | The Salvation Army |
| | CSRA Favors for Foster Families |
| | Backpack Program |
| | Young Philanthropist Society |
| | Distinguished Young Women of Edgefield |
| | Mental Health America |
| | MS Society |
| | Local Fire Departments |
| | Aiken Kiwanis |
| | Upside of Downs |
| | Wounded Warrior |
| | RECing Crew |
| | American Heart Association |
| | Mended Hearts |
| | Mid-Carolina WIRE |
| **Fundraisers for Specific Community Causes** | RUN UNITED – United Way of Aiken County |
| | ORU Golf Tournament – Operation Round Up |
| | WIRE Princess Pancake Breakfast – Area School Backpack Program |
| | Backyard Skeet Shoot – Aiken County Veterans |
| | WIRE Canned Food Drive |

| Berkeley Electric Cooperative | |
|---|---|
| **Volunteer Services** | Trident United Way for food banks within the community |
| | Read Across America |
| | Day of Caring – various projects for schools and community needs |
| | Berkeley County School District – reading partners, lunch buddies, mock interviews, career fairs, and mentorship programs |
| | Volunteered with Heritage Trust Bank for their Reality of Money events at local high schools |
| | Partnered and volunteered with Keep Berkeley Beautiful in cleaning projects within communities |
| | Kids Who Care – Nature scope environment day event |
| | St. Jude's Children's Radiothon and walk/run event |
| | Community Fall Festivals – St. Stephan Catfish Festival, Blue Crab Festival, Cane Bay Firehouse Festival, Trucks, Taps & Tunes Festival, Family Fest in the Park, Latin American Festival, Hispanic parent night |
| | Senior citizen events to educate about energy efficiency and to answer questions about the co-op |
| | Rotary Clubs of Goose Creek and Moncks Corner – Volunteer for reading, dictionary and finance education projects |
| **Sponsorships of Charities and Local Organizations** | Trident United Way |
| | American Red Cross |
| | Berkeley County YMCA sports sponsorships |
| | Berkeley County Sheriff's Office Deputy Day Camp for kids |
| | Miracle League baseball in Moncks Corner |
| | Shuckin' in the Park and holiday fairs |
| | Girl Scouts |
| | Special Day Kids of Cross |
| | Bright Ideas teacher grant program |
| | Back-to-School events |
| | Berkeley Golf Tournament |
| | STEM Youth Camps |
| | Reel Steel Veterans Fishing Tournament – Top sponsor for the Father & Son Military Fishing Tournament |
| | Churches in Berkeley, Dorchester, and Charleston counties |
| **Fundraisers for Specific Community Causes** | Callen-Lacey – provides shelter, food, and care for abused and neglected children |
| | St. Jude's Hospital |
| | Lowcountry Orphan Relief |
| | Relay for Life |
| **Community Development Initiatives** | Involvement/engagement events for active military families and veterans |
| | Increase involvement with local first responders and activate more events within the communities |
| | Increase engagement with member-owners with limited-English proficiency |
| | Grassroot advocacy program |

| | |
|---|---|
| | Host community meetings |
| | Sponsored various chamber events and hosted “Environmental Day” |
| | Host of voter registration drives at the district offices |

| Black River Electric Cooperative | |
|---|---|
| Volunteer Services / Community Development Initiatives | Heart Walk |
| | Relay for Life team and sponsorship |
| | Salvation Army Board and sponsor |
| Sponsorships of Charities and Local Organizations | Kiwanis Pancake Day |
| | Striped Bass Festival |
| | Sumter County Museum and Art Gallery |
| | Shaw Air Force Base events and local school events |
| Fundraisers for Specific Community Causes | Heart Association |
| | Relay for Life team and sponsorship |
| Community Development Initiatives | Work with local economic development boards |

| Blue Ridge Electric Cooperative | |
|---|---|
| Volunteer Services / Community Development Initiatives | Employees can participate in a mentorship program with the Pickens County YMCA |
| | Employees are involved and active leaders in local chambers of commerce and organizations |
| | Local leadership programs |
| Sponsorships of Charities and Local Organizations | Sponsorships for numerous local events and charity events (chamber events, charity balls, The Dream Center in Pickens County, local school initiatives) |
| | Assisted the local career center with equipment needed for electrical/lineman training |
| | Donations to local agencies to help member-owners pay their electrical bills |
| | Sponsored a local school’s security upgrade |
| | Donated a bucket truck to the local technical college to assist with their linemen training program |
| | Sponsored a field trip to Roper Mountain Science Center in Greenville for two elementary schools in the service territory |
| Fundraisers for Specific Community Causes | Annual Blue Ridge Fest – Raises money for 12 local charities |
| | Annual fundraiser for all local United Ways in each county served by Blue Ridge Electric Cooperative |

| Broad River Electric Cooperative | |
|---|---|
| Volunteer Services | Meal on Wheels annual food drive |
| | United Way of the Piedmont (donations) |
| Sponsorships of Charities and Local Organizations | Round-Up Program |

| Central Electric Power Cooperative | |
|---|---|
| Volunteer Services / Community Development Initiatives | Meals on Wheels – pack and deliver meals to local seniors and disabled |
| | Chris Myers' Children Place – performed landscaping, yard work and minor repairs around the property |
| Fundraisers for Specific Community Causes | United Way – yearly campaign drive for monetary donations |
| | School Supply Drive – collect and donate school supplies for a local elementary school |
| | Harvest Hope Food Bank – food drive and money donations to the local food bank |
| | American Heart Association – collect donations and participate in the march to support the American Heart Association |
| | Leukemia & Lymphoma Society – collect donations and participate in the Light the Night walk |
| | Palmetto Place Children and Youth Services – collected money donations |
| | Oliver Gospel Mission – Collect donations for Thanksgiving & Christmas |

| Coastal Electric Cooperative | |
|---|---|
| Sponsorships of Charities and Local Organizations | Colleton County Relay for Life |
| | Rotary Club of Walterboro |
| | Walterboro Criterium |
| | Walterboro Rice Festival |
| Fundraisers for Specific Community Causes | Operation Round Up |
| | Annual CEC Golf Tournament to support Coastal Electric Trust Round Up Program and Colleton County Relay for Life |
| | Smoke in the "Boro" BBQ Event to support Coastal Electric Trust Round Up, Colleton County High School Band of Blue and Colleton Children's Theater |
| Community Development Initiatives | Colleton County Economic Alliance |
| | Mega Site – Industrial Development |

| Edisto Electric Cooperative | |
|---|---|
| Sponsorships of Charities and Local Organizations | American Legion Unit 105- Palmetto Girls State and Boys State, Bamberg Ehrhardt High School, Blackville Hilda High School, Dorchester Academy |
| | Chamber of Commerce |
| | Tri County Chamber of Commerce |
| | Bamberg Lions Club |
| | Beidler Forest – Audubon |
| | Distinguished Young Women of Dorchester County |
| | Dorchester County Economic Development |
| | SC Sheriffs Association |

| Fairfield Electric Cooperative | |
|---|---|
| Volunteer Services | Employees volunteer and support the local sporting leagues as coaches and organizers |
| | Meal preparation assistance for Salkehatchie Summer Services |
| | Employees volunteer & contribute to the Operation Give-A-Turkey & Adopt-the-Elders Programs for Thanksgiving and Christmas each year |
| Sponsorships of Charities and Local Organizations | Rotary Club |
| | Lions Club |
| | Chamber of Commerce |
| | Salkahatchie Summer Services |
| | Fairfield Behavioral Health Organization |
| | Big Red Barn Retreat |
| | Red Cross |
| | Harvest Food Bank |
| | Volunteer Agencies – Wheelchair Ramps |
| | Volunteer Fire Departments |
| | Rescue Squads & smoke detectors |
| | Local Law Enforcement Agencies |
| | Burned Out Fire families |
| Fundraisers for Specific Community Causes | American Cancer Society (Relay for Life) |
| | United Way Payroll Deductions |
| | ACRE / ECHO |
| | Operation Round Up Program |
| Community Development Initiatives | Local county and town economic development initiatives (Industrial Parks, Speculative Building, New Sites) |
| | Washington Youth Tour, Cooperative Youth Summit, & Scholarships for community youth |

| Horry Electric Cooperative | |
|---|---|
| **Volunteer Services** | Trouble in Tiny Town – Safety demonstration to increase safety awareness of potential dangers of electricity on a small scale. Typically presented to schools, civic centers and community organizations |
| | Local Christmas parades |
| | Meet the Linemen – Safety and safety equipment awareness presented to schools and the community |
| | Energy Advisors – Energy tips with Q & A supporting various programs |
| **Sponsorships of Charities and Local Organizations** | WIRE (Women in Rural Electrification) at Horry and at ECSC levels |
| | ORU (Operation Round-Up) – Food, clothing and medication support for the community |
| **Community Development Initiatives** | Bright Ideas – Additional project funding for public schools in Horry County |
| | Washington Youth Tour – Gives high school Juniors the opportunity to visit Washington DC |
| | enLIGHTENSC – Energy related lesson plans for local teachers to better access energy-related information and activities for their classrooms |
| | enLIGHTENSC – Children's Book Challenge which is a competition for $4^{th}$ and $5^{th}$ grade students to write stories focused on how electricity impacts their lives and community |

| Laurens Electric Cooperative | |
|---|---|
| **Sponsorships of Charities and Local Organizations** | WIRE (Women in Rural Electrification) – Jenny Ballard Scholarship |
| | Pay It Forward program |
| | Cooperative Caring Fund- Benefits the Baptist Crisis Center and the Golden Strip Emergency Relief Agency |
| **Fundraisers for Specific Community Causes** | Annual Motorcycle Ride to Give |

| Lynches River Electric Cooperative | |
|---|---|
| **Volunteer Services** | Chesterfield Soup Kitchen – Co-op has the meal catered at the annual event and the employees serve |
| | Community Ambassador Program – Employees can volunteer up to 16 hours during the business day without using vacation time for the following programs: Steam Day at Erwin Elementary; Career Day at Jefferson Elementary or Chesterfield Ruby Middle; Stream Career Day at Buford Elementary |
| | Lineman's Rodeo |
| **Sponsorships of Charities and Local Organizations** | Rainbow Enterprise |
| | Sandhill Volunteer Fire Department |
| | Teals Mill Fire Department |
| | Salem United Methodist Church – Backpack Buddies & Youth Rally |
| | Connie Maxwell Children's Home |
| | Angelus Community Center |
| | Mookie's Place |
| | American Cancer Society |
| | American Legion Aux. 92 |
| | Andrew Jackson High School |
| | Andrew Jackson Middle School |
| | Camden Jr. Welfare League |
| | CareFIRST Carolina |
| | Central High School |
| | Cheraw Air Show |
| | Cheraw Chamber |
| | Cheraw Rotary |
| | Chesterfield County Library |
| | Chesterfield County Schools |
| | Flat Creek Fire Department |
| | Ground 40 Ministries |
| | Town of Heath Springs |
| | Heath Springs Elementary |
| | J-Town Express Travel Baseball |
| | Jefferson-Angelus Legion Post 80 |
| | Jefferson Dixie Youth Baseball |
| | Jefferson Elementary School |
| | 365 Sports |
| | Kershaw County Fine Arts Center |
| | Kershaw Chamber |
| | Kershaw Ducks Unlimited |
| | Lancaster Children's Home |
| | Lancaster County Council of the Arts |
| | Lancaster County Parks and Recreation |
| | Mercy In Me Free Medical Clinic |
| | Mid-Carolina EC |
| | Mt. Calvary Outreach Center |

| | |
|---|---|
| | National Federation of the Blind |
| | New Heights Middle School |
| | North Central High School |
| | Heath Children’s Hospital |
| | Pee Dee Coalition |
| | Petersburg Primary |
| | Rich Hill Community Center |
| | Salkehatchie Camp New Hope |
| | Second Baptist Church |
| | Buford Middle School |
| | Civil Air Patrol |
| | Southpointe Christian School |
| | McDonald-Green Fire Department |
| | Chesterfield Soccer |
| | NAMI Piedmont Tri-County |
| | SC Wildlife Association |
| | Lancaster High School |
| | Kershaw Elementary School |
| | Antioch Fire Department |
| | Hospice of Chesterfield County |
| | Town of Kershaw |
| | Town of Cheraw |
| | Tiney Grove Youth Band |
| | Rich Hill Fire Department |
| | Helping Hands Outreach |
| | Buford High School |
| | Kershaw Area Resource Exchange |
| | Justin Brewer Memorial Foundation |
| | St. James AME Church |
| **Fundraisers for Specific Community Causes** | The LIGHT Foundation: Live auction and golf tournament to raise money for local groups and organizations |
| | Needful Things of Pageland LLC |
| | Mt. Olive Baptist Church |
| | Teal’s Mill Fire Department |
| | Pageland Lions Club |
| | Maranatha Family Center |
| **Community Development Initiatives** | Touchstone Energy Passion Project |
| | Bright Ideas Teacher Grant Program: LREC funding for local teachers to execute unique classroom projects & learning techniques not possible without additional funding |
| | ORU Truck Raffle: supports individuals and organizations within the community during hardships |

| Mid-Carolina Electric Cooperative | |
|---|---|
| **Volunteer Services** | Meals on Wheels through Lexington County Recreation & Aging Commission |
| | Women Involved in Rural Electrification ("Wire") |
| | Employee involvement on Leeza's Care Connection Board |
| | Employee involvement on LRADAC Foundation Board |
| | Employee involvement on Lexington County Sheriff's Association Board |
| | Employee involvement on Saluda Shoals Foundation Board |
| | Employee involvement on Lexington One Educational Foundation Board |
| | Employee involvement on Lexington Chamber Board |
| | Membership in Midlands Business Leadership Group ("MBLG") |
| | Employee involvement on Lexington-Richland Five Business Advisory Board |
| | Employee involvement on Celebrate Freedom Foundation Board |
| **Sponsorships of Charities and Local Organizations** | Mission Lexington, Race for Hunger Title Sponsorship |
| | Lighthouse for Life, Run for Her Life Walk/Race Title Sponsorship |
| | The Courage Center |
| | Local Festivals |
| **Fundraisers for Specific Community Causes** | Sporting Clays Fundraiser for ALS (Lou Gehrig's Disease) & Southeastern Firefighters Burn Association |
| | WIRE Golf Tournament for Becky's Place at Lexington Medical Center |
| | Light the Night Walk – Leukemia Lymphoma Society |
| | Relay for Life – American Cancer Society |
| **Community Development Initiatives** | Operation Round-Up |
| | Touchstone Energy Scholarships |
| | Washington Youth Tour |
| | Cooperative Youth Summit |
| | Bright Ideas – Education Grants |
| | TreeMendUs – tree seedlings to local 3rd graders |
| | Touchstone Energy Cooperative Bowl – Recognizing student athletes |
| | Red Ribbon Week – Bookmarks to 4th graders to strengthen community-wide efforts of drug prevention |
| | Co-op Clean-Up Day |
| | Boys/Girls State |

| Newberry Electric Cooperative | |
|---|---|
| **Volunteer Services** | Boy Scouts |
| | Rural Fire Departments |
| | Hunting and Fishing trips for disabled Veterans and children with disabilities |
| | Augusta Burn Center |
| | Co-op Closet |
| **Sponsorships of Charities and Local Organizations** | Boys Farm |
| | The Manna House |
| | Newberry County Memorial Hospital |
| | Local EMS and Fire Departments |
| | We Care Organization |
| | Fellowship of Christian Athletes |
| | Freedom and Hope Foundation |
| | YMCA |
| | Sponsorship of local basketball, softball, football and volleyball teams |
| | Newberry Special Needs & Disabilities |
| | Veterans Affairs |
| | Mother Against Drunk Drivers |
| | Sister Care |
| | Local church programs |
| | Newberry Free Clinic |
| | Humane Society |
| | Women on a Mission |
| | Hospice |
| | Crisis Pregnancy Center |
| | Council on Aging |
| | Local nursing homes |
| | Interfaith Community Services |
| **Fundraisers for Specific Community Causes** | Operation Round Up Golf Tournament |
| | Breast Cancer Research Foundation |
| | American Heart Association |
| | March of Dimes |
| **Community Development Initiatives** | Funding for spec building |
| | Funding for infrastructure |
| | Funding for land clearing |

| Palmetto Electric Cooperative | |
|---|---|
| **Sponsorships of Charities and Local Organizations** | RBC Heritage |
| | Volunteers in Medicine |
| | Bluffton Self Help |
| | Total Donations of $230,000 over the course of the year to multiple organizations |
| **Fundraisers for Specific Community Causes** | United Way Employee Campaign |
| | Million Dollar Hole in One Event ($42,000 per year) |
| | Operation Round Up ($423,734 in donations in 2019) |
| **Community Development Initiatives** | $400,000 in Utility Tax Credits distributed locally for economic development |
| | Employee representation on the Boards of Southern Carolina Alliance, Beaufort County Economic Development Commission and the Don Ryan Center |

| Pee Dee Electric Cooperative | |
|---|---|
| **Volunteer Services** | Help4Kids |
| | Harvest Hope |
| | Sleep in Heavenly Peace |
| | House of Hope |
| | Christmas toy drives |
| | Donations to local schools |
| **Sponsorship of charities and local organizations** | Operation Round Up/Trust Board- Monthly donations |
| **Community Development Initiatives** | Master plan for Pee Dee Electric's commerce park- Aids in economic development of Florence county. |
| | Holds Regional Chamber and economic board development seats |

| Santee Electric Cooperative | |
|---|---|
| **Volunteer Services** | Christmas in April- Revitalizing member-owner's homes and yards |
| | Reading to students in local schools |
| | Man Up Monday mentorship program |
| | Weekly tutoring at St. Ann's Felician Center |
| | Local involvement with career fairs, boards and committees |
| **Sponsorships of Charities and Local Organizations** | Bright Ideas grants to support local innovative school projects |
| | Local youth programs and scholarships |
| | Donations for Columbia, SC and Washington, D.C. Youth Tours |
| | Local sponsorships for various festivals, tournaments, team sports, etc. |
| | Regional support of economic development groups |
| | Williamsburg County Hospital Foundation- ventilators related to COVID-19 |
| | College scholarships for local students |
| | Discretionary charitable donations |
| | CoBank matching funds for significant projects |
| **Fundraisers for Specific Community Causes** | American Red Cross – hosting blood drives |
| | WIRE fundraisers – Pee Dee Thrift, Pee Dee Coalition, Williamsburg DSS and local school districts |
| **Community Development Initiatives** | Investments in industrial parks, sites, and buildings in service territory |
| | Joint effort with the SC Power Team and regional economic development groups to attract new industries and jobs to the community |
| | Staff serving on the economic development boards for all four counties in the service territory |

| Tri-County Electric Cooperative | |
|---|---|
| **Volunteer Services** | Participation in career fairs and school science fairs |
| | Participation in community events such as festivals and parades |
| | Presentations on electrical safety and energy efficiency at schools, churches & senior community centers |
| | Safety coordinator visits the local fire department to give meter safety presentations |
| **Sponsorship of charities and local organizations** | Various community golf tournaments |
| | Calhoun County Purple Martin Festival, Lower Richland Sweet Potato Festival, variety of community youth leagues |
| | Operation Found Up Program funded: Summer youth programs, equipment and uniforms for youth sports, reading programs, equipment for volunteer firefighters and Peanut Party for children with cancer |
| **Community Development Initiatives** | Fiber Broadband |

| York Electric Cooperative | |
|---|---|
| **Volunteer Services** | Habitat for Humanity |
| | Employees are paid for a full day's work to go volunteer locally |
| **Sponsorships of Charities and Local Organizations** | The Burrell Foundation - 501c3 organization under the York Electric Cooperative umbrella to help those in need in the service territory |
| | Operation Round Up Program |
| | Youth sports, public and private school art programs, food drives, and school supply drives |
| **Fundraisers for Specific Community Causes** | Child Abuse Awareness Month – Teddy Bear Trot 5k to raise money for the Children's Attention Home each year |
| **Community Development Initiatives** | Earth Day, safety demonstrations at local schools, career fairs and classroom discussions, scholarships, Washington Youth Tour, and Cooperative Youth Summit |
| | Come-See-Me festival, Summerfest, Veterans Day Celebration, First Responders recognition, and internships |
| | Economic development initiatives, Bright Ideas, and community solar |

| Common Programs Among All or Most S.C. Cooperatives | |
|---|---|
| **Youth Programs** | Washington Youth Tour – Coordinated as a joint event for all S.C. electric cooperatives, it is an annual six-day educational trip for 75 high school rising seniors. |
| | Cooperative Youth Summit – Coordinated as a joint event for all S.C. electric cooperatives, it is an annual three-day educational trip to Columbia, Statehouse, a power plant, and an electric cooperative headquarters. The 60 students also help assemble care packages for S.C. public school students who are experiencing homelessness. |
| **Education** | EnLIGHTenSC.org - an education initiative and website aimed at teachers, providing energy information, lesson plans, and free master's level continuing education. |
| | Children's Book Challenge – an academic competition aimed at K-12 students in which they write and illustrate an original children's book focusing on energy and electricity in South Carolina. The winner's book is published and distributed to school libraries across the state. |
| **Philanthropy** | Touchstone Energy Bowl North/South All Star Football Game – Collectively, the co-ops are the primary sponsor of this annual recognition of 88 players during a week-long character-building experience which includes a holiday shopping trip for 44 deserving children co-sponsored by the co-ops. The Mr. Football Award recognizes the top prep football player in South Carolina, based on character and on-field performance. |
| **Scholarships** | Educational scholarships for students are associated with several of the programs mentioned. |