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Duke Energy Progress

South Carolina Integrated Resource Plan (Annual Report)

November 1, 2017

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ABBREVIATIONS:	
AMP	Aging Management Programs
CAIR	Clean Air Interstate Rule
CAMR	Clean Air Mercury Rule
CC	Combined Cycle
CCR	Coal Combustion Residuals
CCS	Carbon Capture Sequestration
CECPCN	Certificate of Environmental Compatibility and Public Convenience and Necessity
CFL	Compact Fluorescent Light bulbs
CHP	Combined Heat and Power
CO_2	Carbon Dioxide
COD	Commercial Operation Date
COL	Combined Construction and Operating License
CPCN	Certificate of Public Convenience and Necessity
CPP	Clean Power Plan
IPI	Manufacturing Industrial Production Index
CSAPR	Cross State Air Pollution Rule
CT	Combustion Turbine
DC	Direct Current
DEC	Duke Energy Carolinas
DEP	Duke Energy Progress
DOE	Department of Energy
DSM	Demand Side Management
EE	Energy Efficiency Programs
EGU	Electric Generating Unit
EIA	Energy Information Administration
EPA	Environmental Protection Agency
EPC	Engineering, Procurement, and Construction
EPRI	Electric Power Research Institute
FERC	Federal Energy Regulatory Commission
FGD	Flue Gas Desulfurization
FLG	Federal Loan Guarantee
GALL	Generic Aging Lessons Learned Report
GHG	Greenhouse Gas
HB 589	Competitive Energy Solutions for North Carolina (House Bill 589)
HRSG	Heat Recovery Steam Generator
HVAC	Heating, Ventilation and Air Conditioning
IGCC	Integrated Gasification Combined Cycle
IRP	Integrated Resource Plan
IS	Interruptible Service
ILR	Inverter Load Ratio
ITC	International Trade Commission
ITC	Investment Tax Credit
JDA	Joint Dispatch Agreement`
KW	kilowatt

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ABBREVIATIONS (CONT.):	
LCR Table	Load, Capacity, and Reserve Margin Table
LEED	Leadership in Energy and Environmental Design
LOLE	Loss of Load Expectation
MACT	Maximum Achievable Control Technology
MATS	Mercury Air Toxics Standard
MMBtu	1 million British Thermal Units
MW	Megawatt
MWh	Megawatt-hour
NAAQS	National Ambient Air Quality Standards
NC	North Carolina
NCDAQ	North Carolina Division of Air Quality
NCEMC	North Carolina Electric Membership Corporation
NCMPA1	North Carolina Municipal Power Agency #1
NC REPS	North Carolina Renewable Energy and Energy Efficiency Portfolio Standard
NCTPC	NC Transmission Planning Collaborative
NCUC	North Carolina Utilities Commission
NERC	North American Electric Reliability Corp
NGCC	Natural Gas Combined Cycle
NO_x	Nitrogen Oxide
NRC	Nuclear Regulatory Commission
NSPS	New Source Performance Standard
NUREG	Nuclear Regulatory Commission Regulations
OATT	Open Access Transmission Tariff
O&M	Operations and Maintenance
ONS	Oconee Nuclear Station
PC	Pulverized Coal
PEV	Plug-In Electric Vehicles
PMPA	Piedmont Municipal Power Agency
PPA	Purchase Power Agreement
PSCSC	Public Service Commission of South Carolina
PV	Photovoltaic
PVRR	Present Value Revenue Requirements
PURPA	Public Utility Regulatory Policies Act
QF	Qualifying Facility
REC	Renewable Energy Certificates
REPS	Renewable Energy and Energy Efficiency Portfolio Standard
RFP	Request for Proposal
RIM	Rate Impact Measure
RPS	Renewable Portfolio Standard
SAE	Statistically Adjusted End-Use Models
SAT	Single-Axis Tracking
SC	South Carolina
SC DER	South Carolina Distributed Energy Resource Program
SCE&G	South Carolina Electric & Gas

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ABBREVIATIONS (CONT.):	
SCR	Selective Catalytic Reduction
SEPA	Southeastern Power Administration
SERC	SERC Reliability Corporation
SG	Standby Generation
SIP	State Implementation Plan
SLR	Subsequent License Renewal
SO_2	Sulfur Dioxide
SRP-LR	Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants
SRP-SLR	Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants
STAP	Short-Term Action Plan
TAG	Technology Assessment Guide
TRC	Total Resource Cost
The Company	Duke Energy Progress
The Plan	Duke Energy Progress Annual Plan
UCT	Utility Cost Test
UEE	Utility Energy Efficiency Programs
U.S.	United States
VACAR	Virginia/Carolinas
VAR	Volt Ampere Reactive

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1. INTRODUCTION:

For more than a century, Duke Energy Progress (DEP) has provided affordable and reliable electricity to customers in South Carolina (SC) and North Carolina (NC) now totaling more than 1.5 million in number. The Company continues to serve its customers by planning for future demand requirements in the most reliable and economic way possible using increasingly clean forms of energy.

Historically, each year, as required by the Public Service Commission of South Carolina (PSCSC) and the North Carolina Utilities Commission (NCUC), DEP submits a long-range planning document called the Integrated Resource Plan (IRP). The IRP details potential infrastructure needed to match the forecasted electricity requirements and a reasonable reserve margin to maintain system reliability for our customers over the next 15 years.

In accordance with PSCSC Order No. 98-502 Approving Least-Cost Integrated Resource Planning Process, the Company is providing a Short-Term Action Plan, a 15-year plan and other pertinent information compliant with the Commission's Order.

The Company files separate 2017 IRPs for South Carolina and North Carolina. However, the IRP analyzes the system as 1 DEP utility across both states including customer demand, energy efficiency (EE), demand side management (DSM), renewable resources and traditional supply-side resources. As such, the quantitative analysis contained in both the South Carolina and North Carolina filings is identical, while certain sections dealing with state-specific issues such as state renewable standards or environmental standards may be specific to that state's IRP.

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2. 2017 IRP SUMMARY:

Each year, as required by the PSCSC, DEP submits an IRP detailing potential infrastructure needed to meet the forecasted electricity requirements for its customers over the next 15 years.
The 2017 IRP is the best projection of the Company's capacity and energy portfolio over the next 15 years, based on current data assumptions. This projection may change over time as variables such as the projected load forecasts, fuel price forecasts, environmental regulations, technology performance characteristics and other outside factors change.
The proposed plan will meet the following objectives:

- Provide reliable electricity especially during peak demand periods by maintaining adequate reserve margins. Peak demand refers to the highest amount of electricity being consumed for any given hour across DEP's entire system.
- Add new resources at the lowest reasonable cost to customers. These resources include a balance of EE, DSM, renewable resources, nuclear facilities, hydro generation and natural gas generation.
- Improve the environmental footprint of the portfolio by meeting or exceeding all federal, state and local environmental regulations.

As 2017 is an update year, DEP developed 4 cases which reflect updates to the 2016 IRP base case. The first case, or the "Base Case," is an update to the presented base case in the 2016 IRP, which includes the expectation of future carbon legislation and no relicensing of existing nuclear units. Additionally, a "No Carbon Case" was developed in which no carbon legislation, without nuclear relicensing, is considered. Finally, given the uncertainty of new and existing nuclear generation, the Base Case and No Carbon Case are also evaluated with relicensing of existing nuclear units. All results presented in this IRP represent the Base Case without nuclear relicensing, except where otherwise noted. As discussed in more detail throughout this report, updates in this year's IRP impact the forecasted timing and amount of renewable and natural gas resource additions within the 15 year study window.

Renewable Energy

The Company continues to aggressively pursue additional cost-effective renewable resources as a growing part of its energy portfolio. The Company's commitment, coupled with supporting legislation such as South Carolina's Distributed Energy Resource Program Act (SC DER Program) and North Carolina's Renewable Energy and Energy Efficiency Portfolio Standard (NC REPS), have led to significant growth in renewable resource development in the Carolinas.

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Furthermore, on July 27, 2017, North Carolina Governor Cooper signed into law the "Competitive Energy Solutions for North Carolina" bill or House Bill 589 (HB 589). As discussed in more detail in Section 4.b. of this report, HB 589 calls for the establishment of a competitive procurement process by which the Company will pursue additional solar resources in its service territory, provided that they are cost-effective for consumers. Commensurately, the update contained in this year's IRP reflects the initial forecast of increases in renewable additions as a result of HB 589.

It must be noted, however, that at the time of this report filing, the rules, regulations and details surrounding the implementation of HB 589 are still under development. As these rules are finalized and the Company gains experience with the new competitive procurement process, updated forecasts will be presented in subsequent IRPs.

Natural Gas Resources

As the Company transitions to a more efficient and increasingly clean generation mix, new natural gas generation facilities will play a vital role in meeting consumer demand over the next decade. Technical advancements in new natural gas generation facilities continue to improve unit efficiencies and performance characteristics. This enhanced efficiency and flexibility lowers the operating cost of new units while providing additional operational flexibility to the existing generation fleet, which assists in the integration of incremental solar generation. Beyond improved unit efficiency, continued declines in natural gas prices also lowers the operating cost of new natural gas generation.

Evolving its planning and procurement process, the Company has modified its natural gas procurement practices to now periodically purchase natural gas forward contracts for a period of up to 10 years into the future. These longer-term forward purchases allow the Company to assess the fair value of natural gas and associated power purchases well into the future. The most recent long-dated purchase made just prior to the filing of this IRP demonstrated a continued decline in long-term natural gas prices as compared to those assumed in the 2016 IRP and the subsequent avoided cost rate filing.

In addition to the Renewable Energy and Natural Gas updates, other changes and issues since the 2016 IRP are discussed in this document. Those changes and issues include:

- Load Forecast
- Nuclear Assumptions
- Combined Heat & Power (CHP) Projections
- Resource Adequacy

- Fuel Costs
- Carbon Assumptions
- Technology Construction and Operating Costs

As shown in the 2017 IRP Base Case, projected incremental needs are driven by load growth and the retirement of aging coal-fired resources. The 2017 IRP seeks to achieve a reliable, economic long term power supply through a balance of incremental renewable resources, EE, DSM, and traditional supply-side resources planned over the coming years which allows the Company to maintain a diversified resource mix while also providing increasingly clean energy. Chart 2-A represents the incremental investments required to meet future needs.

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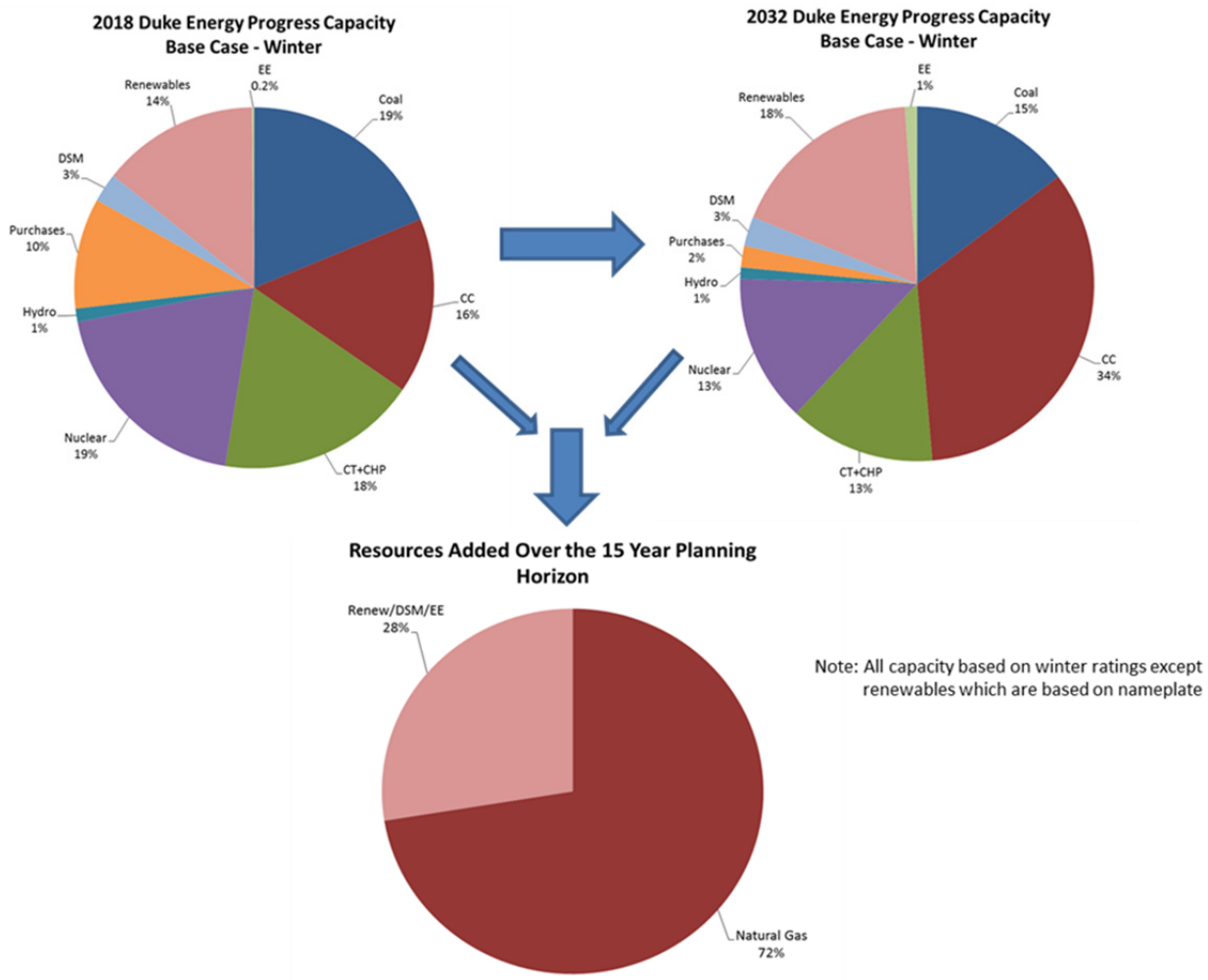
Chart 2-A 2018 and 2032 Base Case Winter Capacity Mix and Sources of Incremental Capacity



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3. IRP PROCESS OVERVIEW:

To meet the future needs of DEP's customers, it is necessary for the Company to adequately understand the load and resource balance. For each year of the planning horizon, the Company develops a load forecast of cumulative energy sales and hourly peak demands. To determine total resources needed, the Company considers the peak demand load obligation plus a 17% minimum planning reserve margin.

The projected capability of existing resources, including generating units, EE and DSM, renewable resources and purchased power contracts, is measured against the total resource need. Any deficit in future years will be met with a mix of additional resources that reliably and cost-effectively meet the load obligation and planning reserve margin while complying with all environmental and regulatory requirements.

Growth in Peak Demand and Energy Consumption	+	Resource Retirements	=	New Resource Needs

It should be noted that DEP considers the non-firm energy purchases and sales associated with the Joint Dispatch Agreement (JDA) with Duke Energy Carolinas (DEC) in the development of its independent Base Case. To accomplish this, DEP and DEC plans are determined simultaneously to minimize revenue requirements of the combined jointly-dispatched system while maintaining independent reserve margins for each company.

For the first time in the 2016 IRP, DEP developed resource plans that also include new resource additions driven by winter peak demand projections inclusive of winter reserve requirements. The completion of a comprehensive reliability study demonstrated the need to include winter peak planning in the IRP process. The study recognized the growing volatility associated with winter morning peak demand conditions such as those observed during recent polar vortex events. The study also incorporated the expected significant growth in solar facilities that provide valuable assistance in meeting summer afternoon peak demands on the system but do little to assist in meeting demand for power on cold winter mornings. As discussed in more detail in the Resource Adequacy section, the significant penetration of solar resources and the associated impact on summer versus winter reserves is the primary driver for the Company's shift to winter capacity planning. Based on results of the reliability study, DEP is now utilizing a winter planning reserve margin of 17% in its planning process.

For the 2017 Update IRP, the Company presents a Base Case with a carbon tax beginning in 2026. The Clean Power Plan (CPP) rule that was finalized on August 3, 2015 by the EPA is under interagency review for potential repeal. As a result, the timing and details of any potential future carbon legislation are highly uncertain. While future carbon legislation is unknown, the Company feels that it is prudent to continue to plan for this scenario, as well as other potential future scenarios. Furthermore, a primary focus of this update IRP is the Short-Term Action Plan (STAP), which covers the period 2018 to 2022. It was determined that the inclusion of the carbon tax did not have a significant impact on the STAP, and therefore the majority of the data presented in this report represents the Base Case.

Figure 3-A represents a simplified overview of the resource planning process in the update years (odd years) of the IRP cycle.

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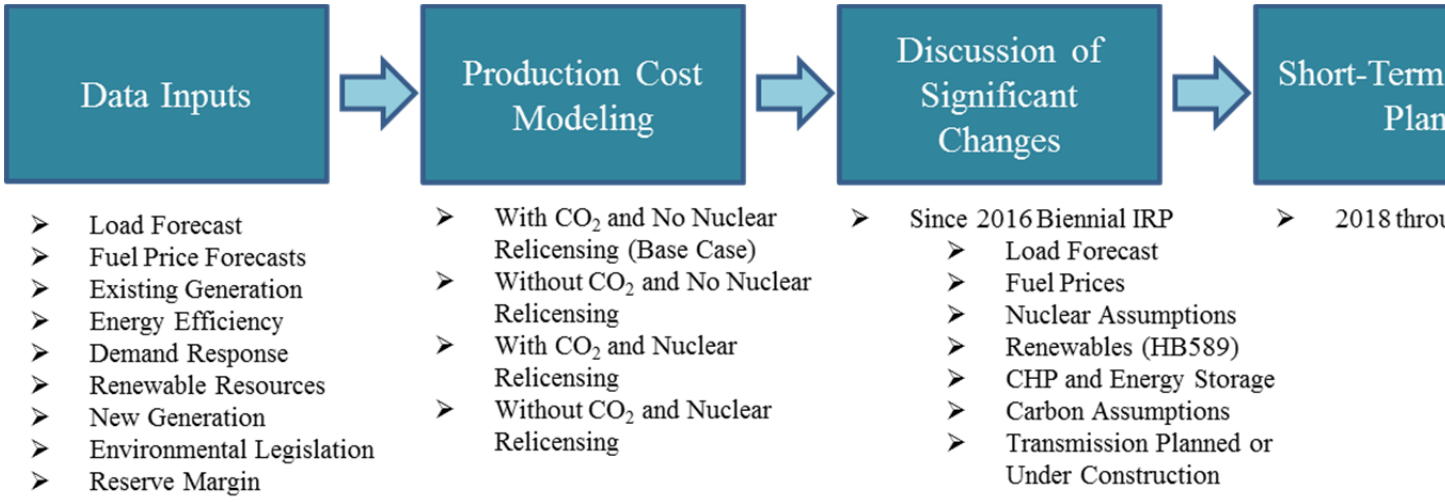
Figure 3-A Simplified IRP Process



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4. SIGNIFICANT CHANGES FROM THE 2016 IRP:

As an initial step in the IRP process, all production cost modeling data is updated to include the most current data. Throughout the year, best practices are implemented to ensure the IRP best represents the Company's planning assumptions including load forecast, generation system, conservation programs, renewable energy and fuel costs. The data and methodologies are regularly updated and reviewed to determine if adjustments can be made to further improve the IRP process and results.

As part of the review process, certain data elements, with varying impacts on the IRP, inevitably change. A discussion of new or updated data elements that have the most substantial impact on the 2017 IRP is provided below.

a) Load Forecast

The Company continues to utilize the statistically adjusted end use models (SAE) provided by ITRON to forecast sales and peaks with reasonable results.

Each time the forecast is updated, the most currently available historical and projected data is used. The Spring 2017 forecast which was used in the development of the Company's 2017 IRP utilizes:

- Moody's Analytics January 2017 base economic projections
- End use equipment and appliance indexes reflecting the 2016 update of ITRON's end-use data, which is consistent with the Energy Information Administration's 2016 Annual Energy Outlook
- A calculation of normal weather using the period 1987-2016

Additional focus is being placed on the hourly shaping of sales, which plays a critical role in forecasting summer and winter peaks. While much of this work is ongoing and will be incorporated in the 2018 IRPs, the Company continues to review the weather sensitivity of winter and summer peaks, as well as the hourly shaping of behind-the-meter solar, utility-sponsored energy efficiency programs (UEE), electric vehicles, and other variables.

Additional focus is also being placed on Duke's load research sample data, to gain a better understanding of historical hourly demand trends, winter and summer peaking characteristics by customer class, and minimums by customer class, in continuous efforts to improve forecast accuracy. Table 4-A depicts the projected average annual growth rates of several key drivers from DEP's Spring 2017 Forecast.

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Table 4-A Key Drivers

	2018-2032
Real Income	2.7%
Manufacturing Industrial Production Index (IPI)	1.3%
Population	1.6%

In addition to economic, demographic, and efficiency trends, the forecast also incorporates the expected impacts of utility-sponsored energy efficient programs, as well as projected effects of electric vehicles and behind-the-meter solar technology.

The results of the Spring 2017 Forecast as compared to Spring 2016 Forecast is presented in Table 4-B below.

Table 4-B 2017 Load Forecast Growth Rates vs. 2016 Load Forecast Growth Rates (Retail and Wholesale Customers)

	2017 Forecast (2018 – 2032)			2016 Forecast (2017 – 2031)		
	Summer Peak Demand	Winter Peak Demand	Energy	Summer Peak Demand	Winter Peak Demand	Energy
Excludes impact of new EE programs	0.9%	0.8%	0.8%	1.3%	1.4%	1.1%
Includes impact of new EE programs	0.7%	0.7%	0.6%	1.1%	1.3%	0.9%

b) Renewable Energy

The growth of renewable generation in the United States continues to outpace that of non-renewable generation. In 2016, more than 16,000 MW of wind and solar capacity were installed nationwide compared to approximately 10,000 MW for natural gas, coal, nuclear, and other technologies.[1]

North Carolina ranked in the top 5 in the country in solar capacity added in 2016, second behind only California in total solar capacity online. Duke Energy's compliance with the North Carolina Renewable Energy and Energy Efficiency Portfolio Standards (NC REPS) and the Public Utilities

[1] All renewable energy MW represent MW-AC (alternating current) unless otherwise noted.

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Regulatory Policy Act (PURPA) as well as the Federal Investment Tax Credit (ITC) were key factors behind the high penetration of solar in the state. North Carolina's current favorable avoided cost rates and 15-year contract terms for qualifying facilities (QFs) under PURPA have contributed to record numbers of projects in the interconnection queue, with the DEP and DEC combined solar queue representing more than 7,000 MW.

To reduce the dependence on PURPA while continuing to support solar growth in a sustainable and economically attractive manner, on July 27, 2017 Governor Cooper signed into law the "Competitive Energy Solutions for North Carolina" bill or House Bill 589 (HB 589). The law reduces the maximum size of standard contracts offered to solar projects to 1 MW and reduces the contract term to 10 years.

HB 589 also introduces a competitive procurement process for renewable resources including large-scale solar facilities that continues to enable third-party and utility-owned renewable development. Capacity referred to as the "Transition" MW in this document represents the total capacity of projects in the combined Duke Balancing Authority area that are (1) already connected; or (2) have entered into purchase power agreements and interconnection agreements as of the end of the 45-month competitive procurement period, provided that they are not subject to curtailment or economic dispatch. HB 589 targets 2,660 MW of competitively procured renewable resources over a 45-month period, which may vary based on the amount of "Transition" MW at the end of the 45-month period. It is expected that 3,500 MW of "Transition" MW will exist in the combined Duke Balancing Authority area at the end of the 45-month period. The capacity additions from the competitive procurement will be in addition to the expected 3,500 MW of "Transition" MW. Projects in both North Carolina and South Carolina are eligible for the competitive procurement process.

Growing customer demand, the federal ITC, and declining installed solar costs make solar capacity the Company's primary renewable energy resource in the 2017 IRP. The 2017 IRP makes the following key assumptions regarding renewable energy:

- Installed solar capacity increases in DEP from 2,448 MW in 2018 to 3,847 MW in 2032.
- Compliance with NC REPS continues to be met through a combination of solar, other renewables, EE, and Renewable Energy Certificate (REC) purchases.
- Achievement of the SC DER Program goal of 39 MW of solar capacity located in DEP-SC;
- Passage of HB 589 and continuing solar cost declines drive solar capacity growth above and beyond NC REPS requirements.

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Interconnection Queue and the Transition

Through the end of 2016, DEP had more than 1,200 MW of third party utility scale solar on its system, with more than 300 MW interconnecting in 2016. When renewable resources were evaluated for the 2017 IRP, DEP reported another approximately 650 MW of third party solar under construction and more than 5,000 MW in the interconnection queue. Table 4-C depicts the interconnection queue for DEP as of June 30, 2017.

Table 4-C DEP QF Interconnection Queue (as of June 30, 2017)

Utility	FacilityState	Energy Source Type	Number of Pending Projects	Pending Capacity (MW AC)
DEP	**NC**	Biogas	1	6
		Biomass	3	50
		Diesel	8	4
		Natural Gas	3	530
		Solar	372	3,998
	NC Total		**387**	**4,588**
	SC	Diesel	1	0
		Solar	111	1,427
	SC Total		**112**	**1,427**
DEP Total			**499**	**6,015**

Projecting future solar connections from the interconnection queue has presented a significant challenge due to the large number of project cancellations and ownership transfers. If the aggregate capacity in the "Transition" exceeds 3,500 MW, the competitive procurement volume of 2,660 MW will be reduced by the excess amount; conversely, if the "Transition" falls short of 3,500 MW the Companies will conduct additional competitive procurement.

DEP's contribution to the "Transition" depends on a number of variables including connecting projects under construction, the number of projects in the queue with power purchase agreements, interconnection agreements, and/or settlement agreements, and SC DER Program Tier I. In total, DEP may contribute roughly three-quarters of the "Transition" MW with DEC accounting for the remaining quarter.

NC REPS Compliance

DEP remains committed to meeting the requirements of NC REPS, including the poultry waste, swine waste, and solar set-asides, and the general requirement, which will be met with additional

solar, hydro, biomass, landfill gas, wind, and energy efficiency resources. DEP's long term general compliance needs are expected to be met through a combination of renewable resources, including solar RECs obtained through the HB 589 competitive procurement process.

HB-589 Competitive Procurement and Utility-Owned Solar

DEP continues to evaluate utility-owned solar additions to grow its renewables portfolio. DEP is operating 4 utility-scale solar projects as part of its efforts to encourage emission free generation resources and help meet its compliance targets, totaling 141 MW-AC:

- Camp Lejeune Solar Facility – 13 MW, located in Onslow County, NC placed in service in November 2015;
- Warsaw Solar Facility – 65 MW, located in Duplin County, NC placed in service in December 2015;
- Fayetteville Solar Facility – 23 MW, located in Bladen County, NC placed in service in December 2015; and
- Elm City Solar Facility – 40 MW, located in Wilson County, NC placed in service in March 2016.

As mentioned above, HB 589 calls for 2,660 MW of additional solar in the Carolinas, which may vary depending upon how the actual "Transition" MW compare to the initial 3,500 MW estimate. RFPs will be issued over a 45-month period under the competitive procurement process; DEP may own up to 30% of the competitive procurement volume it self-develops. DEP will also evaluate the potential for acquiring facilities where appropriate. HB 589 does not stipulate a limit for DEP's option to acquire third party projects. Since the majority of the solar projects connected during the "Transition" will be in DEP's territory, DEC is expected to have the majority of the competitive procurement projects, helping to balance the portfolios and mitigate additional operational challenges in DEP.

HB 589 requires that competitive bids are priced below utility's avoided cost rates, as approved by the NCUC, or it will not be selected. Therefore, the cost of solar is a critical input for forecasting how much of the competitive procurement will materialize. Avoided cost forecasts are subject to variability due to changes in factors such as natural gas and coal commodity prices, system energy and demand requirements, the level and cost of generation ancillary service requirements and interconnection costs. Changes in these factors will result in changing avoided cost values over the upcoming years with the potential to impact the cost-effectiveness of future competitive procurement solicitations.

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Similarly, solar costs are also influenced by a number of variables. Panel prices have decreased at a significant rate and are expected to continue to decline. However, there are political factors, such as the Suniva International Trade Commission (ITC) case, that have the potential to increase panel prices.[2] Additional factors that could put upward pressure on solar costs include direct interconnection costs, as well as costs incurred to maintain the appropriate operational control of the facilities. Finally, as panel prices have decreased, there has been more interest in installing single-axis tracking (SAT) systems and/or systems with higher inverter load ratios (ILR) which change the hourly profile of solar output and increase expected capacity factors. DEP will incorporate different configurations further in the 2018 IRP.

In summary, there is a great deal of uncertainty in both the future avoided cost value of solar and the expected price of solar installations in the years to come. As a result, the Company will continue to closely monitor and report on these changing factors in future IRP and competitive procurement filings.

In preparation for the HB 589 competitive procurement process, the Company continues to build its relationships with suppliers, Engineering, Procurement, and Construction Contractors (EPCs), and other entities to create greater efficiencies in the supply chain, reduce construction costs, reduce operating and maintenance costs (O&M), and enhance system design. In anticipation of future solar growth, DEP is positioning itself to properly integrate renewable resources to the grid regardless of ownership.

In addition to ensuring DEP has operational control over future solar associated with HB 589, the intermittency of solar output will require the Company to evaluate and invest in technologies to provide solutions for voltage, volt-ampere reactive (VAR), and/or higher ancillary reserve requirements.

HB 589 Customer Programs

In addition to the competitive procurement process, HB 589 offers direct renewable energy procurement for major military installations, public universities, and other large customers, as well as a community solar program. These programs will be a great complement to the existing customer-oriented strategies in SC, including the SC DER Program.

[2] In April, 2017, Suniva officially filed a petition to the ITC under Section 201 of the Trade Act of 1974. Suniva is requesting relief against imports from all geographic sources and requesting both a minimum price on crystalline silicon PV modules (initially $0.78/W) and a tariff on cells (initially $0.40/W). As expected, the petition only applies to crystalline silicon. (GTM Research Suniva Trade Dispute Update)

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The renewable energy procurement carve out for large customers such as military installations and universities may have similarities to DEC's Green Source Rider program. The program allows for up to 600 MW of total capacity, with set asides for military installations (100 MW of the 600 MW) and the University of North Carolina (UNC) system (250 MW of the 600 MW). The 2017 IRP base case assumes all 600 MW of this program materialize, with the DEP/DEC split expected to be roughly equal. If all 600 MW are not utilized, the remainder will roll back to the competitive procurement, increasing its volume.

The community solar portion of HB 589 calls for up to 20 MW of shared solar in DEP. This program may have similarities to SC DER Program's community solar program. The 2017 IRP Base Case assumes that all 20 MW of the program materialized.

HB 589 also calls for a rebate program for rooftop solar as well as a leasing program, and the establishment of revised net metering rates. Given the uncertainty around the timing and structuring of these programs, it is challenging to assess the impact HB 589 will have on rooftop solar adoption in NC.

SC DER Program Solar

Steady progress continues to be made with the first 2 tiers of the SC DER Program summarized below, unlocking the third tier:

- Tier I: 13 MW of solar capacity from facilities each >1 MW and <10 MW in size.
- Tier II: 13 MW met of behind-the-meter rooftop solar facilities for residential, commercial and industrial customers, each ≤1 MW , 25% of which must be ≤ 20 kilowatts (kW). Since Tier II is behind the meter, the expected solar generation is embedded in the load forecast as a reduction to expected load.
- Tier III: Investment by the utility in 13 MW of solar capacity from facilities each >1 MW and <10 MW in size. Upon completion of Tiers I and II (to occur no later than 2021), the Company can directly invest in additional solar generation to complete Tier III.

DEP is expected to have 5 MW of Tier I operational by the end of the year allowing the Tier I goal to be achieved before the 2020 in-service deadline specified in the DER program. Tier II rooftop solar in DEP South Carolina has been strongly adopted this year with 5 MW connected so far, which is more than DEP North Carolina year-to-date. In total, DEP SC now has over 6 MW of rooftop solar installed.

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Battery Storage and Wind

In addition to solar, the Company is assessing renewable technologies such as battery storage and wind. Battery storage costs are expected to continue to decline significantly which may make it a viable option in the long run to support grid services including frequency regulation, solar smoothing, and/or energy shifting from localized renewable energy sources with a high incidence of intermittency (i.e. solar and wind). The Company intends to begin investing in multiple systems dispersed throughout its North and South Carolina service territories that will be located on property owned by the Company or leased from its customers. These deployments will allow Duke Energy and its customers to evaluate the costs and impacts of batteries deployed at a significant scale, explore the nature of new offerings desired by customers, and fill knowledge gaps. Among the DEP and DEC territories, as much as 75 MW of utility-owned and operated battery storage may be dispersed in the 2019-2021 time period. Additionally, HB 589 calls for an energy storage study to assess the economic potential for NC customers.

DEP currently has 1 battery constructed and 2 in the interconnection queue in the western Carolinas region to support the Western Carolinas Modernization Project (WCMP). DEP will site at least 15 MW of solar and 5 MW of storage capacity in the DEP-Western Region to support the retirement of the 2 coal units at Asheville.

DEP also considers wind a potential energy resource in the long term to support increased renewables portfolio diversity and long-term general compliance needs. However, investing in wind inside of DEP's footprint may be challenging in the short term, primarily due to a lack of suitable sites, permitting challenges, and more modest capital cost declines relative to other renewable technologies like solar. Opportunities may exist to transmit wind energy into the Carolinas from out-of-state regions where wind is more cost-effective.

Summary of Expected Renewable Resource Capacity Additions

The 2017 IRP incorporates the base case renewable capacity forecast below. This case includes renewable capacity required for compliance with NC REPS, non-compliance PURPA renewable purchases part of the "Transition" MW of HB 589, as well as SC DER Program, and the additional 3 components of HB 589 (competitive procurement, renewable energy procurement for large customers, and community solar). The Company anticipates a diverse portfolio including solar, biomass, hydro, and other resources. Actual results could vary substantially for the reasons discussed previously, as well as other potential changes to legislative requirements, tax policies, technology costs, and other market forces. The details of the forecasted capacity additions, including both nameplate and contribution to winter and summer peaks are summarized in Table 4-D below.

While solar does not normally reach its maximum output at the time of DEP's expected peak load in the summer, solar's contribution to summer peak load is large enough (44% of nameplate solar capacity) that it may push the time of summer peak from hour beginning 4:00 PM to 5:00 PM or later if solar penetration levels continue to increase. However, solar is unlikely to have a similar impact on the morning winter peak due to lower expected solar output in the morning hours (5% of nameplate solar capacity). Contribution to peak assumptions will continue to be evaluated in 2018, with specific attention given to different configurations of solar projects with fixed tilt or tracking systems and different ILRs.

Table 4-D DEP Base Case Total Renewables

DEP Base Renewables - Compliance + Non-Compliance											
	MW Nameplate				MW Contribution to Summer Peak					MW Contribution to Winter Peak	
	Solar	Biomass/ Hydro	Total		Solar	Biomass/ Hydro	Total			Solar	Biomass/ Hydro	Total
2018	2448	256	2704		1077	256	1333		2017/2018	122	256	378
2019	2714	214	2928		1194	214	1408		2018/2019	136	214	350
2020	3162	214	3377		1391	214	1606		2019/2020	158	214	372
2021	3371	214	3586		1483	214	1698		2020/2021	169	214	383
2022	3580	79	3658		1575	79	1654		2021/2022	179	79	258
2023	3767	71	3838		1657	71	1729		2022/2023	188	71	260
2024	3928	71	3999		1728	71	1799		2023/2024	196	71	268
2025	3945	62	4007		1736	62	1798		2024/2025	197	62	259
2026	3925	61	3985		1727	61	1788		2025/2026	196	61	257
2027	3905	61	3966		1718	61	1779		2026/2027	195	61	256
2028	3886	56	3942		1710	56	1766		2027/2028	194	56	251
2029	3866	51	3917		1701	51	1752		2028/2029	193	51	244
2030	3847	45	3892		1693	45	1737		2029/2030	192	45	237
2031	3847	31	3878		1693	31	1724		2030/2031	192	31	224
2032	3847	31	3878		1693	31	1724		2031/2032	192	31	224

* Solar includes 0.5% per year degradation

While high and low solar portfolios were not evaluated compared to the base case for the 2017 IRP, volumes can certainly vary greatly, especially for solar resources. Solar projections may fall short of the base case if the competitive procurement for universal solar facilities, renewable energy procurement for large customers, and/or community solar programs of HB 589 don't materialize to their limits for some of the reasons mentioned earlier. On the upside, there is also the unknown of what occurs after HB 589 which is assumed to have no additional solar growth in the base case. While new policy may stimulate additional growth, a high sensitivity could occur given further improvements in the economics for solar through events such as high carbon dioxide emission regulations or taxes, lower solar capital costs, economical solar plus storage, and/or continuation of renewal subsidies, and/or stronger renewable energy mandates.

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c) Nuclear Assumptions

The Company views all of its existing nuclear plants as excellent candidates for license extensions, however to date, no existing nuclear plant operating licenses have been extended to operate from 60 years to 80 years in the United States. As such, there is uncertainty regarding license extension and any costs associated with continuing to operate for an additional 20 years. The Company is evaluating the feasibility of relicensing its existing nuclear resources. Given the uncertainty of license extension, the IRP Base Case does not assume license extension at this time, but rather considers relicensing as a sensitivity to the Base Case. The Company is evaluating the feasibility of relicensing its existing nuclear resources. A discussion of the Company's activities is included below.

Subsequent License Renewal (SLR) for Nuclear Power Plants

License Renewal is governed by Title 10 of the Code of Federal Regulations (10 CFR) Part 54, Requirements for Renewal of Operating Licenses for Nuclear Power Plants. Additionally, the Nuclear Regulatory Commission (NRC) has issued regulatory guidance documents, specifically the Generic Aging Lessons Learned (GALL) Report (NUREG-1801) and NUREG-1800, Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants (SRP-LR) as a basis for determining the adequacy of Aging Management Programs (AMPs). Currently the NRC has approved applications to extend licenses to 60 years for 87 nuclear units with applications for 5 nuclear units currently under review.

On August 29, 2014 the Nuclear Regulatory Commission issued a Staff Requirements Memorandum to provide the NRC staff with direction on SLR, i.e., extending nuclear power plant licenses to 80 years. Consistent with that direction, the NRC drafted guidance documents specifically applicable to SLR applications. In December 2015, NUREG-2191 (Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report) and NUREG-2192 (Standard Review Plan for the Review of Subsequent License Renewal (SRP-SLR) Applications for Nuclear Power Plants) were issued for public comment. Following an extensive comment process involving Duke Energy, the nuclear industry, and other stakeholders, the NRC published the final NUREGs in the Federal Register on July 14, 2017, thereby establishing formal regulatory guidance for SLR.

Dominion Energy announced on November 6, 2015 that they would pursue SLR for its Surry plant as a Lead Plant and submitted a letter of intent to the NRC. Exelon Corporation made a similar announcement for its Peach Bottom plant on June 7, 2016. Currently, Exelon is planning to submit the Peach Bottom SLR Application in mid-2018 while Dominion is targeting early 2019 for Surry. On May 17, 2017 a third utility notified the NRC of their intent to submit an SLR application by the end of 2017. The letter providing the notification was submitted

requesting withholding information from public disclosure and as a result the name of the utility and licensee(s) is not publicly available.

Duke Energy is considering DEC's Oconee Nuclear Station (ONS) for submission of its first SLR application and extend the licenses to 80 years. The remaining nuclear sites will follow where the cost/benefit balance proves acceptable.

An Advance Funding was approved on May 12, 2016 for the development portion of the ONS SLR project. These funds are being used to further develop and refine the Project Plan including scope, schedule, cost, risk, and other project elements. At this time, a final decision to extend the ONS or any other Duke Energy nuclear power plants' operating licenses to 80 years has not been made.

d) <u>Combined Heat and Power</u>

Combined Heat and Power (CHP) systems, also known as cogeneration, generate electricity and useful thermal energy in a single, integrated system. CHP is not a new technology, but an approach to applying existing technologies. Heat that is normally wasted in conventional power generation is recovered as useful energy, which avoids the losses that would otherwise be incurred from separate generation of heat and power. CHP incorporating a gas-fired combustion turbine (CT) and heat recovery steam generator (HRSG) is more efficient than the conventional method of producing power and usable heat separately with a CT/generator and a stand-alone steam boiler.

Duke Energy is exploring and working with potential customers with good base thermal loads on a regulated Combined Heat and Power offer. The CHP asset is included as part of Duke Energy's IRP as a placeholder for future projects as described below. The steam sales are credited back to the revenue requirement of the projects to reduce the total cost of this resource. Along with the potential to be a cost-competitive generation resource, CHP can result in carbon dioxide (CO_2) emission reductions, and is a potential economic development opportunity for the state. In DEP, discussions with potential steam hosts are currently underway.

Projections for CHP have been included in the following quantities in this IRP:

2021: 22 MW (winter) / 20 MW (summer)
2022: 22 MW (winter) / 20 MW (summer)

As CHP development continues, future IRPs will incorporate additional CHP, as appropriate. Additional technologies evaluated as part of this IRP are discussed in Chapter 7.

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e) Resource Adequacy

Background

Resource adequacy refers to the ability of the electric system to supply the aggregate electrical demand and energy requirements of the end-use customers at all times, taking into account

scheduled and reasonably expected unscheduled outages of system elements. Utilities require a margin of reserve generating capacity in order to provide reliable service. Periodic scheduled outages are required to perform maintenance, inspections of generating plant equipment, and to refuel nuclear plants. Unanticipated mechanical failures may occur at any given time, which may require shutdown of equipment to repair failed components. Adequate reserve capacity must be available to accommodate these unplanned outages and to compensate for higher than projected peak demand due to forecast uncertainty and weather extremes. The Company utilizes a reserve margin target in its IRP process to ensure resource adequacy. Reserve margin is defined as total resources minus peak demand, divided by peak demand. The reserve margin target is established based on probabilistic assessments as described below.

2016 Resource Adequacy Study

The Company retained Astrapé Consulting in 2016 to conduct an updated resource adequacy study.[3] The updated study was warranted due to 2 primary factors. First, the extreme weather experienced in the service territory in recent winter periods was so impactful to the system that additional review with the inclusion of recent years' weather history was warranted. Second, the system has added, and projects to add, a large amount of solar resources that provide meaningful capacity benefits in the summer but very little capacity benefits in the winter. Solar resources contribute approximately 45% (DEP 44%, DEC 46%) of nameplate capacity at the time of the expected summer peak demand which typically occurs during afternoon hours. However, solar resources only contribute about 5% of nameplate capacity at the time of expected winter peak demand which typically occurs during early morning hours. As discussed in the Renewables section of this document, there is a potential to add significantly to the solar resources already incorporated on the system.

[3] Astrapé Consulting is an energy consulting firm with expertise in resource adequacy and integrated resource planning.

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Methodology

The 2016 resource adequacy study incorporated the uncertainty of weather, economic load growth, unit availability, and the availability of transmission and generation capacity for emergency assistance. Astrape analyzed the optimal planning reserve margin based on providing an acceptable level of physical reliability and minimizing economic costs to customers. The most common physical reliability metric used in the industry is to target a system reserve margin that satisfies the 1 day in 10 years Loss of Load Expectation (LOLE) standard. This standard is interpreted as 1 firm load shed event every 10 years due to a shortage of generating capacity. From an economic perspective, as planning reserve margin increases, the total cost of reserves increases while the costs related to reliability events decline. Similarly, as planning reserve margin decreases, the cost of reserves decreases while the costs related to reliability events increase, including the costs to customers for loss of power. Thus, there is an economic optimum point where the cost of additional reserves plus the cost of reliability events to customers is minimized.

Winter Capacity Planning

In the past, loss of load risk was typically concentrated during the summer months and a summer reserve margin target provided adequate reserves in the summer and winter. However, the incorporation of recent winter load data and the significant amount of solar penetration in the updated study, shows that the majority of loss of load risk is now heavily concentrated during the winter period. Since solar capacity contribution to peak is much greater in the summer compared to the winter, maintaining a summer reserve margin target would result in declining winter reserve margins over time due to the impact on summer versus winter reserves as solar capacity increases.

Thus, use of a summer reserve margin target will no longer ensure that adequate reserve levels are maintained in the winter, and winter load and resources now drive the timing need for new capacity additions. As a result, a winter planning reserve margin target is now needed to ensure that adequate resources are available throughout the year to meet customer demand.

It is noted that the primary driver for the shift to winter capacity planning is the high penetration of solar resources and the associated impact on summer versus winter reserves. Winter load volatility impacts LOLE and puts upward pressure on the reserve margin target; however, winter load volatility or the seasonality of summer versus winter peaks is not the driver for the shift to winter capacity planning.

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Results

Based on results of the 2016 resource adequacy assessment, the Company has adopted a 17% minimum winter reserve margin target for scheduling new resource additions. The Company will continue to monitor its generation portfolio and other planning assumptions that can impact resource adequacy and initiate new studies as appropriate.

Adequacy of Projected Reserves

DEP's resource plan reflects winter reserve margins ranging from approximately 17% to 26%. Reserves projected in DEP's IRP meet the minimum planning reserve margin target and thus satisfy the 1 day in 10 years LOLE criterion. Projected reserve margins exceed the minimum 17% winter target by 3% or more through the winter of 2018/2019 primarily due to lower load growth resulting from a slightly slower economic forecast as shown in recent IRPs, as well as a reduction in the wholesale load forecast. Projected reserve margins often exceed the minimum 17% winter target by 3% or more in years immediately following new resource additions. For example, reserves exceed the 17% minimum target by 3% or more in 2019/2020 as a result of the Asheville combined cycle addition. Reserves also exceed the minimum 17% target by 3% or more as a result of resource additions in 2021/2022, 2025/2026 and 2030/2031.

The IRP provides general guidance in the type and timing of resource additions. As previously noted, projected reserve margins will often be somewhat higher than the minimum target in years immediately following new generation additions since capacity is generally added in large blocks to take advantage of economies of scale. Large resource additions are deemed economic only if they have a lower Present Value Revenue Requirement (PVRR) over the life of the asset as compared to smaller resources that better fit the short-term reserve margin need. Reserves projected in the Company's IRP are appropriate for providing an economic and reliable power supply.

f) <u>Fuel Costs</u>

Similar to the 2015 IRP Update Report and the 2016 Biennial IRP Report, the first 10 years of natural gas prices are based on market data and the remaining years are based off of fundamental pricing. Specifically, DEP and DEC are using market-based prices for the first 10 years of the planning period (2018 – 2027). Following the 10 years of market prices, the Companies transition to fundamental pricing over a 5-year period with 100% fundamental pricing in 2033 and beyond.

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Market prices represent liquid, tradable gas prices offered at the present time, also called "future or forward prices." These prices represent an actual contractually agreed upon price that willing buyers and sellers agree to transact upon at a specified future date. As such, assuming market liquidity, they represent the market's view of prices for a given point in the future. Fundamental prices developed through external econometric modeling, on the other hand, represent a projection of fuel prices into the future taking into account changing supply and demand assumptions in the context of the changing dynamics of the external marketplace. The natural gas market is a liquid market with multiple buyers and sellers of natural gas that are willing to transact at longer transaction terms.

To provide price discovery and demonstrate continued market liquidity, the Company has purchased a fixed price natural gas forward swap for 2,500 MMBtu/day extending nearly 10 years

forward. It is worth noting that this purchase shows a continued decline in natural gas prices. The 10-year average price for the most recent purchase, executed on August 17, 2017, was lower than a similar purchase made in April of 2017 and lower than the prices used in the development of the 2016 IRP.

As in the 2016 Biennial IRP Report, coal prices continue to be based on 5 years of market data in the 2017 IRP. Following the 5 years of market prices, the Companies transition to fundamental pricing over a 5-year period with 100% fundamental pricing in 2028.

g) <u>Carbon Assumptions</u>

On August 3, 2015, the Environmental Protection Agency (EPA) finalized a rule establishing CO_2 new source performance standards for pulverized coal (PC) and natural gas combined cycle (NGCC or CC) electric generating units (EGUs) that initiate construction after January 8, 2014. The EPA finalized emission standards of 1,400 lb CO_2 per gross MWh of electricity generation for PC units and 1,000 lb CO_2 per gross MWh for NGCC units. The standard for PC units can only be achieved with carbon capture and sequestration technology. Numerous parties filed petitions with the U.S. Court of Appeals for the District of Columbia (D.C. Circuit) challenging the EPA's final emission standard for new PC units. Briefing in the case is complete, but oral argument is not currently scheduled. On August 10, 2017, the D.C. Circuit ordered that the litigation be suspended indefinitely.

In response to a March 28, 2017 Executive Order, the EPA has undertaken a review of the rule to determine whether it should be suspended, revised, or rescinded. The rule remains in effect pending

the outcome of litigation and EPA's review of the rule. The EPA has not announced a schedule for completing its review.

On August 3, 2015, the EPA finalized the Clean Power Plan (CPP), a rule to limit CO_2 emissions from existing fossil fuel-fired EGUs (existing EGUs are units that commenced construction prior to January 8, 2014). The CPP required states to develop and submit to EPA for approval implementation plans designed to achieve the required CO_2 emission limitations. The CPP required states to submit initial plans by September 6, 2016, and final plans by September 6, 2018. The CPP established 2 rate-based compliance pathways and 2 mass-based compliance pathways for states to choose from when developing their state implementation plans. The CPP required emission limitations to take effect beginning in 2022 and get gradually more stringent through 2030.

Numerous legal challenges to the CPP were filed with the DC Circuit. On February 9, 2016 the Supreme Court issued a stay in the case, halting implementation of the CPP through any final decision in the case by the Supreme Court. This means the CPP has no legal effect, and EPA cannot enforce any of the deadlines or rule requirements while the stay is in place.

Briefing of the case before the D.C. Circuit was completed in April, 2016. Oral argument before the full D.C. Circuit occurred on September 27, 2016. The D.C. Circuit has not issued a decision in the case, and the court has twice issued orders suspending the litigation. On March 28, 2017, President Trump signed an Executive Order directing EPA to review the CPP and determine whether to suspend, revise or rescind the rule. On the same day the DOJ filed a motion with the D.C. Circuit Court requesting that the court stay the litigation of the rule while it is reviewed by EPA. In response to a March 28, 2017 Executive Order, EPA initiated a review of the CPP to determine whether it should be suspended, revised, or rescinded, and on October 10, 2017 issued a Notice of Proposed Rulemaking to repeal the CPP based on a change to EPA's legal interpretation of the section of the Clean Air Act (CAA) on which the CPP was based. In the proposal EPA indicates that it has not determined whether it will issue a rule to replace the CPP, and if it will do so, when and what form that rule will take. Litigation of the CPP remains on hold in the D.C. Circuit and the February 2016 U.S. Supreme Court stay of the CPP remains in effect.

In light of the uncertainty of future carbon legislation, the Base Case assumes a carbon cost beginning in 2026.

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h) Transmission Planned or Under Construction

This section lists the planned transmission line additions. A discussion of the adequacy of DEP's transmission system is also included. Table 4-E lists the transmission line projects that are planned to meet reliability needs.

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Table 4-E: DEP Transmission Line Additions

	Location		Capacity	Voltage	
Year	**From**	**To**	**MVA**	**KV**	**Comments**
2018	Jacksonville	Wallace	556	230	Uprate
2018	Roxboro Plant	Person (Middle)	1084	230	Uprate
2018	Roxboro Plant	Person (Hyco)	1084	230	Uprate
2018	Vanderbilt	West Asheville	307	115	Upgrade
2018	Richmond	Raeford	1195	230	Relocate, new
2018	Ft. Bragg Woodruff St.	Raeford	1195	230	Relocate, new
2019	Asheboro	Asheboro East North Line	307	115	Upgrade
2019	Sutton Plant	Castle Hayne North Line	239	115	Upgrade
2020	Cleveland Matthews Rd. Tap	Cleveland Matthews Rd	621	230	New
2020	Sutton Plant	Wallace	580	230	Uprate
2020	Jacksonville	Grants Creek	1195	230	New
2020	Newport	Harlowe	681	230	New

DEP has no transmission line projects, 161 kV and above, currently under construction.

DEP Transmission System Adequacy

DEP monitors the adequacy and reliability of its transmission system and interconnections through internal analysis and participation in regional reliability groups. Internal transmission planning looks 10 years ahead at available generating resources and projected load to identify transmission

system upgrade and expansion requirements. Corrective actions are planned and implemented in advance to ensure continued cost-effective and high-quality service. The DEP transmission model is incorporated into models used by regional reliability groups in developing plans to maintain interconnected transmission system reliability. DEP works with DEC, NCEMC and ElectriCities to develop an annual NC Transmission Planning Collaborative (NCTPC) plan for the DEP and DEC systems in both North and South Carolina. In addition, transmission planning is coordinated with neighboring systems including South Carolina Electric & Gas (SCE&G) and Santee Cooper under a number of mechanisms including legacy interchange agreements between SCE&G, Santee Cooper, DEP, and DEC.

The Company monitors transmission system reliability by evaluating changes in load, generating capacity, transactions and topography. A detailed annual screening ensures compliance with DEP's Transmission Planning Summary guidelines for voltage and thermal loading. The annual screening uses methods that comply with SERC policy and NERC Reliability Standards and the screening results identify the need for future transmission system expansion and upgrades. The transmission system is planned to ensure that no equipment overloads and adequate voltage is maintained to provide reliable service. The most stressful scenario is typically at projected peak load with certain equipment out of service. A thorough screening process is used to analyze the impact of potential equipment failures or other disturbances. As problems are identified, solutions are developed and evaluated.

Transmission planning and requests for transmission service and generator interconnection are interrelated to the resource planning process. DEP currently evaluates all transmission reservation requests for impact on transfer capability, as well as compliance with the Company's Transmission Planning Summary guidelines and the FERC Open Access Transmission Tariff (OATT). The Company performs studies to ensure transfer capability is acceptable to meet reliability needs and customers' expected use of the transmission system. Generator interconnection requests are studied in accordance with the Large and Small Generator Interconnection Procedures in the OATT and the North Carolina and South Carolina Interconnection Procedures.

SERC Reliability Corporation (SERC) audits DEP every 3 years for compliance with NERC Reliability Standards. Specifically, the audit requires DEP to demonstrate that its transmission planning practices meet NERC standards and to provide data supporting the Company's annual compliance filing certifications. SERC conducted a NERC Reliability Standards compliance audit of DEP in December 2016. DEP received "No Findings" from the audit team.

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DEP participates in a number of regional reliability groups to coordinate analysis of regional, sub-regional and inter-balancing authority area transfer capability and interconnection reliability. Each reliability group's purpose is to:

- Assess the interconnected system's capability to handle large firm and non-firm transactions for purposes of economic access to resources and system reliability;
- Ensure that planned future transmission system improvements do not adversely affect neighboring systems; and
- Ensure interconnected system compliance with NERC Reliability Standards.

Regional reliability groups evaluate transfer capability and compliance with NERC Reliability Standards for the upcoming peak season and 5- and 10-year periods. The groups also perform computer simulation tests for high transfer levels to verify satisfactory transfer capability.

Application of the practices and procedures described above ensures that DEP's transmission system continues to provide reliable service to its native load and firm transmission customers.

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5. LOAD FORECAST:

Methodology

The Duke Energy Progress Spring 2017 Forecast provides projections of the energy and peak demand needs for its service area. The forecast covers the time period of 2018 – 2032 and represents the needs of the following customer classes:

- Residential
- Commercial
- Industrial
- Other Retail
- Wholesale

Energy projections are developed with econometric models using key economic factors such as income, electricity prices, and industrial production indices, along with weather and appliance efficiency trends. Population projections are used in the Residential customer model.

The economic projections used in the Spring 2017 Forecast are obtained from Moody's Analytics, a nationally recognized economic forecasting firm, and include economic forecasts for the Carolinas.

The Retail forecast consists of the 3 major classes: Residential, Commercial, and Industrial.

The Residential class sales forecast is comprised of 2 projections. The first is the number of residential customers, which is driven by population. The second is energy usage per customer, which is driven by variables such as weather, regional economic and demographic trends, electric prices, and efficiency trends.

The usage per customer forecast was derived using a Statistical Adjusted End-Use Model (SAE). This is a regression based framework that uses projected appliance saturation and efficiency trends developed by ITRON using Energy Information Agency (EIA) data. It incorporates naturally occurring efficiency trends and government mandates more explicitly than other models. The outlook for usage per customer is slightly negative through much of the forecast horizon, so most of the growth in sales is related to customer increases. The projected growth rate of the Residential class after considering all impacts (i.e., customer growth, energy efficiency, behind-the-meter solar, etc.) is 0.9% for the period 2018-2032.

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The Commercial forecast also uses a SAE model in an effort to reflect naturally occurring as well as government mandated efficiency changes. The 3 largest sectors in the commercial class are Offices, Education and Retail. The projected growth rate of commercial in the Spring 2017 Forecast after considering all impacts, is 0.6% for the period 2018 to 2032.

The Industrial class is forecasted using a standard econometric model, with drivers such as industrial production and the price of electricity. Overall, Industrial sales are expected to grow 0.7% over the forecast horizon, after all impacts.

System peak demands were projected using the SAE approach in the Spring 2017 Forecast. The peak forecast was developed using a monthly SAE model, similar to the sales SAE models, which includes monthly appliance saturations and efficiencies, interacted with weather and the fraction of each appliance type that is in use at the time of the monthly peak. Over the forecast period, the summer peak demand is expected to grow 0.7% (after all impacts), while the winter peak demand is growing 0.7% (after all impacts).

Weather impacts are incorporated into the models by using Heating Degree Days with a base temperature of 59 degrees F and Cooling Degree Days with a base temperature of 65 degrees F. The forecast of degree days is based on a 30-year average, which is updated every year.

Forecast Enhancements

In 2013, The Company began using the statistically adjusted end use models (SAE) provided by ITRON to forecast sales and peaks. The end use models provide a better platform to recognize trends in equipment /appliance saturation and changes to efficiencies, and how those trends interact with heating, cooling, and "other" or non-weather related sales. The appliance saturation and efficiency trends are developed by ITRON using data from EIA. ITRON is a recognized firm providing forecasting services to the electric utility industry. These appliance trends are used in the residential and commercial sales models. In conjunction with peer utilities and ITRON, the company continually looks for refinements to its modeling procedures to make better use of the forecasting tools, and develop more reliable forecasts.

Each time the forecast is updated, the most currently available historical and projected data is used. The Spring 2017 forecast utilizes:

- Moody's Analytics January 2017 base economic projections.

- End use equipment and appliance indexes reflect the 2016 update of ITRON's end-use data, which is consistent with the Energy Information Administration's 2016 Annual Energy Outlook
- A calculation of normal weather using the period 1987-2016

Additional focus is being placed on the hourly shaping of sales, which plays a critical role in forecasting summer and winter peaks. While much of this work is ongoing and will be incorporated in the 2018 IRP's we continue to review the weather sensitivity of winter and summer peaks, as well as the hourly shaping of behind-the-meter solar, utility sponsored energy efficiency programs (UEE), electric vehicles, and other variables.

Additional focus is also being placed on Duke's load research sample data, to gain a better understanding of historical hourly demand trends, winter and summer peaking characteristics by customer class, and minimums by customer class, in our continuous effort to improve forecast accuracy.

Assumptions

Below are the projected average annual growth rates of several key drivers from DEP's Spring 2017 Forecast.

	2018-2032
Real Income	2.7%
Manufacturing Industrial Production Index (IPI)	1.3%
Population	1.6%

In addition to economic, demographic, and efficiency trends, the forecast also incorporates the expected impacts of utility sponsored energy efficient programs, as well as projected effects of electric vehicles and behind-the-meter solar technology.

Wholesale

The wholesale contracts are included in the forecasted sales and peaks in the following tables. For a complete description of the Wholesale forecast, please see Chapter 12.

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Historical Values

It should be noted that long-term decline of the Textile industry and the recession of 2008-2009 have had an adverse impact on DEP sales. The worst of the Textile decline appears to be over, and Moody's Analytics expects the Carolina's economy to show solid growth going forward.

Tables 5-A & 5-B below the present history of DEP customers and actual sales are given.

Table 5-A Retail Customers (Thousands, Annual Average)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Avg Annual Growth Rate
Residential	1,174	1,195	1,207	1,216	1,221	1,231	1,242	1,257	1,275	1,292	**1.1%**
Commercial	214	216	215	216	217	219	222	222	226	229	**0.8%**
Industrial	4	4	5	5	4	4	4	4	4	4	**-0.1%**
Other	2	2	2	2	2	2	2	2	2	2	**-4.2%**
Total	1,394	1,417	1,429	1,439	1,445	1,457	1,470	1,486	1,507	1,527	**1.0%**

Table 5-B Electricity Sales (GWh Sold - Years Ended December 31)

-	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Avg. Annual Growth Rate
Residential	16,259	17,200	17,000	17,117	19,108	17,764	16,663	18,201	17,954	17,686	**1.1%**
Commercial	13,358	14,033	13,940	13,639	14,184	13,709	13,581	13,887	14,039	14,082	**0.6%**
Industrial	12,416	11,883	11,216	10,375	10,677	10,573	10,508	10,321	10,288	10,274	**-2.0%**
Military & Other	1,419	1,438	1,467	1,497	1,574	1,591	1,602	1,614	1,597	1,563	**1.1%**
Total Retail	43,451	44,553	43,622	42,628	45,544	43,637	42,355	44,023	43,876	43,606	**0.1%**
Wholesale	12,231	12,656	12,868	12,772	12,772	12,267	12,676	13,578	15,782	18,676	**5.1%**
Total System	55,682	57,209	56,489	55,400	58,316	55,903	55,031	57,601	59,658	62,282	**1.3%**

Note the values in Table 5-B are not weather adjusted.

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Utility Energy Efficiency

UEE continues to have a large impact in the acceleration of the adoption of energy efficiency. When including the energy and peak impacts of UEE, careful attention must be paid to avoid the double counting of UEE efficiencies with the naturally occurring efficiencies included in the SAE modeling approach. To ensure there is not a double counting of these efficiencies, the forecast "rolls off" the UEE savings at the conclusion of its measure life. For example, if the accelerated benefit of a residential UEE program is expected to have occurred 7 years before the energy reduction program would have been otherwise adopted, then the UEE effects after year 7 are subtracted ("rolled off") from the total cumulative UEE. With the SAE models framework, the naturally occurring appliance efficiency trends replace the rolled off UEE benefits serving to continue to reduce the forecasted load resulting from energy efficiency adoption.

Table 5-C below illustrates this process:

- Column A: Total energy before reduction of future UEE
- Column B: Historical UEE Roll-Off
- Column C: Forecasted UEE Incremental Roll-On
- Column D: Forecasted UEE Incremental Roll-Off
- Column E: UEE amount to subtract from Column A
- Column F: Total energy after incorporating UEE (column A less column E)

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Table 5-C UEE Program Life Process (GWh)

	Forecast Before UEE	Historical UEE Roll-Off	Forecasted UEE Incremental Roll-On	Forecasted UEE Incremental Roll Off	UEE to Subtract From Forecast	Forecast After UEE
2017	64,361	0	207	0	207	64,154
2018	64,966	5	379	0	379	64,592
2019	65,609	20	554	0	554	65,075
2020	65,464	51	722	0	722	64,794
2021	65,738	106	883	0	883	64,961
2022	66,148	181	1,045	0	1,045	65,284
2023	66,126	269	1,209	2	1,209	65,188
2024	66,930	360	1,361	4	1,361	65,933
2025	67,551	442	1,507	12	1,507	66,498
2026	68,235	505	1,662	32	1,662	67,110
2027	68,938	549	1,841	49	1,841	67,696
2028	69,721	576	2,220	245	2,220	68,323
2029	70,350	589	3,126	1,001	3,126	68,814
2030	70,954	596	3,288	1,054	3,288	69,317
2031	71,593	598	3,412	1,095	3,412	69,873
2032	71,660	598	3,511	1,128	3,511	69,874

Results

A tabulation of the utility's forecasts for 2018-2032, including peak loads for summer and winter seasons of each year and annual energy forecasts, both with and without the impact of UEE programs, are shown below in Tables 5-F and 5-G.

Load duration curves, with and without UEE programs, follow Tables 5-F and 5-G, and are shown as Charts 5-A and 5-B.

The tables below show the results of the forecast:

- Table 5-D: Total retail customers by class
- Table 5-E: Retail sales (at the meter) after the impacts of energy efficiency
- Table 5-F: Forecasted system summer peak, winter peak, and sales – ***before*** including the impact of utility sponsored energy efficiency programs (at generation)
- Chart 5-A: Load duration curve – ***before*** including the impact of utility sponsored energy efficiency programs
- Table 5-G: Forecasted system summer peak, winter peak, and sales – ***after*** including the impact of utility sponsored energy efficiency programs (at generation)

- Chart 5-B: Load duration curve – ***after*** including the impact of utility sponsored energy efficiency programs

Table 5-D Retail Customers (Thousands, Annual Average)

	Residential Customers	Commercial Customers	Industrial Customers	Other Customers	Retail Customers
2018	1,324	234	4	1	1,563
2019	1,340	236	4	1	1,581
2020	1,356	237	4	1	1,599
2021	1,373	239	4	1	1,617
2022	1,389	240	4	1	1,635
2023	1,406	242	4	1	1,653
2024	1,423	244	4	1	1,672
2025	1,441	245	4	1	1,691
2026	1,458	246	3	1	1,710
2027	1,476	248	3	1	1,729
2028	1,494	249	3	1	1,748
2029	1,512	251	3	1	1,768
2030	1,531	252	3	1	1,787
2031	1,549	253	3	1	1,807
2032	1,568	255	3	1	1,828
Avg. Annual Growth Rate	1.2%	0.6%	-1.8%	0.0%	1.1%

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Table 5-E Retail Sales (GWh Sold - Years Ended December 31)

	Residential	Commercial	Industrial	Other	Retail
	Gwh	Gwh	Gwh	Gwh	Gwh
2018	17,925	14,078	10,464	1,556	44,024
2019	18,036	14,125	10,555	1,549	44,266
2020	18,168	14,198	10,628	1,547	44,541
2021	18,314	14,240	10,668	1,546	44,767
2022	18,473	14,305	10,706	1,544	45,028
2023	18,661	14,393	10,813	1,541	45,410
2024	18,869	14,513	10,915	1,540	45,837
2025	19,066	14,611	10,991	1,539	46,206
2026	19,271	14,731	11,049	1,538	46,590
2027	19,460	14,833	11,095	1,538	46,925
2028	19,652	14,939	11,141	1,538	47,270
2029	19,823	15,011	11,200	1,539	47,573
2030	20,005	15,066	11,281	1,540	47,892
2031	20,206	15,129	11,378	1,540	48,254
2032	20,423	15,213	11,470	1,541	48,647
Avg. Annual Growth Rate	0.9%	0.6%	0.7%	-0.1%	0.7%

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Table 5-F Load Forecast without Energy Efficiency Programs (at Generation)

YEAR	SUMMER (MW)	WINTER (MW)	ENERGY (GWH)
2018	13,078	13,310	64,971
2019	13,217	13,429	65,629
2020	13,264	13,446	65,516
2021	13,334	13,489	65,844
2022	13,451	13,596	66,329
2023	13,504	13,620	66,395
2024	13,662	13,788	67,290
2025	13,810	13,897	67,993
2026	13,977	14,041	68,740
2027	14,144	14,186	69,487
2028	14,311	14,352	70,297
2029	14,471	14,480	70,939
2030	14,617	14,613	71,550
2031	14,775	14,756	72,191
2032	14,928	14,912	72,866
Avg. Annual Growth Rate	0.9%	0.8%	0.8%

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Chart 5-A Load Duration Curve without Energy Efficiency Programs (at Generation)

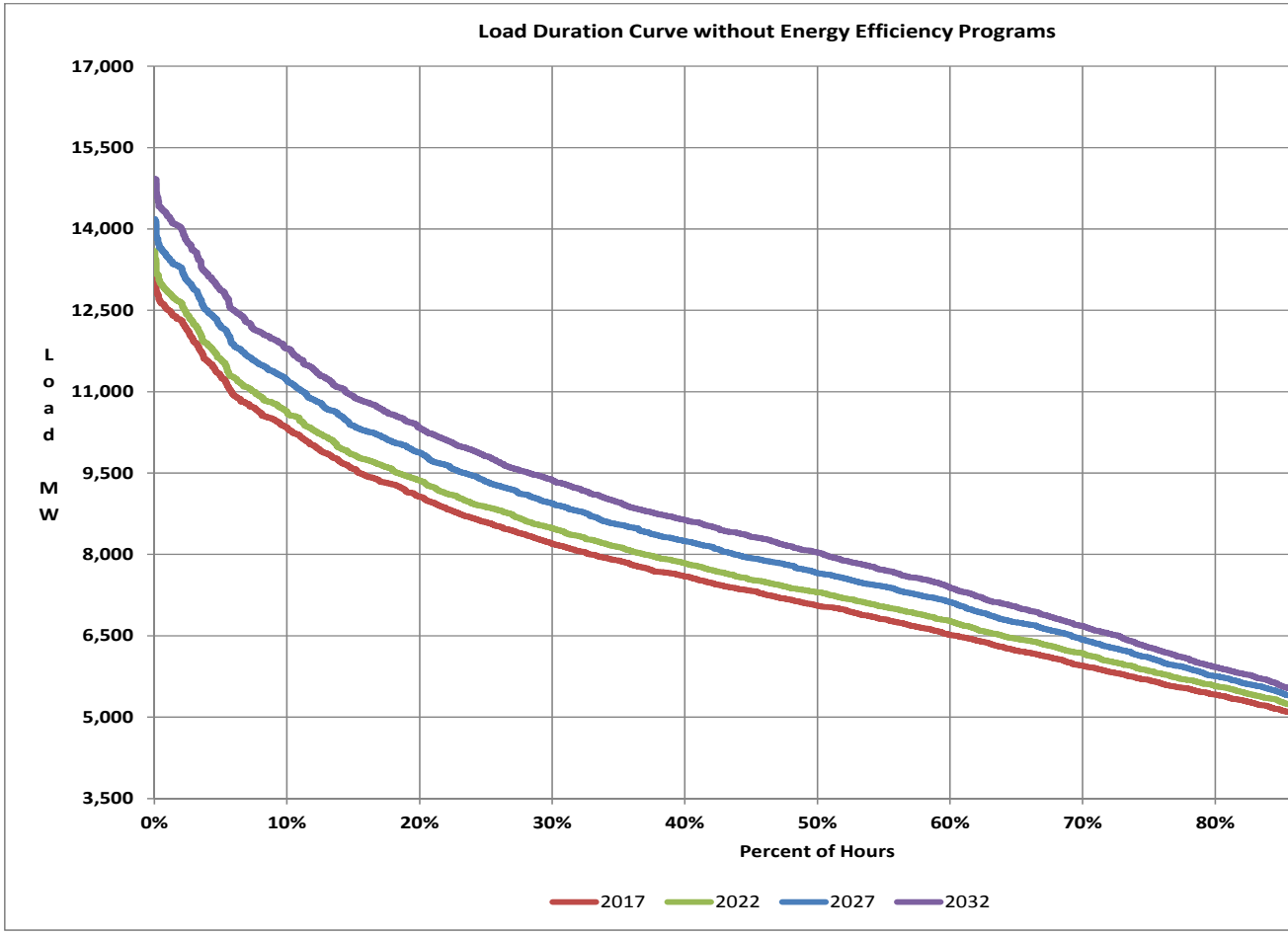

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Table 5-G Load Forecast with Energy Efficiency Programs (at Generation)

YEAR	SUMMER (MW)	WINTER (MW)	ENERGY (GWH)
2018	12,990	13,273	64,592
2019	13,085	13,383	65,075
2020	13,091	13,384	64,794
2021	13,120	13,410	64,961
2022	13,198	13,493	65,284
2023	13,210	13,500	65,188
2024	13,332	13,654	65,933
2025	13,445	13,748	66,498
2026	13,578	13,877	67,110
2027	13,706	14,006	67,696
2028	13,833	14,153	68,323
2029	13,957	14,265	68,814
2030	14,074	14,386	69,317
2031	14,208	14,520	69,874
2032	14,341	14,669	70,483
Avg. Annual Growth Rate	0.7%	0.7%	0.6%

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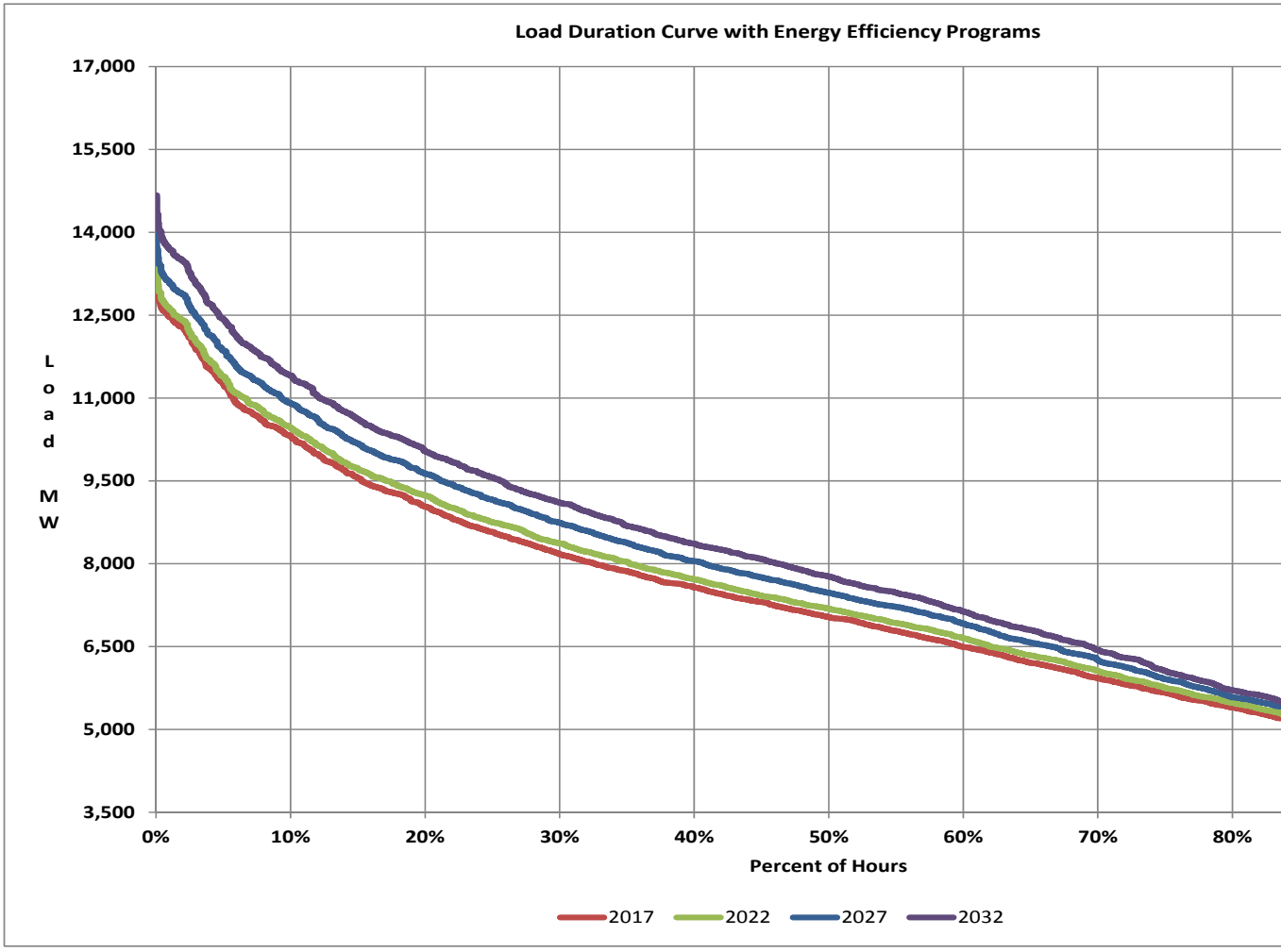
Chart 5-B Load Duration Curve with Energy Efficiency Programs (at Generation)



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6. ENERGY EFFICIENCY AND DEMAND SIDE MANAGEMENT:

Demand Side Management and Energy Efficiency Programs

DEP continues to pursue a long-term, balanced capacity and energy strategy to meet the future electricity needs of its customers. This balanced strategy includes a strong commitment to demand side management and EE programs, investments in renewable and emerging energy technologies, and state-of-the art power plants and delivery systems.

DEP uses EE and DSM programs in its IRP to efficiently and cost-effectively alter customer demands and reduce the long-run supply costs for energy and peak demand. These programs can vary greatly in their dispatch characteristics, size and duration of load response, certainty of load response, and level and frequency of customer participation. In general, programs are offered in 2 primary categories: EE programs that reduce energy consumption and DSM programs that reduce peak demand (demand-side management or demand response programs and certain rate structure programs).

Following are the EE and DSM programs currently available through DEP.

Residential Customer Programs

- Home Energy Improvement
- Residential New Construction
- Neighborhood Energy Saver (Low-Income)
- Appliance Recycling Program
- My Home Energy Report
- Multi-Family Energy Efficiency
- Energy Efficiency Education
- Residential Energy Assessments
- Save Energy and Water Kit
- EnergyWise^{SM} Home

Non-Residential Customer Programs

- Energy Efficiency for Business
- Small Business Energy Saver
- Business Energy Report Pilot
- CIG Demand Response Automation Program
- EnergyWise^{SM} for Business

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Combined Residential/Non-Residential Customer Programs

- Energy Efficient Lighting
- Distribution System Demand Response (DSDR)

Energy Efficiency Programs

Energy Efficiency programs are typically non-dispatchable education or incentive-based programs. Energy and capacity savings are achieved by changing customer behavior or through the installation of more energy-efficient equipment or structures. All cumulative effects (gross of Free Riders, at the Plant[4]) since the inception of these existing programs through the end of 2016 are summarized below. Please note that the cumulative impacts listed below include the impact of any Measurement and Verification performed since program inception and also note that a "Participant" in the information included below is based on the unit of measure for specific energy efficiency measure (e.g. number of bulbs, kWh of savings, tons of refrigeration, etc.), and may not be the same as the number of customers that actually participate in these programs. The following provides more detail on DEP's existing EE programs:

Residential EE Programs

Home Energy Improvement Program

The Home Energy Improvement Program offers DEP customers a variety of energy conservation measures designed to increase energy efficiency for existing residential dwellings that can no longer be considered new construction. The prescriptive menu of energy efficiency measures provided by the program allows customers the opportunity to participate based on the needs and characteristics of their individual homes. A referral channel successfully launched in June 2016, providing free, trusted referrals to customers seeking reliable, qualified contractors for their energy saving home improvement needs. The measures eligible for incentives through the program are:

- High-Efficiency Heat Pumps and Central A/C
- Duct Repair
- HVAC Audit
- Insulation Upgrades/Attic Sealing
- High Efficiency Room Air Conditioners
- Heat Pump Water Heater
- HVAC Quality Installation

[4] "Gross of Free Riders" means that the impacts associated with the EE programs have not been reduced for the impact of Free Riders. "At the Plant" means that the impacts associated with the EE programs have been increased to include line losses.

- Smart Thermostat
- Variable Speed Pool Pumps

Home Energy Improvement			
Cumulative as of:	Number of Participants	Gross Savings (at plant)	
		MWh Energy	Peak kW
December 31, 2016	134,378	57,847	36,985

Residential New Construction Program

The Residential New Construction Program incents the installation of high-efficiency heating ventilating and air conditioning and heat pump water heating equipment in new residential construction. Additionally, the Program incents new construction built to or above the 2012 North Carolina Energy Conservation Code's High Efficiency Residential Option (HERO). If elected by a builder or developer constructing to the HERO standard, the Program also offers the homebuyer a Heating and Cooling Energy Usage Limited Guarantee that guarantees the heating and cooling consumption of the dwelling's total annual energy costs.

The primary objectives of this program are to reduce system peak demands and energy consumption within new homes. New construction represents a unique opportunity for capturing cost effective EE savings by encouraging the investment in energy efficiency features that would otherwise be impractical or more costly to install at a later time. These are often referred to as lost opportunities.

Residential New Construction			
Cumulative as of:	Number of Participants	Gross Savings (at plant)	
		MWh Energy	Peak kW
December 31, 2016	5,745,448	31,009	12,082

Note: The participants and impacts are from both the Residential New Construction program and the previous Home Advantage program.

Neighborhood Energy Saver (Low-Income) Program

DEP's Neighborhood Energy Saver Program reduces energy usage through the direct installation of energy efficiency measures within the households of income qualifying residential customers. The Program utilizes a Company-selected vendor to: (1) provide an on-site energy assessment of the residence to identify appropriate energy conservation measures, (2) install a comprehensive package of energy conservation measures at no cost to the customer, and (3) provide one-on-one energy

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education. Program measures address end-uses in lighting, refrigeration, air infiltration and HVAC applications.

Program participants receive a free energy assessment of their home followed by a recommendation of energy efficiency measures to be installed at no cost to the resident. A team of energy technicians will install applicable measures and provide one-on-one energy education about each measure emphasizing the benefit of each and recommending behavior changes to reduce and control energy usage.

Neighborhood Energy Saver			
	Number of	Gross Savings (at plant)	
Cumulative as of:	Participants	MWh Energy	Peak kW
December 31, 2016	32,405	16,279	2,312

Appliance Recycling Program

The Appliance Recycling Program promotes the removal and responsible disposal of operating refrigerators and freezers from DEP residential customers. An eligible refrigerator or freezer must have a capacity of at least 10 cubic feet but not more than 30 cubic feet. The Program recycles approximately 95% of the material from the harvested appliances.

The implementation vendor for this program abruptly discontinued operations in November 2015. Subsequent participation reflects continued support to those customers with canceled appointments, as well as any participation uploads not previously recorded by the vendor. Future potential impacts associated with this program beyond 2016 are not included in this IRP analysis.

Residential Appliance Recycling			
	Number of	Gross Savings (at plant)	
Cumulative as of:	Participants	MWh Energy	Peak kW
December 31, 2016	48,022	51,127	6,098

My Home Energy Report Program

The My Home Energy Report (MyHER) Program was designed to help customers better understand their energy usage. The program provides customers with a periodic comparative usage report that compares a their energy use to similar residences in the same geographical area based upon the age, size and heating source of the home. Energy saving recommendations are included in the report to encourage energy saving behavior. The reports are distributed up to 12 times per year (delivery

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may be interrupted during the off-peak energy usage months in the fall and spring). Each customer's usage is compared to the average home (top 50 percent) in their area as well as the efficient home (top 25 percent). Suggested energy efficiency improvements, given the usage profile for that home, are also provided. In addition, measure-specific offers, rebates or audit follow-ups from other Company offered programs are offered to customers, based on the customer's energy profile.

An interactive online portal was introduced in 2016, allowing customers to further engage and learn more about their energy use and opportunities to reduce usage. Electronic versions of the My Home Energy Report are sent to customers enrolled on the portal.

My Home Energy Report			
		Gross Savings (at plant)	
Capability as of:	Number of Participants	MWh Energy	Peak kW
December 31, 2016	673,285	128,281	34,858

Energy Efficiency Education Program

The Energy Efficiency Education Program is an energy efficiency program available to students in grades K-12 enrolled in public and private schools who reside in households served by Duke Energy Progress. The Program provides principals and teachers with an innovative curriculum that educates students about energy, resources, how energy and resources are related, ways energy is wasted and how to be more energy efficient. The centerpiece of the current curriculum, which is administered by The National Theatre for Children, is a live theatrical production focused on concepts such as energy, renewable fuels and energy efficiency performed by 2 professional actors. Teachers receive supportive educational material for classroom and student take home assignments. The workbooks, assignments and activities meet state curriculum requirements.

Following the performance, students are encouraged to complete a home energy survey with their family (included in their classroom and family activity book) to receive an Energy Efficiency Starter Kit. The kit contains specific energy efficiency measures to reduce home energy consumption. The kit is available at no cost to all student households at participating schools, including customers and non-customers.

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Energy Efficiency Education			
Cumulative as of:	Number of Participants	Gross Savings (at plant)	
		MWh Energy	Peak kW
December 31, 2016	19,945	4,528	449

Multi-Family Energy Efficiency Program

The Multi-family Energy Efficiency Program allows DEP to utilize an alternative delivery channel which targets multi-family apartment complexes for energy efficiency upgrades. The Program is designed to help property managers upgrade lighting with energy efficient compact fluorescent light bulbs (CFLs) and also save energy by offering water measures such as bath and kitchen faucet aerators, water saving showerheads and pipe wrap to eligible customers with electric water heating. The Program also offers properties the option of direct install service by a third-party vendor or to use their own property maintenance crews to complete the installations. Post-installation Quality Assurance inspections by an independent third-party are conducted on 20 percent of properties that completed installations in a given month.

Multi-Family Energy Efficiency			
Cumulative as of:	Number of Participants	Gross Savings (at plant)	
		MWh Energy	Peak kW
December 31, 2016	587,937	34,490	3,409

Energy Efficient Lighting Program

The Lighting Program launched in January of 2010 and expanded to offer additional measures in January 2013 (now called Energy Efficient Lighting Program). This program works through lighting manufacturers and retailers to offer discounts to DEP customers at the register on CFLs, light emitting diodes (LEDs), and energy-efficient fixtures. Participation levels for all years of the program have been higher than originally forecasted. This success can be attributed to high customer interest in energy efficiency, low socket penetration of energy efficient lighting in the DEP territory and effective promotion of the program in the marketplace.

As the program enters the 7th year, the DEP Energy Efficient Lighting Program will continue to encourage customers to adopt energy efficient lighting through incentives on a wide range of lighting products. Customer education is imperative to ensure customers are purchasing the right bulb for the application in order to obtain high satisfaction with lighting products and subsequent purchases.

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Energy Efficient Lighting			
Cumulative as of:	Number of Participants	Gross Savings (at plant)	
		MWh Energy	Peak kW
December 31, 2016	27,257,393	1,552,908	241,867

Residential Energy Assessments Program

The Residential Energy Assessments Program provides eligible customers with a free in-home energy assessment, performed by a Building Performance Institute (BPI) certified energy specialist and designed to help customers reduce energy usage and save money. The BPI certified energy specialist completes a 60 to 90 minute walk through assessment of a customer's home and analyzes energy usage to identify energy savings opportunities. The energy specialist discusses behavioral and equipment modifications that can save energy and money with the customer. The customer also receives a customized report that identifies actions the customer can take to increase their home's efficiency.

In addition to a customized report, customers receive an energy efficiency starter kit with a variety of measures that can be directly installed by the energy specialist. The kit includes measures such as energy efficiency lighting, low flow shower head, low flow faucet aerators, outlet/switch gaskets, weather stripping and an energy saving tips booklet.

Residential Energy Assessments			
Cumulative as of:	Number of Participants	Gross Savings (at plant)	
		MWh Energy	Peak kW
December 31, 2016	27,614	4,142	692

Save Energy and Water Kit Program

The Save Energy and Water Kit is designed to increase the energy efficiency within single family homes by offering low flow water fixtures and insulated pipe tape to residential customers with electric water heaters. Participants receive a free kit that includes installation instructions and varying numbers (based on the number of full bathrooms in their home) of bath aerators, kitchen aerators, shower heads and pipe insulation tape. The program has a website in place that customers can access to learn more about the program or watch video's produced to aid in the installation of the kit measures.

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Save Energy and Water Kit			
Cumulative as of:	Number of Participants	Gross Savings (at plant)	
		MWh Energy	Peak kW
December 31, 2016	325,146	21,802	1,745

Non-Residential EE Programs

Energy Efficiency for Business Program

The Energy Efficiency for Business Program provides incentives to DEP commercial and industrial customers to install high efficiency equipment in applications involving new construction and retrofits and to replace failed equipment.

Commercial and industrial customers can have significant energy consumption but may lack knowledge and understanding of the benefits of high efficiency alternatives. The Program provides financial incentives to help reduce the cost differential between standard and high efficiency equipment, offer a quicker return on investment, save money on customers' utility bills that can be reinvested in their business, and foster a cleaner environment. In addition, the Program encourages dealers and distributors (or market providers) to stock and provide these high efficiency alternatives to meet increased demand for the products.

The program provides incentives through prescriptive measures, custom measures and technical assistance.

- *Prescriptive Measures*: Customers receive incentive payments after the installation of certain high efficiency equipment found on the list of pre-defined prescriptive measures, including lighting; heating, ventilating and air conditioning equipment; and refrigeration measures and equipment.
- *Custom Measures*: Custom measures are designed for customers with electrical energy saving projects involving more complicated or alternative technologies, whole-building projects, or those measures not included in the Non-Residential Energy Efficiency for Business measure list. The intent of the Program is to encourage the implementation of energy efficiency projects that would not otherwise be completed without the Company's technical or financial assistance. Unlike Prescriptive portion of the program, all Custom measure incentives requires pre-approval prior to the project implementation.
- *Technical Assistance*: Technical Assistance incentives are offered for new construction and retrofit application to provide assistance to qualified customers with development or implementation of system and building enhancements. Assistance may include, but is not limited to, feasibility studies, detailed energy audits, and retro-commissioning of existing

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systems, or for efficiency design or energy modeling for new structures and systems. All measures involving technical assistance incentives must receive pre-approval before implementation.

* Energy Efficiency for Business			
Cumulative as of:	Number of Participants*	Gross Savings (at plant)	
		MWh Energy	Peak kW
December 31, 2016	71,572,504	448,740	82,265

* Note: One participant equals 1 kWh.

Small Business Energy Saver Program

The Small Business Energy Saver Program reduces energy usage through the direct installation of energy efficiency measures within qualifying small non-residential customer facilities. Program measures address major end-uses in lighting, refrigeration, and HVAC applications. The program is available to existing non-residential customers that are not opted-out of the Company's EE/DSM rider and have an average annual demand of 100 kW or less per active account.

Program participants receive a free, no-obligation energy assessment of their facility followed by a recommendation of energy efficiency measures to be installed in their facility along with the projected energy savings, costs of all materials and installation, and up-front incentive amount from Duke Energy Progress. Upon receiving the results of the energy assessment, if the customer decides to move forward with the proposed energy efficiency project, the customer makes the final determination of which measures will be installed. The energy efficiency measure installation is then scheduled at a convenient time for the customer and the measures are installed by electrical subcontractors of the Company-authorized vendor.

All aspects of the program are administered by a single Company-authorized vendor. The program is designed as a pay-for-performance offering, meaning that the Company-authorized vendor administering the Program is only compensated for energy savings produced through the installation of energy efficiency measures.

Small Business Energy Saver			
Cumulative as of:	Number of Participants	Gross Savings (at plant)	
		MWh Energy	Peak kW
December 31, 2016	86,097,574	144,682	27,927

* Note: One participant equals 1 kWh.

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Business Energy Report Pilot

The Business Energy Report Pilot is a periodic comparative usage report that compares a customer's energy use to their peer groups. Comparative groups are identified based on the customer's energy use, type of business, operating hours, square footage, geographic location, weather data and heating/cooling sources. Pilot participants will receive targeted energy efficiency tips in their report informing them of actionable ideas to reduce their energy consumption. The recommendations may include information about other Company offered energy efficiency programs. Participants will receive at least 6 reports over the course of a year.

Business Energy Report			
		Gross Savings (at plant)	
Cumulative as of:	Number of Participants	MWh Energy	Peak kW
December 31, 2016	13,159	4,547	740

With the cost effectiveness of the program expected to decline below the allowable threshold, the program was terminated in 2017. As a result, projected impacts subsequent to 2016 are not included.

Distribution System Demand Response Program (DSDR)

The DSDR program is an application of Smart Grid technology that provides the capability to reduce peak demand for 4 to 6 hours at a time, which is the duration consistent with typical peak load periods, while also maintaining customer delivery voltage above the minimum requirement when the program is in use. The increased peak load reduction capability and flexibility associated with DSDR will result in the displacement of the need for additional peaking generation capacity. This capability is accomplished by investing in a robust system of advanced technology, telecommunications, equipment, and operating controls. The DSDR Program helps DEP implement a least cost mix of demand reduction and generation measures that meet the electricity needs of its customers.

Distribution System Demand Response			
		Gross Savings (at plant)	
Cumulative as of:	Number of Participants	MWh Energy	Summer MW Capability
December 31, 2016	NA	33,941	275

Since DEP's last biennial resource plan was filed on September 2, 2016, there have been 8 voltage control activations through June 30, 2017. The following table shows the date, starting and ending time, and duration for all voltage control activations from July 2016 through June 2017.

Voltage Control			
Date	**Start Time**	**End Time**	**Duration (H:MM)**
7/5/2016	14:00	14:13	0:13
7/26/2016	15:30	19:11	3:41
7/27/2016	15:30	19:15	3:45
7/28/2016	15:30	19:00	3:30
8/19/2016	17:53	18:01	0:08
8/24/2016	13:42	14:00	0:18
11/22/2016	6:00	8:30	2:30
12/21/2016	9:00	10:00	1:00
1/8/2017	6:30	9:46	3:16
1/9/2017	6:30	9:37	3:07
3/16/2017	6:00	8:30	2:30
5/4/2017	13:00	14:30	1:30
5/12/2017	13:00	14:00	1:00

Demand Side Management Programs

Residential EnergyWise^{SM} Home Program

The Residential EnergyWise^{SM} Home Program allows DEP to install load control switches at the customer's premise to remotely control the following residential appliances:

- Central air conditioning or electric heat pumps
- Auxiliary strip heat on central electric heat pumps (Western Region only)
- Electric water heaters (Western Region only).

For each of the appliance options above, an initial one-time bill credit of $25 following the successful installation and testing of load control device(s) and an annual bill credit of $25 is provided to program participants in exchange for allowing the Company to control the listed appliances.

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EnergyWise[SM] Home			
Cumulative as of:	Number of Participants*	MW Capability	
		Summer	Winter
December 31, 2016	161,651	314	12

* Number of participants represents the number of measures under control.

The following table shows Residential EnergyWise[SM] Home Program activations that were not for testing purposes from July 1, 2015through December 31, 2016.

EnergyWise[SM] Home Program Activations			
Start Time	End Time	Duration (Minutes)	MW Load Reduction*
7/21/2015 15:00	7/21/2015 17:30	150	107
8/21/2015 16:00	8/5/2015 17:30	90	113
2/11/2016 6:00	2/11/2016 8:00	120	5
6/23/2016 14:30	6/23/2016 17:00	150	143
7/24/2016 16:00	7/24/2016 18:00	120	115
7/24/2016 18:00	7/24/2016 19:00	60	1
9/8/2016 15:00	9/82016 18:00	180	141

EnergyWise[SM] for Business Program

EnergyWise[SM] for Business is both an energy efficiency and demand response program for non-residential customers that allows DEP to reduce the operation of participants air conditioning units to mitigate system capacity constraints and improve reliability of the power grid.

Program participants can choose between a Wi-Fi thermostat or load control switch that will be professionally installed for free on each air conditioning or heat pump unit. In addition to equipment choice, participants can also select the cycling level they prefer (i.e., a 30%, 50% or 75% reduction of the normal on/off cycle of the unit). During a conservation period, DEP will send a signal to the thermostat or switch to reduce the on time of the unit by the cycling percentage selected by the participant. Participating customers will receive a $50 annual bill credit for each unit at the 30% cycling level, $85 for 50% cycling, or $135 for 75% cycling. Participants that have a heat pump unit with electric resistance emergency/back up heat and choose the thermostat can also participate in a winter option that allows control of the emergency/back up heat at 100% cycling for

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an additional $25 annual bill credit. Participants will also be allowed to override 2 conservation periods per year.

Participants choosing the thermostat will be given access to a portal that will allow them to set schedules, adjust the temperature set points, and receive energy conservation tips and communications from DEP anywhere they have internet access. In addition to the portal access, participants will also receive conservation period notifications, so they can make adjustments to their schedules or notify their employees of upcoming conservation periods.

The DEP EnergyWise^{SM} for Business program was implemented in January 2016.

EnergyWise^{SM} for Business				
		MW Capability		MWh Energy Savings (at plant)
Cumulative as of:	Participants*	Summer	Winter	
December 31, 2016	787	2.2	0.2	1,062

*Number of participants represents the number of measures under control.

There were no DEP EnergyWise^{SM} for Business program activations in 2016 that were not for testing purposes only.

Commercial, Industrial, and Governmental (CIG) Demand Response Automation Program

The CIG Demand Response Automation Program allows DEP to install load control and data acquisition devices to remotely control and monitor a wide variety of electrical equipment capable of serving as a demand response resource. The goal of this program is to utilize customer education, enabling two-way communication technologies, and an event-based incentive structure to maximize load reduction capabilities and resource reliability. The primary objective of this program is to reduce DEP's need for additional peaking generation. This is accomplished by reducing DEP's seasonal peak load demands, primarily during the summer months, through deployment of load control and data acquisition technologies.

CIG Demand Response Automation Statistics			
	Number of Participants	MW Capability	
Cumulative as of:		Summer	Winter
December 31, 2016	59	19.0	12

The table below shows information for each CIG Demand Response Automation Program non-test control event from July 1, 2015 through December 31, 2016.

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CIG Demand Response Automation			
Start Time	End Time	Duration (Minutes)	MW Load Reduction*
7/21/2015 13:00	7/21/2015 19:00	360	17
6/23/2016 13:00	6/23/2016 19:00	360	19
7/8/2016 13:00	7/8/2016 19:00	360	21
7/26/2016 13:00	7/26/2016 19:00	360	21

Previously Existing Demand Side Management and Energy Efficiency Programs

Prior to the passage of North Carolina Senate Bill 3 in 2007, DEP had a number of DSM/EE programs in place. These programs are available in both North and South Carolina and include the following:

Energy Efficient Home Program
Program Type: Energy Efficiency

In the early 1980s, DEP introduced an Energy Efficient Home program that provides residential customers with a 5% discount of the energy and demand portions of their electricity bills when their homes met certain thermal efficiency standards that were significantly above the existing building codes and standards. Homes that pass an ENERGY STAR® test receive a certificate as well as a 5% discount on the energy and demand portions of their electricity bills.

Curtailable Rates
Program Type: Demand Response

DEP began offering its curtailable rate options in the late 1970s, whereby industrial and commercial customers receive credits for DEP's ability to curtail system load during times of high energy costs and/or capacity constrained periods. There were no curtailable rate activation not for testing during the period from July 1, 2015 through December 31, 2016.

Time-of-Use Rates
Program Type: Demand Response

DEP has offered voluntary Time-of-Use (TOU) rates to all customers since 1981. These rates provide incentives to customers to shift consumption of electricity to lower-cost off-peak periods and lower their electric bill.

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Thermal Energy Storage Rates
Program Type: Demand Response

DEP began offering thermal energy storage rates in 1979. The present General Service (Thermal Energy Storage) rate schedule uses two-period pricing with seasonal demand and energy rates applicable to thermal storage space conditioning equipment. Summer on-peak hours are noon to 8 p.m. and non-summer hours of 6 a.m. to 1 p.m. weekdays.

Real-Time Pricing
Program Type: Demand Response

DEP's Large General Service (Experimental) Real Time Pricing tariff was implemented in 1998. This tariff uses a two-part real time pricing rate design with baseline load representative of historic usage. Hourly rates are provided on the prior business day. A minimum of 1 MW load is required. This rate schedule is presently fully subscribed.

Summary of Available Existing Demand-Side and Energy Efficiency Programs

The following table provides current information available at the time of this report on DEP's pre-Senate Bill 3 DSM/EE programs (i.e., those programs that were in effect prior to January 1, 2008). This information, where applicable, includes program type, capacity, energy, and number of customers enrolled in the program as of the end of 2016, as well as load control activations since those enumerated in DEP's last biennial resource plan. The energy savings impacts of these existing programs are embedded within DEP's load and energy forecasts.

Program Description	Type	Capacity (MW)	Annual Energy (MWH)	Participants	Activations Since Last Biennial Report
Energy Efficiency Programs[5]	EE	469	NA	NA	NA
Real Time Pricing (RTP)	DSM	45	NA	105	NA
Commercial & Industrial TOU	DSM	11	NA	30,547	NA
Residential TOU	DSM	6	NA	27,282	NA
Curtailable Rates	DSM	278	NA	66	0

[5] Impacts from these existing programs are embedded within the load and energy forecast.

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Future EE and DSM Programs

DEP is continually seeking to enhance its DSM/EE portfolio by: (1) adding new or expanding existing programs to include additional measures, (2) program modifications to account for changing market conditions and new measurement and verification (M&V) results, and (3) other EE pilots.

Potential new programs and/or measures will be reviewed with the DSM Collaborative then submitted to the Public Utility Commissions as required for approval.

EE and DSM Program Screening

The Company evaluates the costs and benefits of DSM and EE programs and measures by using the same data for both generation planning and DSM/EE program planning to ensure that demand-side resources are compared to supply side resources on a level playing field.

The analysis of energy efficiency and demand side management cost-effectiveness has traditionally focused primarily on the calculation of specific metrics, often referred to as the California Standard tests: Utility Cost Test, Rate Impact Measure Test, Total Resource Cost Test, and Participant Test (PCT).

- The UCT compares utility benefits (avoided costs) to the costs incurred by the utility to implement the program, and does not consider other benefits such as participant savings or societal impacts. This test compares the cost (to the utility) to implement the measures with the savings or avoided costs (to the utility) resulting from the change in magnitude and/or the pattern of electricity consumption caused by implementation of the program. Avoided costs are considered in the evaluation of cost-effectiveness based on the projected cost of power, including the projected cost of the utility's environmental compliance for known regulatory requirements. The cost-effectiveness analyses also incorporate avoided transmission and distribution costs, and load (line) losses.
- The RIM Test, or non-participants test, indicates if rates increase or decrease over the long-run as a result of implementing the program.
- The TRC Test compares the total benefits to the utility and to participants relative to the costs to the utility to implement the program along with the costs to the participant. The benefits to the utility are the same as those computed under the UCT. The benefits to the participant are the same as those computed under the Participant Test, however, customer

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incentives are considered to be a pass-through benefit to customers. As such, customer incentives or rebates are not included in the TRC.

- The Participant Test evaluates programs from the perspective of the program's participants. The benefits include reductions in utility bills, incentives paid by the utility and any State, Federal or local tax benefits received.

The use of multiple tests can ensure the development of a reasonable set of cost-effective DSM and EE programs and indicate the likelihood that customers will participate.

Energy Efficiency and Demand-Side Management Program Forecasts

Forecast Methodology

In 2016, DEP commissioned a new EE market potential study to obtain new estimates of the technical, economic and achievable potential for EE savings within the DEP service area. The final reports (1 for North Carolina and 1 for South Carolina) were prepared by Nexant Inc. and issued on December 19, 2016.

The Nexant study results are suitable for IRP purposes and for use in long-range system planning models. This study also helps to inform utility program planners regarding the extent of EE opportunities and to provide broadly defined approaches for acquiring savings. This study did not, however, attempt to closely forecast EE achievements in the short-term or from year to year. Such an annual accounting is highly sensitive to the nature of programs adopted as well as the timing of the introduction of those programs. As a result, it was not designed to provide detailed specifications and work plans required for program implementation. The study provides part of the picture for planning EE programs. Fully implementable EE program plans are best developed considering this study along with the experience gained from currently running programs, input from DEP program managers and EE planners, feedback from the DSM Collaborative and with the possible assistance of implementation contractors.

The Nexant market potential study included projections of energy efficiency impacts over a 25-year period for years 2017-2041. Additionally, the cumulative savings projections included an assumption that when the EE measures included in the forecast reach the end of their useful lives, the impacts associated with these measures are removed from the future projected EE impacts, a process defined as "rolloff".

The table below provides the projected MWh load impacts of all DEP EE programs implemented since 2007 on a Net of Free Riders basis. The Company assumes total EE savings will continue to

grow on an annual basis throughout the planning, however, the components of future programs are uncertain at this time and will be informed by the experience gained under the current plan. Please

note that this table includes a column that shows historical EE program savings since the inception of the EE programs in 2007 through the end of 2016, which accounts for approximately an additional 1,682 gigawatt-hour (GWh) of net energy savings.

The following forecast is presented without the effects of "rolloff":

Projected MWh Impacts of EE Programs

Year	Annual MWh Load Reduction - Net	
	Including measures added in 2017 and beyond	Including measures added since 2007
2007-16		1,681,811
2017	164,969	1,846,780
2018	330,409	2,012,220
2019	500,868	2,182,679
2020	654,059	2,335,870
2021	811,352	2,493,163
2022	972,366	2,654,177
2023	1,136,403	2,818,214
2024	1,302,834	2,984,645
2025	1,469,125	3,150,936
2026	1,636,283	3,318,094
2027	1,804,162	3,485,973
2028	1,972,610	3,654,421
2029	2,141,912	3,823,723
2030	2,311,458	3,993,269
2031	2,482,706	4,164,517
2032	2,655,559	4,337,370

**Please note that the MWh totals included in the tables above represent the annual year-end impacts associated with EE programs, however, the MWh totals included in the load forecast portion of this document represent the sum of the expected hourly impacts.*

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The MW impacts from the EE programs are included in the Load Forecasting section of this IRP. The table below provides the projected MW load impacts of all current and projected DEP DSM.

Projected Load Impacts of DSM Programs

Year	Summer Peak MW Reduction					
	EnergyWise Home	CIG Demand Response	DSDR	Pre SB-3 Programs	EnergyWise for Business	Total Summer Peak
2017	327	26	224	314	5	897
2018	348	35	228	317	9	938
2019	368	46	232	320	14	980
2020	384	56	235	323	19	1,018
2021	395	67	238	327	24	1,050
2022	401	71	241	330	29	1,071
2023	401	71	244	331	29	1,076
2024	401	71	247	331	29	1,079
2025	401	71	250	331	29	1,083
2026	402	71	254	331	29	1,087
2027	402	71	257	331	29	1,090
2028	402	71	260	331	29	1,093
2029	402	71	264	331	29	1,097
2030	402	71	267	331	29	1,100
2031	402	71	271	331	29	1,104
2032	402	71	274	331	29	1,107

Note: For DSM programs, Gross and Net are the same.

Pursuing EE and DSM initiatives is not expected to meet the growing demand for electricity. DEP still envisions the need to secure additional generation, as well as cost-effective renewable generation, but the EE and DSM programs offered by DEP will address a significant portion of this need if such programs perform as expected.

Programs Evaluated but Rejected

Duke Energy Progress has not rejected any cost-effective programs as a result of its EE and DSM program screening.

Looking to the Future - Grid Modernization (Smart Grid Impacts)

Duke Energy Progress' Distribution System Demand Response (DSDR) program is an Integrated Volt-Var Control (IVVC) program that better manages the application and operation of voltage regulators (the Volt) and capacitors (the VAR) on the Duke Energy Progress distribution system. In general, the project tends to optimize the operation of these devices, resulting in a "flattening" of the

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voltage profile across an entire circuit, starting at the substation and continuing out to the farthest endpoint on that circuit. This flattening of the voltage profile is accomplished by automating the substation level voltage regulation and capacitors, line capacitors and line voltage regulators while integrating them into a single control system. This control system continuously monitors and operates the voltage regulators and capacitors to maintain the desired "flat" voltage profile. Once the system is operating with a relatively flat voltage profile across an entire circuit, the resulting circuit voltage at the substation can then be operated at a lower overall level. Lowering the circuit voltage at the substation, results in an immediate reduction of system loading during peak conditions.

Discontinued Demand Side Management and Energy Efficiency Programs

Since the last biennial Resource Plan filing, DEP discontinued the following DSM/EE programs or measures.

- Business Energy Report Pilot Program – With the cost effectiveness of the program expected to decline below the allowable threshold, the program was terminated in 2017.

Current and Anticipated Consumer Education Programs

In addition to the DSM/EE programs previously listed, DEP also has the following informational and educational programs.

- On Line Account Access
- "Lower My Bill" Toolkit
- Online Energy Saving Tips
- Energy Resource Center
- Large Account Management
- eSMART Kids Website
- Community Events

On Line Account Access

On Line Account Access provides energy analysis tools to assist customers in gaining a better understanding of their energy usage patterns and identifying opportunities to reduce energy consumption. The service allows customers to view their past 24 months of electric usage including the date the bill was mailed; number of days in the billing cycle; and daily temperature information. This program was initiated in 1999.

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"Lower My Bill" Toolkit

This tool, implemented in 2004, provides on-line tips and specific steps to help customers reduce energy consumption and lower their utility bills. These range from relatively simple no-cost steps to more extensive actions involving insulation and heating and cooling equipment.

Online Energy Saving Tips

DEP has been providing tips on how to reduce home energy costs since approximately 1981. DEP's web site includes information on household energy wasters and how a few simple actions can increase efficiency. Topics include: Energy Efficient Heat Pumps, Mold, Insulation R-Values, Air Conditioning, Appliances and Pools, Attics and Roofing, Building/Additions, Ceiling Fans, Ducts, Fireplaces, Heating, Hot Water, Humidistats, Landscaping, Seasonal Tips, Solar Film, and Thermostats.

Energy Resource Center

In 2000, DEP began offering its large commercial, industrial, and governmental customers a wide array of tools and resources to use in managing their energy usage and reducing their electrical demand and overall energy costs. Through its Energy Resource Center, located on the DEP web site, DEP provides newsletters, online tools and information, which cover a variety of energy efficiency topics such as electric chiller operation, lighting system efficiency, compressed air systems, motor management, variable speed drives and conduct an energy audit.

Large Account Management

All DEP commercial, industrial, and governmental customers with an annual electric bill greater than $250,000 are assigned to a DEP Account Executive (AE). The AEs are available to personally assist customers in evaluating energy improvement opportunities and can bring in other internal resources to provide detailed analyses of energy system upgrades. The AEs provide their customers with a monthly electronic newsletter, which includes energy efficiency topics and tips. They also offer numerous educational opportunities in group settings to provide information about DEP's new DSM and EE program offerings and to help ensure the customers are aware of the latest energy improvement and system operational techniques.

e-SMART Kids Website

DEP is offering an educational online resource for teachers and students in our service area called e-SMART Kids. The web site educates students on energy efficiency, conservation, and renewable energy and offers interactive activities in the classroom. It is available on the web at http://www.e-smartonline.net/safeelectricity/.

Community Events

DEP representatives participated in community events across the service territory to educate customers about DEP's energy efficiency programs and rebates and to share practical energy saving tips. DEP energy experts attended events and forums to host informational tables and displays, and distributed handout materials directly encouraging customers to learn more about and sign up for approved DSM/EE energy saving programs.

Discontinued Consumer Education Programs

DEP has not discontinued any consumer education programs since the last biennial Resource Plan filing.

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7. DEVELOPMENT OF THE RESOURCE PLAN:

The following section details the Company's expansion plan and resource mix that is required to meet the needs of DEP's customers over the next 15 years. The section also includes a discussion of the various technologies considered during the development of the IRP, as well as, a summary of the resources required in the "No Carbon" sensitivity case.

Tables 7-A and 7-B represent the winter and summer Load, Capacity, and Reserves tables for the Base Case.

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Table 7-A Load, Capacity and Reserves Table - Winter

Winter Projections of Load, Capacity, and Reserves
for Duke Energy Progress 2017 Annual Plan

	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30
Load Forecast													
1 Duke System Peak	13,310	13,429	13,446	13,489	13,596	13,620	13,788	13,897	14,041	14,186	14,352	14,480	14,6
2 Firm Sale	150	150	150	150	150	150	150	0	0	0	0	0	
3 Cumulative New EE Programs	(37)	(45)	(62)	(79)	(103)	(120)	(135)	(149)	(163)	(180)	(199)	(215)	(2
4 Adjusted Duke System Peak	**13,423**	**13,533**	**13,534**	**13,560**	**13,643**	**13,650**	**13,804**	**13,748**	**13,877**	**14,006**	**14,153**	**14,265**	**14,3**
Existing and Designated Resources													
5 Generating Capacity	13,937	13,981	13,991	14,173	13,597	13,597	13,597	13,609	13,609	13,609	13,609	13,616	13,6
6 Designated Additions / Uprates	108	10	566	4	0	0	12	0	0	0	239	0	
7 Retirements / Derates	(64)	0	(384)	(580)	0	0	0	0	0	0	(232)	0	
8 Cumulative Generating Capacity	**13,981**	**13,991**	**14,173**	**13,597**	**13,597**	**13,597**	**13,609**	**13,609**	**13,609**	**13,609**	**13,616**	**13,616**	**13,6**
Purchase Contracts													
9 Cumulative Purchase Contracts	**2,029**	**2,043**	**1,750**	**1,753**	**1,190**	**815**	**554**	**554**	**553**	**553**	**546**	**544**	**5**
Non-Compliance Renewable Purchases	134	148	168	173	121	123	122	121	121	120	117	115	1
Non-Renewables Purchases	1,895	1,895	1,582	1,580	1,070	692	432	432	432	432	429	429	4
Undesignated Future Resources													
10 Nuclear													
11 Combined Cycle					1,282				1,282				
12 Combustion Turbine													
13 Solar													
Renewables													
13 **Cumulative Renewables Capacity**	244	202	204	210	137	137	146	138	136	135	134	130	1
14 **Combined Heat & Power**	0	0	0	22	22	0	0	0	0	0	0	0	
15 Cumulative Production Capacity	**16,254**	**16,236**	**16,127**	**15,582**	**16,250**	**15,874**	**15,634**	**15,626**	**16,906**	**16,905**	**16,903**	**16,897**	**16,8**
Demand Side Management (DSM)													
16 Cumulative DSM Capacity	**495**	**510**	**524**	**539**	**553**	**559**	**563**	**566**	**570**	**573**	**577**	**580**	**5**
17 Cumulative Capacity w/ DSM	**16,750**	**16,746**	**16,652**	**16,121**	**16,803**	**16,433**	**16,197**	**16,192**	**17,476**	**17,478**	**17,480**	**17,477**	**17,4**
Reserves w/ DSM													
18 Generating Reserves	3,326	3,213	3,118	2,560	3,160	2,783	2,393	2,445	3,598	3,472	3,327	3,212	3,0
19 % Reserve Margin	**25%**	**24%**	**23%**	**19%**	**23%**	**20%**	**17%**	**18%**	**26%**	**25%**	**24%**	**23%**	**2**

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Table 7-B Load, Capacity and Reserves Table – Summer

Summer Projections of Load, Capacity, and Reserves
for Duke Energy Progress 2017 Annual Plan

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Load Forecast												
1 Duke System Peak	13,078	13,217	13,264	13,334	13,451	13,504	13,662	13,810	13,977	14,144	14,311	14,471
2 Firm Sale	150	150	150	150	150	150	150	0	0	0	0	0
3 Cumulative New EE Programs	(88)	(132)	(173)	(213)	(253)	(294)	(330)	(366)	(399)	(437)	(478)	(514)
4 Adjusted Duke System Peak	**13,140**	**13,235**	**13,241**	**13,270**	**13,348**	**13,360**	**13,482**	**13,445**	**13,578**	**13,706**	**13,833**	**13,957**
Existing and Designated Resources												
5 Generating Capacity	12,803	12,760	12,764	12,883	12,453	12,453	12,461	12,461	12,461	12,461	12,463	12,508
6 Designated Additions / Uprates	5	4	497	0	0	8	0	0	0	2	221	0
7 Retirements / Derates	(48)	0	(378)	(430)	0	0	0	0	0	0	(176)	0
8 Cumulative Generating Capacity	**12,760**	**12,764**	**12,883**	**12,453**	**12,453**	**12,461**	**12,461**	**12,461**	**12,461**	**12,463**	**12,508**	**12,508**
Purchase Contracts												
9 Cumulative Purchase Contracts	**2,406**	**2,358**	**2,390**	**1,940**	**1,597**	**1,614**	**1,389**	**1,385**	**1,380**	**1,375**	**1,364**	**1,358**
Non-Compliance Renewable Purchases	659	779	957	996	979	996	991	986	981	977	969	962
Non-Renewables Purchases	1,747	1,579	1,434	944	618	618	398	398	398	398	395	395
Undesignated Future Resources												
10 Nuclear												
11 Combined Cycle					1,151				1,151			
12 Combustion Turbine												
13 Solar												
Renewables												
13 Cumulative Renewables Capacity	674	630	649	702	675	732	808	812	806	802	797	790
14 Combined Heat & Power	0	0	0	20	20	0	0	0	0	0	0	0
15 Cumulative Production Capacity	**15,840**	**15,751**	**15,922**	**15,115**	**15,916**	**15,999**	**15,850**	**15,848**	**16,989**	**16,982**	**17,011**	**16,998**
Demand Side Management (DSM)												
16 Cumulative DSM Capacity	**938**	**980**	**1,018**	**1,050**	**1,071**	**1,076**	**1,079**	**1,083**	**1,087**	**1,090**	**1,093**	**1,097**
17 Cumulative Capacity w/ DSM	**16,778**	**16,731**	**16,940**	**16,166**	**16,988**	**17,075**	**16,929**	**16,931**	**18,075**	**18,072**	**18,105**	**18,094**
Reserves w/ DSM												
18 Generating Reserves	3,638	3,496	3,699	2,895	3,639	3,715	3,447	3,486	4,497	4,365	4,271	4,137
19 % Reserve Margin	**28%**	**26%**	**28%**	**22%**	**27%**	**28%**	**26%**	**26%**	**33%**	**32%**	**31%**	**30%**

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DEP - Assumptions of Load, Capacity, and Reserves Table

The following notes are numbered to match the line numbers on the Winter Projections of Load, Capacity, and Reserves table. All values are MW (winter ratings) except where shown as a Percent.

1. Planning is done for the peak demand for the Duke Energy Progress System.

2. Firm sale of 150 MW through 2024.

3. Cumulative energy efficiency and conservation programs (does not include demand response programs).

4. Peak load adjusted for firm sales and cumulative energy efficiency.

5. Existing generating capacity reflecting designated additions, planned uprates, retirements and derates as of July 1, 2017.

6. Capacity Additions include:

   Planned nuclear uprates totaling 44 MW in the 2017-2027 timeframe.

   100 MW Sutton Blackstart combustion turbine addition in July 2017.

   560 MW Asheville combined cycle addition in November 2019.

   Potential 235 MW Asheville combustion turbine addition in December 2027.

7. Planned Retirements include:

   384 MW Asheville Coal Units 1-2 in November 2019.

   64 MW Sutton CT Units 2A and 2B in July 2017.

   580 MW Darlington CT Units 1-8 and 10 by 2020.

   232 MW Blewett CT Units 1-4 and Weatherspoon CT units 1-4 in December 2027.

   Planning assumptions for nuclear stations assume retirement at the end of their current license extension.

   797 MW Robinson 2 in 2030.

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DEP - Assumptions of Load, Capacity, and Reserves Table (cont.)

All retirement dates are subject to review on an ongoing basis. Dates used in the 2017 IRP are for planning purposes only, unless already planned for retirement.

8. Sum of lines 5 through 7.

9. Cumulative Purchase Contracts have several components:

   Purchased capacity from PURPA Qualifying Facilities.

   Additional line items are shown under the total line item to show the amounts of renewable and traditional QF purchases.

   Renewables in these line items are not used for NC REPS compliance.

10. New nuclear resources economically selected to meet load and minimum planning reserve margin .

    Capacity must be on-line by June 1 to be included in available capacity for the summer peak of that year and by December 1 to be included in available capacity for the winter peak of that year.

    No new nuclear resources were selected in the Base Case in the 15 year study period.

11. New combined cycle resources economically selected to meet load and minimum planning reserve margin.

    Capacity must be on-line by June 1 to be included in available capacity for the summer peak of that year and by December 1 to be included in available capacity for the winter peak of that year.

    Addition of 1,282 MW of combined cycle capacity in December of 2021, 2025 and 2031.

12. New combustion turbine resources economically selected to meet load and minimum planning reserve margin.

    Capacity must be on-line by June 1 to be included in available capacity for the summer peak of that year and by December 1 to be included in available capacity for the winter peak of that year.

    No new CT resources were selected in the Base Case in the 15 year study period.

DEP - Assumptions of Load, Capacity, and Reserves Table (cont.)

13. Resources to comply with NC REPS and HB 589 along with solar customer product offerings such as Green Source and SC DER Program were input as existing resources.

14. New 21.7 MW (winter) combined heat and power units included in December of 2020 and 2021.

15. Sum of lines 8 through 14.

16. Cumulative Demand Side Management programs including load control and DSDR.

17. Sum of lines 15 and 16.

18. The difference between lines 17 and 4.

19. Reserve Margin = (Cumulative Capacity-System Peak Demand)/System Peak Demand

    Line 18 divided by Line 4.

    Minimum target planning reserve margin is 17%.

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Technologies Considered

Similar to the 2016 IRP, the Company considered a diverse range of technology choices utilizing a variety of different fuels in order to meet future generation needs in the 2017 IRP. The Company conducted an economic screening analysis of various technologies as part of the 2017 IRP, with changes from the 2016 IRP highlighted below.

Dispatchable (Winter Ratings)

- Base load – 782 MW Ultra-Supercritical Pulverized Coal with CCS
- Base load – 557 MW 2x1 IGCC with CCS
- Base load – 2 x 1,117 MW Nuclear Units (AP1000)
- Base load – **638 MW** – 1x1x1 Advanced Combined Cycle (**No Inlet Chiller** and Fired)
- Base load – **1,281 MW** – 2x2x1 Advanced Combined Cycle (**No Inlet Chiller** and Fired)
- Base load – 21.7 MW – Combined Heat & Power
- Peaking/Intermediate – **195 MW** 4 x LM6000 Combustion Turbines (CTs)
- Peaking/Intermediate – 200 MW, 12 x Reciprocating Engine Plant
- Peaking/Intermediate – **549 MW 2 x G/H-Class Combustion Turbines (CTs)**
- Peaking/Intermediate – **740 MW 2 x J-Class Combustion Turbines (CTs)**
- Peaking/Intermediate – **942 MW** 4 x 7FA.05 Combustion Turbines (CTs)
- Renewable – **5 MW / 2.5 MWh** Li-ion Battery
- Renewable – **5 MW / 20 MWh** Li-ion Battery
- Renewable – **2 MW Solar PV plus 2 MW / 8 MWh** Li-ion Battery

Non-Dispatchable (Nameplate)

- Renewable – 5 MW Landfill Gas
- Renewable – 150 MW Wind - On-Shore
- Renewable – 5 MW Solar PV, Fixed-tilt (FT)
- Renewable – **50 MW Solar PV, Fixed-tilt (FT)**
- Renewable – **50 MW Solar PV, Single Axis Tracking (SAT)**
- Renewable – **1300 MW Pumped Storage - Brownfield**
- Renewable – 5 MW Landfill Gas

Combined Cycle base capacities and technologies: Based on proprietary third party engineering studies, the 2x2x1 Advanced CC saw an increase in base load of 62 MW. The older version base 2x1 CC and the 3x1 Advanced CC were not considered in the updated IRP. However, as the Company begins the process of evaluating particular technologies for future undesignated generation needs, these technologies, along with other new technologies, may be considered based on factors such as generation requirements, plot size, new environmental regulations, etc.

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Combustion Turbine base capacities and technologies: Based on proprietary third party engineering studies, the F-Frame CT technology saw a slight increase in winter capacity. The LM6000 CTs were not considered in the updated IRP. However, as the Company begins the process of evaluating particular technologies for future undesignated generation needs, these technologies, along with other new technologies, may be considered based on factors such as generation requirements, plot size, new environmental regulations, etc.

CHP: As mentioned previously, two 21.7 MW (winter) blocks of Combined Heat & Power are considered in the 2017 IRP and are included as resources for meeting future generation needs. While no contracts have yet been signed for DEP, discussions with potential steam hosts are currently underway. As CHP continues to be implemented, future IRP processes will incorporate additional CHP, as appropriate.

Energy Storage: Energy storage solutions, in particular batteries, are becoming an increasing necessity for support of grid services, including frequency regulation, solar smoothing, and/or energy shifting from localized renewable energy sources with a high incidence of intermittency (i.e. solar and wind). These technologies are capable of providing resiliency benefits and economic value for the utility and its customers. Duke Energy owns and operates several battery projects that have been in operation since 2011 through its Emerging Technology Office, mainly in support of regulating grid frequency and voltage, integrating renewables and energy time shifting.

Duke Energy is committed to supporting emerging technologies that can complement more conventional technologies and is in a prime position to optimize the investment in batteries by dispatching them in a manner that directly benefits customers. The Company intends to begin investing in multiple systems dispersed throughout its North and South Carolina service territory that will be located on property owned by the Company or leased from its customers. These deployments will allow Duke Energy and its customers to evaluate the costs and impacts of batteries deployed at a significant scale, explore the nature of new offerings desired by customers, and fill knowledge gaps. The goals of the Western Carolinas Modernization Project will also be supported by the battery deployment plan.

Duke Energy Progress currently has 1 battery constructed and 2 in the interconnection queue in the western Carolinas region.

Pumped Storage Hydropower (PSH): PSH is another form of Energy Storage and is the only conventional, mature, commercial, utility-scale bulk electricity storage option available currently. This technology consumes off-peak electricity by pumping water from a lower reservoir to an upper reservoir. When the electric grid needs more electricity and when electricity prices are higher, water

is released from the upper reservoir. As the water flows from the upper reservoir to the lower reservoir, it goes through a hydroelectric turbine to generate electricity. Many operational pumped storage hydropower plants are providing electric reliability and reserves for the electric grid in high demand situations.

PSH can provide a high amount of power because its only limitation is the capacity of the upper reservoir. Typically, these plants can be as large as 4,000 MW, and have an efficiency of 76% - 85% (Electric Power Research Institute (EPRI), 2012). Therefore, this technology is effective at meeting electric demand and transmission overload by shifting, storing, and producing electricity.

This is important because an increasing supply of intermittent renewable energy generation such as solar will cause challenges to the electric grid. PSH installations are greatly dependent on regional geography and face several challenges including: environmental impact concerns, a long permitting process, and a relatively high initial capital cost. Duke Energy currently has 2 PSH assets, Bad Creek Reservoir and Jocassee Hydro in the DEC territory with an approximate combined generating capacity of 2,140 MW.

Expansion Plan and Resource Mix

A tabular presentation of the 2017 Base Case resource plan represented in the above LCR table is shown below:

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Table 7-C DEP Base Case Resources – Winter (with CO_2)

Duke Energy Progress Resource Plan [1] Base Case - Winter				
Year	**Resource**		**MW**	
2018	Nuclear Uprates	Sutton Blackstart CT	8	100
2019	Nuclear Uprates		10	
2020	Nuclear Uprates	Asheville CC	6	560
2021	CHP	Nuclear Uprates	22	4
2022	CHP	New CC	22	1282
2023				
2024	Nuclear Uprates		12	
2025				
2026	New CC		1282	
2027				
2028	Nuclear Uprates	Potential Asheville CT	4	235
2029				
2030				
2031	New CC		1282	
2032				

Notes: (1) Table includes both designated and undesignated capacity additions
Future additions of renewables, EE and DSM not included

Table 7-D DEP Base Case Resources (with CO_2) Cumulative Winter Totals

DEP Base Case Resources
Cumulative Winter Totals - 2018 - 2032

Nuclear	44
CC	4406
CT	335
CHP	44
Total	4829

The following charts illustrate both the current and forecasted capacity by fuel type for the DEP system, as projected in the Base Case. As demonstrated in Chart 7-A, the capacity mix for the DEP system changes with the passage of time. In 2032, the Base Case projects that DEP will have a smaller percentage reliance on coal, nuclear and external purchases, and a higher reliance on gas-fired resources, renewable resources and EE as compared to the current state.

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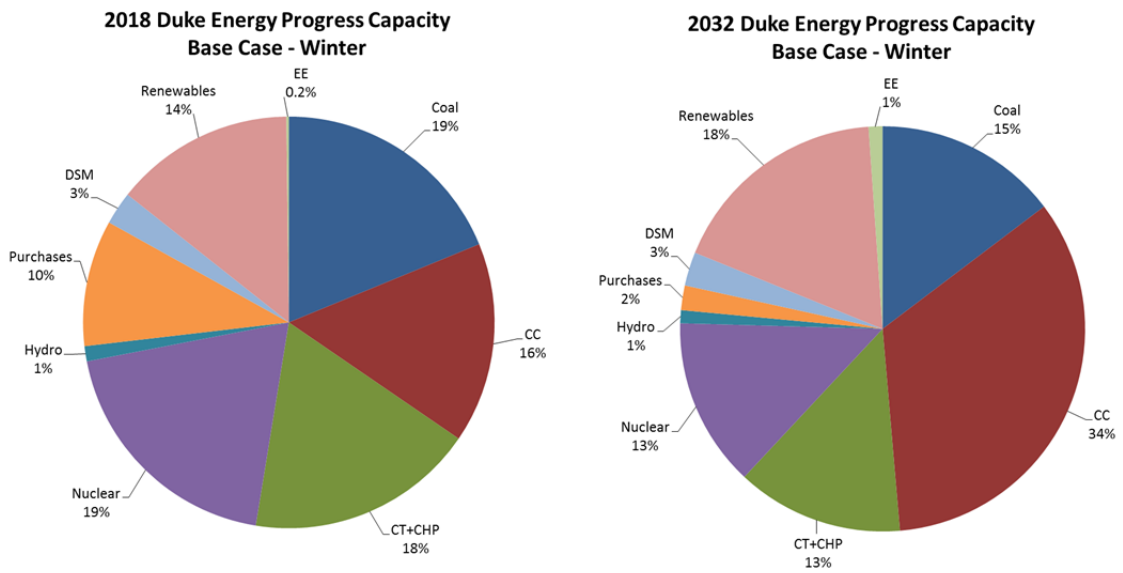
Chart 7-A 2018 and 2032 Base Case Winter Capacity Mix



As discussed earlier, the Company developed 3 additional cases which represent variations of the Base Case.

A description of these additional cases are:

- "No Carbon Case" – No carbon legislation and without nuclear relicensing.
- "Carbon and Nuclear Relicensing Case" – Carbon legislation in 2026 and with nuclear relicensing.
- "No Carbon with Nuclear Relicensing Case" – No carbon legislation and with nuclear relicensing.

A representation of the expansion plans for these cases is shown in Table 7-E.

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Table 7-E Additional Cases - Winter

Duke Energy Progress Resource Plans Additional Cases - Winter (Resource - MW)						
Year	No Carbon Case w/o Relicensing Case		Carbon w/ Relicensing Case		No Carb Relicensi	
2018	Nuclear Uprates - 8	Sutton Blackstart CT - 100	Nuclear Uprates - 8	Sutton Blackstart CT - 100	Nuclear Uprates - 8	Su
2019	Nuclear Uprates - 10		Nuclear Uprates - 10		Nuclear Up	
2020	Nuclear Uprates - 6		Nuclear Uprates - 6		Nuclear Up	
	Asheville CC - 560		Asheville CC - 560		Asheville C	
2021	CHP - 22		CHP - 22		CHP	
	Nuclear Uprates - 4		Nuclear Uprates - 4		Nuclear Up	
2022	CHP - 22		CHP - 22		CHP	
	New CC - 1282		New CC - 1282		New CC	
2023						
2024	Nuclear Uprates - 12		Nuclear Uprates - 12		Nuclear Up	
2025						
2026	New CT - 471		New CC - 1282		New CT	
2027						
2028	Nuclear Uprates - 4	New CT - 471	Nuclear Uprates - 4	New CT - 235	Nuclear Uprates - 4	
2029						
2030						
2031	New CC - 1282				New CT	
2032						

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8. SHORT-TERM ACTION PLAN:

The Company's Short-Term Action Plan, which identifies accomplishments in the past year and actions to be taken over the next 5 years, is summarized below:

Continued Reliance on EE and DSM Resources

The Company is committed to continuing to grow the amount of EE and DSM resources utilized to meet customer growth. The following are the ways in which DEP will increase these resources:

- Continue to execute the Company's EE and DSM plan, which includes a diverse portfolio of EE and DSM programs spanning the residential, commercial, and industrial classes.

- Continue on-going collaborative work to develop and implement additional cost-effective EE and DSM products and services.

- Continue to seek enhancements to the Company's EE/DSM portfolio by: (1) adding new or expanding existing programs to include additional measures, (2) program modifications to account for changing market conditions and new measurement and verification (M&V) results and (3) other EE research & development pilots.

- Continue to seek additional DSM programs that will specifically benefit during winter peak situations.

Continued Focus on Renewable Energy Resources

- DEP is committed to complying with the newly signed HB 589 legislation. DEP has made assumptions to account for the non-compliance PURPA renewable purchases part of the "Transition" MW of HB 589, as well as the competitive procurement, renewable energy procurement for large customers, and community solar components of the bill.

- DEP is committed to full compliance with the SC DER Program in South Carolina and NC REPS in North Carolina. As previously discussed, the Company has experienced a substantial increase in solar QFs in the interconnection queue over the past few years. With this significant level of interest in solar development, DEP continues to procure renewable purchase power resources, when economically viable, as part of its Compliance Plans. DEP is also pursuing the addition of new utility-owned solar on the DEP system.

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- DEP continues to evaluate market options for renewable generation. PPAs have been signed with developers of solar PV and landfill gas resources. Additionally, REC purchase agreements have been executed for purchases of unbundled RECs from wind, solar PV, solar thermal and hydroelectric facilities.

- DEP continues to pursue CHP opportunities, as appropriate, and placeholders have been included in the IRP.

Addition of Clean Natural Gas Resources

- Continue to evaluate older CTs on the DEP system. The Company is evaluating the condition and economic viability of the older CTs on the system. In doing so, DEP is preparing for the potential retirement of these units. This includes determining the type of resources needed to reliably replace these units to maintain a minimum planning reserve margin.

  - Sutton CT Unit 1 (12 MW/11 MW winter/summer) was officially retired in March 2017. Sutton CT Units 2A and 2B (64 MW/48 MW winter/summer) were retired in July 2017.

  - New Sutton Blackstart CT (100 MW/84 MW winter/summer) began commercial operation in July 2017.

  - Darlington CT Unit 11 was officially retired in November 2015, while Darlington CT Unit 9 was officially retired in June 2017.

  - Darlington CT Units1-8 and 10 are projected to retire in 2020.

- Continue construction of the new combined cycle units at the Asheville facility (560 MW/ 495 MW winter/summer) in the 2019 timeframe as part of the Western Carolinas Modernization Project (WCMP).

  - Asheville Coal Units are expected to retire in 2019 upon the commercial operation of the Asheville combined cycle.

- Take actions to ensure capacity needs beginning in 2022 are met. In addition to seeking to meet the Company's EE and DSM goals and meeting the Company's NC REPS and the SC DER Program requirements, as well as the new HB 589 bill, actions to secure additional capacity may include purchased power, short-term PPAs or Company-owned

generation. The 2017 IRP projects that the best resources to meet this 2022 demand are combined cycle units.

Expiration of Wholesale Purchase Contracts

In the 2018-2022 timeframe, DEP has several wholesale purchase contracts that are scheduled to expire. At this time, DEP is not relying on contract extensions on these contracts. As such, these contract expirations are included in the IRP and Short-Term Action Plan. A summary of those expirations is shown in Table 8-A below. In addition to the expirations shown in this 5 year period, additional contracts expire during the 15 year IRP study period.

Table 8-A Wholesale Purchase Contract Expirations - Winter

DEP	
	Wholesale Purchase Contract Expirations - Winter
2018	-
2019	
2020	**313 MW**
2021	
2022	**510 MW**
Total	**823 MW**

Continued Focus on System Reliability and Resource Adequacy for DEP System

The 2016 and 2017 DEP and DEC IRPs incorporated a 17% winter reserve margin target based on results of the resource adequacy studies completed in 2016. The NCUC's 2016 IRP Order concluded that the reserve margins included in the DEP and DEC IRPs are reasonable for planning purposes. However, the Commission noted concerns outlined by the Public Staff and a report submitted by SACE, NRDC and Sierra Club consultant Wilson. DEP and DEC responded to these concerns in the Companies' detailed 2016 IRP Reply Comments regarding reserve margins and winter capacity planning. In addition, since the issuance of the 2016 IRP Order, the Companies have met with and initiated further discussions with the Public Staff to identify and address any remaining issues. The Companies and the Public Staff plan to file a joint report summarizing the on-going review and conclusions within 150 days of the filing of the Companies' 2017 IRP updates as directed by the NCUC.

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Continued Focus on Evolving Regulations, Environmental Compliance and Wholesale Activities

- As of December 2013, all of DEP's older, un-scrubbed coal units have been retired. In total, DEP has retired 1,600 MW of older vintage coal units since 2011. Additionally, over the same period, DEP has retired approximately 400 MW of older vintage fuel-oil turbines bringing total retirements to 2,000 MW.

- The 2017 IRP shows an additional 1,000 MW of retirements over the study period with just under 400 MW of coal being retired at the Asheville site and just under 600 MW of combustion turbines being retired at the Darlington site.

- Continue to monitor the status of EPA's Clean Power Plan.
    - In response to a March 28, 2017 Executive Order, EPA has undertaken a review of the rule to determine whether it should be suspended, revised, or rescinded. The rule remains in effect pending the outcome of litigation and EPA's review of the rule.
    - On October 10, 2017, EPA issued a Notice of Proposed Rulemaking to repeal the CPP based on a change to EPA's legal interpretation of the section of the Clean Air Act (CAA) on which the CPP was based.
    - EPA indicates that it has not determined whether it will issue a rule to replace the CPP, and if it will do so, when and what form that rule will take.
    - Continue to investigate the future environmental control requirements and resulting operational impacts associated with existing and potential environmental regulations such as the Mercury and Air Toxics Standards (MATS), the Coal Combustion Residuals Rule (CCR), the Cross State Air Pollution Rule (CSAPR), and the new Ozone National Ambient Air Quality Standard (NAAQS).

- Aggressively pursue compliance in South Carolina and North Carolina in addressing coal ash management and ash pond remediation. Ensure timely compliance plans and their associated costs are contemplated within the planning process and future integrated resource plans, as appropriate.

- Continue to pursue existing and potential opportunities for wholesale power sales agreements.

- Continue to monitor energy-related statutory and regulatory activities.

- Continue to examine the benefits of joint capacity planning and pursue appropriate regulatory actions.

A summarization of the capacity resources for the reference plan in the 2017 IRP is shown in Table 8-B below. Capacity retirements and additions are presented as incremental values in the year in which the change is projected to impact the winter peak. The values shown for renewable resources, EE and DSM represent cumulative totals.

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Table 8-B DEP Short-Term Action Plan

Duke Energy Progress Short-Term Action Plan [1]					
			Compliance Renewable Resources (Cumulative Nameplate MW)		
Year	Retirements[2]	Additions	Solar [3]	Biomass/Hydro	EE
2018	64 MW Sutton 2A, 2B	100 MW Sutton CT Repl 8 MW Nuc Uprate	2448	256	37
2019		10 MW Nuc Uprate	2714	214	45
2020	384 MW Asheville 1-2	560 MW Asheville CC 6 MW Nuc Uprate	3162	214	62
2021	580 MW Darlington CT	4 MW Nuc Uprate 22 MW CHP	3371	214	79
2022		1282 Generic CC 22 MW CHP	3580	79	103

Notes:

(1) Capacities shown in winter ratings unless otherwise noted.

(2) Sutton GT1 retired 3/30/17.

Darlington Units 1-8 and 10 are assumed to retire March 2020. Darlington 9 is currently offline and is represented as a derate through 2020 until r

(3) Capacity is shown in nameplate ratings. For planning purposes, solar has a 5% contribution to winter peak.

(4) Includes impacts of grid modernization.

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9. CONCLUSIONS:

DEP continues to focus on the needs of customers by meeting the growing demand in the most economical and reliable manner possible. The Company continues to improve the IRP process by determining best practices and making changes to more accurately and realistically represent the DEP System in its planning practices. The 2017 IRP represents a 15-year projection of the Company's plan to balance future customer demand and supply resources to meet this demand plus a 17% minimum winter planning reserve margin. Over the 15-year planning horizon, DEP expects to require 4,829 MW of additional generating resources in addition to the incremental renewable resources, EE and DSM already in the resource plan.

The Company focuses on the needs of the short-term, while keeping a close watch on market trends and technology advancements to meet the demands of customers in the long-term. The Company's short-term and long-term plans are summarized below:

Short-Term

Over the next 5 years, DEP's 2017 IRP focuses on the following:

- Construction was completed on the Sutton Blackstart CTs in July 2017.
- Continue construction of the 2 new combined cycle units at the Asheville facility in the 2019 timeframe as part of the WCMP.
- Pursue investment in a limited number of battery storage projects to gain additional operational and technical experience with evolving utility-scale storage technologies.
- Take actions to ensure system capacity needs beginning in 2022 are met.
- Continue work with Astrapé and the NC Public Staff to resolve outstanding issues regarding the 2016 resource adequacy study conducted for the DEP system.
- Procure CHP resources as cost-effective and diverse generation sources, as appropriate.
- Continue to meet requirements of the SC DER Program and NC REPS.
- Begin compliance with HB 589, by completing the "Transition" MW, and connecting a portion of the competitive procurement, renewable energy procurement for large customers, and community solar components of the bill.
- Continue to invest in EE and DSM in the Carolinas region.
- Continue to seek additional DSM programs that will specifically benefit during winter peak situations.

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Long-Term

Beyond the next 5 years, DEP's 2017 IRP focuses on the following:

- Continue to seek the most cost-effective, reliable resources to meet the growing customer demand in the service territory. Currently, those are new combined cycle units and combustion turbine units in the 15-year planning horizon.
- Procure CHP resources as cost-effective and diverse generation sources, as appropriate.
- Continue to meet NC REPS compliance plans, as well as the new HB 589 bill, and invest in additional cost-effective and diverse renewable resources.
- Continue implementing all portions of the HB 589 bill.
- Continue to grow and enhance EE and DSM in the Carolinas region.
- Continue to seek additional DSM programs that will specifically benefit during winter peak situations.

DEP's goal is to continue to diversify the DEP system by adding a variety of cost-effective, reliable, clean resources to meet customer demand. Over the next 15 years, the Company projects filling the increasing demand with investments in natural gas, renewables, EE and DSM.

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10. WESTERN CAROLINAS MODERNIZATION (WCMP) UPDATE:

Western Carolinas Modernization – Energy Innovation Task Force

Since the 2016 IRP submittal, the Energy Innovation Task Force has been up and running full speed.

The task force leadership established 4 working groups focused on data analytics, EE and DSM programs, technology and community engagement. The Energy Innovation Task Force has met monthly for the past year to listen to the community and learn more about the efforts around targeted megawatt-reduction goals, existing programs, program barriers, existing and evolving technologies, and upcoming investment of the 3 co-conveners *(Duke Energy Progress, City of Asheville and Buncombe County)*.

The co-conveners engaged Rocky Mountain Institute as a key partner early in the process to provide analytical support. Because of their participation and expertise, we now know more about how customers in Duke Energy progress-West use electricity than ever before. This analysis has determined a target of 17 megawatts of savings annually to avoid construction of the contingent CT in 2023. It also highlights the need to focus program offerings on heating system efficiency. This information is critically important to refining recommendations to achieve both goals:

- Transition DEP-West region to a smarter and cleaner energy future.
- Avoid or delay construction of the contingent CT.

The research of Rocky Mountain Institute identified the current lack of AMI in the region as a barrier to the effort's overall success. Therefore, Duke Energy Progress plans to deploy and install AMI in DEP-West beginning in March 2018, with some targeted deployment in 2017. Additionally, Duke Energy Progress continues to pursue efforts associated with advanced demand-side management programs, solar and battery storage. In 2016, through door-to-door canvassing, EnergyWise Home experienced 70 percent growth in winter participation.

Duke Energy Progress, working closely with community stakeholders, has evaluated more than 30 sites for possible utility-scale solar/battery installations.

Both the Asheville City and Buncombe County are also making sizable investments to advance the work of the Energy Innovation Task Force. Both included money in their governmental 2017-2018 budget for building audits, staff support and other direct investments in low-income weatherization.

Specifically, Buncombe County is reviewing proposals for solar on the County's retired landfill (estimated 3-5 megawatts) and investing $7 million to install LEDs in each school. This is made possible largely by Duke Energy Progress incentives for LED retrofits.

Work is also underway with the Shelton Group, a nationally-recognized firm that focuses on energy and sustainability marketing and communications, to create a brand and campaign for the Energy Innovation Task Force's work. This work is being completed in close coordination with a diverse representation of community members. The campaign will launch in Q4 2017.

Through all of these efforts and updates to the overall system load forecast, the contingent CT is now needed in 2027, instead of 2023.

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11. DUKE ENERGY PROGRESS OWNED GENERATION:

Duke Energy Progress' generation portfolio includes a balanced mix of resources with different operating and fuel characteristics. This mix is designed to provide energy at the lowest reasonable cost to meet the Company's obligation to serve its customers. Duke Energy Progress-owned generation, as well as purchased power, is evaluated on a real-time basis in order to select and dispatch the lowest-cost resources to meet system load requirements. In 2016, Duke Energy Progress' nuclear, gas-fired and coal-fired generating units met the vast majority of customer needs by providing 46%, 35% and 18%, respectively, of Duke Energy Progress' energy from generation. Hydroelectric generation, Combustion Turbine generation, Combined Cycle generation, solar generation, long term PPAs, and economical purchases from the wholesale market supplied the remainder.

The tables below list the Duke Energy Progress' plants in service in North Carolina and South Carolina with plant statistics, and the system's total generating capability.

Existing Generating Units and Ratings [1, 3, 5]
All Generating Unit Ratings are as of August 11, 2017 unless otherwise noted.

Coal						
	Unit	Winter (MW)	Summer (MW)	Location	Fuel Type	Resource Type
Asheville	1	192	189	Arden, NC	Coal	Intermediate
Asheville	2	192	189	Arden, NC	Coal	Intermediate
Mayo [2]	1	746	727	Roxboro, NC	Coal	Intermediate
Roxboro	1	380	379	Semora, NC	Coal	Intermediate
Roxboro	2	673	671	Semora, NC	Coal	Intermediate
Roxboro	3	698	691	Semora, NC	Coal	Intermediate
Roxboro [2]	4	711	698	Semora, NC	Coal	Intermediate
Total Coal		3,592	3,544			

Combustion Turbines						
	Unit	Winter (MW)	Summer (MW)	Location	Fuel Type	Resource Type
Asheville	3	185	160	Arden, NC	Natural Gas/Oil	Peaking
Asheville	4	185	160	Arden, NC	Natural Gas/Oil	Peaking
Blewett	1	17	13	Lilesville, NC	Oil	Peaking
Blewett	2	17	13	Lilesville, NC	Oil	Peaking
Blewett	3	17	13	Lilesville, NC	Oil	Peaking
Blewett	4	17	13	Lilesville, NC	Oil	Peaking
Darlington	1	63	50	Hartsville, SC	Natural Gas/Oil	Peaking
Darlington	2	64	46	Hartsville, SC	Oil	Peaking
Darlington	3	63	50	Hartsville, SC	Natural Gas/Oil	Peaking
Darlington	4	66	48	Hartsville, SC	Oil	Peaking
Darlington	5	66	49	Hartsville, SC	Natural Gas/Oil	Peaking
Darlington	6	62	43	Hartsville, SC	Oil	Peaking
Darlington	7	65	49	Hartsville, SC	Natural Gas/Oil	Peaking
Darlington	8	66	46	Hartsville, SC	Oil	Peaking
Darlington	10	65	49	Hartsville, SC	Oil	Peaking
Darlington	12	133	118	Hartsville, SC	Natural Gas/Oil	Peaking
Darlington	13	133	116	Hartsville, SC	Natural Gas/Oil	Peaking
Smith [4]	1	189	157	Hamlet, NC	Natural Gas/Oil	Peaking
Smith [4]	2	187	156	Hamlet, NC	Natural Gas/Oil	Peaking
Smith [4]	3	185	155	Hamlet, NC	Natural Gas/Oil	Peaking
Smith [4]	4	186	159	Hamlet, NC	Natural Gas/Oil	Peaking
Smith [4]	6	187	145	Hamlet, NC	Natural Gas/Oil	Peaking
Sutton	4	50	40	Wilmington, NC	Natural Gas/Oil	Peaking
Sutton	5	50	40	Wilmington, NC	Natural Gas/Oil	Peaking
Wayne	1/10	192	177	Goldsboro, NC	Oil/Natural Gas	Peaking
Wayne	2/11	192	174	Goldsboro, NC	Oil/Natural Gas	Peaking
Wayne	3/12	193	173	Goldsboro, NC	Oil/Natural Gas	Peaking
Wayne	4/13	191	170	Goldsboro, NC	Oil/Natural Gas	Peaking
Wayne	5/14	195	163	Goldsboro, NC	Oil/Natural Gas	Peaking
Weatherspoon	1	41	31	Lumberton, NC	Natural Gas/Oil	Peaking
Weatherspoon	2	41	31	Lumberton, NC	Natural Gas/Oil	Peaking
Weatherspoon	3	41	32	Lumberton, NC	Natural Gas/Oil	Peaking
Weatherspoon	4	41	30	Lumberton, NC	Natural Gas/Oil	Peaking
Total NC		2,599	2,205			
Total SC		846	664			
Total CT		3,445	2,869			

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Combined Cycle						
	Unit	Winter (MW)	Summer (MW)	Location	Fuel Type	Resource Type
Lee	CT1A	225	170	Goldsboro, NC	Natural Gas/Oil	Base
Lee	CT1B	227	170	Goldsboro, NC	Natural Gas/Oil	Base
Lee	CT1C	228	170	Goldsboro, NC	Natural Gas/Oil	Base
Lee	ST1	379	378	Goldsboro, NC	Natural Gas/Oil	Base
Smith [4]	CT7	189	154	Hamlet, NC	Natural Gas/Oil	Base
Smith [4]	CT8	189	153	Hamlet, NC	Natural Gas/Oil	Base
Smith [4]	ST4	175	169	Hamlet, NC	Natural Gas/Oil	Base
Smith [4]	CT9	216	174	Hamlet, NC	Natural Gas/Oil	Base
Smith [4]	CT10	216	175	Hamlet, NC	Natural Gas/Oil	Base
Smith [4]	ST5	248	248	Hamlet, NC	Natural Gas/Oil	Base
Sutton	CT1A	224	170	Wilmington, NC	Natural Gas/Oil	Base
Sutton	CT1B	224	171	Wilmington, NC	Natural Gas/Oil	Base
Sutton	ST1	271	266	Wilmington, NC	Natural Gas/Oil	Base
Total CC		3,011	2,568			

Hydro						
	Unit	Winter (MW)	Summer (MW)	Location	Fuel Type	Resource Type
Blewett	1	4	4	Lilesville, NC	Water	Intermediate
Blewett	2	4	4	Lilesville, NC	Water	Intermediate
Blewett	3	4	4	Lilesville, NC	Water	Intermediate
Blewett	4	5	5	Lilesville, NC	Water	Intermediate
Blewett	5	5	5	Lilesville, NC	Water	Intermediate
Blewett	6	5	5	Lilesville, NC	Water	Intermediate
Marshall	1	2	2	Marshall, NC	Water	Intermediate
Marshall	2	2	2	Marshall, NC	Water	Intermediate
Tillery	1	21	21	Mt. Gilead, NC	Water	Intermediate
Tillery	2	18	18	Mt. Gilead, NC	Water	Intermediate
Tillery	3	21	21	Mt. Gilead, NC	Water	Intermediate
Tillery	4	24	24	Mt. Gilead, NC	Water	Intermediate
Walters	1	36	36	Waterville, NC	Water	Intermediate
Walters	2	40	40	Waterville, NC	Water	Intermediate
Walters	3	36	36	Waterville, NC	Water	Intermediate
Total Hydro		227	227			

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Nuclear						
	Unit	**Winter (MW)**	**Summer (MW)**	**Location**	**Fuel Type**	**Resource Type**
Brunswick [2]	1	975	938	Southport, NC	Uranium	Base
Brunswick[2]	2	953	932	Southport, NC	Uranium	Base
Harris [2]	1	973	928	New Hill, NC	Uranium	Base
Robinson	2	797	741	Hartsville, SC	Uranium	Base
Total NC		2,901	2,798			
Total SC		797	741			
Total Nuclear		3,698	3,539			

Solar						
	Unit	**Winter (MW)**	**Summer (MW)**	**Location**	**Fuel Type**	**Resource Type**
NC Solar		7.1	62.0	NC	Solar	Intermittent

Total Generation Capability		
	Winter Capacity (MW)	**Summer Capacity (MW)**
TOTAL DEP SYSTEM - N.C.	12,337	11,404
TOTAL DEP SYSTEM - S.C.	1,643	1,405
TOTAL DEP SYSTEM	13,980	12,809

Note 1: Ratings reflect compliance with NERC reliability standards.

Note 2: Duke Energy Progress completed the purchase from NCEMC of jointly owned Roxboro 4, Mayo 1, Brunswick 1 & 2 and Harris 1units effective 7/31/2015.

Note 3: Resource type based on NERC capacity factor classifications which may alternate over the forecast period.

Note 4: Richmond County Plant renamed to Sherwood H. Smith Jr. Energy Complex.

Note 5: As a result of the retirement of LV Sutton units GTA and GTB and the addition of the LV Sutton Black Start units 4 and 5, an updated Capacity Letter was issued on 8/11/2017.

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Planned Uprates			
Unit	**Completion Date**	**Winter MW**	**Summer MW**
Brunswick 1 [1]	Spring 2020	4	2
Brunswick 2 [1]	Spring 2019	6	4
Brunswick 2 [1]	Spring 2023	6	4
Brunswick 2 [1]	Spring 2027	4	2
Brunswick 2 [1]	Spring 2023	6	4
Harris 1 [1]	Fall 2016	8	4
Harris 1[1]	Spring 2018	10	5

Note 1: Capacity not reflected in Existing Generating Units and Ratings section.

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Retirements				
Unit & Plant Name	**Location**	**Capacity (MW) Winter / Summer**	**Fuel Type**	**Expected Retirement Date**
Cape Fear 5	Moncure, NC	148 / 144	Coal	10/1/12
Cape Fear 6	Moncure, NC	175 / 172	Coal	10/1/12
Cape Fear 1A	Moncure, NC	14 / 11	Combustion Turbine	3/31/13
Cape Fear 1B	Moncure, NC	14 / 12	Combustion Turbine	3/31/13
Cape Fear 2A	Moncure, NC	15 / 12	Combustion Turbine	3/31/13
Cape Fear 2B	Moncure, NC	14 / 11	Combustion Turbine	10/1/12
Cape Fear 1	Moncure, NC	12 / 11	Steam Turbine	3/31/11
Cape Fear 2	Moncure, NC	12 / 7	Steam Turbine	3/31/11
Darlington 9	Hartsville, SC	65 / 50	Combustion Turbine	6/30/2017
Darlington 11	Hartsville, SC	67 / 52	Combustion Turbine	11/8/15
Lee 1	Goldsboro, NC	80 / 74	Coal	9/15/12
Lee 2	Goldsboro, NC	80 / 68	Coal	9/15/12
Lee 3	Goldsboro, NC	252 / 240	Coal	9/15/12
Lee 1	Goldsboro, NC	15 / 12	Combustion Turbine	10/1/12
Lee 2	Goldsboro, NC	27 / 21	Combustion Turbine	10/1/12
Lee 3	Goldsboro, NC	27 / 21	Combustion Turbine	10/1/12
Lee 4	Goldsboro, NC	27 / 21	Combustion Turbine	10/1/12
Morehead 1	Morehead City, NC	15 / 12	Combustion Turbine	10/1/12
Robinson 1	Hartsville, SC	179 / 177	Coal	10/1/12
Robinson 1	Hartsville, SC	15 / 11	Combustion Turbine	3/31/13
Weatherspoon 1	Lumberton, NC	49 / 48	Coal	9/30/11
Weatherspoon 2	Lumberton, NC	49 / 48	Coal	9/30/11
Weatherspoon 3	Lumberton, NC	79 / 74	Coal	9/30/11
Sutton 1	Wilmington, NC	98 / 97	Coal	11/27/13
Sutton 2	Wilmington, NC	95 / 90	Coal	11/27/13
Sutton 3	Wilmington, NC	389 / 366	Coal	11/4/13
Sutton GT1	Wilmington, NC	12 / 11	Combustion Turbine	3/1/2017
Sutton GTA	Wilmington, NC	31 / 23	Combustion Turbine	7/8/2017
Sutton GTB	Wilmington, NC	33 / 25	Combustion Turbine	7/8/2017
Total		2,088 MW / 1,921 MW		

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Planning Assumptions – Unit Retirements [a]					
Unit & Plant Name	**Location**	**Winter Capacity (MW)**	**Summer Capacity (MW)**	**Fuel Type**	**Expected Retirement**
Asheville 1	Arden, N.C.	192	189	Coal	11/2019
Asheville 2	Arden, N.C.	192	189	Coal	11/2019
Mayo 1	Roxboro, N.C.	746	727	Coal	12/2035
Roxboro 1	Semora, N.C.	380	379	Coal	12/2032
Roxboro 2	Semora, N.C.	673	671	Coal	12/2032
Roxboro 3	Semora, N.C.	698	691	Coal	12/2035
Roxboro 4	Semora, N.C.	711	698	Coal	12/2035
Robinson 2 [b]	Hartsville, S.C.	797	741	Nuclear	N/A
Darlington 1	Hartsville, S.C.	63	50	Natural Gas/Oil	12/2020
Darlington 2	Hartsville, S.C.	64	46	Oil	12/2020
Darlington 3	Hartsville, S.C.	63	50	Natural Gas/Oil	12/2020
Darlington 4	Hartsville, S.C.	66	48	Oil	12/2020
Darlington 5	Hartsville, S.C.	66	49	Natural Gas/Oil	12/2020
Darlington 6	Hartsville, S.C.	62	43	Oil	12/2020
Darlington 7	Hartsville, S.C.	65	49	Natural Gas/Oil	12/2020
Darlington 8	Hartsville, S.C.	66	46	Oil	12/2020
Darlington 10	Hartsville, S.C.	65	49	Oil	12/2020
Blewett 1	Lilesville, N.C.	17	13	Oil	12/2027
Blewett 2	Lilesville, N.C.	17	13	Oil	12/2027
Blewett 3	Lilesville, N.C.	17	13	Oil	12/2027
Blewett 4	Lilesville, N.C.	17	13	Oil	12/2027
Weatherspoon 1	Lumberton, N.C.	41	31	Natural Gas/Oil	12/2027
Weatherspoon 2	Lumberton, N.C.	41	31	Natural Gas/Oil	12/2027
Weatherspoon 3	Lumberton, N.C.	41	32	Natural Gas/Oil	12/2027
Weatherspoon 4	Lumberton, N.C.	41	30	Natural Gas/Oil	12/2027
Total NC		3,824	3,720		
Total SC		1,377	1,171		
Total		5,201	4,891		

Note a: Retirement assumptions are for planning purposes only; dates are based on useful life expectations of the unit.
Note b: Nuclear retirements for planning purposes are based on the end of current operating license.

Planning Assumptions – Unit Additions					
Unit & Plant Name	**Location**	**Winter Capacity (MW)**	**Summer Capacity (MW)**	**Fuel Type**	**Expected Commercial Date**
Asheville CC	Arden, N.C.	560	495	Natural Gas	11/2019
Asheville CT	Arden, N.C.	235	221	Natural Gas	12/2027

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Operating License Renewal

Planned Operating License Renewal				
Unit & Plant Name	**Location**	**Original Operating License Expiration**	**Date of Approval**	**Extended Operating License Expiration**
Blewett #1-6 [1]	Lilesville, NC	04/30/08	April 2015	2055
Tillery #1-4 [1]	Mr. Gilead, NC	04/30/08	April 2015	2055
Robinson #2	Hartsville, SC	07/31/10	04/19/2004	07/31/2030
Brunswick #2	Southport , NC	12/27/14	06/26/2006	12/27/2034
Brunswick #1	Southport, NC	09/08/16	06/26/2006	09/08/2036
Harris #1	New Hill, NC	10/24/26	12/12/2008	10/24/2046

Note 1: The license renewal for the Blewett and Tillery Plants was received in April 2015. The license extension was granted for 40 years.

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12. NON-UTILITY GENERATION & WHOLESALE:

The following information describes the tables included in this chapter.

Wholesale Sales Contracts
This table includes wholesale sales contracts that are included in the 2017 Load Forecast.

Wholesale Purchase Contracts
This table includes all wholesale purchase contracts that are included as resources in the 2017 IRP.

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Table 12-A Wholesale Sales Contracts

DEP Aggregated Wholesale Sales Contracts								
Commitment (MW)								
2018	2019	2020	2021	2022	2023	2024	2025	2026
3989	4032	3988	3976	4013	3958	4013	3908	3954

Notes:
- For wholesale contracts, Duke Carolinas/Duke Progress assumes all wholesale contracts will renew unless there is an indication that the contract will not be renewed.
- For the period that the wholesale load is undesignated, contract volumes are projected using the same methodology as was assumed in the original contract (e.g. econometric modeling, past volumes with weather normalization and growth rates, etc.).

Table 12-B DEP Firm Wholesale Purchased Power Contracts

Purchased Power Contract	Summer Capacity (MW)	Location	Volume of Purchases (MWh) Jul 16-Jun 17
Peaking	510	SC	540,623
Peaking	340	SC	307,162
Peaking	220	NC	12,364
Peaking	345	NC	240,397
Peaking	168	NC	45,264
Intermediate	150	NC	1,184,517
Peaking	2	SC	0
Peaking	5	NC	0
Peaking	2	NC	0

Notes: Data represented above represents contractual agreements. These resources may be modeled differently in the IRP.

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