

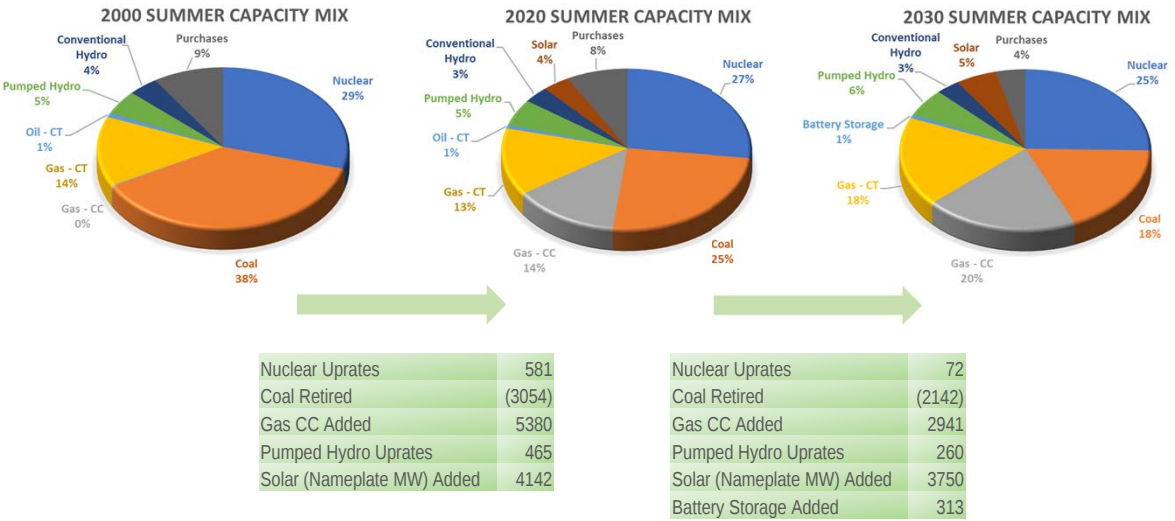
The Evolution of the U.S. Electric Grid: Implications for Nuclear Technology

Nuclear Implications from a Changing Resource Mix



BUILDING A SMARTER ENERGY FUTURE®

Duke Energy's Changing Resource Mix



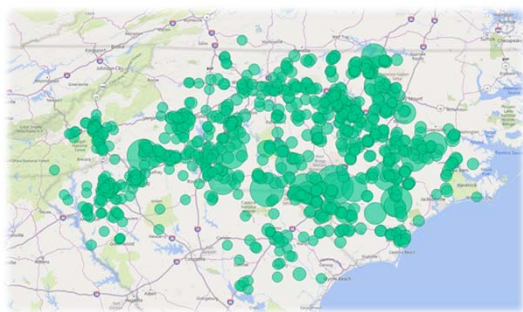
Source: 2019 DEC and DEP IRPs

Influences on Resource Change in the Carolinas

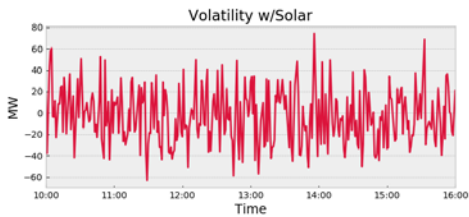
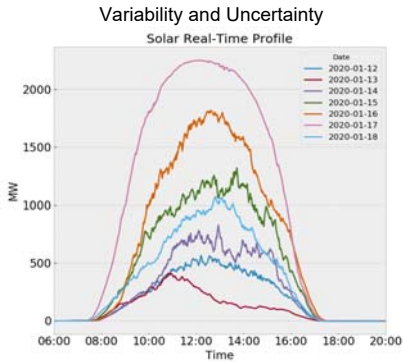
- NC General Statute § 62-2(3a) requires "...energy planning and fixing of rates in a manner to result in the least cost mix of generation and demand side reduction measures which is achievable,..."
- SC Code of Laws § 58-27-810 - Every rate made, demanded or received by any electrical utility or by any two or more electrical utilities jointly shall be just and reasonable
- NC SB1078 (2001) - NC Clean Smokestacks Act – 77% NOx Reduction and 73% SO2 Reduction by 2013
- NC SB3 (2007) – REPS - 12.5% of retail electricity sales from renewable energy resources by 2021
 - DEP long-term PPAs with avoided cost rates from \$55 to \$85 per MWh for Qualifying Facilities
 - 35% NC Renewable Energy Tax Credit ("RETC") – ended 2015
 - 30% Federal solar investment tax credit incentive ("ITC") – decreasing after 2019 down to 10% in 2022
- NC HB589 (2017) - Competitive Procurement of Renewable Energy (CPRE) - Procure 2660MW of renewable energy over 45 months via competitive bid
- SC H3569 (2019) - Once an electrical utility has executed interconnection agreements and power purchase agreements with qualifying small power production facilities located in South Carolina with an aggregate nameplate capacity equal to twenty percent of the previous five-year average of the electrical utility's South Carolina retail peak load, that electrical utility shall offer to enter into fixed price power purchase agreements with small power producers for the purchase of energy and capacity at avoided cost, ➔ purchase 1060MW nameplate solar with 10-yr contracts

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Integrating Renewables and Storage



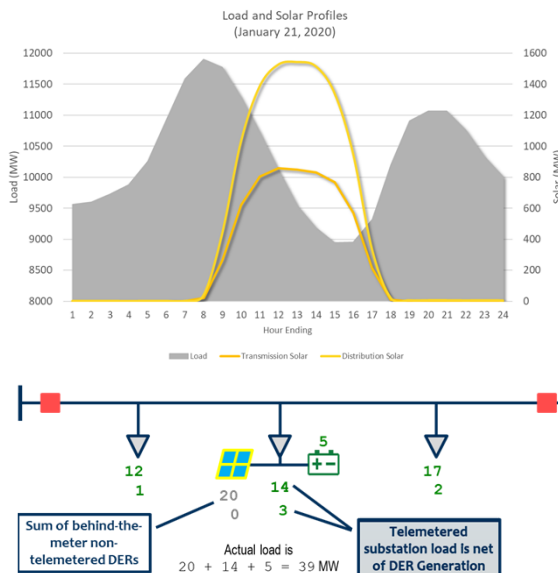
Region	Connected Solar (Nameplate MW) Feb 2020
DEC	874
Transmission	311
Distribution	461
DEP	2741
Transmission	995
Distribution	1552
Wholesale	194



Integrating Renewables and Storage

Impacts on Network Modeling

- Solar injection profiles are not coincident with load profiles
 - Affects the statistical results in state estimation
 - Requires segregation of generation from load
- Separation of generation from load improves
 - State estimation statistics, and thus power flow and contingency analysis accuracy
 - Control and granularity of power flow studies as load and generation can be altered independently
- Accurate state estimation allows for accurate prediction of post-trip switchyard voltage to ensure NPIRs are met



Our Future - Sustainable, Reliable, Resilient, Cost Effective, Clean Energy, Coexisting Grid

Climate Change and Clean Energy Sep 27, 2019

NC Governor Executive Order 80:

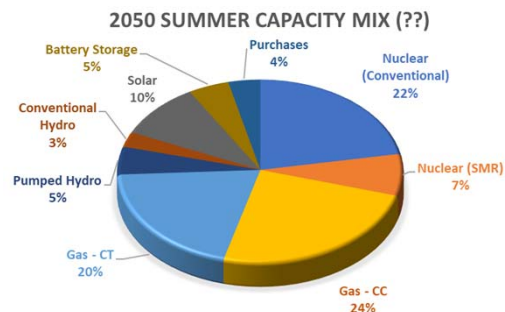
- 70% reduction in power sector greenhouse gas emissions below 2005 levels by 2030 with carbon neutrality by 2050.
- Strategies for modernizing regulatory and planning processes to foster long-term energy affordability and price stability
- Acceleration of clean energy innovation
- Increase the number zero-emission vehicles (ZEVs) to at least 80,000
- Reduce energy consumption per square foot in state-owned buildings by at least 40 percent from fiscal year 2002-2003 levels

SC S998 - Electricity Market Reform Measures Study Committee Introduced in the Senate on January 14, 2020

Duke Energy aims to achieve net-zero carbon emissions by 2050

September 17, 2019

- **Company accelerates to reducing carbon by at least 50% by 2030**
- **Path to zero carbon requires investments in research, technology**
- **National leaders applaud bold new goals**



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