Decarbonizing North Carolina's Energy Sector

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I. Introduction

An increasingly important factor of energy policy is decarbonization through new technology and new energy resources. In 2019, North Carolina's Department of Environmental Quality (DEQ) published the Clean Energy plan which included steps to reduce electric power sector greenhouse gas emissions by 70% below 2005 levels by 2030 and attain carbon neutrality by 2050.[1] There are three central themes surrounding the conversation of decarbonization: energy storage, modernizing the grid, and energy sources.

Perhaps the most challenging part of decarbonization is improving the energy storage of renewable sources. Renewable energy sources create real-time weather dependent generation that does not always coincide with real time demand; however, excess energy during periods of lower demand can be stored for use in high demand periods.

For example, a case study by Arbabzadeh, et. al.[2], shows the impact of energy storage in California, demonstrating that adding twenty gigawatts (GW) of wind and forty GW of solar—without energy storage— to the California system would achieve 76% Greenhouse Gas (GHG) reductions.[3] However, adding energy storage technologies increase that reduction to 93%.[4] Thus, effective energy storage is vital to decarbonization. Although there are highly efficient energy storage mechanisms, the primary hinderance of implementation is cost as high-efficiency

[1] *Clean Energy Plan Development Process*, NC DEQ, https://deq.nc.gov/energy-climate/climate-change/nc-climate-change-interagency-council/climate-change-clean-energy-2#draft-plan-documents (last accessed Jan. 2021).
[2] Maryam Arbabzadeh, Ramteen Sioshansi, Jeremiah X. Johnson & Gregory A. Keoleian , *The role of energy storage in deep decarbonization of electricity production in California*,10 NAT COMMC'N 1, 2 (2019) https://doi.org/10.1038/s41467-019-11161-5.
[3] *Id*.
[4] *Id.* at 2.

energy storage only exists at a high capital.[5.] This is because energy storage additions are not economically feasible compared to distribution upgrades, but they could become more viable if cost reduction practices continue to advance.[6]

Another solution to the many challenges of decarbonization is modernizing the energy grid through microgrids. The energy grid itself connects homes, businesses, and other buildings to central power sources. A microgrid is a smaller version of the main electric grids, that combine local energy resources and control technologies to provide power.[7] Some microgrids are connected to the main grid but can also operate on its own during a crisis; others are fully self-sufficient energy systems that serve a small geographic footprint. Microgrids improve system reliability, because when the part of the main grid needs to be repaired, the whole grid is affected; microgrids mitigate the damage by providing local power. Further, a microgrid may be powered by a diverse energy profile, such as distributed generators, batteries, and/or renewable sources of energy.[8] Microgrids further diversify the main energy profile by using local energy sources that would greatly lose value by traveling long distances.

Additionally, microgrids reduce power supply costs by providing an alternative source of power.[9] Microgrids greatly utilize renewable energy and battery-based energy storage. North Carolina is already home to excellent examples of implementing microgrids. For instance, there will be a collaboration between Tideland EMC and the Rose Acre farms to create an agricultural microgrid that will use a solar panel and battery array to offset costs, enhance power resiliency,

[5] *Id.* at 7.
[6] *Id.*
[7] *How Microgrids Work*, ENERGY.GOV (Dec. 11, 2020, 1:47 PM), https://www.energy.gov/articles/how-microgrids-work.
[8] *Id.*
[9] *Id.*

and improve environmental sustainability for the farm and surrounding community.[10] Moreover, in 2019 Duke Energy was approved for pilot microgrids in Hot Springs, North Carolina.[11] The 2019 North Carolina Clean Energy Plan stresses the importance of the state government encouraging utilities to consider additional microgrids but recognizes that the technology required to do so may be too cost prohibitive to be economically feasible.[12] Technology for microgrids based on solar energy and storage are often economically infeasible.

Another pathway of solving decarbonization is the energy source profile itself. The most common energy sources are natural gas, nuclear, coal/oil, hydroelectric, wind, and solar. As discussed beforehand, the challenge with increasing the usage of renewable energy (hydroelectric, wind, and solar) is storage. Renewable energy, unlike other energy sources such as oil or natural gas, are not easily captured and stored in their natural states.

Accordingly, governments must look to our energy sources, how we store our energy, and the implement of microgrids to effectively plan for the future of the energy sector. For North Carolina, Governor Cooper signed an executive order on October 29, 2018, which called for a 40% reduction in statewide greenhouse gases by 2025[13]. North Carolina's 2019 Clean Energy Plan further set the goal for reduction of greenhouse gas emissions by 70% below 2005 levels by 2030 and provided a comprehensive look into how to reach that goal.[14]

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[10] *Microgrids*, NC ELECT. COOP., https://www.ncelectriccooperatives.com/energy-innovation/microgrids/ (last visited Dec. 11, 2020).
[11] *North Carolina Clean Energy Plan*, NC DEQ, 1,35 (Oct. 2019) htttps://files.nc.gov/ncdeq/climate-change/clean-energy-plan/NC_Clean_Energy_Plan_OCT_2019_.pdf.
[12] *Id.*at 11.
[13] Exec. Order No. 80 (2018), https://files.nc.gov/ncdeq/climate-change/EO80--NC-s-Commitment-to-Address-Climate-Change---Transition-to-a-Clean-Energy-Economy.pdf.
[14] *North Carolina Clean Energy Plan*, *supra* note 11, at 146.

Specifically, the goal for 2030 levels is equal to 23.8 million metric tons of CO_2, and the plan calls for complete carbon neutrality by 2050.[15] The Clean Energy Plan does not define carbon neutrality, but the term generally refers to balancing carbon pollutants with activities that remove an equal amount of carbon pollutants.[16] Additionally, there are the sustainability goals of North Carolina's major electricity providers: Duke Energy and the North Carolina Electric Cooperatives.

II. North Carolina's Energy Profile

North Carolina was ranked as the eighth largest electricity generating state in both 2017 and 2018, making the state's energy profile more than a local concern[17]. According to the 2019 Clean Energy Plan, North Carolina's 2017 electricity production was mostly generated at central power plants and was composed of: 30% natural gas; 33% nuclear; 27% coal; 4% hydropower; 4%; 2% biomass; less than 1% of wind; and less than 1% of petroleum.[18]

Duke Energy generates most of the electricity consumed in North Carolina and is one of the largest electric power companies in the United States with approximately 7.7 million retail customers in both Carolinas, Florida, Ohio, Kentucky, and Indiana.[19] In the past four years, Duke Energy has added more than 2500 megawatts (MW) of solar capacity to the grid in an effort to meet their sustainability goals.[20] Duke Energy's current energy profile, in MW-hour

[15] *Id.* at 11.
[16] *North Carolina Power Sector Carbon Policies*, DUKE NICHOLAS INST. https://nicholasinstitute.duke.edu/project/north-carolina-power-sector-carbon-policies (last visited Dec. 11, 2020).
[17] *North Carolina Clean Energy Plan*, *supra* note 11at 19.
[18] *Id.*
[19] *2019 Sustainability Report*, DUKE ENERGY 2, 55 (Apr. 2020) https://www.duke-energy.com/_/media/PDFs/External/2019-Duke-Energy-Sustainability-Report.pdf?_ga=2.183325539.493039175.1602336301-240132052.1601399955.
[20] *Id.* at 26.

output, is composed of: 35% natural gas; 34% nuclear; 26% coal/oil; and 5% of hydro, wind and solar[21]. This profile is a positive change from Duke's 2005 energy profile which consisted of 60% coal/oil, 33% nuclear, 6% natural gas, and 1% of hydro, wind, and solar combined.[22]

Besides Duke Energy, North Carolina receives a large portion of electricity from North Carolina Electric Cooperatives. These cooperatives are local, independent, and are governed by a board of directors. North Carolina's Cooperatives operate on seven guiding principles: (1) voluntary and open membership; (2) democratic member control; (3) member's economic participation; (4) education for members, representatives, managers and employees; (5) autonomy and independence; (6) cooperation among cooperatives; and (7) concern for community[23].

For 2018, North Carolina's electric cooperative energy profile consisted of: 57% nuclear; 24% gas/oil; 5% coal; 5% renewables; 2% hydro; and 7% purchased from wholesale markets[24]. The electric cooperatives also operate three microgrid sites (Butler Farms, Heron's Nest, and Ocracoke) with two microgrids in development (Eagle Chase and Rose Acre Farms).[25]

III. North Carolina's Sustainability Goals

North Carolina has previously worked towards the goal of decarbonization with The State's Clean Smokestacks Act, Renewable Energy and Energy Efficiency Portfolio Standard,

[21] *Id.* at 29.
[22] *Id.*
[23] *Who We Are*, NC ELEC. COOP., https://www.ncelectriccooperatives.com/who-we-are/ (last visited Dec. 11, 2020).
[24] *Our Power*, NC ELEC. COOP.,, https://www.ncelectriccooperatives.com/our-power/ (last visited Dec. 11, 2020).
[25] *Id.*

and Public Utility Regulatory Policies Act. Relative to the 2005 GHG levels, emissions in 2019 from the electric power sector have declined 34%.[26]

Both Duke Energy and the Electric Cooperative share the goal of reducing carbon emissions by 50% from 2005 levels.[27] So far, Duke has decreased carbon dioxide emissions by 39% from 2005 levels.[28] Duke Energy provides a more in-depth look into how they plan to increase their level of renewable energy sources; they plan to own or contract 16,000 MW of wind, solar, and biomass by 2025.[29] As of 2019, Duke had reached 8,100 MW from these sources. Duke also plans to double its portfolio of solar, wind, and biomass by 2025 and has a 2030 profile goal of: 41% natural gas, 28% nuclear, and 19% hydro, wind, and solar combined.[30]

Further, Duke has mapped their priority issues according to the United Nation's Sustainable Development Goals, which recognize ending deprivations goes hand-in-hand with strategies that improve environmental sustainability, health and education, reduce inequality, and increase economic growth.[31] The North Carolina Electric Cooperatives' plan prioritizes increasing nuclear energy and natural gas production to meet the 2030 goal.[32]

Likewise, the North Carolina Clean Energy Plan was written by the Department of Environmental Quality (DEQ) and sets out the government's energy goals and mechanisms to meet those goals. The DEQ's objective in the Clean Energy Plan is to encourage the "use of clean energy resources and technologies and to foster the development of a modern and resilient

[26] *North Carolina Clean Energy Plan*, *supra* note 11.
[27] *Achieving a Net Zero Carbon Future: Duke Energy 2020 Climate Report*, DUKE ENERGY (2020) 1,36 https://www.duke-energy.com/_/media/pdfs/our-company/climate-report-2020.pdf.
[28] *Id.* at 1.
[29] *Id.* at 10.
[30] *Id.*
[31] *2019 Duke Energy Sustainability Report*, *supra* note 19.
[32] *Our Power*, *supra* note 24.

electric system."[33] There are essentially five goals: reduce GHG emissions by 70% below 2005 levels by 2030; attain carbon neutrality by 2050; energy affordability and price stability through modernization; accelerate clean energy innovation and deployment to create economic opportunities for rural and urban areas; and attain these goals by market-based policies, performance-based policies, and modernizing the grid[34].

Further, the plan outlines recommendations to accomplish these goals in *Policy and Action Recommendations*, including the pathway of decarbonization.[35] The Plan's recommendations are grouped into six strategies: carbon reduction; utility incentives and comprehensive system planning; grid modernization and resilience; clean energy deployment and economic development; equitable access and just transition; and energy efficiency and electrification strategies.[36]

First, the DEQ outlined two recommendations for stakeholders in efforts to reduce carbon in the electricity sector. The first is to develop a report (by combined efforts of the legislature, state agencies, and academia) that recommends carbon-reduction policies.[37] Specifically, the report would evaluate the following carbon reduction strategies: accelerated coal retirements; market-based carbon reduction programs; clean energy policies (such as an updated Renewable Energy and Energy Efficiency Portfolio Standard, also known as REPS); and a combination of these strategies[38].

[33] *North Carolina Clean Energy Plan*, *supra* note 11, at 6.
[34] *Id.* at 52.
[35] *Id.*
[36] *Id.* at 53.
[37] *Id.* at 55.
[38] *North Carolina Clean Energy Plan*, *supra* note 11, at 56.

For North Carolina, accelerated coal retirement would be retiring all coal power plants by 2030 and shifting to non-emitting sources.[39] For example, "a market-based carbon reduction program" could be establishing a carbon reduction program that is linked with similar program in other states and setting an initial carbon budget that would gradually decrease. Also, a clean energy policy would most likely be expanding REPS by requiring a certain percentage of a utility's retail electricity sales that must come from low-emitting sources, high energy efficient sources, or implementing demand-side measures.[40] Finally, the plan describes an example combination of a market-based carbon and clean energy policy that would link the market-based program with a clean energy technology standard.[41]

Next, the second recommendation is to require integrated resource plan (IRP) and distribution system plans (DSP) to use portfolios and action strategies that incorporate a cost of carbon into the portfolio that is selected for use by the utility.[42] IRP is a plan for meeting future electricity needs that reviews supply and demand options, and shows how the resource portfolio for electricity is expected to evolve.[43] DSP is a process that identifies areas of the electric grid that must adapt to new technologies and markets, and the process serves as a valuable guide to utility investment.[44] This recommendation goes along with the Competitive Procurement of Renewable Energy program which brings price competitive renewable energy into the standard utility package provided by Duke.[45]

[39] *Id.* at 59.
[40] *Id.* at 60.
[41] *Id.*
[42] *Id.* at 62.
[43] Coley Girouard, *Understanding IRPs: How Utilities Plan for the Future,* ADVANCED ENERGY ECON. (Dec. 14 2020, 12:34 PM), https://blog.aee.net/understanding-irps-how-utilities-plan-for-the-future.
[44] *North Carolina Clean Energy Plan*, *supra* note 11, at 37.
[45] *Id.* at 93.

However, without implementation of the clean energy plan's recommendations, North Carolina is not on trend to meet the goal of reducing power sector GHG emissions by 70% below 2005 levels by 2030 and achieving carbon neutrality by 2050.[46] Despite the increasing trend of decarbonization, North Carolina is on path to decrease emission of greenhouse gases only by 47% by 2030.[47]

Accordingly, The Nicholas Institute for Environmental Policy Solutions at Duke University and the University of North Carolina at Chapel Hill Center on Climate, Energy, Environment, and Economics have been developing the framework for a North Carolina Power Sector Carbon Policy Plan since 2019.[48] The policy plan follows recommendation one by the clean energy plan to develop the framework for a North Carolina Power Sector Carbon Policy Plan by identifying, defining, and modeling the outcomes of different decarbonization policies.

Moreover, the report follows and expands those policies identified in the first recommendation: accelerated coal retirement; carbon adder; declining carbon cap; clean energy standard; and other policies such as construction of battery storage.[49] Carbon adder refers to requiring utilities to add the cost of pollution when making decisions, and declining carbon cap refers to setting a declining annual budget on carbon pollution that the electricity sector may pollute.[50] The Carbon Policy Plan is on track to be submitted to Governor Cooper by the end of 2020.

[46] *Id.* at 59.
[47] *Id.*
[48] *North Carolina Power Sector Carbon Policies*, *supra* note 16..
[49] *Id.*
[50] *Id.*