



CLOSUP Working Paper Series  
Number 62

December 2023

# Renewable Energy Portfolio: North Carolina

Katherine Cafaro, University of Michigan  
Marisol Mendez, University of Michigan  
Evan Shea, University of Michigan

This paper is available online at <http://closup.umich.edu>

Any opinions, findings, conclusions, or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the view of the Center for Local, State, and Urban Policy or any sponsoring agency

Center for Local, State, and Urban Policy  
Gerald R. Ford School of Public Policy  
University of Michigan

A white wind turbine is shown against a solid blue background. The turbine's tower, nacelle, and one of its blades are visible, extending from the bottom left towards the center of the frame.

RENEWABLE ENERGY PORTFOLIO:  
**NORTH CAROLINA**

DECEMBER 2023

# **Acknowledgments**

December 2023 | URP 610; Section 4

The following report was created as part of a graduate student course at the University of Michigan Taubman College of Architecture and Urban Planning.

Student Team:

Katherine Cafaro, Bachelor of Science in Urban Technology  
Marisol Mendez, Master of Urban and Regional Planning  
Evan Shea, MBA candidate at Ross and MS candidate at SEAS

The team would like to thank the following:

Dr. Sarah Mills, Course Instructor  
Robert Josey, Public Staff Utilities Commission, Staff Attorney  
Jeffrey Thomas, Public Staff Utilities Commission, Engineer

*Title Picture from Unspalsh: Brady Bellini*

# ***Table of Contents***

List of Abbreviations .....	4
State Background.....	5
The Utility Landscape and Structure in North Carolina.....	5
Renewable Energy Potential in North Carolina.....	7
Local narratives about renewable energy and transitioning from fossil fuels.....	9
Existing Energy Policy Research .....	10
Geography and Demographics .....	11
Policy Analysis .....	15
Explicit Climate Policy.....	15
PUC Policy in North Carolina .....	16
Taxation .....	17
Siting.....	19
Public Lands .....	21
Infrastructure Investments.....	22
Conclusion.....	25
Bibliography.....	27

## ***List of Abbreviations***

---

CEP	Clean Energy Plan
CPIRP	Carbon Plan Integrated Resource Plan
DSIRE	Database of State Incentives for Renewables & Efficiency
FERC	Federal Energy Regulatory Commission
GW	Gigawatts
GWh	Gigawatt hours
HB	House Bill
HOA	Homeowners Association
IRA	Inflation Reduction Act
IRP	Integrated resource planning
IOUs	Investor Operated Utilities
MW	Megawatts
NCDEQ	North Carolina Department of Environmental Quality
NCEC	North Carolina Energy Cooperatives
NCSEA	North Carolina Sustainable Energy Association
NCUC	North Carolina Utilities Commission
NREAL	National Renewable Energy Laboratory
OSW	Offshore Wind
PUC	Public Utility Commissions
PURPA	Public Utility Regulatory Policies Act
REPS	Renewable Energy and Energy Efficiency Portfolio Standard

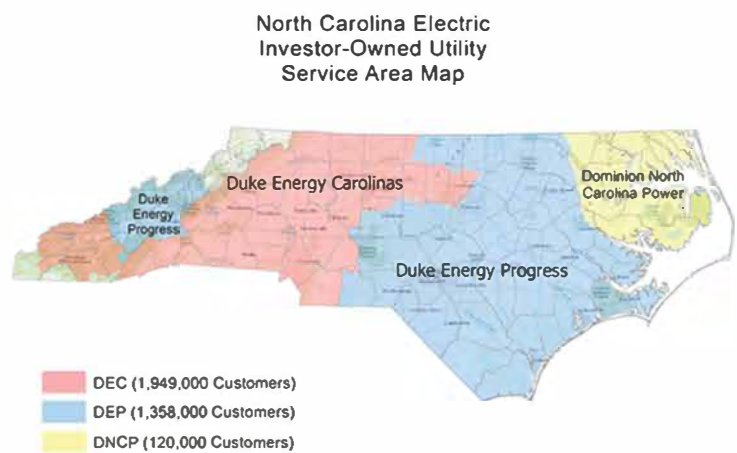
# State Background

## The Utility Landscape and Structure in North Carolina

The Southeastern state of North Carolina has a diverse landscape that can be separated into three parts, the Blue Ridge Mountains to the West, the Piedmont Plateau in the center where most of the state's population resides, and the Coastal Plain to the East. With a large population of around 10,550,000 residents, it is one of the largest consumers of energy in the country, with four times as much power being sourced from out of state than in state.

As shown in Figure 1, most of the state gets its energy from one of three IOUs (investor-operated utilities):<sup>1</sup> Dominion North Carolina Power (DNCP),<sup>2</sup> Duke Energy Carolinas (DEC),<sup>3</sup> and Duke Energy Progress (DEP). The latter, formerly known as Progress Energy, became a subsidiary of DEC in 2012, though the state of North Carolina still recognizes DEP as its own separate IOU. DEC and DEP serve 3.3 million North Carolinians and DNCP serves over 120,000 North Carolinians. All of the IOUs have set a goal to have net zero carbon emissions by 2050. Duke Energy plans to shutter all coal operations by 2035, despite currently owning and operating several of the largest coal plants in America.

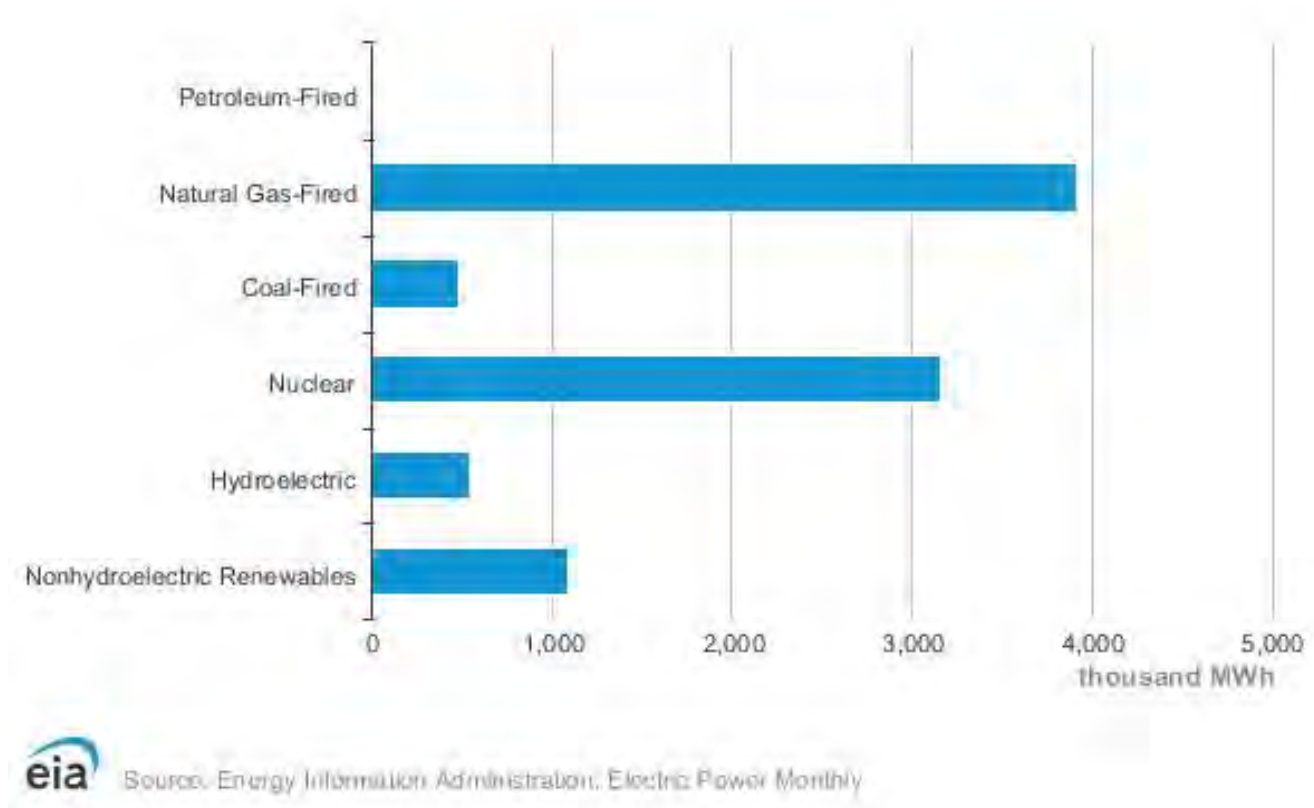
**Figure 1: Map of North Carolina Energy Providers <sup>4</sup>**



Source: North Carolina's Public Utility Infrastructure & Regulatory Climate Presented by North Carolina Utilities Commission (October 2017)

In addition to the IOUs, there are 76 Municipal and University-owned electric distribution systems (munis), serving approximately 599,000 customers in North Carolina. NCEMPA (Eastern N.C.) and NCMPA1 (Western N.C.) which are the two separate organizations that govern over the munis (East and West), have their power supply managed by ElectricCities,<sup>5</sup> a non-profit which collectively organizes public power communities. NCEMPA partnered with Duke Energy in 2015 and sold its energy production assets, lowering wholesale costs. Another major alternative to IOUS is energy cooperatives which provide service to 2.5 million North Carolina residents across 93 of the 100 counties in the state. There are 26 co-ops in the state, and all are members of the North Carolina Energy Cooperatives (NCEC)<sup>6</sup> which groups the members' financial resources to buy stakes in power production sites. 54% of NCEC power comes from emissions-free nuclear power, sourced from the Catawba Nuclear Station in South Carolina in which NCEC owns a majority share. NCEC also owns and operates two natural gas peak-generating plants and two peaking generators, all in North Carolina, along with having a minority share of a combined-cycle natural gas plant in South Carolina.

**Figure 2. North Carolina Net Electricity Generation by Source <sup>9</sup>**



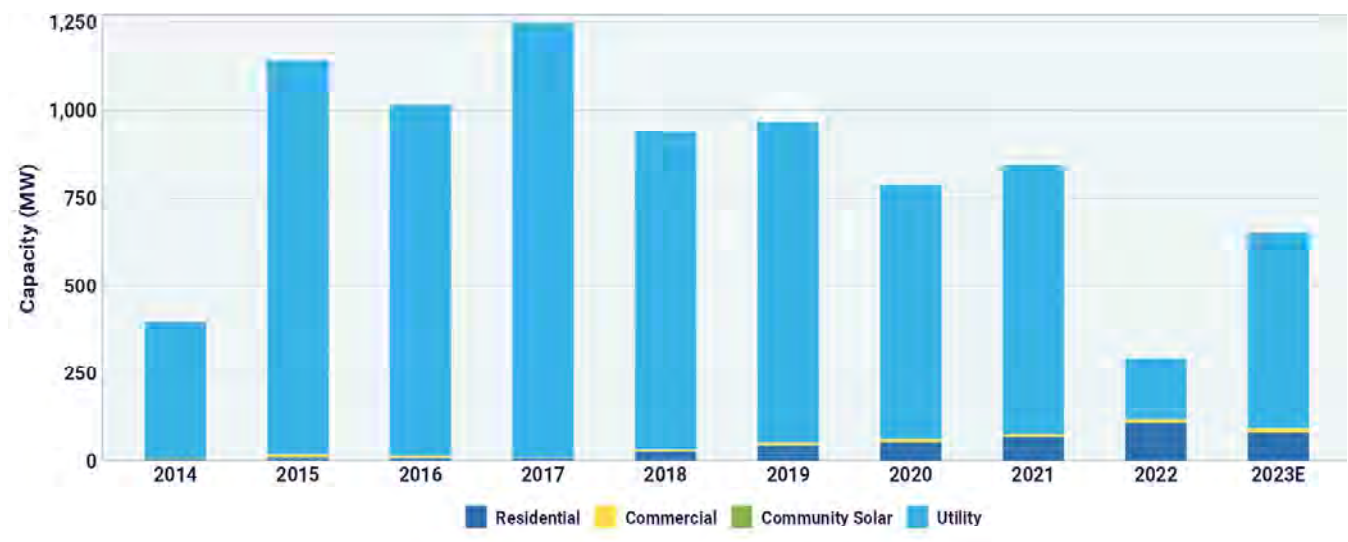
**Electricity Mix:** Natural gas is the largest power source accounting for 39% of the state’s energy in 2021 (Figure 2), all of which is piped into the state from either Virginia or South Carolina.<sup>7</sup> The sector of natural gas has increased in usage at a rate similar to the decline in coal usage in the state from the past 15 years, with coal now only accounting for 11.7% of the energy mix, down from 50% in 2012. The second largest sector is nuclear power which is sourced in the state from three plants with a total of five reactors that are controlled by DEC. All of these plants have been renewed and though nuclear power is emissions-free, it is not a renewable energy source. Only 15% of North Carolina’s energy mix came from renewable sources, 4% came from hydroelectric power from the western portion of the state, and 8% was solar, with the state producing the fourth largest amount of solar energy in America.<sup>8</sup>



## Renewable Energy Potential in North Carolina

North Carolina has the potential to harness enough energy from the wind and sun to match the state's annual electricity demand. Total consumption of electricity is 2,630 trillion British thermal units (Btus), which is the equivalent of 770,777 gigawatt hours (GWh).<sup>10</sup> The primary areas of renewable energy potential to power the needs of North Carolina businesses and residences are offshore wind, onshore wind, and solar. According to a study in 2010, North Carolina has nearly 300 GW of offshore wind capacity, using the parameters of 90 meters above the surface within 50 miles of the coast.<sup>11</sup> This level of offshore wind capacity is the largest resource potential of any state on the US's Atlantic coast.<sup>12</sup> If offshore wind developers were to build to max capacity, and assuming 50% net capacity factor,<sup>13</sup> North Carolina's offshore wind development could generate 1,300,860 GWh annually. In other words, North Carolina's offshore wind potential, if tapped fully, could generate nearly double the amount of annual electricity demanded by North Carolina; however, no offshore projects have been developed yet. While there are no existing efforts for offshore projects, there are some efforts made in onshore wind power development. With only 208 MW of onshore wind power capacity installed in North Carolina, the state's wind remains a largely untapped resource.<sup>14</sup> Onshore wind power capacity in North Carolina is roughly 78 GW, or 152 GWh estimated by 2030.<sup>15</sup>

**Figure 3. North Carolina Annual Solar Installation** <sup>16</sup>



Another renewable energy source for North Carolina is solar. In total, North Carolina has the technical potential to install 38 GW of Urban utility-scale solar<sup>17</sup> and 2,347 GW of Rural utility-scale solar. NC also has technical potential for 23 GW of additional rooftop solar. The corresponding GWh potentials are 4,232,790 GWh for Rural utility-scale; 68,346 GWh for Urban utility-scale; and 28,420 GWh for rooftop solar. As of 2023, North Carolina currently has 8,648 MW of solar installed and is expected to grow in the next 5 years.<sup>18</sup> Prices have also fallen by 42% in the past 10 years, which boosted residential installation as shown in Figure 3.<sup>19</sup>



An important factor in the renewable energy sector is land for siting. To better understand North Carolina's potential to expand renewables, land use must be considered. Figure 4 displays the overall land use of North Carolina with categories such as: Water, Agriculture, Forest, Open Space, and Urban. Note that Water includes marshland and wetlands.

**Figure 4. Current Land Use Cover in North Carolina<sup>20</sup>**

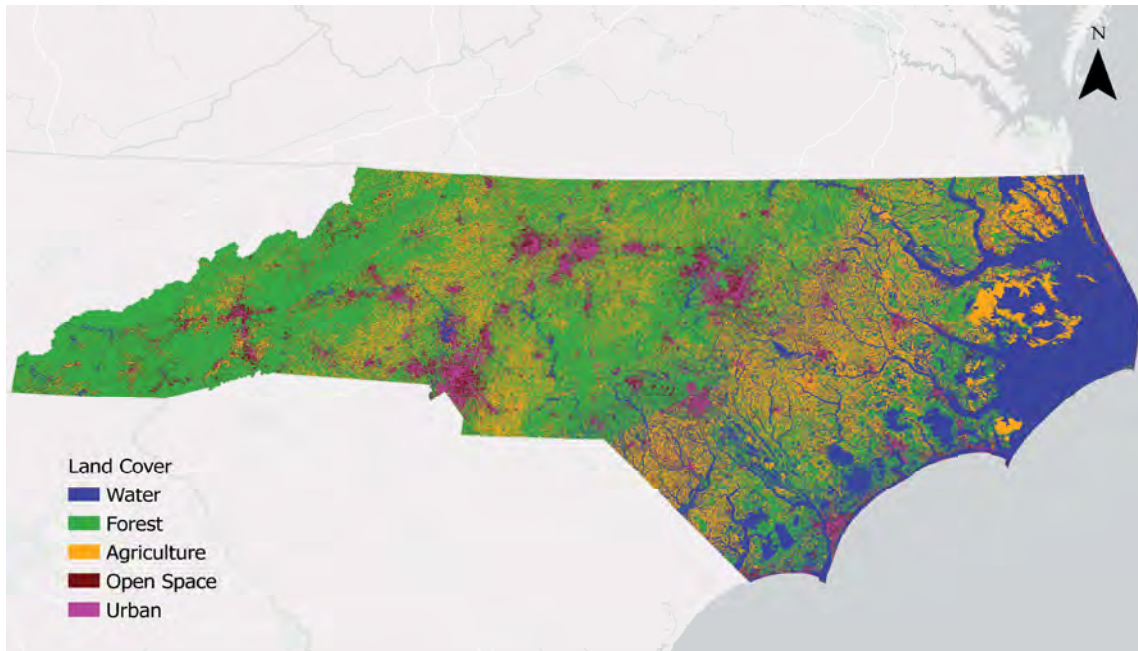
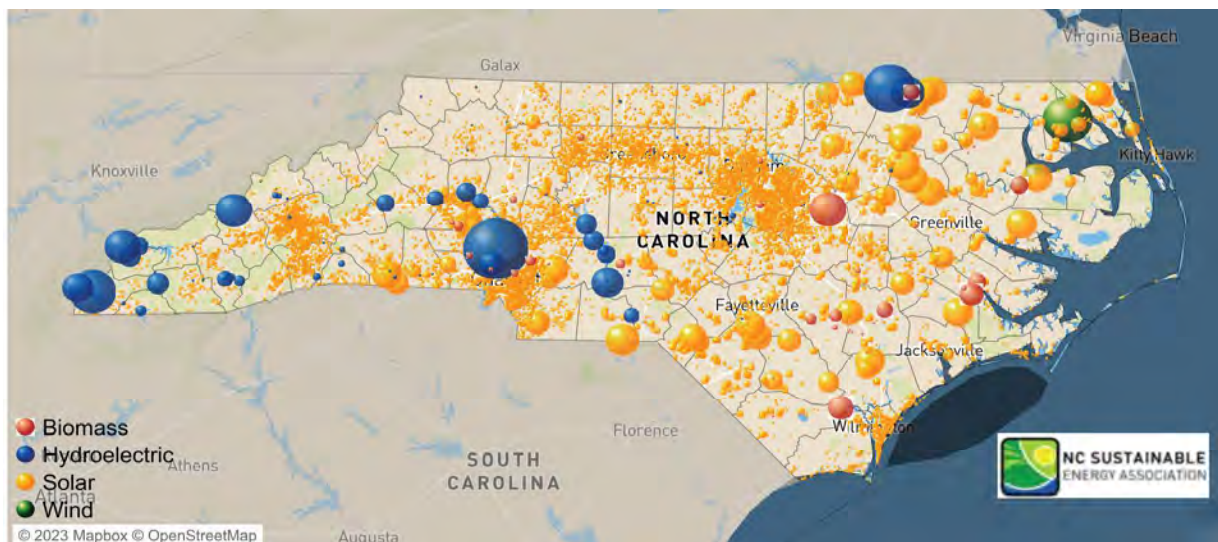


Figure 5 displays the placement of current various renewable energy sources across the state. Solar energy sources are the most common in the state, alluding to an increase of residential solar. Meanwhile, the only wind energy source is found along the coast, the classified as Agriculture and Water. As shown in Figure 4, North Carolina lacks open space so if the state decides to expand onshore wind sources, it may have to expand into the forested regions. North Carolina can embrace offshore wind energy or partner with the agriculture sector to expand onshore wind.

**Figure 5. Installed Renewable Energy Systems<sup>21</sup>**



## *Local narratives about renewable energy and transitioning from fossil fuels*

Over the last few years, renewable energy development—namely solar, and onshore and offshore wind—has been depicted as beneficial to North Carolina by major news outlets. The state’s leading newspaper, *The News & Observer*, paints renewable energy in a favorable light for a couple of reasons, such as a cost-effective alternative to fossil fuels and lower emissions.

First, in light of flooding and hurricanes caused by climate change, *The News & Observer* presents renewable energy as a cost-effective and lower-emission alternative to fossil fuels.<sup>22</sup> Duke Energy is represented as being the manifestation of fossil fuel interests in the state, which is blocking the development of solar and wind power that “can create a more affordable, safer, and secure electric system.”<sup>23</sup> Also in line with renewables being a threat to the fossil fuel industry, *The News & Observer* reported that renewable energy is a cost-saving alternative to fossil fuels in the context of high oil prices in November 2021.<sup>24</sup> Second, the leading paper has expressed frustration that offshore wind development is being blocked due to national defense interests claiming broad areas off the shores of North Carolina as being incompatible with offshore wind turbines.<sup>25</sup> Overall, statewide news coverage presents renewable energy favorably.

Local narratives in North Carolina vary in response to onshore wind, offshore wind, and solar. Onshore wind, which has been slow to develop in the state, is viewed as a positive economic opportunity for local communities. Timbermill Wind, a project developed by Apex in Chowan County, is set to go online in late 2024.<sup>26</sup> According to the *Chowan Herald*, this project is expected to be an impressive economic opportunity for the county: “Apex’s plan to inject \$350 million into Chowan’s economy is expected to be a bonanza for local businesses and contractors.”<sup>27</sup> This local narrative aligns with a statewide narrative from Spectrum News 1, based out of Charlotte, which reported that the Timbermill Wind project will “bring income for farmers and other landowners in Chowan County who will get annual lease payments for having wind turbines on their land.”<sup>28</sup> Additionally, the local article reveals that the development is attracting other industries, with Google agreeing to purchase all of the electricity produced in a power purchasing agreement.<sup>29</sup> This sentiment of attracting outside industry is echoed for solar as well, with local news reporting that Apple is powering its data center in Maiden, North Carolina, a rural town in Catawba County.<sup>30</sup> Regarding offshore wind development, the local narrative is not as adamantly supportive as the leading state news outlets. *Island Free Press*, which represents local interests of North Carolina’s Outer Banks region, had an article to raise awareness of potential fishing industry concerns related to offshore wind development.<sup>31</sup> In this case of OSW development, the local community is concerned of how these projects may impact their local economies.

In regard to solar, local narratives range from opposing due to unwanted land use to supporting increased development. Opposition to solar development in rural North Carolina areas is that it is an unwanted land use. Specifically for a Catawba County project, arguments raised at the public hearing for a proposed solar project were that “fields full of panels are ruining rural areas and occupying land better suited for farming in a state where agriculture is the leading industry.”<sup>32</sup> There is evidence of renewables projects being blocked by local opposition, with

four North Carolina counties “institut[ing] moratoriums on new solar farms.”<sup>33</sup> For onshore wind, “regulatory uncertainty”—a form of projects being blocked by local and state influences—has historically prevented development in the state.<sup>34</sup> The opposition to onshore wind development was officially positioned as being out of concern for negative impacts on military activity.<sup>35</sup> On the other end of the spectrum, there is vocal support from local communities to expand renewable energy. Carrboro, Chapel Hill, and Orange Counties clamored for renewables development in 2017, leading to them being the first communities in North Carolina to participate in SolSmart with a “Bronze” designation.<sup>36</sup> This designation is awarded to counties open to distributed generation and community solar development, and it aligns with the overall trend that North Carolina has developed many smaller scale projects due to PURPA regulations (See PUC Section).

Lastly, the Republican-led state legislature is portrayed as being controlled by anti-renewables interests, and Governor Roy Cooper, a Democrat, is outwardly pro-renewables. In 2021, Duke Energy was reportedly interested in maintaining a buildout of natural gas facilities and keeping coal plants online.<sup>37</sup> However, the executive branch of North Carolina, helmed by Governor Roy Cooper, has helped to maintain and expand pro-renewables policy (See Explicit Climate Policy Section). He has received an “A” from the North Carolina League of Conservation Voters, as recognition for his commitment to pro-environmental causes.<sup>38</sup> It is important to note that Governor Cooper has received multiple political donations from Dominion Energy.<sup>39</sup>

## *Existing Energy Policy Research*

There is very limited published research about how energy policy in North Carolina is affecting the establishment of further renewable energy sources, despite North Carolina having a Renewable Energy Portfolio Standard since 2007.<sup>40</sup> Much of the existing reports are affiliated with colleges located in the state, such as Duke University, North Carolina State University, and UNC-Chapel Hill, yet these reports are focused on the analysis of policy rather than research on outcomes.

The National Renewable Energy Laboratory (NREL) partnered with Duke Energy to conduct a comprehensive study over multiple years to identify the most effective pathway for carbon-free energy in the region.<sup>41</sup> The study is connected to policy in that it stemmed from North Carolina’s passage of state legislation that had two goals: reduce emissions by 70% by 2030 and achieve net-zero carbon dioxide emissions by 2050.<sup>42</sup> The results of the research reveal the technically feasible pathways to meet these two goals through several electricity generation mix scenarios. See the Explicit Climate Policy section for more detail on this partnership.

North Carolina benefits from a strong research university community that supports policy research and development. For example, North Carolina State University (NC State) houses the NC Clean Energy Technology Center, which has been around for 35 years. The purpose of the Center is to “advance a sustainable energy economy by educating, demonstrating, and providing support for clean energy technologies, practices and policies.”<sup>43</sup> A practical tool that the Center has created and maintained is DSIRE or the Database of State Incentives for Renewables & Efficiency. In addition to the tool, the Center releases quarterly reports on “The

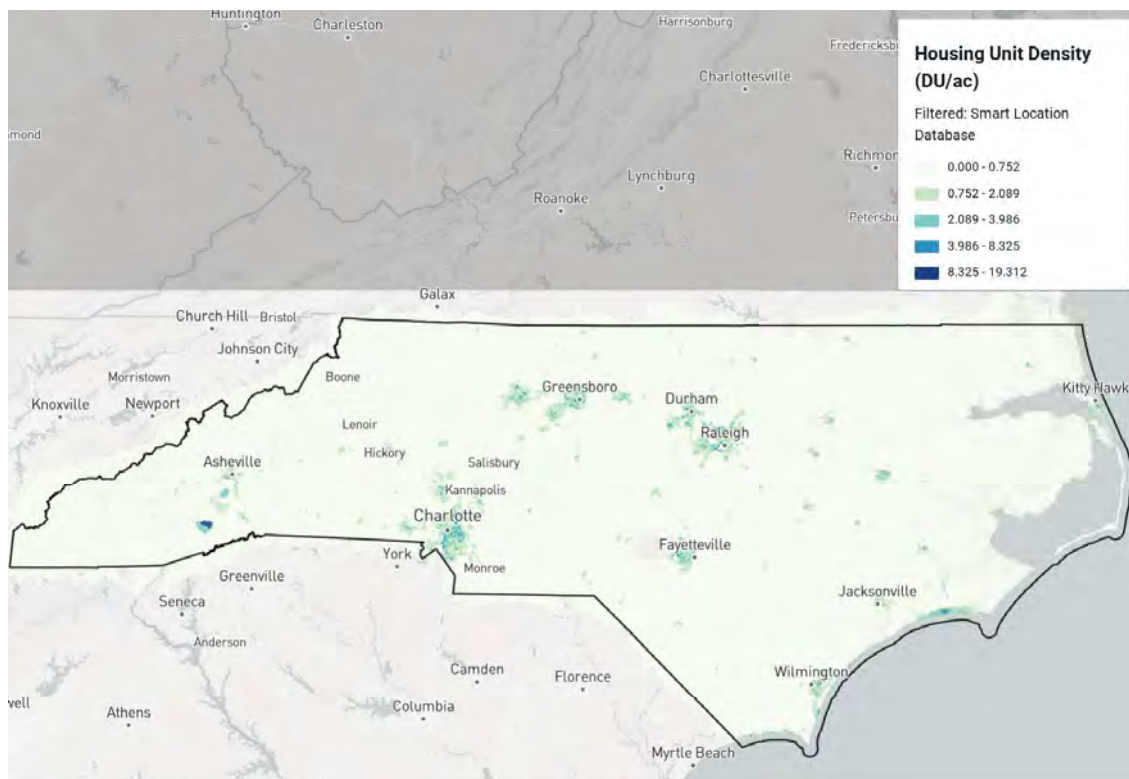
50 States of Solar.” In the Q2 2023 version, North Carolina ranked in the top 11 states in the country in terms of distributed solar policy actions taken place in this most recent quarter alone.<sup>44</sup> Duke University, a private university located less than an hour away from NC State, also aims to further energy policy research. In 2017, Duke University’s Sanford School of Public Policy hosted the NC Leadership Forum. As a part of the Forum, the University highlighted the Ocracoke Microgrid project.<sup>45</sup> This microgrid research showed the resiliency of microgrids in the context of coastal communities.

Regarding NGOs, the NC Sustainable Energy Association (NCSEA) is active in the policy advocacy space. NCSEA focuses on producing data and research to influence future policy formation related to advancing solar development. Finally, the Frontier Group has released reports on the potential for rooftop solar in the state, estimating that North Carolina has the potential to install at least 15 GW of solar.<sup>46</sup> The advocacy group details numerous policies that should be advanced to support the state in actualizing this potential.

### Geography and Demographics

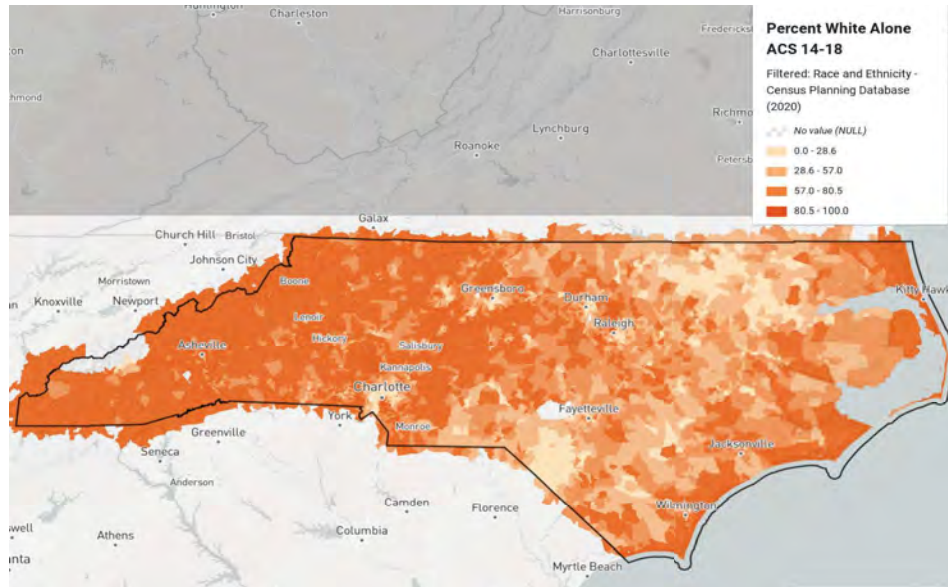
North Carolina is located along the east coast, surrounded by the states of Virginia, Tennessee, Georgia, and South Carolina. The capital of the state is Raleigh and the largest is Charlotte. Only 7.7% of the land is owned by the federal government.<sup>47</sup> The state has a current population of 10.6 million people, making it the 9th largest state in the country.<sup>48</sup> North Carolina is mostly rural, as displayed in Figure 6, which shows the housing unit density of the state. Raleigh, Charlotte, Asheville, Durham, and Greensboro display some housing unit density, with the highest concentrated area having 19 units per acre (DU/ac) as shown below.

**Figure 6. Housing Unit Density per Acre<sup>49</sup>**



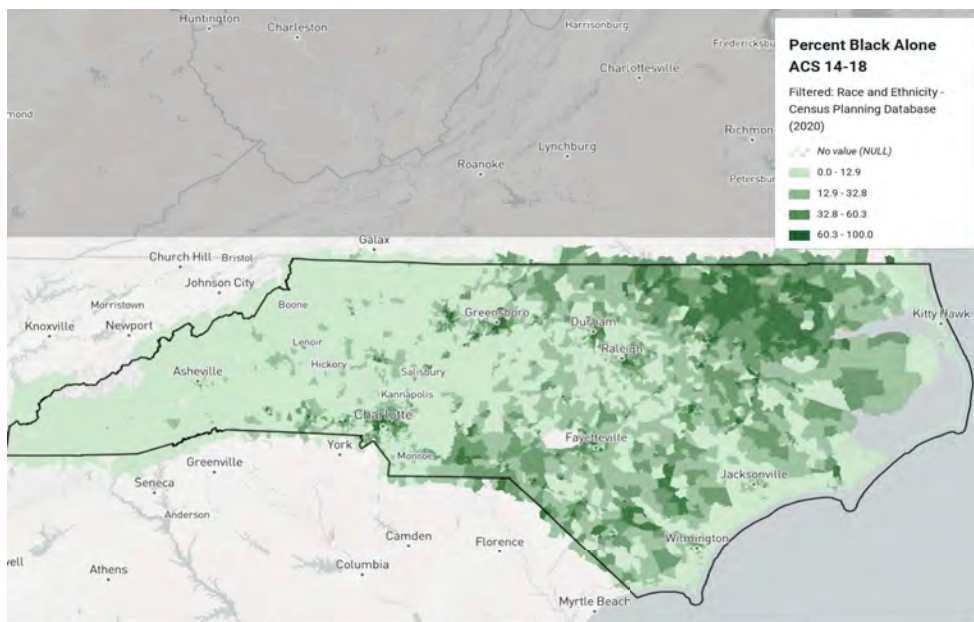
As of the 2020 Census, 69.9% of the state’s population is white. 22.2% is Black or African American, 10.5% is Hispanic/Latino, 3.6% is Asian, and 1.6% is American Indian or Alaska Native.<sup>50</sup> Figure 7 displays the white population makeup in North Carolina. Meanwhile, Figure 8 displays the Black or African American population makeup. When comparing Figure 8 to Figure 6, most of the urban development is occurring in areas that have a white majority.

**Figure 7. White Population** <sup>52</sup>



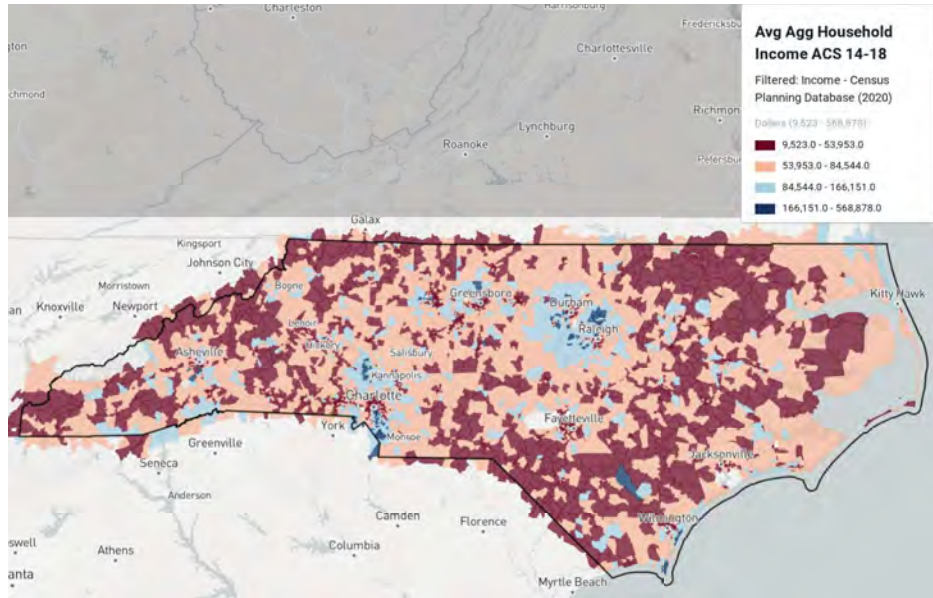
Earlier, under “Renewable Energy Potential in NC,” Figure 4 displayed the land use of North Carolina. When comparing that with Figure 8, there seems to be a relationship between agricultural land use and the black population. North Carolina has a long history of slavery, legally practicing it until the signing of the Emancipation Proclamation. The eastern coast of North Carolina served as a port for receiving slaves.<sup>51</sup> Due to various forms of systemic racism, Black Carolinians have remained in the same area as shown in Figure 8.

**Figure 8. Black Population** <sup>53</sup>



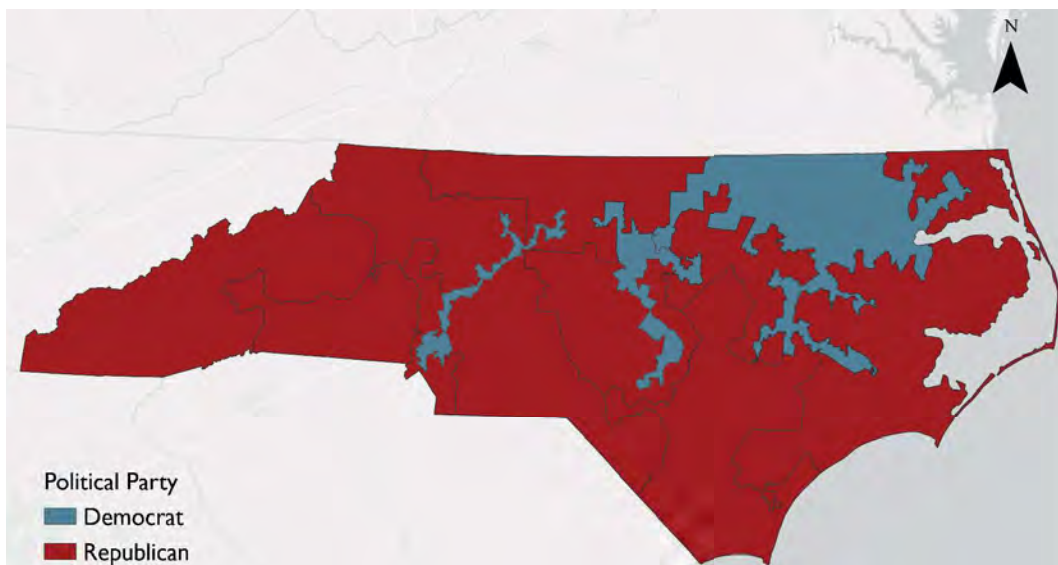
The median household income in North Carolina is \$60,516. Figure 9 displays the average household income in the state. The urban areas in the state have the highest household income whereas the coast has the lowest household income, mostly below the median income.

**Figure 9. Average Household Income from the Census 2020 Database** <sup>54</sup>



The North Carolina Department of Commerce released a report on employment statistics. Healthcare and Social Assistance is the largest industry in the state and is expected to add 76,000 jobs. The state is expected to gain 446,000 jobs by 2030, having an annual growth rate of 0.97%. However, the goods-producing sector, such as manufacturing and agriculture, is expected to decline by 2.1%.<sup>55</sup> Additionally, the solar industry is also expected to grow. As of 2023, there are 252 solar companies in the state providing a total of 7,072 jobs to North Carolinians.<sup>56</sup> As the industry continues to expand, more job opportunities and training will become available.

**Figure 10. Political Party. 114th Congress** <sup>57</sup>





According to a study conducted by the Pew Research Center, 41% of adults identify with the Republican Party, 43% lean towards the Democrat Party, and 17% have no affiliation.<sup>58</sup> Figure 10 displays which parts of the state have an elected official who identifies as Republican or Democrat based on the 114th Congress. North Carolina is considered to be a purple state, being a battleground state during the 2020 Presidential election. Governor Cooper has continued to push for legislation that achieves his environment and climate change goals. As previously mentioned, some of his goals include reducing greenhouse gas emissions to 40% below the state's 2005 levels and reducing energy consumption per square foot.<sup>59</sup> As of October 2nd, Governor Cooper has vetoed 2 bills that were introduced by a republican lawmaker that pushed for traditional power plants.<sup>60</sup> The governor stated that this would not be in line with his plan to provide affordable clean energy for the residents of North Carolina.

# **Policy Analysis**

## *Explicit Climate Policy*

House Bill 951 (HB 951) —ratified and signed into law by Governor Cooper on October 13, 2021— is the explicit climate policy in North Carolina. HB 951 has two overarching goals: have electric public utilities reduce CO<sub>2</sub> emissions by 70% by 2030 using 2005 levels as the baseline and achieve net-zero emissions by 2050.<sup>61</sup> In addition to setting this goal for public utilities, each electric public utility needs to develop a program to be approved by the NCUC for competitive procurement of energy from renewable energy facilities. The competitive procurement process is limited to facilities with nameplate capacity of 80 MW or less.<sup>62</sup>

Prior to HB 951, Governor Cooper signed Executive Order 80 in October 2018 as a form of explicit climate policy. Executive Order 80 directed NC's Department of Environmental Quality (NC DEQ) to write the North Carolina Clean Energy Plan (CEP).<sup>63</sup> The CEP's stated goals are threefold: 1) reduce greenhouse emissions by 70% by 2030 and attain carbon neutrality by 2050, 2) facilitate long-term energy affordability for residents by updating regulatory and planning processes, and 3) accelerate clean energy innovation and deployment across the state.<sup>64</sup> Governor Cooper's Executive Order acted as the precursor to what the Democratic led state legislature passed in 2021.

Prior to HB 951 and the CEP, the state legislature passed North Carolina's Renewable Energy and Energy Efficiency Portfolio Standard (REPS) in 2007. This law required IOUs in NC to meet up to 12.5% of their energy needs through renewable energy sources or through energy efficiency means by 2021.<sup>65</sup> The only renewable energy technology minimum set by the REPS was solar, with the minimum being 0.2% by 2018.<sup>66</sup> Onshore and offshore wind were mentioned as eligible technologies, but no technology minimums were set. The CEP Executive Order also called for an updated REPS, specifically requesting to require "a certain percentage of a utility's retail electricity sales must come from non- or low-emitting resources, energy efficiency, or demand side measures."<sup>67</sup>

Regarding perceptions from the public and host communities, the aggregated common concerns are an increase in utility bills and that HB 951 may be difficult to enforce long term if politics change due to the 2030 and 2050 target dates.<sup>68</sup> Given that the bill promotes the further development of wind and solar energy, host communities that have historically been opposed to renewables development will oppose the impending impacts of this legislation. However, North Carolina has demonstrated that it broadly views solar development positively given its status as top four producer of solar energy in the country; and as seen in the taxation policy section, renewable development has proven to be a key driver of revenues for counties across the state.

In terms of developer actions, Duke Energy partnered with National Renewable Energy Lab (NREL) to create the Carbon-Free Resource Integration Study.<sup>69</sup> The purpose of the analysis conducted by NREL and Duke Energy was to identify a range of pathways for integrating carbon-free resources over the upcoming decades. It is important to note that the NREL analysis does not replace the traditional integrated resource planning (IRP) effort executed



Duke Energy, but it “provides additional insight into the challenges and opportunities for achieving a carbon-free system.<sup>70</sup>” The partnership demonstrates that Duke Energy is actively working to plan out what the most cost-effective solution is to achieve the goals set by HB 951. Although the results of the study are not necessarily directly related to steel in the ground, they serve as an important accountability metric: given the national nature of this partnership, the public knows that Duke Energy has the ability to cost effectively meet its prescribed decarbonization goals. (See Infrastructure Investment for more Information)

In the Spring of 2023, State House Democrats proposed HB 720 to establish a state goal of 100% clean energy by 2050.<sup>74</sup> This proposal demonstrates that Democrats believe that HB 951 did not go far enough for its long term decarbonization goal. The proposal is that “it shall be the goal of the State that one hundred percent (100%) of the total retail sales of electricity in North Carolina shall be generated from renewable energy resources by December 31, 2050.<sup>75</sup>” In order to achieve this goal, “the State Energy Office, in consultation with the Commission and the Public Staff, shall develop a plan to achieve this goal and shall submit the plan to the 2024 Regular Session of the 2023 General Assembly upon its convening.<sup>76</sup>” The last action of the bill as of December 2023 is that it was referred to the House Committee on Rules, Calendar, and Operations.



### *PUC Policy in North Carolina*

A necessary area in the renewable energy sector is the Public Utility Commissions (PUC) which can implement energy standards, infrastructure investment, modernization policies, and rate regulation policies. In North Carolina, the PUC is called the North Carolina Utilities Commission (NCUC), an agency of the State of North Carolina.<sup>71</sup> The NCUC is responsible for public utilities and has played an important role in the push for renewable energy. However, renewable energy has been heavily privatized, with many policies benefiting local and corporate businesses.

In 1978, the Public Utility Regulatory Policies Act (PURPA) was created by the federal government in response to the 1970s energy crisis. PURPA calls on the electric utilities to purchase cogeneration facilities and small power production facilities.<sup>72</sup> Its purpose was to promote competition and renewable resources in energy generation. The Federal Energy Regulatory Commission (FERC) determines which facilities qualify to be purchased by a state PUC. This impacts North Carolina as it has the most “PURPA qualifying solar facilities.<sup>73</sup>”

North Carolina is doing more to change its policies to align with PURPA improvements. An example is HB 589, “Competitive Energy Solutions for North Carolina,” which was passed in 2017.<sup>77</sup> HB 589 called for an increase in favorable contract terms which would not only provide a more competitive space but also lower purchase prices. One such example is Duke Energy, which is required to produce 6,160 MW through PURPA facilities. The state is also lowering the standard offer size limit to 1 MW as of 2017,<sup>78</sup> meaning that facilities that can produce up to 1MW would be PURPA-qualified. Once these facilities cap at 100 MW per public utility, the standard offer size limit becomes 100 kW.<sup>79</sup> Because of PURPA, North Carolina tends to implement more fixed-rate pricing as it can help qualify parties for private-sector financial support. Its state law provides fixed-rate terms of up to 10 years, but with HB 589, there is more flexibility in contract terms and consider avoided costs on the rates.<sup>80</sup> In addition to this, regulated utilities are allowed to own a maximum of 30% of renewable energy capacity but the rest goes to qualifying facilities that respond to an existing request for proposal (RFP).<sup>81</sup> The overall difference in North Carolina’s PURPA approach is that it is the only state in the southeast region that provides a large platform for corporate ownership of off-site renewable energy.<sup>82</sup>



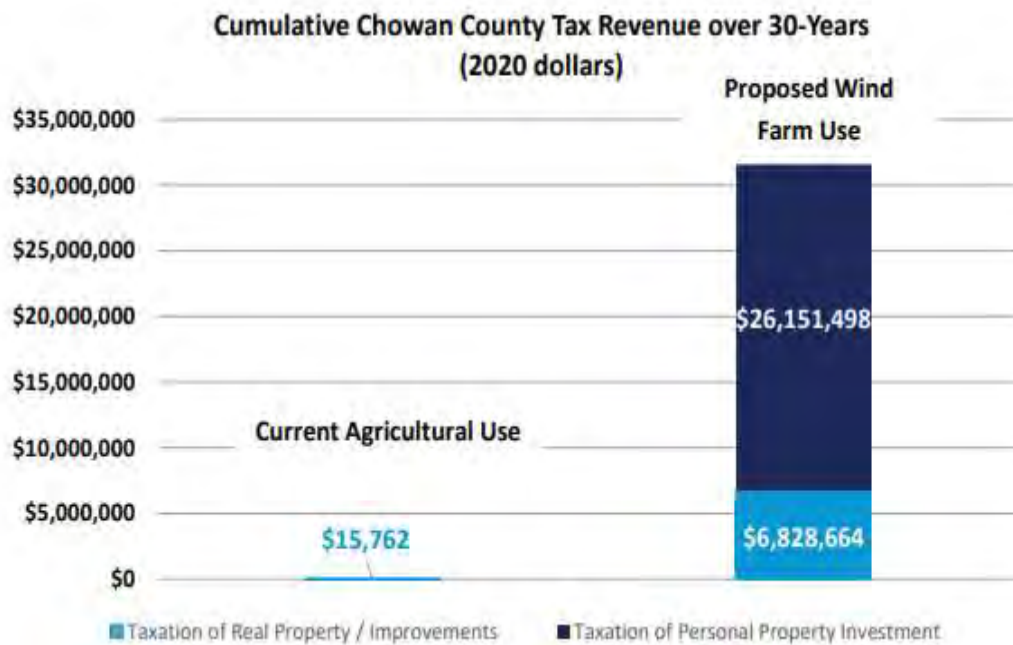
## *Taxation*

Renewable energy development in North Carolina has demonstrated substantial tax revenues for counties across the state. In NC, real estate taxes consist of two components: real property taxes (e.g. land and buildings), and personal property taxes (e.g. solar equipment).<sup>83</sup> Solar arrays increase both of these real property and personal property taxes. Counties and cities are responsible for setting real estate taxes in North Carolina. Regarding real property taxes, solar arrays can increase these taxes paid by the parcel of land because the development of solar classifies the land as having a “commercial” use, which has a higher assessed real property tax than other land uses.<sup>84</sup> Similarly, personal property taxes on solar development increases county revenues because the property now has costly solar equipment on the land.

When solar is developed on agricultural land, which has a 75% reduction of its tax valuation, the solar arrays owe a roll-back tax: the county ends up taxing the land for the difference of the three years of subsidization prior to the land changing to solar generation. In nearly all cases of repurposing agricultural land, the solar developers pay these roll-back taxes.<sup>85</sup>

As of June 2021, North Carolina does not have special property tax treatment for utility scale wind development.<sup>86</sup> There is only one wind farm operational in North Carolina, and one additional project which has been approved in North Carolina by the Department of Environmental Quality. This new project under development, Timbermill Wind, will be Chowan County's largest taxpayer, with the project projected to create "approximately \$33 million in tax revenue for the community."<sup>87</sup> This \$33 million comes over a 30-year period, so \$1.1 million annually to the county. Wind projects generate county tax revenues both for real property / improvements and personal property investment. Timbermill's tax revenues over 30 years are below for reference:

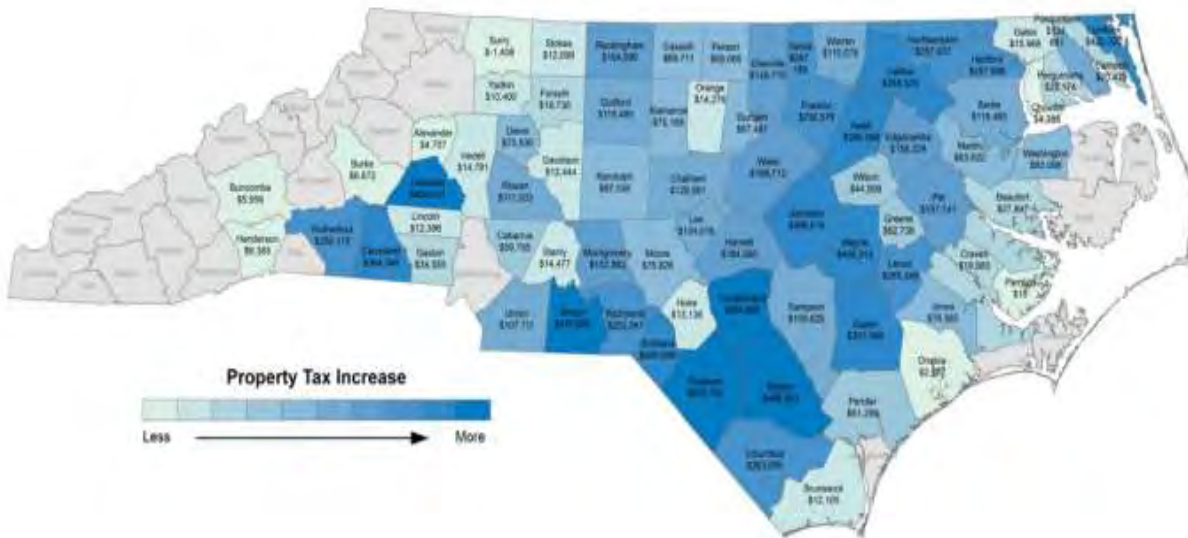
**Figure 11. Cumulative Tax Revenue with and without wind farm in Chowan County<sup>88</sup>**



Regarding tax credits for developers, North Carolina had a sizable tax credit for renewable energy, which expired in January 2016.<sup>89</sup> As of March 2017, NC still "exempts 80% of the appraised value of a solar photovoltaic (PV) system from property tax."<sup>90</sup> This tax exemption is for any solar development; residential solar systems that are not used to generate income or in connection with a business are able to be fully exempt from property taxation given that they are non-business personal property.

From the data, North Carolinian counties adopt solar and reap the financial rewards. According to NC Sustainable Energy Association's (NCSEA) research, the solar industry "employs nearly 7,000 North Carolinians and has delivered over \$15 billion in investments – most of which are in the most economically distressed counties (57% in Tier 1 and 27% in Tier 2)."<sup>91</sup> NCSEA's report cites positive interviews from host community leaders, ranging from NC Representative Larry Strickland (R-Johnston) to local farmers to conservative County Commissioners. From Figure 12, it appears that the strong solar potential across the state has been taken advantage.

**Figure 12. Increase in Annual Property Tax Revenue for Tax Year After Solar System Developed<sup>92</sup>**



Earlier this year, House Democrats proposed HB 443, “Credit for investing in renewable energy property.” HB 443 shows that House Democrats are still pushing to pass additional legislation to increase incentives for renewable energy development. In opposition to more solar development, there are “discussions of eliminating North Carolina’s personal property tax abatement for solar energy.”<sup>93</sup> This opposing rationale is rooted in the belief that solar development costs counties, rather than financially benefiting them.

### Siting

In North Carolina, the level of government with siting authority depends on the category of energy. For solar development, the local governments, whether it be county or municipality, controls the siting authority and policy for projects within its jurisdiction. Meanwhile, siting of wind energy projects is a dual system. Wind development that has a proposed output of 1 MW or greater must file for a permit with the State’s department of Energy and Natural Resources, hold a public hearing in any county impacted by the project, and get approved by the department committee. In addition to the state requirements, the project must adhere to the local ordinances for wind.

In 2007, North Carolina passed a law that prevents local ordinances from prohibiting the installation of solar, as long as it is not facing public access or common areas on detached single-family residences.<sup>94</sup> This law makes it nearly impossible for local governments to block residential solar and reduces most barriers for proposed solar farms in rural areas unless the municipality is successfully able to exclude solar from zoning types, a potential reason why North Carolina became the fourth largest producer of solar energy in the US. In 2022, the North Carolina Supreme Court ruled in *Belmont v. Farwig* that homeowners’ associations cannot stop homeowners from installing solar, which HOAs had been attempting to do by claiming that a preexisting land covenant applies. This clarification strengthens homeowner’s property rights when it comes to solar installation.

In 2023, state law S.L. 2023-58 was enacted that requires owners of utility scale solar operations to register with the NCDEQ and submit a decommissioning plan that outlines financial assurance that the company can cover the cost of decommissioning.<sup>95</sup> The stipulated actions to successfully decommission a site were outlined in the law: the project must be disconnected from the grid, all equipment and waste relating to the project must be removed and properly disposed of, and the land must either be restored to its previous condition or to a condition previously agreed upon by the landowner. In 2021, 56 of North Carolina's 100 counties had decommissioning plan requirements in place for utility scale solar operations.<sup>96</sup> This law expands the principles of corporate responsibility for decommissioning statewide and streamlines the process through state level government rather than local governments.

Unlike solar, wind does not have the same degree of legal protections that encourage development in the state. The Amazon Wind Farm is the only wind farm in the state which spans between two intercoastal counties: Perquimans with 48 turbines and Pasquotank with 56 turbines.<sup>97</sup> Both counties have a height maximum of 600 feet and the minimum setback requirement is derived from a set value based on the surrounding property type, which is multiplied by the height of the turbine. In Perquimans County, wind farms that are bigger than 25 acres must have a setback 2.5 times the turbine height for occupied buildings and residences and 1.5 times the turbine height for non-participating property lines and public roads.<sup>98</sup> In Pasquotank County, wind farms larger than 25 acres must have a setback 1.1 times the turbine height for occupied buildings on participating property, 2.5 times the turbine height for occupied buildings on non-participating property, and 1.5 times the turbine height for non-participating property lines and public roads.<sup>99</sup> A Perquimans County couple tried in 2016 to challenge the project in court to stop its construction, but it was dismissed by the judge and the Amazon Wind Farm began operating in 2017. The general opinion of the project from residents is positive due to the payments to landowners, increased tax revenue, and job creation.



In Chowan County, adjacent to Perquimans County, the Timbermill Wind Farm is currently being constructed. Once completed, it will feature 45 turbines with the potential to produce 189 megawatts of power.<sup>100</sup> Chowan County classifies projects of at least 250 acres as a large wind facility and designates the maximum turbine height of 600 feet. The setback standards for Chowan County are 2.5 times the turbine height for occupied buildings and non-participating residences, and 1.5 times the turbine height for non-participating property lines and public roads.<sup>101</sup> Noise from the turbines are not allowed to exceed 55 decibels and there is to be no more than 30 hours/ year of shadow flicker. Apex also had to establish a bond to cover the estimated future costs of decommissioning the project.

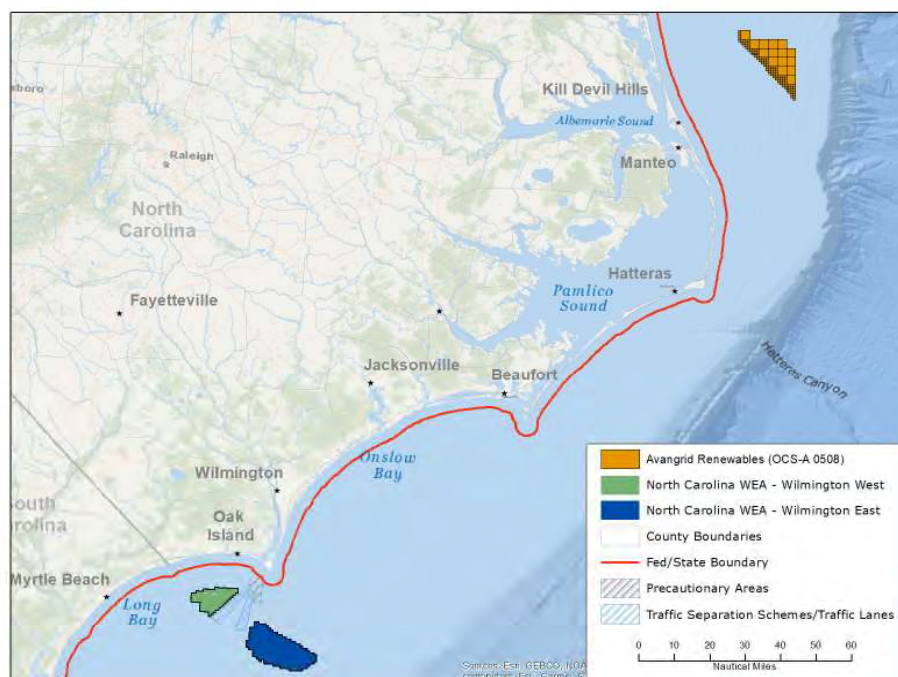
## Public Lands

North Carolina has 5 million acres of public land,<sup>102</sup> though there is a large enough supply of fields that people are willing to lease to solar companies that solar developers haven't had the need to look to public land for solar sites. The state has control of the ocean area within three nautical miles off its coast. Despite ocean area between three and two hundred nautical miles off the coast being federally controlled, the state of North Carolina works directly with the management of the territory. Though any offshore wind farms would be located on federal public land, the state government has authority over sites that the federal government deems leasable.<sup>103</sup>

As mentioned before, North Carolina has some of the best potential for offshore wind in America, but currently has none. One reason for this is that in 2017, a year after the Amazon Wind Farm began operation, an 18-month moratorium on all wind development was approved by the governor,<sup>104</sup> who reasoned that the effects of wind turbines on military installations needed to be studied. North Carolina touts itself as 'the most military friendly state' with five military bases located in the coastal region of the state.

Now that the legislation lapsed and efforts to renew it has failed, wind developers are eager to start offshore wind farms in the state after the Bureau of Ocean Energy Management identified three sites (Figure 13) that would be available for a commercial lease in 2021, Kitty Hawk North Wind, Wilmington East, and Wilmington West.<sup>105</sup> The two Wilmington sites, referred to as Carolina Long Bay, were auctioned for \$315M dollars for the 110,091 acre site which has the proposed potential to generate 1.3 GW of power. The 122,405-acre Kitty Hawk site with proposed potential to generate 3,500 MW of power, was auctioned for \$9M dollars. Another proposed site was blocked by the Department of Defense due to potential naval interference.<sup>106</sup>

**Figure 13. Bureau of Ocean Energy Management North Carolina Offshore Wind Sites** <sup>107</sup>



The economy in the Outer Banks revolves heavily around summer tourism with many of the houses being vacation homes that have a high property value. The year around and seasonal residents have strongly opposed offshore wind development, many citing the turbines being visible from the shore as the reason for their dissent.<sup>108</sup> The Kitty Hawk site is 27 miles off the coast and not visible from shore and has faced less opposition from locals. The Carolina Long Bay site is 17 miles off the shore and may also not be visible from shore, yet residents are still apprehensive about the offshore turbines.

In addition to the ocean, the Western Mountain region of North Carolina is also public land. Construction of wind turbines in the mountains is rendered impossible by the 1983 Mountain Ridge Protection Act,<sup>109</sup> which blocks structures taller than 40 feet from being built on any ridge or crest on a mountain 3,000 feet or taller, though a 2009 amendment created exceptions that apply to private personal use wind turbines that are not connected to the grid. In the original 2009 amendment, commercial wind projects would be outright banned in all land located in the Mountain Region of the state. This addition was approved by the State Senate but failed to get approval by the house.<sup>110</sup> Nevertheless, the state is protective of its scenic areas and can refuse a permit to wind projects if it could interfere or cause a disturbance with nature or wildlife.

## *Infrastructure Investments*

*Federal Investment:* To support the ongoing development of the renewable energy sector, infrastructure investment is needed. Infrastructure investment can entail maintenance, development, and construction of needed facilities for renewable energy. North Carolina—first in the nation for offshore wind energy potential and fifth state with growing solar energy potential<sup>111</sup>—is leading the push for increasing infrastructure investment through policy changes.

The American Clean Power PAC (ACP) reports that \$30 million was raised annually through local and state taxes and \$42 million through land lease payments.<sup>112</sup> Clean energy will increase by 2030 and is expected to receive \$15 billion in investments until then.<sup>113</sup> In addition to in-state support, North Carolina receives federal funding to expand infrastructure investment. The Inflation Reduction Act (IRA) provided additional support for renewable energy infrastructure. The IRA is expected to bring an additional \$2.7 billion by 2030 to energy generation and storage; \$8.7 billion to the battery supply chain; and \$23 million to expand EV charging stations.<sup>114</sup> Under the IRA, the North Carolina Department of Environmental Quality (DEQ) has also received nearly \$200 million to expand its home rebate program to encourage solar energy use in households. North Carolina is also working on a grant to garner more funds to expand residential and community solar farms, especially for low-income and marginalized communities.<sup>115</sup>

North Carolina also received additional help from the USDA's Rural Energy for America Program (REAP), with additional funding from the IRA. REAP aids agricultural producers to expand renewable energy systems or improvements.<sup>116</sup> REAP also allows agricultural producers to apply for energy-efficient equipment or loans for agricultural production and processing.<sup>117</sup> The funds can be used for renewable energy systems such as solar, wind,

biothermal, geothermal, and hydropower. North Carolina has benefitted from REAP and recently received \$32 million. The money has gone towards counties such as Alexander County which received \$72,000 for a 296-kW solar array and Warren County which received a \$25 million loan for a 48.57-MW solar system.<sup>118</sup> Overall, USDA REAP allows for states like North Carolina to build energy independence through the private sector while also lowering future energy costs.

*Offshore Wind:* Offshore wind has the potential to thrive in North Carolina due to the strides made in infrastructure investment and its continued commitment to support this sector. Governor Roy Cooper created a task force in 2022 to investigate how to expand offshore wind development in the state. The task force, also known as the North Carolina Taskforce for Offshore Wind Economic Resource Strategies (NC TOWERS), has released its annual report with recommendations to support offshore wind development.<sup>119</sup> The task force recommends the need to invest in “waterside/quayside infrastructure assets” through private funding or changes in legislation.<sup>120</sup>



In addition to the task force, North Carolina has also acknowledged the need to strengthen the physical supply chain and transportation infrastructure for offshore wind (OSW) development. For wind development, there are two components of the physical supply chain: tier-1 components and low-tier supply chain.<sup>121</sup> Tier-1 components refer to the major components of the turbine such as the blades, the tower, the foundation, and the balance of the plant (BOP). Low-tier supply chain refers to the manufacturing firms that provide the smaller components of the wind turbine. The study done by North Carolina mostly focuses on tier-1 components and how the state can continue to support the supply chain. One suggestion is to strengthen regional collaboration and become a major supplier of physical components for other states.<sup>122</sup> North Carolina can benefit by becoming the top supplier on the east coast not just because of its resources, but also because of the various ports found along the coast.



Another major component of infrastructure investment is transportation to provide access to OSW. Currently, North Carolina has a “fully integrated, up-to-date high-capacity intermodal transport system” which can help the OSW industry.<sup>123</sup> Investment is mostly needed in the Operations and Maintenance (O&M) to support the transport system. Overall, infrastructure upgrades are expensive in OSW, with costs ranging from \$5 million to over \$100 million.<sup>124</sup> The recommendations made will, ideally, guide future public and private investments to expand OSW.

*Private Investment:* While North Carolina does receive a significant amount of its investment through federal and municipal funds, other stakeholders also play a pivotal role in infrastructure investment. As mentioned before, under “Climate Action Policy,” Duke Energy created the Carbon Plan Integrated Resource Plan (CPIRP) in response to HB.951.<sup>125</sup> In the CPIRP, it outlines plans to add 6GW of solar PV with an addition of 2.7GW in energy storage assets.<sup>126</sup> Duke Energy also provided a general framework to address infrastructure gaps and needs, helping boost North Carolina’s energy sector. Some suggestions include increasing solar and wind capacity, along with transmission and interconnection facilities.<sup>127</sup> Additional specific actions are listed below:

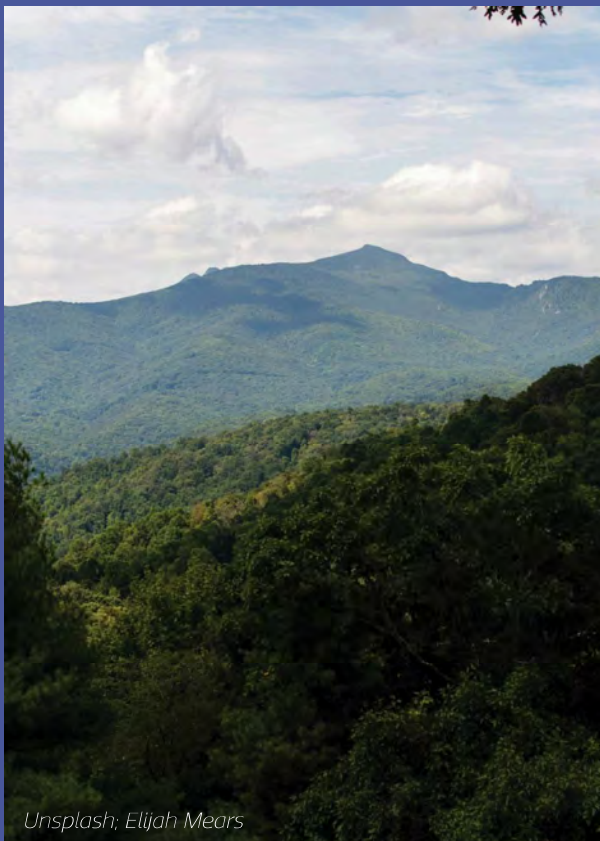
- **Directs Duke to conduct two competitive procurements between 2023-2024 targeting 2,350 MW of new solar generation to be placed into service by 2028**
- **Authorizes Duke to procure 1,000 MW standalone battery storage and 600 MW of battery storage paired with solar generation**
- **Authorizes Duke to upgrade necessary transmission facilities to interconnect new solar generation**
- **Directs Duke to engage with onshore wind stakeholders and economically model utility-owned onshore wind in its next round of modeling.**<sup>128</sup>

While there are efforts at the federal and private levels to expand infrastructure investment, more should be done to incorporate rural and agricultural communities that could also lease their land to private developers. So far, USDA REAP is one of the few programs in North Carolina that directly benefits agricultural producers who are slowly investing in the renewable sector. More efforts should be made to allow agricultural producers to benefit from infrastructure investment, whether by providing land for storage facilities or buying their land to expand the transportation system.

## Conclusion

In North Carolina, solar development has flourished over the past decade whereas wind development has failed to gain traction to date. Solar development has excelled in North Carolina due to developers leveraging the PURPA federal mandate and the state government passing key legislation, like REPS formulation in 2007 and HB 951 in 2021. Community buy-in of solar has been achieved by having tax policies in place that ensure revenues flow from projects to local communities. On the other hand, wind development in North Carolina has been hindered by siting and permitting issues.

North Carolina has been a leading example on how to harmoniously weave federal and state energy policies and incentives together. Despite North Carolina being only the 28th largest by area in the United States, it ranks in the top five states in terms of installed solar capacity. The state certainly benefits from being an early mover in the solar space, managing to pass REPS in 2007. It is important to note that the REPS only included technology minimums for solar, not wind. The current Governor is seeking to maintain and build momentum in the state by creating more ambitious REPS through the CEP. Additionally, the Republican-controlled state legislature passed HB 951, which sets emissions reductions targets for public utilities by 2030 and 2050 benchmarks. These efforts show that the state is able to continue to strengthen its goals and targets regardless of political leadership. Incentivizing renewable energy development, particularly solar, has proven to be politically viable for Republican legislatures.



*Unsplash; Elijah Mears*

North Carolina also benefits from developers pursuing the opportunity that PURPA provided. A key learning is that high volumes of smaller scale solar projects, although still referred to as “utility-scale” if they are greater than 1 MW, can contribute meaningfully to overall solar output. When utilities are required to interconnect certain size projects, these projects have less obstacles in the way of getting built. Thus, developers are more incentivized to work in states that make it easier to connect to the grid. There is potentially an additional benefit of this smaller-scale approach: improved chances for community buy-in. When projects are smaller in scale, there are less landowners that need to be convinced, and potentially less overall incidence of grassroots opposition campaigns forming. For example, a 2 MW project is less likely to be in the line of sight of residents than a 200 MW project. The outcome of PURPA implementation in North Carolina is clear: it acted as a key incentive for solar development over the past decade.

Regarding wind development, siting and permitting have prevented the industry from advancing in North Carolina. Most of the western part of the state is off limits for wind development due to the Mountain Ridge Protection Act, and only one onshore wind facility is operational in the state. Lack of policy, funding, and community support has also impacted the way OSW has developed. Just as North Carolina is starting to embrace more solar, the pattern may manifest in wind as well. Most efforts made to research wind expansion and development have occurred over the past 5 years, setting the stage for future development. As mentioned under Infrastructure Investment, NCTOWERS is also researching potential funding sources to support the industry in the future. Despite efforts being made to expand wind, there are still sociopolitical barriers that impact siting and development. The moratorium (under Public Lands) was mainly placed due to “unknown impacts” on military bases, while other residents opposed future OSW as it could impact property values or disrupt the local area. Generally, community support heavily impacts future development but allowing residents to be a part of the planning process or providing informational sessions could strengthen the trust between residents and the renewable energy sector. Once the financial benefits from the soon to be built Timbermill Project wind farm can be distributed, developers may be able to convince more communities to site future projects.

However, if North Carolina cannot overcome the political and economic barriers to expand wind, then North Carolina could embrace becoming a part of the manufacturing of OSW. From providing blades to foundations to other states, North Carolina still has the potential to play a large role in the OSW industry. As North Carolina continues to expand OSW, it must also consider the role that private developers play to support the development. New OSW development approved by NCDEQ provides developers a positive sign that business can flourish in the state, making them more hospitable to OSW projects. Additionally, support from the federal government provides an additional level of financial support, encouraging more developers to stay in North Carolina.

Overall, North Carolina has the opportunity to continue to support and expand the renewable energy sector. To ensure that the industry succeeds, more investments and trust must be built between communities and local governments. As previously mentioned, the solar industry will be bringing more than 7,000 jobs to the state. With more support, from both funding and legislation, both solar and wind could provide the same benefits to residents and the states. Because North Carolina has both wind and solar energy potential, this difference in development reflects the importance of favorable siting and permitting policies and also REPS. Amending the Mountain Ridge Protection Act may pave the way for ameliorating the permitting and siting issues that wind development currently faces in the western part of the state. By including technology minimums in a future updated REPS for both onshore and offshore may act as a catalyst to spur growth. Lastly, financial support from public and private sectors could provide the necessary infrastructure and trust to expand and strengthen the industry to ensure a clean future by 2050.

## Endnotes

- 1 "North Carolina – State Energy Profile Overview – U.S. Energy Information Administration (EIA)," Eia.gov, 2016, <https://www.eia.gov/state/?sid=NC>.
- 2 "Dominion Energy" Dominion Energy, <http://www.dominionenergy.com/>.
- 3 "Duke Energy Corporation," Duke Energy, 2019, <https://www.duke-energy.com/our-company/about-us>.
- 4 NC Sustainable Energy Association. "Clean Energy Maps | North Carolina Sustainable Energy Association." NC Sustainable Energy Association, January 28, 2022. <https://energync.org/maps/>.
- 5 "Who We Are," Electricities, 2022, <https://www.electricities.com/about-us/who-we-are/>.6 "Advanced Grid Operations," North Carolina's Electric Cooperatives, June 21, 2023, <https://www.ncelectriccooperatives.com/energy-innovation/grid-operations/>.
- 7 "Advanced Grid Operations," North Carolina's Electric Cooperatives, June 21, 2023, <https://www.ncelectriccooperatives.com/energy-innovation/grid-operations/>.
- 8 "NCUC: Natural Gas," Ncuc.gov, 2023, <https://www.ncuc.gov/industries/naturalgas/naturalgas.html#:~:text=--Natural%20gas%20is%20delivered%20to>.
- 9 Eia.gov. "U.S. Energy Information Administration – EIA – Independent Statistics and Analysis," 2021. <https://www.eia.gov/state/?sid=NC#tabs-4>.
- 10 "North Carolina State Energy Profile." North Carolina Profile. Accessed December 1, 2023. <https://www.eia.gov/state/print.php?sid=NC>.
- 11 Economic Development Partnership of North Carolina | EDPNC. <https://edpnc.com/wp-content/uploads/2020/07/Offshore-Wind-Energy-Brochure-2020.pdf>.
- 12 IEA. "Offshore Wind Outlook 2019 – Analysis." IEA. Accessed December 12, 2023. <https://www.iea.org/reports/offshore-wind-outlook-2019>.
- 13 Ibid
- 14 U.S. Installed and Potential Wind Power Capacity and Generation." WINDEXchange. Accessed December 12, 2023. <https://windexchange.energy.gov/maps-data/321>
- 15 SEIA. "North Carolina Solar | SEIA," 2023. <https://www.seia.org/state-solar-policy/north-carolina-solar>
- 16 Ibid
- 17 Lopez, A. et al. (2012). "U.S. Renewable Energy Technical Potentials: A GIS-Based Analysis." NREL/TP-6A20-51946. Golden, CO: National Renewable Energy Laboratory.
- 18 SEIA. "North Carolina Solar | SEIA," 2023. <https://www.seia.org/state-solar-policy/north-carolina-solar>
- 19 Ibid
- 20 Land, National. "National Land Cover Database (NLCD)." Ncsu.edu, 2021. <https://www.lib.ncsu.edu/gis/nlcd>.
- 21 NC Sustainable Energy Association. "Clean Energy Maps | North Carolina Sustainable Energy Association." NC Sustainable Energy Association, January 28, 2022. <https://energync.org/maps/>.
- 22 Chavis, Donna. NC needs to expand its use of renewable energy quickly | Raleigh News ..., February 2019. <https://www.newsobserver.com/opinion/article226650834.html>.
- 23 Ibid
- 24 Barnett, Ned. Renewable energy could cut today's high energy costs | Raleigh News ..., November 28, 2021. <https://www.newsobserver.com/opinion/article256092197.html>.
- 25 Wagner, Adam. New NC offshore wind leases halted by U.S. Navy Key Areas | Raleigh ..., August 9, 2023. <https://www.newsobserver.com/news/politics-government/article278029168.html>.
- 26 Timbermill Wind. Accessed December 12, 2023. <https://www.timbermillwind.com/>.
- 27 Fueston, Vernon. "Google to Buy 100% of Power from Timbermill Project." Chowan Herald, August 29, 2023. [https://www.dailyadvance.com/chowan/news/local/google-to-buy-100-of-power-from-timbermill-project/article\\_75cc1128-468f-11ee-abff-3fae2019bd64.html](https://www.dailyadvance.com/chowan/news/local/google-to-buy-100-of-power-from-timbermill-project/article_75cc1128-468f-11ee-abff-3fae2019bd64.html).
- 28 Duncan, Charles. "First Wind Farm in North Carolina Approved by State Regulators." First wind farm in N.C. approved by state regulators, March 15, 2023. <https://spectrumlocalnews.com/nc/charlotte/news/2023/03/15/first-wind-farm-in-north-carolina-approved-by-state-regulators#:~:text=%E2%80%9CThe%2045%2Dturbine%20project%20will,its%20lifetime%2C%E2%80%9D%20he%20said>.
- 29 Ibid
- 30 Deem, John. "Bigger Fights': Opposition to Solar Farms Growing in NC." Winston-Salem Journal, May 2, 2022. [https://journalnow.com/news/local/bigger-fights-opposition-to-solar-farms-growing-in-nc/article\\_11f7719e-c71d-11ec-9813-4b06f341167a.html](https://journalnow.com/news/local/bigger-fights-opposition-to-solar-farms-growing-in-nc/article_11f7719e-c71d-11ec-9813-4b06f341167a.html).
- 31 Hibbs, Mark. "Fishing Interests to Get Say on Offshore Wind." Island Free Press, April 2, 2019. <https://islandfreepress.org/fishing-report/fishing-interests-to-get-say-on-offshore-wind/>.
- 32 Deem, John. "Bigger Fights': Opposition to Solar Farms Growing in NC." Winston-Salem Journal, May 2, 2022. [https://journalnow.com/news/local/bigger-fights-opposition-to-solar-farms-growing-in-nc/article\\_11f7719e-c71d-11ec-9813-4b06f341167a.html](https://journalnow.com/news/local/bigger-fights-opposition-to-solar-farms-growing-in-nc/article_11f7719e-c71d-11ec-9813-4b06f341167a.html).

33 Ibid

34 Duncan, Charles. "First Wind Farm in North Carolina Approved by State Regulators." First wind farm in N.C. approved by state regulators, March 15, 2023. <https://spectrumlocalnews.com/nc/charlotte/news/2023/03/15/first-wind-farm-in-north-carolina-approved-by-state-regulators#:~:text=%E2%80%9CThe%2045%2Dturbine%20project%20will,its%20lifetime%2C%E2%80%9D%20he%20said.>

35 Mai, HJ. "North Carolina Removes Anti-Wind Provision from Bill." Utility Dive, June 14, 2019. [https://www.utility-dive.com/news/north-carolina-anti-wind-bill-would-freeze-development-devastate-industry/556891/.](https://www.utility-dive.com/news/north-carolina-anti-wind-bill-would-freeze-development-devastate-industry/556891/)

36 "Solar Friendly Community." Solar Friendly Community | Carrboro, NC - Official Website. Accessed December 12, 2023. [https://townofcarrboro.org/1104/SolSmart.](https://townofcarrboro.org/1104/SolSmart)

37 Steinberg, Jossie. "Duke Energy's Plan to Keep North Carolina Addicted to Fossil Fuels." NRDC Action Fund, May 26, 2021. [https://www.nrdcactionfund.org/duke-energys-plan-to-keep-north-carolina-addicted-to-fossil-fuels/.](https://www.nrdcactionfund.org/duke-energys-plan-to-keep-north-carolina-addicted-to-fossil-fuels/)

38 NCLCV-Editor. "Gov. Roy Cooper's 2019 Scorecard." North Carolina League of Conservation Voters, December 19, 2019. [https://nclcv.org/2019-scorecard-cooper/.](https://nclcv.org/2019-scorecard-cooper/)

39 "Vendor/Recipient Profile: Roy+cooper+for+north+carolina." OpenSecrets. Accessed December 12, 2023. [https://www.opensecrets.org/campaign-expenditures/vendor?cycle=2022&vendor=Roy%2BCooper%2B-For%2BNorth%2BCarolina.](https://www.opensecrets.org/campaign-expenditures/vendor?cycle=2022&vendor=Roy%2BCooper%2B-For%2BNorth%2BCarolina)

40 "North Carolina." NCUC. Accessed December 12, 2023. [https://www.ncuc.gov/Reps/Reps.html.](https://www.ncuc.gov/Reps/Reps.html)

41 Oct. 5, 2022 | By Connor O'Neil | Contact media relations. "Integrating Carbon-Free Generation in the Carolinas." NREL. Accessed December 12, 2023.

42 Oct. 5, 2022 | By Connor O'Neil | Contact media relations. "Integrating Carbon-Free Generation in the Carolinas." NREL. Accessed December 12, 2023. <https://www.nrel.gov/news/program/2022/integrating-carbon-free-generation-in-the-carolinas.html#:~:text=In%202021%2C%20North%20Carolina%20passed,emissions%20power%20system%20by%202050.>

43 "Mission & Funding." NC Clean Energy Technology Center. Accessed December 12, 2023. [https://nccleantech.ncsu.edu/about-us/sustainable-energy-mission-funding/.](https://nccleantech.ncsu.edu/about-us/sustainable-energy-mission-funding/)

44 Helm, Shannon. "PRESS RELEASE: The 50 States of Solar: States Address Equity Issues in Solar Program and Rate Design During Q2 2023." NC Clean Energy Technology Center. Accessed December 12, 2023. [https://nccleantech.ncsu.edu/2023/07/19/press-release-the-50-states-of-solar-states-address-equity-issues-in-solar-program-and-rate-design-during-q2-2023/.](https://nccleantech.ncsu.edu/2023/07/19/press-release-the-50-states-of-solar-states-address-equity-issues-in-solar-program-and-rate-design-during-q2-2023/)

45 "Microgrids." North Carolina's Electric Cooperatives, December 20, 2022. [https://www.ncelectriccooperatives.com/energy-innovation/microgrids/.](https://www.ncelectriccooperatives.com/energy-innovation/microgrids/)

46 Kaplan, Siena, and Elizabeth Ouzts. "Growing Solar in North Carolina." Frontier Group, August 23, 2022. <https://frontiergroup.org/resources/growing-solar-north-carolina/#:~:text=Based%20on%20the%20rate%20of,and%2014%20percent%20by%202030.>

47 Department of Interior. "North Carolina | Natural Resources Revenue Data." Accessed October 3, 2023. <https://archive.revenuedata.doi.gov/explore/NC/#:~:text=Federal%20land%20represents%207.7%25%20of%20all%20land%20in%20North%20Carolina.>

48 Peter Spence Gilchrist, and David Grier Martin. "North Carolina | Capital, Map, History, & Facts." In Encyclopædia Britannica, October 5, 2018. [https://www.britannica.com/place/North-Carolina-state.](https://www.britannica.com/place/North-Carolina-state)

49 Urban Footprint Public Dataset. Urbanfootprint.com

50 "U.S. Census Bureau QuickFacts: North Carolina," US Census, n.d., [https://www.census.gov/quickfacts/fact/table/NC/PST045222.](https://www.census.gov/quickfacts/fact/table/NC/PST045222)

51 Urban Footprint Public Dataset. Urbanfootprint.com

52 Equal Justice Initiative Reports. "The Carolinas | the Transatlantic Slave Trade." Accessed October 3, 2023. [https://eji.org/report/transatlantic-slave-trade/carolinas/#north-carolina-trafficking.](https://eji.org/report/transatlantic-slave-trade/carolinas/#north-carolina-trafficking)

53 Urban Footprint Public Dataset. Urbanfootprint.com

54 Ibid

55 Department of Commerce NC. "Employment Projections | NC Commerce," n.d. [https://www.commerce.nc.gov/data-tools-reports/labor-market-data-tools/employment-projections.](https://www.commerce.nc.gov/data-tools-reports/labor-market-data-tools/employment-projections)

56 SEIA. "North Carolina Solar | SEIA," 2023. [https://www.seia.org/state-solar-policy/north-carolina-solar.](https://www.seia.org/state-solar-policy/north-carolina-solar)

57 Pew Research Center's Religion & Public Life Project. "Religious Landscape Study," n.d. [https://www.pewresearch.org/religion/religious-landscape-study/state/north-carolina/party-affiliation/.](https://www.pewresearch.org/religion/religious-landscape-study/state/north-carolina/party-affiliation/)

58 Ibid

59 [https://www.deq.nc.gov/energy-climate/climate-change/nc-climate-change-interagency-council/climate-change-clean-energy-plans-progress.](https://www.deq.nc.gov/energy-climate/climate-change/nc-climate-change-interagency-council/climate-change-clean-energy-plans-progress) "Climate Change & Clean Energy: Plans & Progress." North Carolina Environmental Quality, n.d.

60 WUNC. "NC Governor Vetoes 2 Bills, Saying They Hurt His Climate and Environment Efforts." David Boraks,

October 2, 2023. <https://www.wunc.org/2023-10-02/n-c-governor-vetoes-2-bills-saying-they-hurt-his-climate-and-environment-efforts>.

61 General Assembly of North Carolina Session 2021 House Bill 951 ratified. <https://www.ncleg.gov/Sessions/2021/Bills/House/PDF/H951v5.pdf>.

62 Ibid

63 North Carolina Clean Energy Plan, October 2019. [https://files.nc.gov/ncdeq/climate-change/clean-energy-plan/NC\\_Clean\\_Energy\\_Plan\\_OCT\\_2019\\_.pdf](https://files.nc.gov/ncdeq/climate-change/clean-energy-plan/NC_Clean_Energy_Plan_OCT_2019_.pdf).

64 Ibid

65 "North Carolina Renewable Energy and Energy Efficiency Portfolio Standard (REPS)." NCUC. Accessed December 12, 2023. <https://www.ncuc.gov/Reps/reps.html#:~:text=Under%20this%20new%20law%2C%20investor,to%20a%2010%25%20REPS%20requirement>.

66 "Clean Energy and Energy Efficiency Portfolio Standard." DSIRE, December 6, 2023. <https://programs.dsireusa.org/system/program/detail/2660>.

67 North Carolina Clean Energy Plan, October 2019. [https://files.nc.gov/ncdeq/climate-change/clean-energy-plan/NC\\_Clean\\_Energy\\_Plan\\_OCT\\_2019\\_.pdf](https://files.nc.gov/ncdeq/climate-change/clean-energy-plan/NC_Clean_Energy_Plan_OCT_2019_.pdf).

68 Cross, Olivia. "House Bill 951 in North Carolina – What Is It and What Is Duke Energy's Plan?" ALL4, September 29, 2022.

69 Ibid

70 Ibid

71 2023 NC H 720, April 19, 2023. [https://custom.statenet.com/public/resources.cgi?id=ID%3A-bill%3ANC2023000H720&ciq=ncsl29e&client\\_md=81b2978f35abd4e9d5c0aa83b826fa95&mode=current\\_text](https://custom.statenet.com/public/resources.cgi?id=ID%3A-bill%3ANC2023000H720&ciq=ncsl29e&client_md=81b2978f35abd4e9d5c0aa83b826fa95&mode=current_text).

72 Ibid

73 Ibid

74 ncuc.gov. "NCUC: About Us," 2023. <https://www.ncuc.gov/Aboutncuc.html>.

75 Publicpower.org. "The Public Utility Regulatory Policies Act of 1978 | American Public Power Association," 2019. <https://www.publicpower.org/policy/public-utility-regulatory-policies-act-1978>.

76 everestagency. "Three Trends in State PURPA Implementation | NC Clean Energy Technology Center." Ncsu.edu, May 27, 2020. <https://nccleantech.ncsu.edu/2020/05/27/three-trends-in-state-purpa-implementation/>.

73 NC Sustainable Energy Association. "HB589." NC Sustainable Energy Association, October 19, 2022. <https://energync.org/hb589/>.

78 Ibid

79 Ibid

80 North Carolina General Assembly. House Bill 589: Competitive Energy Solutions for North Carolina. S.L. 2017-192. 2017. [https://dashboard.ncleg.gov/api/Services/BillSummary/2017/H589-SMRI-69\(sl\)-v-5](https://dashboard.ncleg.gov/api/Services/BillSummary/2017/H589-SMRI-69(sl)-v-5)

81 Ibid

82 National Renewable Energy Laboratory. 2019. "Corporate Renewable Energy Procurement Pathways in the Southeast: North Carolina." NREL.

83 Ibid

84 Brookshire, Daniel, Hannah Budds, Jerry Carey, and Daniel Parker. "Increased North Carolina County Tax Revenue from Solar Development – 2022 Update." NCSEA, September 2022. <https://news.duke-energy.com/releases/duke-energy-carolinas-proposes-annual-adjustment-for-fuel-and-other-riders-with-north-carolina-utilities-commission>.

85 Ibid

86 Ibid

87 Uebelhor, Emma, Olivia Hintz, and Eli Gold. "Inventory of State Wind Property Tax Treatments." CLOSEUP, June 2021. <https://closup.umich.edu/sites/closup/files/2021-08/closup-wp-55-Uebelhor-Hintz-Gold-Inventory-of-State-Wind-Property-Tax-Treatments.pdf>.

88 "Construction Updates." Timbermill Wind. [https://www.timbermillwind.com/construction\\_updates](https://www.timbermillwind.com/construction_updates).

89 "TIMBERMILL WIND ECONOMIC AND FISCAL CONTRIBUTION TO CHOWAN COUNTY, NORTH CAROLINA," Economic and Fiscal Contribution of Timbermill Wind, March 2021. [https://d3n8a8pro7vhmx.cloudfront.net/timbermill-wind/pages/1092/attachments/original/1617288073/Apex\\_Timbermill\\_Report\\_032521.pdf?1617288073](https://d3n8a8pro7vhmx.cloudfront.net/timbermill-wind/pages/1092/attachments/original/1617288073/Apex_Timbermill_Report_032521.pdf?1617288073).

90 "Programs." DSIRE. Accessed December 12, 2023. <https://programs.dsireusa.org/system/program/nc>.

91 NORTH CAROLINA SOLAR POLICIES AND INCENTIVES, March 2017. <https://www.orangecountync.gov/DocumentCenter/View/1313/North-Carolina-Solar-Policies-and-Incentives-PDF?bidId=>.

92 Petrusa, Jeffrey, Avery Tilley, and Manuel Gonzalez. Economic Impact Analysis of Clean Energy Development in North Carolina—2021 Update, June 2021. [https://energync.org/wp-content/uploads/2021/06/NCSEA\\_2021\\_Final\\_06222021.pdf](https://energync.org/wp-content/uploads/2021/06/NCSEA_2021_Final_06222021.pdf)

- 93 H Brookshire, Daniel, Hannah Budds, Jerry Carey, and Daniel Parker. "Increased North Carolina County Tax Revenue from Solar Development – 2022 Update." NCSEA, September 2022.
- 94 Harris. 2023 NC H 443, March 3, 2023. [https://custom.statenet.com/public/resources.cgi?id=ID%3A-bill%3ANC2023000H443&ciq=ncsl29e&client\\_md=16c4e23ac9086497144762e5d9847103&mode=current\\_text](https://custom.statenet.com/public/resources.cgi?id=ID%3A-bill%3ANC2023000H443&ciq=ncsl29e&client_md=16c4e23ac9086497144762e5d9847103&mode=current_text).
- 95 Brookshire, Daniel, Hannah Budds, Jerry Carey, and Daniel Parker. "Increased North Carolina County Tax Revenue from Solar Development – 2022 Update." NCSEA, September 2022.
- 96 Branan, Robert. "Solar Energy: NC Department of Environmental Quality Releases HB 329 Decommission Study." Ncsu.edu. 2021. <https://farmlaw.ces.ncsu.edu/2021/01/solar-energy-nc-department-of-environmental-quality-releases-hb-329-decommission-study/>.
- 97 Cowell, Janet. 2007. "SESSION LAW 2007-279 SENATE BILL 670 ." Wwww.ncleg.net. 2007.
- 98 Haskins, Elizabeth; Adams III, Weston. 2023. "Nelson Mullins – New Requirements for North Carolina Utility-Scale Solar Projects." Nelson Mullins Riley & Scarborough LLP. July 2023. [https://www.nelsonmullins.com/idea\\_exchange/alerts/megawatt-minute/all/new-requirements-for-north-carolina-utility-scale-solar-projects](https://www.nelsonmullins.com/idea_exchange/alerts/megawatt-minute/all/new-requirements-for-north-carolina-utility-scale-solar-projects).
- 99 "AMAZON WIND FARM NORTH CAROLINA –DESERT WIND Location." AvanGrid Renewables. 2017. [https://s24.q4cdn.com/489945429/files/doc\\_downloads/2017-1654-AR-AWFNC-Desert-Wind-fact-sheet-111017.pdf](https://s24.q4cdn.com/489945429/files/doc_downloads/2017-1654-AR-AWFNC-Desert-Wind-fact-sheet-111017.pdf)
- 100 "Perquimans County, NC Ordinances." 2021. Perquimans County Government. 2021. <https://www.perquimanscountync.gov>.
- 101 "§ 157.137 ADDITIONAL RESTRICTIONS IMPOSED on CERTAIN SPECIAL USES." 2023. American Legal Publishing. Pasquotank County Government. 2023. [https://codelibrary.amlegal.com/codes/pasquotankcon/latest/pasquotank-co\\_nc/0-0-0-4116](https://codelibrary.amlegal.com/codes/pasquotankcon/latest/pasquotank-co_nc/0-0-0-4116).
- 102 "About Timbermill Wind." 2023. Timbermill Wind. 2023. [https://www.timbermillwind.com/about\\_timbermill](https://www.timbermillwind.com/about_timbermill).
- 103 "Building North Carolina's Offshore Wind Supply Chain the Roadmap for Leveraging Manufacturing and Infrastructure Advantages," 2021. <https://www.commerce.nc.gov/report-building-north-carolinas-offshore-wind-supply-chain/download>.
- 104 "Article 8, Development Standards for Individual Uses." 2006. Chowan County. [https://d3n8a8pro7vhmx.cloudfront.net/timbermillwind/pages/64/attachments/original/1475768607/NEW\\_CHOWAN\\_Wind\\_Ordinance\\_Section\\_8\\_109\\_\\_\\_NPHighlights\\_bb.pdf?1475768607](https://d3n8a8pro7vhmx.cloudfront.net/timbermillwind/pages/64/attachments/original/1475768607/NEW_CHOWAN_Wind_Ordinance_Section_8_109___NPHighlights_bb.pdf?1475768607).
- 105 "Protection and Access of NC Public Lands – North Carolina Wildlife Federation." 2020. North Carolina Wildlife Federation. March 12, 2020. <https://ncwf.org/habitat/protection-access-public-lands/#:~:text=There%20are%20more%20than%205>.
- 106 Shallenberger, Krysti. 2017. "North Carolina Governor Signs Solar Bill, Targets Wind Moratorium with Executive Order." Utility Dive. July 2017. <https://www.utilitydive.com/news/north-carolina-governor-signs-solar-bill-targets-wind-moratorium-with-exec/448091/#:~:text=Brown%20added%20a%20last%2Dminute>
- 107 "North Carolina Activities | Bureau of Ocean Energy Management." 2022. Wwww.boem.gov. 2022. <https://www.boem.gov/renewable-energy/state-activities/north-carolina-activities>.
- 108 Garcia, Celeste. 2022. "Coastal Residents Raise Concerns about North Carolina Offshore Wind Farms." WUNC. February 18, 2022. <https://www.wunc.org/environment/2022-02-18/coastal-residents-raise-concerns-north-carolina-offshore-wind-farms>.
- 109 "North Carolina Activities | Bureau of Ocean Energy Management." 2022b. Bureau of Ocean Energy Management. Wwww.boem.gov. 2022. <https://www.boem.gov/renewable-energy/state-activities/north-carolina-activities>.
- 110 Romoser, James. 2009. "State Senate Bans Wind Turbines in Mountains." Hickory Daily Record. August 7, 2009. [https://hickoryrecord.com/state-senate-bans-wind-turbines-in-mountains/article\\_e0b90ced-0a63-5506-9a9f-222200564cf0.html](https://hickoryrecord.com/state-senate-bans-wind-turbines-in-mountains/article_e0b90ced-0a63-5506-9a9f-222200564cf0.html).
- 111 Economic Development Partnership of North Carolina. "Renewable Energy in North Carolina | Wind & Solar | EDPNC," April 17, 2023. <https://edpnc.com/industries/renewable-energy/>.
- 112 American Clean Power. (2023). Clean Energy Power Report: North Carolina. <https://cleanpower.org/resources/clean-energy-powers-north-carolina/>
- 113 Ibid
- 114 Ibid
- 115 Ibid
- 116 Ibid
- 117 Rural Development. "USDA Invests \$32 Million in Critical Infrastructure to Lower Costs, Create Jobs, and Combat Climate Change in Rural North Carolina," <https://www.rd.usda.gov/newsroom/news-release/usda-invests-32-million-critical-infrastructure-lower-costs-create-jobs-and-combat-climate-change>.
- 118 Ibid
- 119 Rural Development. "USDA Invests \$32 Million in Critical Infrastructure to Lower Costs, Create Jobs, and Com-

bat Climate Change in Rural North Carolina," <https://www.rd.usda.gov/newsroom/news-release/usda-invests-32-million-critical-infrastructure-lower-costs-create-jobs-and-combat-climate-change>.

120 Nc.gov. "N.C. Taskforce for Offshore Wind Economic Resource Strategies [NC Towers] | NC Commerce," 2021. <https://www.commerce.nc.gov/about-us/boards-commissions/nc-taskforce-offshore-wind-economic-resource-strategies-nc-towers>.

121 Ibid

122 "Building North Carolina's Offshore Wind Supply Chain the Roadmap for Leveraging Manufacturing and Infrastructure Advantages," 2021. <https://www.commerce.nc.gov/report-building-north-carolinas-offshore-wind-supply-chain/download?attachment>.

123 Ibid

124 Ibid

125 Ibid

126 Duke Energy. "Duke Energy Files Updated Carbon Plan to Serve the Growing Energy Needs of a Thriving North Carolina." Duke Energy | News Center, 2023. <https://news.duke-energy.com/releases/duke-energy-files-updated-carbon-plan-to-serve-the-growing-energy-needs-of-a-thriving-north-carolina#:~:text=The%20Carbon%20Plan%20Integrated%20Resource,North%20Carolina's%20clean%20energy%20law>.

127 Ibid

128 Ibid