BEFORE THE NORTH CAROLINA UTILITIES COMMISSION
DOCKET NO. E-100, SUB 179

In the Matter of Duke Energy Progress, LLC, and Duke Energy Carolinas, LLC, 2022 Biennial Integrated Resource Plans and Carbon Plan	)))))	**LIMITED COMMENTS OF AVANGRID RENEWABLES, LLC**

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NOW COMES Avangrid Renewables, LLC ("Avangrid Renewables"), an intervenor in this proceeding, pursuant to North Carolina S.L. 2021-165 ("HB951") and the pertinent procedural orders entered by the North Carolina Utilities Commission (the "Commission") in this docket and provides the following limited comments in response to the Duke Energy Progress, LLC ("DEP") and Duke Energy Carolinas, LLC ("DEC") (DEP and DEC collectively "Duke") *Verified Petition for Approval of Carbon Plan* and accompanying appendices filed on May 16, 2022 ("Duke Carbon Plan").

EXECUTIVE SUMMARY

HB951 mandates that the Commission take "all reasonable steps to achieve a seventy percent (70%) reduction in emissions of carbon dioxide (CO2) emitted in the State from electric generating facilities owned or operated by electric public utilities from 2005 levels by the year 2030 and carbon neutrality by the year 2050."[1] This includes, most notably, developing a plan for Duke to achieve these reduction goals where such plan "may, at a minimum, consider power generation, transmission and distribution, grid modernization, storage, energy efficiency measures, demand-side management, and the

[1] HB951, Part I, Section 1.

latest technological breakthroughs to achieve the least cost path consistent with this section to achieve compliance with the authorized carbon reduction goals[.]"[2]

Reasonable steps to achieve the emissions reductions required by HB951 must give proper consideration to the abundant potential for offshore wind generation off the North Carolina coast and a pathway to utilizing these offshore wind resources as economically, efficiently, and expeditiously as possible to achieve both the 2030 and 2050 emission reduction mandates. Avangrid Renewables generally identifies the following issues with the Duke Carbon Plan proposal: it artificially constrains the development of offshore wind resources for North Carolina by proposing inefficient project design capacities, assumes timelines that cannot meet HB951's deadlines, and fails to articulate a low-cost transmission strategy for the near-term build out of offshore wind.

Avangrid Renewables submits these limited comments as an experienced onshore and offshore wind developer and the owner of the Kitty Hawk Wind lease area (OCS-A 0508) ("Kitty Hawk"), an offshore wind leasehold area off the cost of North Carolina with the potential to deliver abundant and cost-effective offshore wind generation within the timeline required by HB951. Kitty Hawk is the largest offshore lease capable of delivering to North Carolina, and the only lease area within the Carolinas region to have already submitted applications for federal permits. Of the lease areas in the region, Kitty Hawk provides the highest value and cost and schedule certainty to North Carolina electricity consumers and thereby complies with the current law and practice of least-cost planning for generation.

[2] HB951, Part I, Section 1(1).

Given the shortcomings in the Duke Carbon Plan proposal with regards to offshore wind, Avangrid Renewables requests that the Commission: (1) require the initiation of an independent, objective third party study to evaluate and prioritize each wind lease offshore of the Carolinas and determine the best pathway to incorporate offshore wind generation resources into Duke's planning portfolio; (2) require that such study consider levelized cost of energy ("LCOE"), viability, schedule, size and overall plan, along with any other Commission-determined metrics, in making its recommendations; (3) provide for stakeholder input and regular reports to the Commission about the status of the study, for filing of the final study (including transparent data and modelling inputs), and an opportunity for intervenors to file comments regarding the study; and (4) following a comment period and any further actions that the Commission deems fit, require that Duke select offshore wind resource additions in a prioritized order, beginning with the project(s) that provide North Carolina ratepayers with the best overall combination of reliability, schedule, and cost. Alternatively, should the Commission decline to take the foregoing steps, Avangrid Renewables requests that, at a minimum, the Carbon Plan be modified to address the shortcomings identified in these limited comments.

Avangrid Renewables believes the issues identified above regarding the Duke Carbon Plan and the recommendations made herein about how to correct those issues merit consideration at an expert witness hearing.

BACKGROUND

I. *HB951 and the Carbon Plan Proceeding*

HB951 requires the Commission to take "all reasonable steps" to achieve 70% carbon emissions reductions by 2030 and achieve carbon neutrality by 2050.[3] With input from Duke and stakeholders, the Commission is also required to develop a Carbon Plan by December 31, 2022 to meet these mandated emissions reductions by using a least-cost approach.[4] The emissions reductions can be achieved in a variety of ways, including use of renewable energy, so long as the method complies with the least-cost criteria.

II. *Avangrid Renewables is an Experienced Offshore Wind Developer*

Avangrid Renewables is a subsidiary of AVANGRID, Inc ("AVANGRID"). AVANGRID has approximately $40 billion in assets across two primary lines of business – Avangrid Networks and Avangrid Renewables. Avangrid Renewables, among the three largest wind energy generators in the United States, owns and operates more than 8,000 megawatts ("MW") of electricity capacity, primarily through wind and solar power, with a presence in over 20 states across the country. This includes ownership of the only major operating wind project in North Carolina.[5]

AVANGRID's primary shareholder, IBERDROLA S.A., is a global energy leader and top producer of wind power in the world. This relationship allows Avangrid Renewables to benefit from the experience of affiliates, such as ScottishPower Renewable Energy Ltd and Iberdrola Renovables SAS. These affiliates have substantial expertise in

[3] HB951, Part I, Section 1.
[4] HB951, Part I, Section 1(1).
[5] The Commission approved this project's Petition for Certificate to Construct Merchant Plant & Registration as New Renewable Energy Facility in 2011 and the project has been generating electricity since 2017. For further details about the project's approval by the Commission, see Commission Docket No. EMP-49, Sub 0.

offshore and onshore wind development, finance, construction, and operations. Collectively, they own one of the largest offshore wind portfolios in Europe, including nine projects that are already successfully constructed or in advanced development stages, with many more in the pipeline.

Avangrid Renewables, through its Vineyard Wind joint venture, developed and is currently constructing the 800-MW Vineyard Wind 1 project in federal waters off the coast of Massachusetts. The project is expected to reach commercial operation in 2024 and will be the first commercial-scale offshore wind project in the United States. In addition, Avangrid Renewables is the sole owner of two other offshore wind projects off the coast of Massachusetts – the 804-MW Park City Wind and 1,232-MW Commonwealth Wind projects, which have both signed contracts for offtake and are in advanced stages of development.

Kitty Hawk Wind, LLC, a wholly owned subsidiary of Avangrid Renewables, is currently the sole lessee of the 122,405-acre Kitty Hawk lease area (OCS-A 0508), located more than 27 miles from the Outer Banks. Kitty Hawk represents at least 2,500 MW of available offshore wind capacity in the Southeast and has submitted two federal Construction and Operations Plans ("COPs") for the entire lease area to the Bureau of Ocean Energy Management ("BOEM"). BOEM projects that Kitty Hawk will receive all required federal permitting approvals by early 2026, with the potential for one or more projects to reach commercial operation by 2029.

DISCUSSION

I. *Efficient, Cost-Effective Offshore Wind Resources are Critical to North Carolina Achieving the Emissions Reductions Mandated by HB951.*

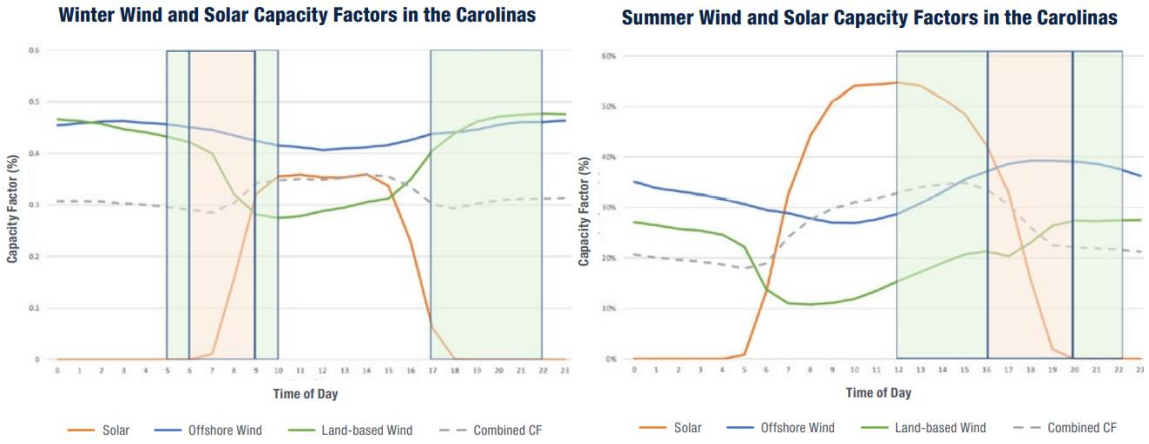
Avangrid Renewables agrees with Duke that "[o]ffshore wind will likely be critical to achieving the interim and long-term emissions reductions targets of HB951,"[6] including the 70% reduction in emissions to be achieved by 2030.[7] Such an emission reduction is a challenging task and will require a diverse mix of clean energy resources, including a robust offshore wind portfolio.

As recognized by Duke, in regions with high penetration of solar energy, such as North Carolina, "[o]ffshore wind can both reduce carbon emissions and increase renewable resource diversity," in part because "[t]he energy profile of offshore wind complements the energy profile of solar for both daily and seasonal generation."[8] As shown in the illustration below, offshore wind can support system capacity needs during times when other generation sources are less able to do so, including winter peak.

[6] Duke Carbon Plan, Appendix J, page 5.

[7] According to Duke, achieving a 70% reduction of carbon dioxide emissions from generation assets located within Duke's Carolinas territories requires a reduction of 18,243,529 short tons of carbon dioxide from current levels and, for carbon neutrality, Duke calculates that its 2021 carbon dioxide emissions totaled 41,003,085 short tons, which indicates that to achieve carbon neutrality Duke will need to reduce its carbon dioxide emissions by that amount. Duke Carbon Plan, Appendix A, pp. 5-8.

[8] Duke Carbon Plan, Appendix J, page 5.



Images Source: "North Carolina Offshore Wind Cost-Benefit Analysis", Southeastern Wind Coalition, January 2022

In addition to a complementary generation profile, offshore wind offers an opportunity to expand renewable energy generation even after the more favorable locations for onshore generation diminish. As the penetration of onshore generation increases, whether it is onshore renewables, such as solar or wind or onshore conventional fuels, it gradually becomes harder to find generation sites with low levels of conflict among competing landowner, abutter, environmental and other stakeholder interests. Offshore wind sites, by contrast, have the unique advantage of having already been through a multi-year de-conflicting process by the federal government and are sited far from where most people live, work, and play.

The economic case for offshore wind is also compelling. As recognized by Duke, "offshore wind is a mature, scalable, and increasingly cost-effective zero-carbon resource."[9] Since 2015, maturing technology, rapidly evolving supply chains, increased competition, and experience from utility-scale installations have driven costs down and broadened the deployment of offshore wind energy infrastructure across the globe, with

[9] Duke Carbon Plan, Appendix J, page 1.

over 200 projects already in operation. As a result, offshore wind's LCOE declined by 28-51% between 2014 and 2020.[10]

Offshore wind development also brings significant economic benefits to local and regional communities.[11] These benefits increase proportionally, sometimes exponentially, relative to offshore wind project volume. This is true both for direct economic benefits – such as direct expenditures, state, and local tax revenues, and short- and long-term jobs – as well as indirect economic benefits. As an example, the Commonwealth Wind project is approximately 50% larger than the Vineyard Wind 1 project and is expected to result in $1.33 billion more in direct expenditures and a 300% increase in direct full-time equivalent job-years.[12] In a study published in 2020, Avangrid Renewables estimated that to develop and construct Kitty Hawk over the next decade and deliver power to Virginia and North Carolina would result in $2 billion of total economic impact (in 2020 US Dollars) and over 1,700 jobs to those states.[13]

From a broader perspective, the nascent domestic offshore wind industry has seen that when states or state entities establish a transparent, accelerated schedule for offshore wind development, it incentivizes significant regional supply chain investment and the relocation of company operations from all over the world to the specific region of interest. For example, as part of developing its recently awarded Commonwealth Wind project, Avangrid Renewables and its partners were able to recruit the first offshore wind industry

[10] Musial, Walt, Beiter, Philipp, Spitsen, Paul, Duffy, Patrick, Marquis, Melinda, Cooperman, Aubryn, Hammond, Robert, Shields, Matt. 2021. Offshore Wind Market Report: 2021 Edition. Washington, D.C.: U.S. Department of Energy Office of Energy Efficiency & Renewable Energy. https://energy.gov/eere/wind/articles/offshore-wind-market-report-2021-edition-released.

[11] Carbon Plan Appendix J; *see also* "Building North Carolina's Offshore Wind Supply Chain", https://files.nc.gov/nccommerce/documents/Policymaker-Reports/Report_North-Carolina-OSW-Supply-Chain-Assessment_BVGAssociates_asPublished-Mar3-2021.pdf

[12] Sourced from Vineyard Wind 1 bid materials; Commonwealth Wind bid materials.

[13] Economic Impact of Kitty Hawk Offshore Wind Report, accessed at www.kittyhawkoffshore.com.

Tier 1 supplier[14] to Massachusetts by committing to a guaranteed project pipeline.[15] The more offshore wind capacity a state commits to procuring – whether through a competitive procurement, like in New England, or in the form of policy and utility resource planning, such as the Commission's Carbon Plan in North Carolina – the more economic benefits a state can anticipate.

II. *Duke's Carbon Plan Proposal Artificially Constrains Offshore Wind to the Detriment of Ratepayers.*

While Duke is wise to include offshore wind in its planning, Duke's Carbon Plan proposal includes offshore wind assumptions that do not represent the full range of offshore wind resources available to North Carolina. Rather than consider the specific attributes of the offshore wind sites in the region, Duke modelled generalized offshore wind inputs and assumptions, and as a result Duke over-estimates the time and costs required for offshore wind deployment.

A. The Duke Carbon Plan Proposal to construct offshore wind capacity in 800-MW phases is inefficient and detrimental to ratepayers.

The Duke Carbon Plan arbitrarily proposes a maximum total deployment of 800-MW or 1,600-MW of offshore wind by 2035, which does not accurately reflect the offshore wind resources that are available to meet HB951's carbon emissions reductions mandate. If fully developed (with no viewshed buffers in place), each of the recently awarded Carolina Long Bay (CLB) lease areas could individually support at least 1,000 MW by 2032 (timeline per the Duke Carbon Plan proposal). Kitty Hawk, by contrast, could support

[14] Tier 1 suppliers are the manufacturers of primary offshore wind project components, such as wind turbine generators, foundations, or cables.

[15] Press Release: https://www.businesswire.com/news/home/20220217005870/en/AVANGRID-Prysmian-Group-Come-Together-to-Bring-First-Offshore-Wind-Manufacturing-Facility-to-Massachusetts.

at least 2,500 MW as early as 2029.[16] With 15 MW turbines becoming the standard in project design envelopes,[17] and 17-20 MW turbines well under development,[18] the construction of an 800-MW fixed-bottom foundation project ready to deploy in 2030 or later would utilize only a portion of the existing lease areas, underutilizing this potential resource and potentially making later development of the remaining portion of the lease area uneconomic.

Phases based on 800 MW are an inefficient approach for offshore wind construction when larger projects are possible. While the initial wave of offshore wind projects procured in the Northeast were approximately 800 MW in capacity, offshore wind developers have increasingly shifted towards larger projects,[19] that are able to leverage economies of scale, newer technologies, and more developed supply chains to achieve lower prices for ratepayers.[20]

In addition to underutilizing available space, the use of 800 MW deployments is inefficient in terms of transmission. Conventional subsea high voltage alternating current ("HVAC") transmission lines can typically carry electricity about 100 km before they become inefficient.[21] The distances from the currently available lease areas to the New Bern point of interconnection ("POI"), which is the POI assumed in calculating

[16] More detail on each lease area fundamentals, including acreage and capacity, can be found in Appendix I. More detail on a potential "viewshed buffer" can be found in Section III and Appendix II.

[17] Orsted's Construction and Operations Plan for Sunrise Wind: https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/SRW01-COP-2021-08-23.pdfs; see also Equinor holds a Preferred Supplier Agreement with Vestas for its Empire Wind project website (https://www.empirewind.com/about/technology/).

[18] RENews Issue 483, July 7, 2022.

[19] https://www.businesswire.com/news/home/20210113005811/en/Equinor-Selected-for-Largest-ever-U.S.-Offshore-Wind-Award; https://www.utilitydive.com/news/new-jersey-approves-27-gw-of-offshore-wind-in-largest-combined-award-in-us/602694/; https://www.renewableenergymagazine.com/wind/avangrid-renewables-commonwealth-wind-joint-venture-selected-20211220.

[20] "The Future of Offshore Wind Is Big—Literally". U.S. Department of Energy Office of Energy Efficiency & Renewable Energy: https://www.energy.gov/eere/wind/articles/future-offshore-wind-big-literally.

[21] https://www.boem.gov/sites/default/files/renewable-energy-program/Studies/TAP/722AA.pdf Pages 6, 9.

transmission costs for all possible offshore wind projects in the Duke Carbon Plan proposal, greatly exceed 100 km and thus require the use of high-voltage direct current ("HVDC") transmission infrastructure to cost-effectively and efficiently deliver power to shore. Additional information about transmission and export cable length comparisons is included in Appendix III.

Currently, HVDC technology can transmit approximately 1,320 MW per 320 kV circuit. Delivering 800 MW via an HVDC line would therefore underutilize the design capacity of HVDC technology, resulting in a highly inefficient and uneconomic use of HVDC technology. Offshore wind projects utilizing HVDC technology generally seek to build close to the HVDC line's maximum capacity to ensure that the fixed cost of the technology can be utilized as economically as possible. Given this inefficiency, Duke's proposal to construct in 800-MW increments would be detrimental to each project's economics and North Carolina ratepayers.

B. <u>The Duke Carbon Plan proposes scenarios that fail to meet the mandated 2030 emissions reduction and does not accurately reflect the offshore wind capacity that can meet the target deadline.</u>

HB951 mandates two emissions reductions: (1) a 70% reduction in CO2 emissions by 2030, and (2) carbon neutrality by 2050. HB951 provides that the Commission can only extend the 2030 target deadline if certain circumstances exist:

> "[T]he Commission shall not exceed the dates specified to achieve the authorized carbon reduction goals by more than two years, except in the event the Commission authorizes construction of a nuclear facility or wind energy facility that would require additional time for completion due to technical, legal, logistical, or other *factors beyond the control of the electric public utility*, or in the event necessary to maintain the adequacy and reliability of the existing grid. In making such determinations, the Utilities Commission shall receive and consider stakeholder input."[22]

[22] HB951, Section 1(4) (emphasis added).

These conditions do not exist, and therefore the Commission and the Carbon Plan should make every effort to meet the 2030 deadline.

Three of the four portfolios proposed by Duke include offshore wind.[23] Yet only Portfolio 1 includes offshore wind as a renewable resource that will contribute to meeting the 2030 mandated emissions reduction – and only 800 MW are considered.[24] Portfolios 2 and 4 provide 1,600 MW and 800 MW from offshore wind by 2032 and 2034, respectively. Portfolio 3 does not consider offshore wind contributing to the 2030 mandated reductions.

There are three (3) federal wind lease areas sited offshore of the Carolinas that can serve to meet HB951's carbon emissions reductions mandate. While all three of these lease areas are essential to meet the mandated carbon neutrality by 2050, only one of these leases – Kitty Hawk – is in the position to help meet the mandated emissions reduction by 2030. While Duke's Carbon Plan proposal acknowledges that Kitty Hawk could support earlier project development due to its advanced development stage,[25] the proposed Execution Plan being considered for approval clearly focuses on advancing the earlier stage CLB lease area(s), including the lease owned by a Duke affiliate. As the Duke Carbon Plan proposal states, the auction and execution of the two CLB leases only recently took place over the last few months, and they likely cannot achieve commercial operations by 2030.[26] Utilization of even a portion of the available Kitty Hawk lease area would enable Duke to meet the 2030 deadline and to leverage a more economical design than the 800 MW propoesd by Duke.

[23] *See* Figure 3-1 in the Duke Carbon Plan Proposal.
[24] See Figure 3-1 and Table 4-1 in the Duke Carbon Plan Proposal
[25] See Appendix P, page 17 and Appendix J, page 6.
[26] Appendix J, pages 7-8.

C. The Duke Carbon Plan proposal does not accurately include the lowest-cost or fastest transmission strategy for near-term build out of offshore wind.

Duke's Carbon Plan proposal assumes that all offshore wind projects included within the plan will interconnect at New Bern and in doing so fails to consider other viable transmission options for offshore wind interconnection. While Avangrid Renewables agrees that New Bern is a robust POI well-suited for offshore interconnection, and that a hub at New Bern with a 500 kV line could support a significant amount of offshore wind capacity, injecting all future offshore wind capacity at New Bern would require exorbitant transmission upgrades to maintain stability. Such costs could artificially inflate the LCOE of future offshore wind projects and thereby reduce the amount of offshore wind included in the Carbon Plan adopted by the Commission. As Duke plans the future grid to allow for the integration of these large-scale renewables resources, it is critical to ensure that the system is both robust and reliable, while remaining fair to ratepayers. Revising the Carbon Plan proposal to consider interconnections at multiple POIs, such as Greenville and Havelock in addition to New Bern, will not only be the most cost-effective approach but will also ensure a robust and reliable system during emergency conditions. Furthermore, Duke's assumptions led to an overestimated timeline required for minimum viable transmission infrastructure upgrades, which Avangrid Renewables experts assess to be within 4-5 years as opposed to 10 years. Additional detail on transmission analysis is included in Appendix III.

III. *Based on Timing, Viability, and Affordability, Kitty Hawk is the Best Offshore Wind Resource to Achieve the 2030 Emissions Reduction.*

	OCS-A 0508 "Kitty Hawk" Avangrid Renewables	**OCS-A 0545 "CLB West" TotalEnergies Renewables USA**	**OCS-A 0546 "CLB East" Duke Energy Renewables Wind**
Acres	122,405	54,937	55,154
Lease Price (2022$)	$11 million	$160 million	$155 million
Est. NCF[A]	43%	36%	36%
Est. Capacity[B]	~2.5 GW	0.6 – 1.3 GW [C]	0.7 – 1.3 GW [C]
Earliest COD	2029	2032	2032

Note A: NCF: Net Capacity Factor
Note B: Assuming 15-MW wind turbine generator power rating[27], ~0.75x1.25 spacing.
Note C: Range due to potential 24-nautical mile viewshed buffer, requested by North Carolina Delegation.[28]

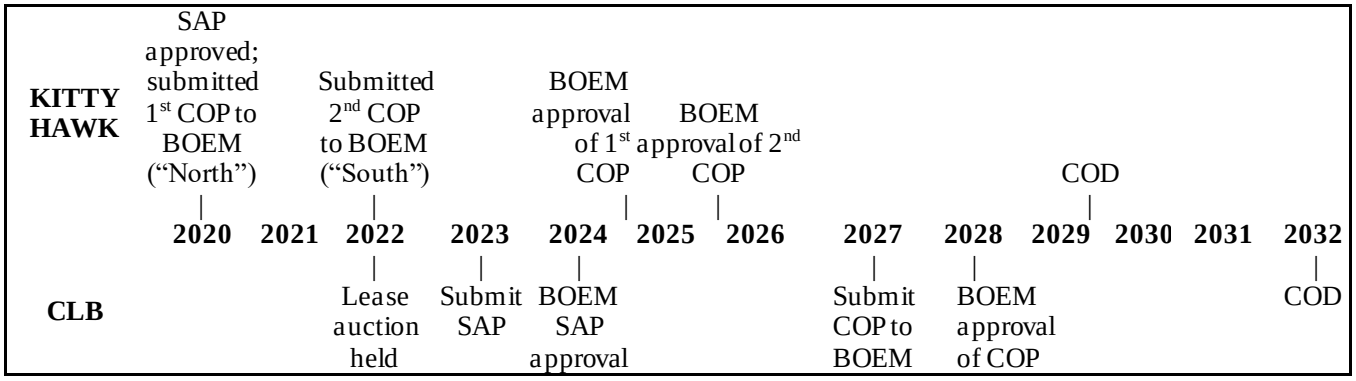
Ratepayers deserve projects that deliver the best, most viable, most efficient project for their investment. Although it was not a part of the Execution Plan for Offshore Wind in Duke's Carbon Plan proposal, Kitty Hawk provides ratepayers these attributes. Not only is Kitty Hawk the only offshore wind site that can help achieve the mandated 2030 emissions reduction, but it is also the most viable and affordable offshore wind source. Duke did not account for any differentiating attributes between Kitty Hawk and the CLB leases in its Carbon Plan proposal.

A. Kitty Hawk is the only wind site that can definitively meet the mandated 2030 emissions reduction deadline.

Kitty Hawk, which makes up approximately half of the total developable acreage leased in federal waters offshore of the Carolinas and is estimated to support at least 2,500

[27] As discussed in the prior section, 15-MW turbines are becoming the new standard, but 17-MW and 20-MW turbines are in advanced stages of development and are already being marketed, meaning these capacity estimates may increase. The number of available turbine positions will remain relatively unchanged, and can be found in Appendix I.
[28] Appendices I and II include additional background on available lease areas' fundamentals and risks (including background on viewshed risk that may lead to a 24-nautical mile buffer requirement).

MW of offshore wind capacity, was acquired by Avangrid Renewables in 2017 and immediately entered development. Kitty Hawk has conducted extensive site surveys of its lease territory, submitted, and received approval of its Site Assessment Plan ("SAP") in 2020, and submitted two COPs to BOEM in 2020 and 2022. On July 30, 2021, BOEM issued a Notice of Intent to Prepare an Environmental Impact Statement ("EIS") for the first of the two phases. BOEM is expected to issue its Record of Decision ("ROD") on the first COP by late 2023,[29] with other cooperating agencies granting the final federal permit approvals by 2025. The second phase is on schedule to receive its ROD and final approvals in 2026. In contrast, the Duke Carbon Plan proposal acknowledges that a COP for the CLB area would likely not be submitted earlier than 2027.[30] As a result, Kitty Hawk is on a much earlier permitting timeline than the CLB leases and could support achievement of HB951's 2030 target.



B. Kitty Hawk is the most viable wind site that can be utilized for the Carbon Plan.

Project viability is a critical concept in vertically integrated markets, such as the Carolinas, where ratepayers inevitably bear more risk for cost and schedule overruns than

[29] Kitty Hawk North Permitting Dashboard: https://www.permits.performance.gov/permitting-project/kitty-hawk-north-wind-project and Kitty Hawk South Permitting Dashboard: https://www.permits.performance.gov/permitting-project/kitty-hawk-south-offshore-wind-project

[30] *See* Duke Carbon Plan Proposal Table 4-9.

in markets in which third-party developers bear that risk. The offshore wind project development lifecycle – at roughly 8-10 years from lease acquisition – is long compared to other asset classes. Throughout that lifecycle, offshore wind developers must overcome many project risks and external factors that can delay, shrink, or even cancel a project entirely. As a project matures, and is de-risked over time, project viability is increased. Kitty Hawk has the advantage of being a more mature project, and as such is currently the most viable offshore wind site for development.

1. Kitty Hawk has significantly lower risks than the CLB offshore wind leases.

As detailed in Appendix II and Appendix III, Kitty Hawk has already been significantly de-risked around major questions like the suitably of seabed conditions, viewshed acceptability, fisheries and public stakeholder relations, and interconnection optionality. Moreover, the CLB lease areas need to strategize to overcome two key risks that Kitty Hawk has already addressed: viewshed and severe weather.

In a letter to BOEM Director Amanda Lefton, the North Carolina Congressional Delegation supported a request previously made by several local agencies within and near Brunswick County to enact a "buffer" such that any offshore wind projects built in the final CLB lease areas be sited at least 24 nautical miles from shore.[31] In response, while BOEM did not implement a full 24-nautical mile buffer, it increased the buffer of the CLB lease areas from 17 miles (as originally proposed) to 20 miles from shore.[32] Thus, viewshed remains an issue of concern for the CLB leases. The CLB leases could face project delays as a result of viewshed issues, and if a 24-nautical mile viewshed barrier is ulimately

[31] The 24-mile buffer advocated by local entities within Brunswick County is based on the 24 nautical mile buffer previously adopted for Kitty Hawk.
[32] One (1) nautical mile is equivalent to approximately 1.15 miles.

imposed, the capacity of the CLB leases may be limited, making it more difficult for a single CLB lease area to meet the full requirements of HB951.

Furthermore, as depicted by NOAA charts in Appendix II, the Kitty Hawk lease area has historically been more protected from the most severe storms (e.g. Category 3 and Category 4 hurricanes) than the CLB lease areas. Due to their position south of key coastal features, the CLB lease areas are more exposed to hurricane paths and are at a more serious risk of severe weather impacts than the Kitty Hawk lease area. Such factors should be considered when evaluating reliability and even LCOE, due to potential differences in technology requirements to withstand such metocean conditions.

2. Kitty Hawk has the lowest LCOE in the region.

LCOE is an important metric because it is used to evaluate the viability of new generation procurement. It measures the project's CapEx, OpEx, and any tax credits over the lifetime energy generation. For the same dollar investment, a more productive project will deliver cheaper renewable offshore MWh to ratepayers. For the same generation, a cheaper project delivers a lower LCOE.

Kitty Hawk has the lowest LCOE in the region due to, among other things, its superior wind speeds, which drive superior NCFs – a bigger denominator in the LCOE calculation. At 165 meter hub height, CLB wind speeds are roughly 8.6 m/s, where Kitty Hawk average wind speed is approximately 9.4m/s. Avangrid Renewables estimates that this yields a 36% NCF for CLB lease areas versus a 43% NCF for the Kitty Hawk lease area. This delta represents well north of a $10/MWh to $15/MWh difference in LCOE, depending on the discount rate. Kitty Hawk's superior CapEx also drives a lower LCOE. Its lower CapEx has one primary driver: lower lease cost – over 14 times less than the cheapest CLB lease area. Additionally, depending on the Carbon Plan's final offshore wind

requirements, Kitty Hawk can leverage its larger size, either by developing multiple projects in the zone simultaneously or by serving the Carbon Plan with a single large project. Kitty Hawk can leverage economies of scale through volume discounts, shared mobilizations and demobilizations, and shared fixed costs, while smaller lease areas cannot.[33]

C. HB951 is not a barrier to the Commission including Kitty Hawk and other offshore wind lease areas in the Carbon Plan.

HB951's ownership requirements should not prevent the Commission from taking Kitty Hawk into account in the Carbon Plan. Duke and Avangrid Renewables are sophisticated parties and have a range of options available to develop and deliver one or more phases of Kitty Hawk in a way that satisfies the requirements of HB951. Currently, none of the three offshore lease areas are owned by Duke's regulated North Carolina utilities.[34] Each of the current offshore leaseholders - Duke Energy Renewables Wind, LLC, TotalEnergies Renewables USA, LLC, and Avangrid Renewables - must take HB951's ownership requirements into account when planning for delivery of electric generation to the regulated Duke utilities.

RECOMMENDATIONS

Given the identified shortcomings with Duke's Carbon Plan proposal, and the tremendous benefits that offshore wind resources could provide to North Carolina, Avangrid Renewables recommends that the Commission take the following steps:

[33] In terms of *cost*, the lease price in 2022 dollars is $11 million for Kitty Hawk Wind (Avangrid Renewables) compared to $160 million for OCS-A 0545 (Total Energies) and $155 million for OCS-A 0546 (Duke Energy Renewables Wind). In terms of *sizing*, Kitty Hawk is 55% larger than each CLB lease area by acreage – much more, if the area inside the 24-nautical mile ("nm") buffer is discounted.

[34] https://www.doi.gov/pressreleases/biden-harris-administration-announces-winners-carolina-long-bay-offshore-wind-energy.

1. Require an independent, objective third party study to evaluate and prioritize each wind lease offshore of the Carolinas and determine the best pathway to incorporate offshore wind generation resources into Duke's planning portfolio.

2. Require that such study consider LCOE, viability, schedule, size and overall plan, along with any other Commission-determined metrics, in making its recommendations for achieving the Carbon Plan's goals.

3. Provide for stakeholder input, regular reports to the Commission about the status of the study, the filing of the comprehensive study (including transparent data and modelling inputs and assumptions) by June 30, 2023, and, upon filing of the study, the opportunity for intervenors to file comments responsive to the study.

4. Upon filing of the study, the completion of the comment period, and any further actions that the Commission deems fit, the Commission should require that Duke select offshore wind resource additions in a prioritized order, beginning with the project with the best overall combination of reliability, schedule, and cost.

5. Avangrid Renewables believes the issues identified above regarding the Duke Carbon Plan and the recommendations made herein about how to correct those issues merit consideration at an expert witness hearing.

Alternatively, should the Commission deem any of the above steps unnecessary or inappropriate, Avangrid Renewables would request that, at a minimum, the Carbon Plan be modified to address the shortcomings identified in these limited comments, with an emphasis on offshore wind resource reliability, schedule, and cost. All of these metrics bolster the requirements of HB951 and Chapter 62 of the North Carolina General Statutes, generally, and the failure to assess and prioritize offshore wind projects in such a manner would be counter to applicable law and ratepayer interest.

CONCLUSION

The Commission should issue a Carbon Plan that achieves the best interests of North Carolina ratepayers. The Duke Carbon Plan proposal includes project capacities and delivery timelines that do not accurately reflect the availability and value of offshore wind resources for North Carolina. Duke's implied reliance on generic wind areas, which happen to match one of the recently awarded CLB lease areas, may preclude the Commission from meeting HB951's requirements, including the mandated 2030 interim date, and is detrimental to ratepayers as it does not meet the "least cost" criteria. To best meet the needs of ratepayers, the Commission should more thoroughly evaluate the metrics of offshore resources in the region – including delivery timeline, cost effectiveness, and project viability – and consider appointing an independent evaluator to assess these factors.

For the reasons set forth herein, Avangrid Renewables requests the Commission enter a Carbon Plan order that incorporates the Recommendations set forth above and for any such other and further relief as the Commission deems just and necessary.

This 15th day of July, 2022.

/s/ Benjamin W. Smith
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CERTIFICATE OF SERVICE

I, Benjamin W. Smith, certify that on this date I served the foregoing document upon all parties of record by hand delivery, electronic mail and/or depositing a copy thereof in the United States mail, postage prepaid and addressed.

This 15th day of July, 2022.

/s/ Benjamin W. Smith
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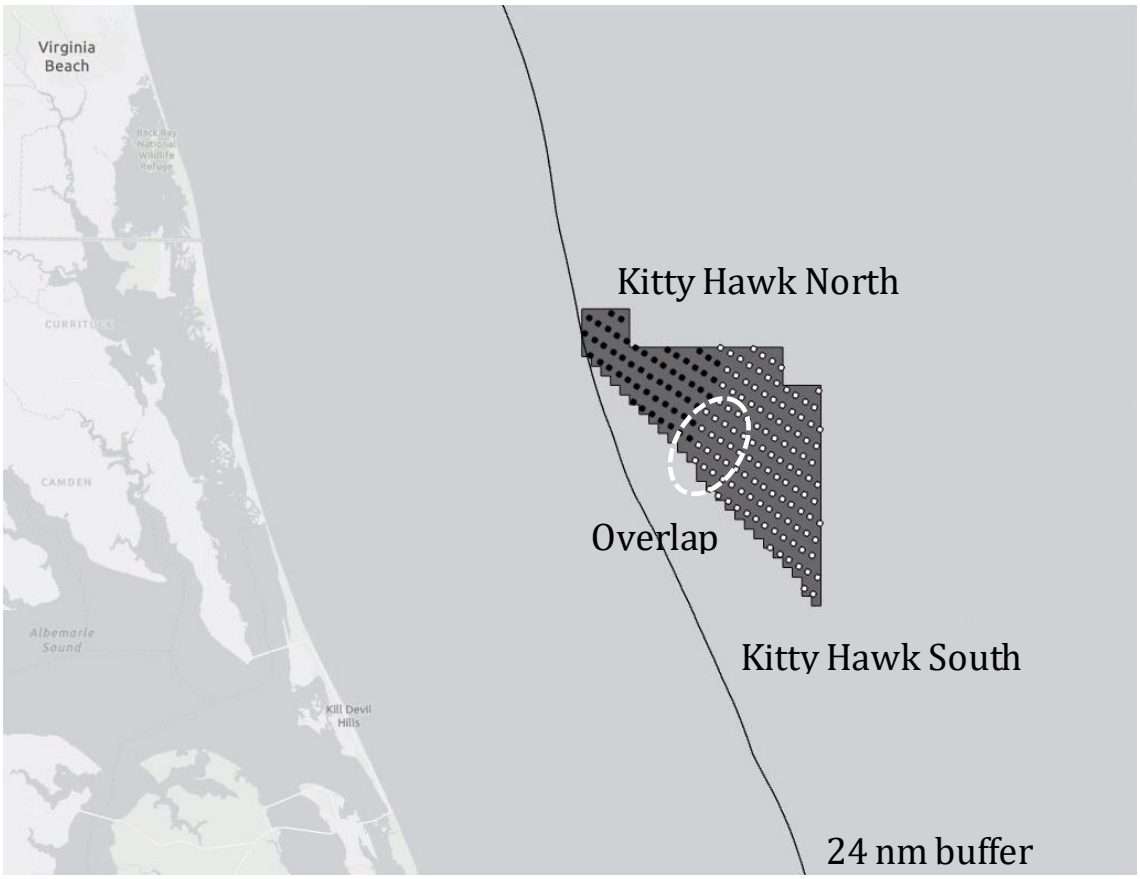
Appendix I: Fundamentals for Federal Offshore Wind Leases Off Carolinas

Kitty Hawk Wind Lease OCS-A 0508

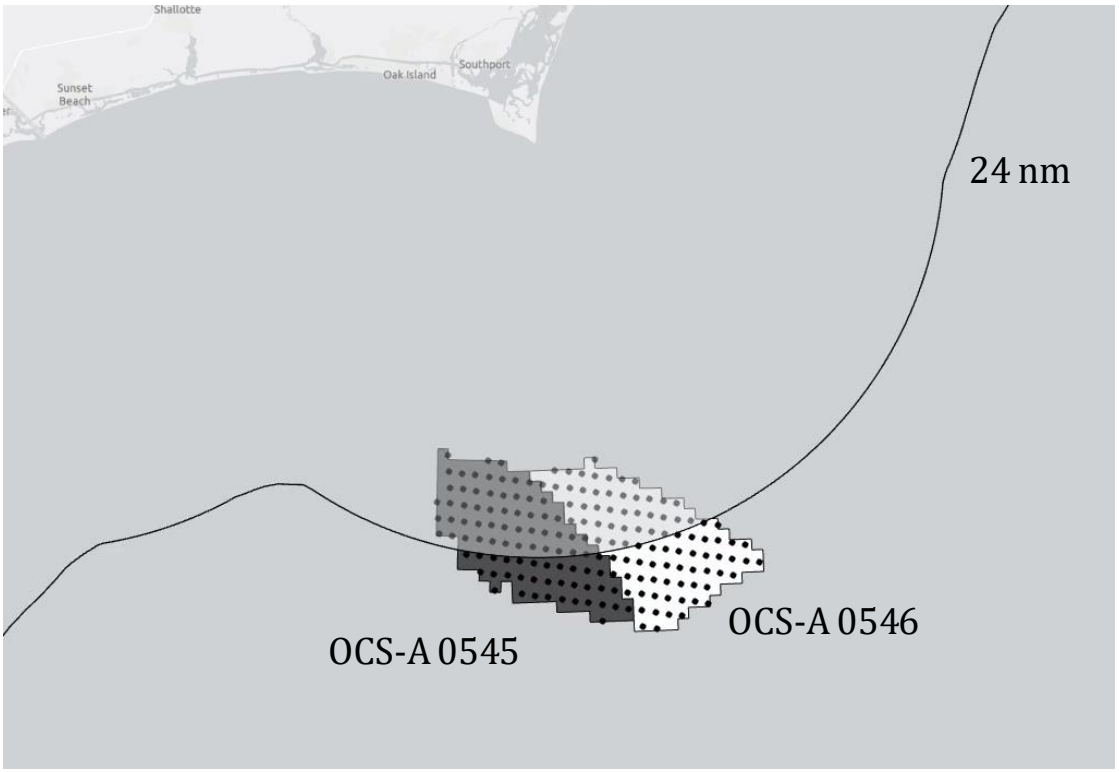


TOTAL ACRES	122,405
DISTANCE TO SHORE	24 nm
# OF WTG* POSITIONS	175 WTG positions (10 overlap)
# OF WTG POSITIONS PAST 24 NM	175
AVG. WIND SPEED	~9.4 m/s
AVG. DEPTH	35 m
EST. NCF	43%
FEDERAL PERMITTING MILESTONES**	
SITE ASSESSMENT PLAN SUBMITTED	2019
SITE ASSESSMENT PLAN APPROVED	2020
COP SUBMITTED	(1) Dec 2020; (2) Apr 2022
NOI ISSUED	(1) Jul 2021; (2) Oct 2022
ROD ISSUED	(1) Aug 2023; (2) Oct 2025
COP APPROVED	(1) Nov 2023; (2) Jan 2023

*Wind Turbine Generator or "WTG"

**Kitty Hawk North (1) Future dates are expected, based on Federal Permitting Improvement Steering Council (FPISC) permitting dashboard accessed 7/14/2022.

Carolina Long Bay Leases OCS-A 0545 & OCS-A 0546



	OCS-A 0545	OCS-A 0546
TOTAL ACRES	54,937	55,154
DISTANCE TO SHORE	16 nm	16 nm
# OF WTG POSITIONS	86	89
# OF WTG POSITIONS PAST 24 NM	37	46
AVG. WIND SPEED	8.6 m/s	8.6 m/s
AVG. DEPTH	27 m	27 m
EST. NCF	36%	36%

Appendix II: Risk Assessment for Federal Offshore Wind Leases Off Carolinas

In Appendix II, Avangrid Renewables highlights two existential risks that the Carolina Long Bay lease areas face, which Kittyhawk does not: first, viewshed concems at the local, state, and federal levels for turbines placed within 24 nautical miles of shore; and second, high frequency of hurricanes for which current wind turbine technology is not engineered and rated to endure.

APPENDIX II-A: North Carolina Delegation letter to BOEM on Viewshed Risk of Wind Energy Areas Preceding CLB Leases

Congress of the United States
Washington, DC 20515

January 7, 2022

Director Amanda Lefton
Bureau of Ocean Energy Management
1849 C St. NW
Washington, D.C. 20240

Dear Director Lefton,

The state of North Carolina is a leader in renewable energy production, and we understand the positive benefits offshore wind energy production could bring to our state. However, with the development of any new energy asset, it is paramount that surrounding communities support and see the benefits of the proposed project. Today, we write to reiterate the concerns of our constituents regarding the Bureau of Ocean Energy Management (BOEM) plans to develop the Wilmington East and Wilmington West wind energy areas (WEA) off North Carolina's coast.

It is our desire to ensure that any development of wind energy in these areas be treated similar to the Kitty Hawk WEA, which will have no turbines constructed any closer than 24 nautical miles (nm) from shore and no closer than 33.7 nm from the closest historic lighthouse, Bodie Island Lighthouse.

We respectfully request the same consideration be given to the Wilmington East and Wilmington West WEAs. As you know, the Wilmington East and Wilmington West WEAs are only about 10-15 nm from shore, and only slightly farther from the Bald Head Island Lighthouse, "Old Baldy," which is the oldest freestanding lighthouse in North Carolina and sits adjacent to Bald Head Island's shore.

Several local communities have passed resolutions opposing wind turbines within 24 nm from shore. These communities include: the Village of Bald Head Island; the Town of Kure Beach; the Town of Caswell Beach; the Town of Ocean Isle Beach; and the Town of Sunset Beach.

It is important for the communities surrounding these offshore wind installations to be supportive of this production, which would open new potential revenues for local governments and energy development for years to come. Viewshed concerns need to be addressed sooner rather than later to ensure that all stakeholders are comfortable moving forward.

We look forward to continuing to work with BOEM to harness the benefits of offshore wind energy development for our state, and to ensure our constituents' concerns are addressed.

Sincerely,

Sen. Richard Burr
U.S. Senator

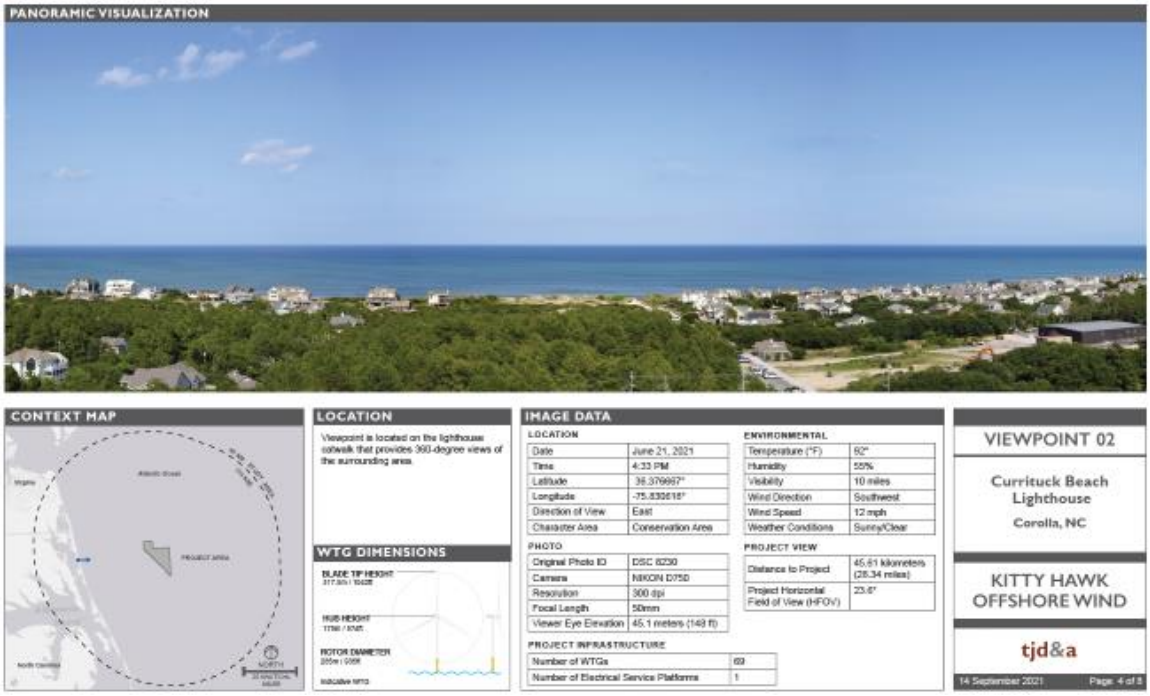
Sen. Thom Tillis
U.S. Senator

Rep. David Rouzer
Member of Congress

Rep. Gregory F. Murphy, M.D.
Member of Congress

APPENDIX II-B: Viewshed Simulations

Simulated Visual Impacts from Kitty Hawk Wind as seen from Currituck Beach Lighthouse (Source: Avangrid Renewables, Kitty Hawk Public Meeting, March 2022)



APPENDIX II-C: Bald Head Island Resolution

VILLAGE OF BALD HEAD ISLAND RESOLUTION IN OPPOSITION TO ISSUANCE OF WIND ENERGY LEASES WITHIN 24 NAUTICAL MILES OF NORTH CAROLINA'S SHORES

WHEREAS; the Village of Bald Head Island is specially positioned as a remote and picturesque community where tourists and residents can enjoy beautiful, natural, scenic vistas and significant cultural and historical resources, including Old Baldy (North Carolina's oldest standing lighthouse). Fort Holmes, Frying Pan Shoals and numerous shipwrecks and artifacts comprising the Graveyard of the Atlantic.

WHEREAS; the natural coastal beauty of our viewshed is an essential driver of our economy.

WHEREAS; we are deeply committed to and will fight for protection of our viewshed.

WHEREAS; the onshore visual impact of wind energy turbines is overwhelmingly determined by a single causal factor, distance of wind turbines from shore.

WHEREAS; wind turbines located within the Bald Head Island viewshed would transform ourcommunity's natural and historic vista of open ocean to a view of massive industrial machinery.

WHEREAS; such a change would represent for us the most destructive commitment of ocean resources that we have ever heard proposed in North Carolina - one that could irreversibly damage the natural environment and resources that we cherish and that drive our economy.

WHEREAS; BOEM knows that wind turbines will have adverse visual impacts if located within 24 nautical miles from shore. BOEM, based on the 33.7 nautical mile buffer BOEM established for Bodie Island Lighthouse, demonstrates that BOEM knows how to calculate the distance to protect Old Baldy (listed in the National Park Service's National Register of Historic Places as Bald Head Island Lighthouse. National Register Information System ID 75001242) from adverse visual impacts.

WHEREAS; BOEM has established a 24 nautical mile no-leasing buffer for the State of Virginia to protect viewsheds. BOEM has established a 24 nautical mile no-leasing buffer for theKitty Hawk WEA to protect viewsheds, and BOEM has established a 33.7 nautical mile no- leasing buffer to protect the Bodie Island Lighthouse.

NOW, THEREFORE, BE IT RESOLVED; the Village of Bald Head Island respectfully requests that BOEM restrict leasing and approval of site assessment plans in the Wilmington East WEA and Wilmington West WEA to exclude locations within 24 nautical miles of Bald Head Island and

locations where wind turbines would be visible from Bald Head [stand Lighthouse ("Visual Impact Exclusion Area");

APPENDIX II-D: Severe Weather Risk Assessment

Due to differences in coastal features, the Carolina Long Bay lease areas are more exposed to hurricane paths and are at a more serious risk of severe weather impacts than the Kitty Hawk Wind lease area, which historically has been protected from the most severe storms.

Avangrid Renewables' analysis, based on NOAA data, shows that Kitty Hawk has a Category 3 storm every 56.7 years, whereas the Carolina Long Bay (shown below as Wilmington East area) has a Category 3+ storm every 28.3 years.

Kitty Hawk Offshore Wind							
Category	**1**	**2**	**3**	**4**	**5**	**Overall**	**3 & 4**
#Storms	15	10	3	0	0	28	3
Return Period (yr)	11.3	17.0	56.7	-	-	6.1	56.7

Wilmington East Wind Energy Area							
Category	**1**	**2**	**3**	**4**	**5**	**Overall**	**3 & 4**
#Storms	17	8	3	3	0	31	6
Return Period (yr)	10	21.3	56.7	56.7	-	5.5	28.3

NOAA: Previous Storm Paths Crosscutting Kitty Hawk

CATEGORY 1

Hurricane List

Search Filter Criteria

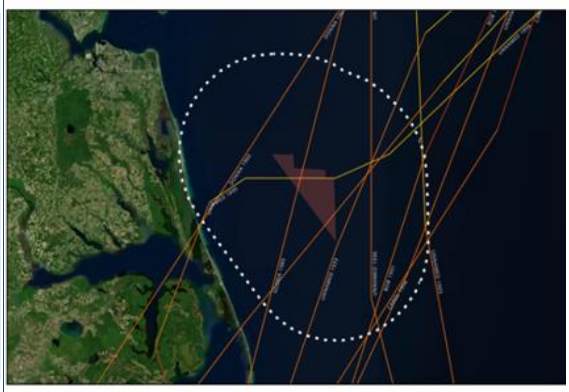
Location: Custom Polygon

Categories: H1
Months: ALL
Years: ALL
El Niño-Southern Oscillation (ENSO): ALL
Minimum Pressure (mb) below: 1150
Include Unknown Pressure Rating: TRUE
Buffer Distance: 25
Buffer Unit: Nautical Miles

STORM NAME	DATE RANGE	MAX WIND SPEED	MIN PRESSURE	MAX CATEGORY
IRENE 2011	Aug 21, 2011 to Aug 30, 2011	105	942	H3
BONNIE 1998	Aug 19, 1998 to Aug 31, 1998	100	954	H3
CHARLEY 1986	Aug 13, 1986 to Aug 30, 1986	70	980	H1
IONE 1955	Sep 10, 1955 to Sep 27, 1955	120	938	H4
BARBARA 1953	Aug 11, 1953 to Aug 16, 1953	80	973	H1
UNNAMED 1945	Jun 20, 1945 to Jul 04, 1945	85	-1	H2
UNNAMED 1934	Sep 05, 1934 to Sep 10, 1934	90	-1	H2
UNNAMED 1908	May 24, 1908 to May 31, 1908	65	989	H1
UNNAMED 1903	Sep 12, 1903 to Sep 17, 1903	85	990	H2
UNNAMED 1901	Jul 04, 1901 to Jul 13, 1901	70	-1	H1
UNNAMED 1899	Aug 03, 1899 to Sep 04, 1899	130	930	H4
UNNAMED 1894	Sep 18, 1894 to Oct 01, 1894	105	985	H3
UNNAMED 1885	Aug 21, 1885 to Aug 28, 1885	90	958	H2
UNNAMED 1880	Sep 06, 1880 to Sep 11, 1880	70	987	H1
UNNAMED 1861	Nov 01, 1861 to Nov 03, 1861	70	999	H1

CATEGORY 2

Hurricane List



Search Filter Criteria

Location: Custom Polygon

Categories: H2
Months: ALL
Years: ALL
El Niño-Southern Oscillation (ENSO): ALL
Minimum Pressure (mb) below: 1150
Include Unknown Pressure Rating: TRUE
Buffer Distance: 25
Buffer Unit: Nautical Miles

STORM NAME	DATE RANGE	MAX WIND SPEED	MIN PRESSURE	MAX CATEGORY
ARTHUR 2014	Jun 28, 2014 to Jul 09, 2014	85	972	H2
BOB 1991	Aug 16, 1991 to Aug 29, 1991	100	950	H3
GLORIA 1985	Sep 16, 1985 to Oct 02, 1985	125	920	H4
DONNA 1960	Aug 29, 1960 to Sep 14, 1960	125	930	H4
CAROL 1954	Aug 25, 1954 to Sep 01, 1954	100	955	H3
UNNAMED 1936	Sep 08, 1936 to Sep 25, 1936	105	962	H3
UNNAMED 1933	Sep 08, 1933 to Sep 22, 1933	120	952	H4
UNNAMED 1903	Sep 12, 1903 to Sep 17, 1903	85	990	H2
UNNAMED 1899	Aug 03, 1899 to Sep 04, 1899	130	930	H4
UNNAMED 1858	Sep 14, 1858 to Sep 17, 1858	90	979	H2

CATEGORY 3

Hurricane List

Search Filter Criteria

Location: Custom Polygon

Categories: H3
Months: ALL
Years: ALL
El Niño-Southern Oscillation (ENSO): ALL
Minimum Pressure (mb) below: 1150
Include Unknown Pressure Rating: TRUE
Buffer Distance: 25
Buffer Unit: Nautical Miles

STORM NAME	DATE RANGE	MAX WIND SPEED	MIN PRESSURE	MAX CATEGORY
EMILY 1993	Aug 22, 1993 to Sep 06, 1993	100	960	H3
UNNAMED 1944	Sep 09, 1944 to Sep 16, 1944	125	940	H4
UNNAMED 1879	Aug 13, 1879 to Aug 20, 1879	100	971	H3

CATEGORY 4+

Hurricane List

Search Filter Criteria

Location: Custom Polygon

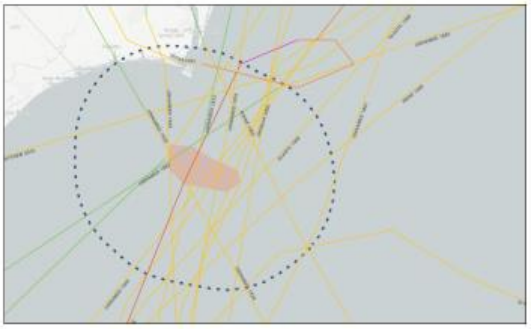
Categories: H5, H4
Months: ALL
Years: ALL
El Niño-Southern Oscillation (ENSO): ALL
Minimum Pressure (mb) below: 1150
Include Unknown Pressure Rating: TRUE
Buffer Distance: 25
Buffer Unit: Nautical Miles

STORM NAME	DATE RANGE	MAX WIND SPEED	MIN PRESSURE	MAX CATEGORY

NOAA: Previous Storm Paths Crosscutting Carolina Long Bay Wind Lease Area

CATEGORY 1

Hurricane List



Search Filter Criteria

Location: Custom Polygon

Categories: H1
Months: ALL
Years: ALL
El Niño-Southern Oscillation (ENSO): ALL
Minimum Pressure (mb) below: 1150
Include Unknown Pressure Rating: TRUE
Buffer Distance: 25
Buffer Unit: Nautical Miles

STORM NAME	DATE RANGE	MAX WIND SPEED	MIN PRESSURE	MAX CATEGORY
MATTHEW 2016	Sep 28, 2016 to Oct 10, 2016	145	934	H5
ARTHUR 2014	Jun 28, 2014 to Jul 09, 2014	85	972	H2
OPHELIA 2005	Sep 06, 2005 to Sep 23, 2005	75	976	H1
IRENE 1999	Oct 12, 1999 to Oct 19, 1999	95	958	H2
GLADYS 1968	Oct 13, 1968 to Oct 21, 1968	75	965	H1
GINNY 1963	Oct 17, 1963 to Oct 30, 1963	95	948	H2
DIANE 1955	Aug 07, 1955 to Aug 23, 1955	90	969	H2
UNNAMED 1945	Jun 20, 1945 to Jul 04, 1945	85	-1	H2
UNNAMED 1944	Jul 30, 1944 to Aug 04, 1944	70	985	H1
UNNAMED 1920	Sep 19, 1920 to Sep 24, 1920	75	-1	H1
UNNAMED 1908	Jul 24, 1908 to Aug 03, 1908	70	-1	H1
UNNAMED 1882	Oct 05, 1882 to Oct 15, 1882	120	-1	H4
UNNAMED 1880	Sep 06, 1880 to Sep 11, 1880	70	987	H1
UNNAMED 1876	Sep 12, 1876 to Sep 19, 1876	100	980	H3
UNNAMED 1872	Oct 22, 1872 to Oct 28, 1872	70	-1	H1
UNNAMED 1861	Nov 01, 1861 to Nov 03, 1861	70	999	H1
UNNAMED 1861	Sep 27, 1861 to Sep 28, 1861	70	-1	H1

CATEGORY 2

Hurricane List

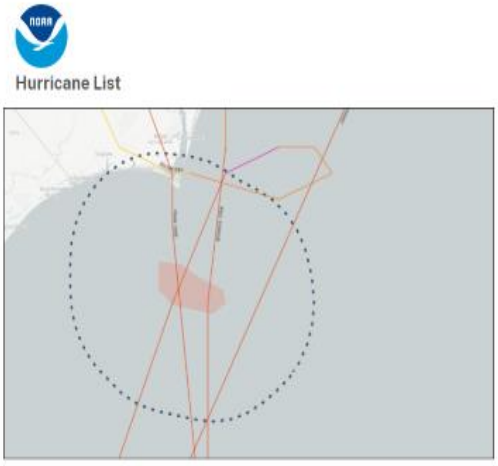
Search Filter Criteria

Location: Custom Polygon

Categories: H2
Months: ALL
Years: ALL
El Niño-Southern Oscillation (ENSO): ALL
Minimum Pressure (mb) below: 1150
Include Unknown Pressure Rating: TRUE
Buffer Distance: 25
Buffer Unit: Nautical Miles

STORM NAME	DATE RANGE	MAX WIND SPEED	MIN PRESSURE	MAX CATEGORY
DORIAN 2019	Aug 24, 2019 to Sep 09, 2019	160	910	H5
FLOYD 1999	Sep 07, 1999 to Sep 19, 1999	135	921	H4
BERTHA 1996	Jul 05, 1996 to Jul 17, 1996	100	960	H3
DONNA 1960	Aug 29, 1960 to Sep 14, 1960	125	930	H4
UNNAMED 1883	Sep 04, 1883 to Sep 13, 1883	110	-1	H3
UNNAMED 1881	Sep 07, 1881 to Sep 11, 1881	90	975	H2
UNNAMED 1878	Oct 18, 1878 to Oct 25, 1878	90	963	H2
UNNAMED 1857	Sep 06, 1857 to Sep 18, 1857	90	961	H2

CATEGORY 3



Hurricane List

Search Filter Criteria

Location: Custom Polygon

Categories: H3
Months: ALL
Years: ALL
El Niño-Southern Oscillation (ENSO): ALL
Minimum Pressure (mb) below: 1150
Include Unknown Pressure Rating: TRUE
Buffer Distance: 25
Buffer Unit: Nautical Miles

STORM NAME	DATE RANGE	MAX WIND SPEED	MIN PRESSURE	MAX CATEGORY
BONNIE 1998	Aug 19, 1998 to Aug 31, 1998	100	954	H3
FRAN 1996	Aug 23, 1996 to Sep 10, 1996	105	946	H3
UNNAMED 1879	Aug 13, 1879 to Aug 20, 1879	100	971	H3

CATEGORY 4+

Hurricane List

Search Filter Criteria

Location: Custom Polygon

Categories: H5, H4
Months: ALL
Years: ALL
El Niño-Southern Oscillation (ENSO): ALL
Minimum Pressure (mb) below: 1150
Include Unknown Pressure Rating: TRUE
Buffer Distance: 30
Buffer Unit: Nautical Miles

STORM NAME	DATE RANGE	MAX WIND SPEED	MIN PRESSURE	MAX CATEGORY
DIANA 1984	Sep 08, 1984 to Sep 16, 1984	115	949	H4
HELENE 1958	Sep 21, 1958 to Oct 04, 1958	130	930	H4
HAZEL 1954	Oct 05, 1954 to Oct 18, 1954	115	938	H4

Appendix III: Transmission

While Avangrid Renewables agrees that New Bern is a robust POI well-suited for offshore interconnection, it is not the only POI that can support offshore wind's transmission requirements, nor is a massive multi-project hub is only one possible approach to transmission planning.

To inject all regional offshore wind generation capacity at New Bern, as Duke proposes, would require extremely high transmission upgrades to maintain stability. The costs may well exceed the estimates provided in Appendix P of the Carbon Plan. Avangrid Renewables is concerned that this option may prove overbuilt for near-term needs and is too expensive to approve. If the fate of Offshore Wind in the Carbon Plan is tied to the fate of this ambitious regional hub, it would put offshore wind resources at undue risk of not being included in the final portfolio adopted. As the Commission plans the grid of the future to allow for the integration of these large-scale renewables resources, it is critical to ensure that the system is both robust and reliable, while remaining fair to ratepayers. **Allowing for multiple interconnections at multiple POIs, such as Greenville, Havelock, and New Bern, for single-project interconnections is not only cost-effective but will also ensure a robust and reliable system during emergency conditions.**

In late 2021, Avangrid Renewables commissioned an Independent Consultant to perform offshore wind injection studies to assess the feasibility of interconnecting capacity at different POIs on Duke's transmission network. The Independent Consultant's studies included steady-state thermal transfer analysis as well as short circuit and voltage stability sensitivity analyses. The third-party analysis ultimately identified transmission options to inject offshore wind into the system at a lower cost than a large-scale build at New Bern. Furthermore, the studies determined that the POIs in the Wilmington vicinity, along the

Southern coast of North Carolina, are heavily constrained and that the POIs nearer to New Bern can support more offshore wind capacity with fewer upgrades required. The studies – when combined with supplementary internal analysis of potential interconnection routing options from both the Carolina Long Bay and Kitty Hawk lease areas – can be used for planning purposes and to compare fundamentals and cost estimates between different resources.

Figure III-1. Substation Map (Northern & Central North Carolina Coast)

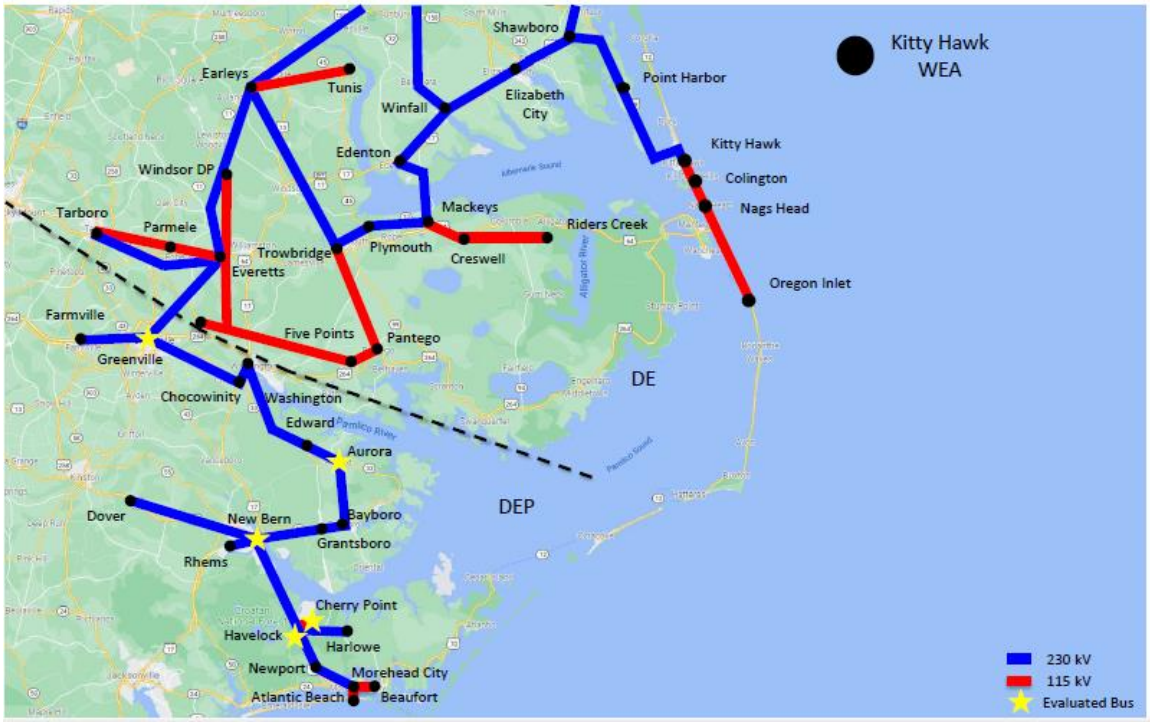
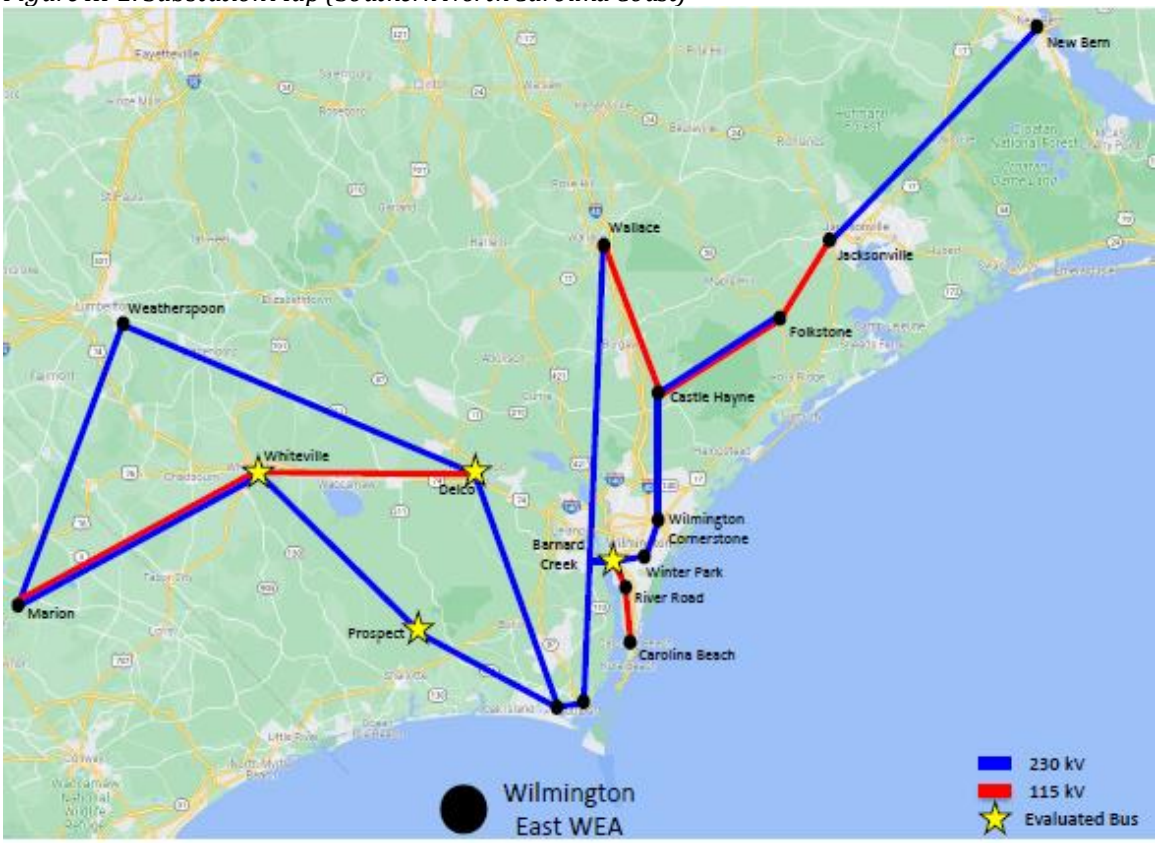


Figure III-2. Substation Map (Southern North Carolina Coast)



Summary of Recommended Injections and Upgrade Costs

Table III-1. Summary of Independent Consultant's Injection Study

POI	Recommended Injection (MW)	Network Upgrade Indicative Cost ($)	System Strength
Greenville 230 kV	1,400	$550m	1. Meets reliability 2. Stability issues with > 1,400 MW injection
New Bern 230 kV	1,200	$400m	1. Meets reliability 2. Stability issues with > 1,200 MW injection
Havelock 230 kV	1,100	$420m	1. Meets reliability 2. Stability issues with > 1,100 MW injection

The Independent Consultant's analysis concluded that, in addition to New Bern, several other POIs would be strong candidates for offshore wind interconnection. Multiple POIs were initially evaluated for thermal injection, and a short list advanced through short circuit and voltage stability sensitivity analyses for size optimization and upgrade costs

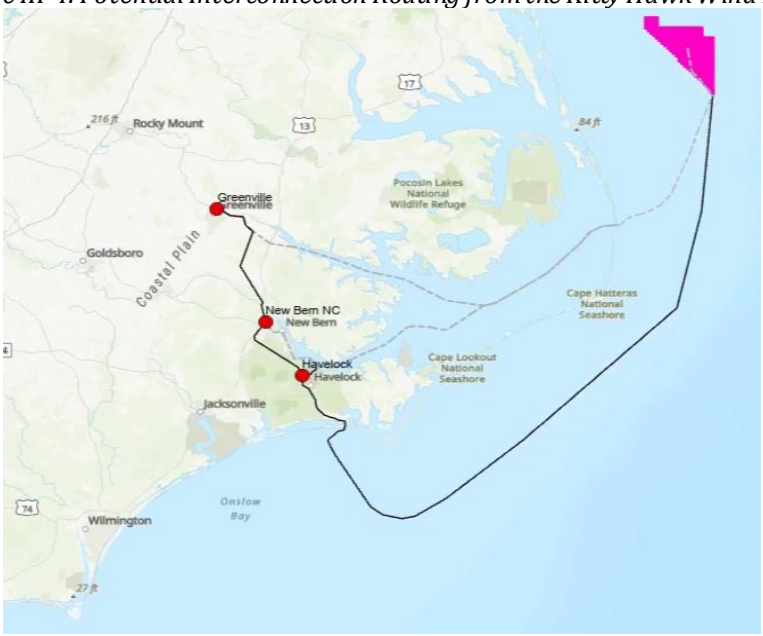
estimation. Three options were deemed top choices – New Bern 230 kV, Greenville 230 kV and Havelock 230 kV. A high-level summary of the Independent Consultant's recommended injection capacities and associated upgrade costs are shown below. **Based on the Independent Consultant's study and Avangrid Renewables' own internal analysis, we recommend that the Carbon Plan be amended to accommodate interconnections at Greenville and Havelock locations in addition to New Bern.**

Interconnection Routing Options

Figures III-3 and III-4 show the CLB leases and the Kitty Hawk Wind lease, respectively, relative to the New Bern, Greenville, and Havelock POIs.

Figure III-3. Potential Interconnection Routing from Either Carolina Long Bay Lease

Figure III-4. Potential Interconnection Routing from the Kitty Hawk Wind Lease



As summarized in Table III-2, Avangrid Renewables' GIS analysis estimates that each lease area is located over 200 km from any of the three favored injection points. Industry studies estimate the break-even distance (i.e. the distance at which HVDC becomes more economical than HVAC) is approximately 50 km for subsea cables, though the technical limit is higher[35]; at the calculated distances HVAC export cables would incur extraordinary transmission losses, making HVDC the clear winner on efficiency and cost effectiveness for injections to the favored points.

Table III-2. Summary of Cable Route Lengths

POI	Cable Route Length to Kitty Hawk (km)	Est. Cable Route Length to a CLB Lease (km)
Greenville 230 kV	277	315
New Bern 230 kV	266	248
Havelock 230 kV	241	210

[35] Ryndzionek, Roland & Sienkiewicz, Łukasz. (2020). Evolution of the HVDC Link Connecting Offshore Wind Farms to Onshore Power Systems. Energies. 13. 1914. 10.3390/en13081914.