Final Technical Report

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Executive Summary

The public outreach and education efforts of the Wind Powering America (WPA) program are critical to meeting utility-scale wind build-out goals such as the Department of Energy's *20% Wind by 2030* scenario. WPA programs seek to improve citizens' and policy makers' understanding and perception of wind energy technology through outreach activities including workshops tailored to local government officials, farmers, land owners, and the public at-large. The key element of the WPA outreach strategy is to disseminate factual information, to spur discussion, and to answer questions about wind energy technology in advance of wind development proposals that might arise in a particular region. It is in this spirit that the *Wind Powering America: The Next Steps in North Carolina* project has worked to inform and educate stakeholders in North Carolina.

Through the following tasks, the project team worked to expand the North Carolina WPA program's ability to tackle barriers to significant utility-scale wind development:

1. Convene Utility Interest Group of the NC WWG

The project team proposed to build on the work coordinating the North Carolina Wind Working Group (WWG) by enhancing regional, state, and local outreach to and collaboration with electric utilities and other stakeholders. To this end the project team planned to establish a Utility Interest Group (UIG), to serve as a forum for dedicated collaboration between North Carolina and southeastern electric utilities and the NC WWG. Due to a lack of resources for stakeholder groups to travel and engage in the UIG, it was determined that the goals of this task would be accomplished through meetings with and presentations to groups already engaged in utility issues. As a part of this task, the project team gave presentations on utility issues; engaged with utility and transmission focused groups; and facilitated regional discussions and partnerships to advance the wind industry.

2. Perform education and outreach to state government officials

The activities under Task 2 were proposed as an effort surrounding wind permitting legislation that was being investigated at the time. It was expected that during the General Assembly's consideration of wind permitting, and in the months and years that follow the enactment of such a permitting regime, there would be a need to provide information to government officials. For this task, the project team focused on outreach to legislators, participated in the NC Energy Policy Council and provided educational opportunities for industry and the public.

3. Expand education and outreach to local decision makers

The NC WWG created a model wind ordinance for North Carolina in 2008. The project team proposed to build on that effort by undertaking additional outreach to promote the model ordinance to counties in the state. Outreach efforts under this task reached all counties within the state and over 25 counties received direct assistance, phone contact or in-person contact from the project team. The online "Guide to Wind Energy in North Carolina" was created as part of this task, to provide an overview of issues surrounding wind development in the state.

4. Develop and conduct a transmission infrastructure outreach campaign.

The activities under Task 4 were designed to educate the public of North Carolina about the transmission infrastructure that will be necessary to allow the development of a significant portion of North Carolina's wind resources - for example the 12+ GW nameplate capacity proposed in the DOE 20% Wind by 2030 scenario. The goal of this campaign is to provide the public with fact-based information regarding the benefits and costs - including environmental impacts - that would accompany such transmission

infrastructure development. The project team held workshops covering utility and transmission issues in several coastal locations and prepared a website as an additional source of information for stakeholders.

Over the course of this project, North Carolina has seen two utility scale wind projects proposed and begin to move through the permitting process. The Desert Wind project proposed by Iberdrola Renewables in Pasquotank County received Utilities Commission approval in May 2011 and the Pantego project proposed by Invenergy received Utilities Commission approval in March 2012. Several other developers are considering projects in other coastal counties and the efforts of this project have helped to educate the policy-makers and public in those counties.

The onshore wind projects in the state have yet to secure a power purchase agreement and policies to create a market for the electricity produced by offshore wind projects will be necessary for development to occur. Additionally, in a regulated utility market like North Carolina, the utilities will be a key component for offshore wind development in the state and a new model, other than the power purchase agreement, may need to be created to bring the utilities on board. These issues form the basis of the next phase of utility related discussions in North Carolina.

Introduction

The public outreach and education efforts of the Wind Powering America (WPA) program are critical to meeting utility-scale wind build-out goals such as the Department of Energy's *20% Wind by 2030* scenario. WPA programs seek to improve citizens' and policy makers' understanding and perception of wind energy technology through outreach activities including workshops tailored to local government officials, farmers, land owners, and the public at-large. The key element of the WPA outreach strategy is to disseminate factual information, to spur discussion, and to answer questions about wind energy technology in advance of wind development proposals that might arise in a particular region.

One of the major barriers to reaching a 20% Wind by 2030 goal is the lack of transmission infrastructure to bring wind-generated electricity from where wind resources are located to where electricity is demanded. New electricity transmission lines must pass through diverse human and natural communities along the rural-urban gradient that typically separates generating capacity from consumers. Traditionally, the siting of such transmission lines involves acrimony between affected communities and transmission project developers, utilities, and government agencies.

The goal of this project is to apply the WPA's proactive outreach strategy to the problem of educating the public about the likely transmission infrastructure developments concomitant to the significant development of wind energy resources in North Carolina. Given the lead time to develop significant new transmission infrastructure (5-10 years), it is critical to begin this outreach work today, so that wind resources can be developed to adequately meet the 20% by 2030 goal in the mid- to long-term (10-20 years). The project team planned to develop a transmission infrastructure outreach campaign for North Carolina by: (1) convening a utility interest group (UIG) of the North Carolina Wind Working Group (NC WWG) consisting of electric utilities in the state and the Southeast; and (2) expanding outreach to local and state government officials in North Carolina.

Background

A successful transmission infrastructure outreach campaign will depend on: (1) the NC WWG's knowledge of North Carolina's wind resource potential; (2) electric utilities' knowledge of the geography

of the state's electricity demand forecasts as well as the capacities and limitations of the regional electricity transmission and distribution systems; and (3) the cooperation of state and local government officials. Through the following tasks, the project team will expand the North Carolina WPA program's capacity to erode the looming transmission infrastructure barriers to significant utility-scale wind development:

1. Convene Utility Interest Group of the NC WWG;
2. Perform education and outreach to state government officials;
3. Expand education and outreach to local decision makers; and
4. Develop and conduct a transmission infrastructure outreach campaign.

The North Carolina Solar Center (NCSC) led the project and performed all project management and reporting tasks. Appalachian State University (ASU) assisted with Tasks 1, 2 and 4. The North Carolina Sustainable Energy Association (NCSEA) will be solely responsible for Task 3. Previous experiences at each of these organizations provide the basis needed to carry out the project tasks.

The North Carolina Solar Center brings ten years of experience in fostering responsible wind development in North Carolina by coordinating the NC wind working group; facilitating education and outreach workshops for the general public and government officials; steering the development of a model wind ordinance for use by NC towns and counties; and providing technical assistance to North Carolina state agencies on wind issues.

Wind energy research and education has been a component of the Appropriate Technology (AT) Program at ASU since its inception in 1984; however, the work has significantly increased since 2000 with the DOE funding of a Wind Energy Feasibility Study for Western NC. This project was followed in 2002 with an Anemometer Loan Program and related wind energy outreach activities also funded by the DOE. In 2004 the Small Wind Initiative was proposed and funded by the NC State Energy Office. ASU has operated a small wind testing and education facility on Beech Mountain since 2004 and has conducted many educational programs at the site including tours from representatives of utility companies, state and regional policy makers and many others. Finally, ASU has organized numerous conferences, meetings, forums, and workshops on wind energy and has also given many presentations on the topic.

NCSEA is a statewide non-profit that works to promote renewable energy and energy efficiency through education, public policy, and economic development. NCSEA works with government, business, communities, and partner organizations to provide opportunities for North Carolinians to learn about and implement sustainable energy solutions. The organization also engages in technical policy design negotiations and regulatory proceedings. NCSEA played an instrumental role in the passage of the NC Renewable Energy and Energy Efficiency Portfolio Standard and participates in the NC Wind Working Group. NCSEA also played a leadership role in the development of the state's model ordinance for local governments.

Accomplishments and Results

Task 1: Convene Utility Interest Group

The project team proposed to build on the work of coordinating the North Carolina Wind Working Group (WWG) by enhancing regional, state, and local outreach to and collaboration with electric utilities. To this end the project team would establish a Utility Interest Group (UIG), to serve as a forum for dedicated collaboration between North Carolina and southeastern electric utilities and the NC WWG. The goals of

this task include communicating wind development opportunities, benefits, and challenges to electric utilities; understanding the desire of electric utilities to work with wind energy technologies and the constraints that may be limiting their ability to do so; and establish state and regional wind project development partnerships with electric membership corporations (EMCs), investor-owned electric utilities (IOUs), electric utility associations, and generation and transmission organizations. Efforts to create the Utility Interest Group stalled in 2010 due to a lack of resources for stakeholder groups to travel and engage in the UIG - this led to the decision that the goals of this task would be accomplished through meetings with and presentations to groups already engaged in utility issues.

Subtask 1.1: Research potential UIG members

Potential UIG members were identified at the onset of the project through a UIG advisory group comprised of Brian Miles, NC Solar Center; Dennis Scanlin Appalachian State University; Randy Manion, Western Area Power Administration; Sandy Smith, Utility Wind Integration Group; and Jesus Marsden, Southeastern Power Administration. Potential UIG members that were identified included Duke Energy, Progress Energy, Dominion Virginia Power, GreenCo Solutions, Inc., North Carolina Municipal Power Agency Number 1 (NCMPA1), North Carolina Eastern Municipal Power Agency (NCEMPA), North Carolina Association for Municipal Electric Systems. The NC Solar Center also contacted the NC Transmission Planning Collaborative to become involved – and then attended meetings of the Transmission Advisory Group and shared information from this group with the NC WWG.

Subtask 1.2: Develop and maintain interactive website

Appalachian State University staff identified and contacted all utilities in the state to identify any wind turbines interconnected in their territory. It was determined that over 48 wind turbines in the state have an estimated total capacity of over 275 KW. A map of turbines in the state, with linked photographs and information about the turbines, is available at http://wind.appstate.edu/turbine-map.

Subtask 1.3 & 1.4: Plan and facilitate 8 UIG meetings

The project team and DOE agreed on a variance to this task allowing meetings with and presentations to groups already engaged in utility issues to meet the requirements of this task. There have been 7 presentations and 2 meetings during which utilities and other relevant stakeholders were educated on wind energy issues in North Carolina.

- In early 2010, NC Solar Center Staff attended a North Carolina Transmission Planning Collaborative meeting to inform participants of our project and to let the group know that we have resources to do public outreach on transmission and wind issues.
- In August 2010, Appalachian State University staff organized, advertised and conducted a Wind Summit that was held in Asheville, NC. All utilities, as well as county and state officials, in western NC were notified of the summit. A total of 6 presentations were made to the Wind Summit and Southeastern Energy Expo participants.
- On October 26, 2010, NC Solar Center and Appalachian State University provided a presentation of small wind information and issues for a GreenCo Solutions conference held for managers and representatives of the electric cooperatives in North Carolina. Staff

established contacts at the cooperative level and began discussions with co-op managers about transmission and siting issues.

- NC Solar Center participated in a number of NC Transmission Planning Collaborative Transmission Advisory Group meetings during the course of the project – providing feedback on aspects of the group's work and providing information from this group to the NC WWG.
- In Q4FY2011, the NC Solar Center participated in a meeting with the N.C. Department of Commerce, N.C. Offshore Wind Coalition, Duke Energy and Progress Energy to discuss the future for offshore wind in North Carolina.

Subtask 1.5: Establish state and regional partnerships

- The NC Solar Center represented North Carolina at the WPA Mid-Atlantic Regional Meeting in Arlington, VA, on March 16, 2011.
- During Q3FY2011, the NC Solar Center discussed with Santee Cooper (South Carolina utility) as well as other South Carolina groups (Clemson University Restoration Institute and the SC Coastal Conservation League) the possibility of partnerships between NC and SC utilities and other offshore wind stakeholders.
- NCSC organized and held a meeting in June, 2011, with the U.S. Department of Energy Savannah River National Laboratory, Santee Cooper, N.C. Offshore Wind Coalition, N.C. Department of Commerce, N.C. Solar Center, N.C. Energy Office, N.C. Sustainable Energy Association, S.C. Energy Office, Clemson University Restoration Institute, Coastal Carolina University, S.C. Coastal Conservation League, North Strand Coastal Wind Team, and the City of North Myrtle Beach in June to begin a regional dialogue on offshore wind energy. NCSC managed the creation of a joint press release on the meeting to raise the profile of NC and SC's efforts in the national media. The story was picked up by over 20 media outlets. Appendix A contains the press release.
- In Q1FY2012, the NC Solar Center facilitated discussion among NC and SC university researchers to share information on projects and find areas for future collaboration. A call was held on September 20, 2011, with participation from ten researchers. Information on past and current research was collected and can be found in Appendix B.
- In Q1FY2012, NC Solar Center began facilitating discussions with NC and SC groups to organize a regional onshore and offshore wind conference to be held in spring 2012. These discussions led to the planning of the Southeastern Coastal Wind Conference, which was held March 8-9, 2012, in Charlotte, NC. Jen Banks was the Co-chair of the conference along with Brian O'Hara of the NC Offshore Wind Coalition. As Co-chair, Jen served on the Organizing Committee, provided oversight and assistance to the Public Relations and Local Organizing Committees and was the co-lead for the Program Committee. The program co-chairs led the charge on this collaborative effort that included over 50 organizing partners from Virginia, North Carolina, South Carolina and Georgia. The conference covered onshore and offshore wind, with a focus on the supply chain and offshore wind opportunities in the region. The strengths of the Southeast region were highlighted – excellent offshore wind resource, some of the largest and fastest growing electricity markets on the East Coast, and existing world-class supply chain infrastructure and highly-skilled, low-cost labor markets. The conference was a success, with approximately 300 stakeholders in attendance – including a great mix of attendees from

within the region and the broader U.S. wind industry. The conference allowed groups within the region to network and was a great way to support regional partnerships.
    - The NC Solar Center also had representatives on two of the conference's state support teams. NCSEA ran the financials/registration for the conference and several staff members participated in the conference planning committees.
- In early 2012, Jen Banks was selected to present on the NC wind industry supply chain at the WINDPOWER 2012 conference in Atlanta. The presentation covered NC's economic development story - with existing wind supply chain facilities despite the fact that there is not yet utility scale development. It also covered the potential for offshore wind manufacturing to tap into the existing onshore wind supply chain and to utilize the Morehead City port. Outreach to the supply chain companies in North Carolina was conducted to gather information for the case studies included in the presentation. A copy of the presentation can be found in Appendix C. The NC Solar Center also participated as an Event Partner for the WINDPOWER 2012 conference – promoting the event through the Wind Working Group.
- NCSC attended the WINDPOWER 2012 conference – networking with companies already in North Carolina and those that are interested in locating wind projects or manufacturing facilities in the state. The NC Solar Center organized several meetings with key industry contacts at the conference and participated in the WPA regional summit following WINDPOWER 2012.
- In mid-2012, the NC Solar Center prepared and submitted an abstract for AWEA's Offshore WINDPOWER Conference in October that was accepted as a poster. The poster, titled *Southeastern Offshore Wind: Accepting and Building on our Differences*, covered the Southeast's potential to become a major contributor to the U.S. offshore wind industry based on the excellent resource potential, onshore wind manufacturing base and ports capabilities. The poster can be found in Appendix D. The NC Solar Center also acted as an Event Partner for the Offshore WINDPOWER 2012 conference and promoted the event to the NC Wind Working Group.

Task 2: Perform education and outreach to state government officials

The activities under Task 2 were proposed as an effort surrounding wind permitting legislation that was being investigated at the time. It was expected that during the General Assembly's consideration of wind permitting, and in the months and years that follow the enactment of such a permitting regime, there would be a need to provide information to government officials. Policy-makers would need to understand the benefits and limitations of wind energy, the transmission infrastructure and other challenges to wind development in North Carolina. The wind permitting legislation in play in 2010 ultimately failed to pass and the political climate was not conducive to holding workshops with state agency staff or legislators. Instead, the NC Solar Center and NCSEA participated in the meetings of the NC Energy Policy Council (EPC) as a means of informing Legislators on wind energy issues. Participation was extensive with EPC meetings and associated work group meetings (both NCSEA and NC Solar Center served on work groups). Per discussions with DOE sponsors, separate meetings with key representatives and outreach efforts to provide resources to all representatives will count as one workshop.

Subtask 2.1 and 2.2: Plan and facilitate 4 Workshops

- A wind forum for NC legislators was planned and held in January 2010. The forum, attended by approximately 20 NC state legislators and staffers included presentations by Jen Banks and Jessica Isaacs of the American Wind Energy Association.
- After the wind permitting legislation failed to move, NCSEA and the NC Solar Center began participating in the newly formed Renewable Energy Work Group at the North Carolina Energy Policy Council that was reconstituted in December 2009. The Council consisted of 15 members appointed by Governor Beverley Perdue. Members were charged with developing a comprehensive set of energy policy recommendations for North Carolina. The Council was strongly interested in policies that would create economic development opportunities and benefit North Carolina in a low-carbon regulatory environment. Four work groups were formed to develop initial policy recommendations – renewable energy, low-carbon base-load, energy efficiency and transportation. The product of these work groups – and the entire Energy Policy Council – was to be the educational foundation for a variety of government officials. In this venue, NCSEA and NCSC worked with a diverse range of industry, utility, government, and nonprofit stakeholders to develop state policy recommendations for renewable energy resources. In this capacity, they worked to build a collective understanding of the North Carolina's wind resource and ensure that the work group considers effective policy recommendations for onshore and offshore wind. The recommendations were expected to be presented to the full NC Energy Policy Council in early 2011, which in turn, would provide Governor Perdue and the NC General Assembly policy recommendations. Due to political dynamics, a formal vote on policy recommendations was never held by the North Carolina Energy Policy Council. The Council did provide a statement in support of the North Carolina Renewable Energy and Energy Efficiency Portfolio Standard, which is encouraging the prospecting and development of utility-scale wind in Northeastern North Carolina. In addition, the Council has commissioned an independent report by the La Capra Associates to assess the past and future impact of the Portfolio Standard in North Carolina. Through separate funds, NCSEA contributed to the financing of that report. As a result, NCSEA predicates in an advisory committee that is overseeing the development of the report and ensuring wind energy is appropriately represented.
- Per discussions with DOE sponsors, separate meetings with key representatives and outreach efforts to provide resources to all representatives will count as one workshop. The above Energy Policy Council efforts and the following meetings satisfy this variance.
    - During Q4FY2009, wind permitting discussions with NC Rep. Pricey Harrison, and NC Rep. Phillip Frye's offices.
    - During Q3FY2011, NCSC attended meetings with representatives Mitch Gillespie and Pat McElraft – provided information on wind energy in general and the offshore wind potential in North Carolina.
    - During Q3FY2011, Appalachian State University developed a legislative packet to share with legislators in meetings. These packets were provided during meetings with Representatives Frye, Ray Rapp, Ralph Hise and Mike Hager. Three of these individuals were co-sponsors of the wind permitting bill.
        - The packets contained AWEA materials, including documents titled *American Wind Power* and *In the Public Interest How and Why to Permit for Small Wind Systems: A Guide for State and Local Governments*. The packets were also supplied to county managers, commissioners and planners.

- During Q3FY2011, Appalachian State University helped to develop ideas for a bill to support a pilot utility scale wind project and commented on early drafts. Comments included a request that they remove language that would limit development to 100 feet in height. Subsequently, that language was taken out of the bill and this bill was introduced in both the NC house (H694) and Senate (S665). Appalachian State University project team members met with Appalachian State University officials to identify and discuss talking points related to wind energy and this ASU Wind Demonstration project proposed.
- During Q3FY2011, NC Solar Center organized a session for the North Carolina Sustainable Energy Conference on offshore and onshore wind potential and issues in North Carolina.
- During Q3FY2011, NC Solar Center participated in meetings with Representative Gillespie and Representative McElraft to provide information on the economic development potential for offshore wind in North Carolina.

- During Q1FY2012, efforts began to organize offshore wind public education events in two coastal counties – Onslow and Brunswick. The events were subsequently held in December 2011 in Jacksonville (Onslow County) and Calabash (Brunswick County). Local government officials and the Legislators from these areas were invited to attend the meetings, which had a utility and transmission focus (to also comply with workshop requirements of Task 4). The speakers and their presentation topics are below and the presentations can be found in Appendix E.

    - Brian O'Hara, NC Offshore Wind Coalition, and Jen Banks, NCSC – offshore wind 101 and why NC is suited for offshore wind
    - Larry Shirley and Bob Leker, NC Department of Commerce – BOEM NC state task force and other state efforts for offshore wind
    - Tate Johnson, Governor's Office – Presented a letter from the Governor about recent offshore wind efforts
    - Mark Byrd, Progress Energy – NC Transmission Planning Collaborative studies
    - Christopher Fallon, Duke Energy – Duke's DOE funded transmission and interconnection study

Subtask 2.3: Prepare Report – Government Guide to Wind Permitting in North Carolina

Because the wind permitting bill (S.B. 1068) failed to pass in the legislature, the status of wind permitting became uncertain and therefore a government guide to wind permitting was deemed to not be feasible. Instead, during a Fall 2010 meeting with DOE, the project team determined that this guide would be rolled into the Community Guide to Wind Energy in North Carolina listed in Task 3.

Task 3: Expand education and outreach to local decision makers

The NC WWG created a model wind ordinance for North Carolina in 2008. The project team proposed to build on that effort by undertaking additional outreach to promote the model

ordinance to counties in the state. Outreach efforts under this task reached all counties within the state and over 25 counties received direct assistance, phone contact or in-person contact from the project team. Due to the success and extent of the outreach under Subtask 3.1 and 3.2, and without requests to participate in public meetings, it was determined that the excess meetings from these tasks would meet the requirements of Subtask 3.3.

Subtask 3.1 and 3.2: Plan and Facilitate 12 meetings with local officials interested in developing a local wind ordinance

- In early 2010, NCSEA planned and facilitated 4 meetings with local officials interested in wind ordinances: Town of Duck, Camden County, Perquimans County, Pasquotank County, and Washington County officials. Follow-up assistance was also provided to the Perquimans County Planning Director on anemometer permitting language. NCSEA also reviewed Brunswick County renewable energy permitting language to be included in the Unified Development Ordinance and assisted the Mitchell County Attorney in understanding decommissioning language in the NC Model Wind Ordinance.
- During Q4FY2010, the county managers and county commissioners in 24 western counties were provided an informational packet on the NC model wind ordinance and informed that the project team could provide any assistance needed. A follow up meeting occurred with the Buncombe County Planning Department and county commissioners on June 21, 2010. Follow up phone calls were also made to all 24 county managers - with follow up calls received from Wilkes and Graham counties.
    - As a follow-up, Appalachian State University researched and identified contact information or listservs for all the county commissioners, county managers and county planners in NC and developed a letter which they sent via e-mail to all county commissioners, county managers, and county planners. This e-mail was sent on October 25th, 2011, and included the NC model wind ordinance, links to NC Wind maps, several wind reports documenting the wind resources in NC, recent survey work, and examples of ordinances adopted by other counties in NC. Follow up phone calls were made to counties to see if there were any questions after receiving the materials.
- On June 4, 2010, in Elizabeth City, NC, the project team presented at the North Carolina Chapter of the American Planning Association Section 5 Workshop. A joint presentation and discussion with Iberdrola Renewables provided an overview of wind energy technologies and permitting of small and utility-scale wind energy turbines. Meeting was attended by planning staff from approximately 10 counties located in Northeastern North Carolina.
- During Q1FY2011, Appalachian State University had meetings with three counties: Buncombe, Brunswick, and Johnston Counties to discuss wind energy and wind turbine ordinances. Appalachian State University staff had two separate meetings with Buncombe County Planning officials to assist them in developing a wind ordinance and have reviewed and commented on several drafts of their ordinance. Buncombe county and Johnston county officials were also given a tour of the Northwind 100 turbine on Appalachian's campus and provided with a presentation describing the range of wind turbine technology on the market today.
    - ASU continued to provide technical assistance to several counties that were actively engaged in developing a county wind ordinance - including Buncombe, Davidson, Johnston and Brunswick counties.
- Appalachian State University staff presented at the Land of Sky conference, "Clean Energy Now" in Flat Rock, NC, on October 8th, 2011. The Land of Sky organization is a Council of

Government (COG) in western NC dedicated to assisting local governmental officials in policy development.

- Throughout the project timeframe, NCSEA continued to track the development of and assist with local ordinances in Northeast North Carolina.
    - In early 2011, NCSEA provided the Town Planner / Code Enforcement Officer of the Town of Southern Shores information on turbine noise, noise reduction strategies, blade failure, turbine failure, and shut down / restart timing of wind turbines. This information was being collected and informing the drafting of a local wind ordinance.
    - During Q3FY2011, NCSEA intervened in the NC Utilities Commission filing for the Pantego Wind Energy project in Beaufort County.
- Appalachian State University activities in early 2011 included:
    - Planning meetings with Avery and Alleghany County Planning boards and county commissioners to introduce the model wind ordinance.
    - Distributing materials to Legislators, including DOE's 20% by 2030 report, North Carolina wind maps and the invite for a free webinar by the Southern Appalachian Regional Wind Energy Institute and Mid-Atlantic Wind Energy Institute.
    - Meetings or conversations with officials in Wilkes, Alleghany, Avery and Buncombe Counties regarding the NC model wind ordinance.

Subtask 3.3: Attend 6 public hearings on local wind ordinances

It was determined during a discussion with Dwight Bailey in June, 2011, that the additional meetings over the required 12 from Subtask 3.2 will be used to meet the requirement of Subtask 3.3. Public meetings were not the focus, as it proved to be most useful to provide information upfront as counties explore the possibility of creating ordinances and then assisting with questions throughout the process. Counties have been very pleased with the assistance they have received and NCSEA's attendance at public meetings has not been requested.

Subtask 3.4: Prepare report – Community Guide to Wind Energy in North Carolina

In early 2011, the project team discussed the requirements for this task with Dwight Bailey and determined that the community report will be called "Guide to Wind Energy in North Carolina" and will be an online guide as opposed to a printed document. This will provide for flexibility in organizing the guide and will allow for it to be more interactive with links throughout the text. The text of this webpage, which is located on the NC Solar Center wind website (http://ncsc.ncsu.edu/index.php/technology/renewable-energy/wind-energy/guide-to-wind-energy-in-north-carolina/), can be found in Appendix F.

Task 4: Develop and conduct a transmission infrastructure outreach campaign

The activities under Task 4 were designed to educate the public of North Carolina about the transmission infrastructure that will be necessary to allow the development of a significant portion of North Carolina's wind resources - for example the 12+ GW nameplate capacity proposed in the DOE 20% Wind by 2030 scenario. The goal of this campaign is to provide the public with fact-based information regarding the benefits and costs - including environmental impacts - that would accompany such transmission infrastructure development. These activities will serve as the first phase of ongoing efforts to educate the public about electric transmission infrastructure upgrades related to renewable energy development in the Southeast.

Subtask 4.1: Develop and maintain factsheets

NCSC prepared wind factsheets covering onshore wind, offshore wind and transmission issues. Factsheets can be found in Appendix G.

Subtask 4.2: Develop and maintain interactive website

A new webpage was created on the NCSC website, and as part of the online "Guide to Wind Energy in North Carolina" that focuses on utility and transmission issues. The page includes information on the utility structure in North Carolina, links to transmission studies and recent transmission and utility news. The text of the website can be found in Appendix F.

Subtask 4.3 and 4.4: Plan and facilitate 4 transmission outreach workshops

- In early 2011, NC Solar Center discussed the potential for collaborating with the US Offshore Wind Collaborative on efforts to gather regional stakeholders for offshore wind transmission roundtables that were being planned for the east coast. Specifically to locate one of these events here in NC so that NCSC can assist in planning and outreach to potential attendees. This would count as one of the transmission outreach workshops. NCSC continued discussions with the US Offshore Wind Collaborative on a regional meeting, but the scope of the broader effort evolved and it was no longer feasible to site a meeting in North Carolina.
- During Q1FY2012, efforts began to organize offshore wind public education events in two coastal counties – Onslow and Brunswick. The events were subsequently held in December 2011 in Jacksonville (Onslow County) and Calabash (Brunswick County). Local government officials and the Legislators from these areas were invited to attend the meetings, which had a utility and transmission focus (to comply with workshop requirements of Tasks 2 and 4). The speakers and their presentation topics are below and the presentations can be found in Appendix E.
    - Brian O'Hara, NC Offshore Wind Coalition, and Jen Banks, NCSC – offshore wind 101 and why NC is suited for offshore wind
    - Larry Shirley and Bob Leker, NC Department of Commerce – BOEM NC state task force and other state efforts for offshore wind
    - Tate Johnson, Governor's Office – Presented a letter from the Governor about recent offshore wind efforts
    - Mark Byrd, Progress Energy – NC Transmission Planning Collaborative studies
    - Christopher Fallon, Duke Energy – Duke's DOE funded transmission and interconnection study
- NCSC planned the two additional workshops for this task to be in conjunction with the rollout of the Bureau of Ocean Energy Management's (BOEM) Call for Information and Nominations, which was expected to be at the end of November 2012. These meetings were postponed to early 2013 due to the delayed release of the Call for Information and per a conversation with Gretchen Andrus in November 2012, it was agreed that these workshops would qualify as part of this task.
    - Originally, the NC workshops were to be a separate session held just before the BOEM meetings – however, the North Carolina presentations were simply added to the beginning of the BOEM meetings. The meetings were held in Nags Head on January 7, 2013, and in Wilmington on January 9, 2013.
    - The NCSC organized the following speakers and topics.
        - Offshore Wind 101 - Jen Banks, NC Solar Center
        - Background for NC Offshore Wind - Bob Leker, State Energy Office
        - Why North Carolina and the Southeast - Brian O'Hara, Southeastern Coastal

Wind Coalition
- The North Carolina presentations from these events can be found in Appendix H.

Subtask 4.5: Develop transmission outreach toolbox

The transmission outreach toolbox is rolled into the utility and transmission focused webpage in Subtask 4.2.

Conclusions and Recommendations

Over the course of this project, North Carolina has seen two utility scale wind projects proposed and begin to move through the permitting process. The Desert Wind project proposed by Iberdrola Renewables in Pasquotank County received Utilities Commission approval in May 2011 and the Pantego project proposed by Invenergy received Utilities Commission approval in March 2012. Several other developers are considering projects in other coastal counties and the efforts of this project have helped to educate the policy-makers and public in those counties. The Desert Wind project will be located in Pasquotank County and Perquimans County – both counties created wind ordinances using the NC Model Wind Ordinance as a guide and both also received guidance on that process from NCSEA as part of this project.

During the last several years, the effort to identify sites for offshore wind in North Carolina has also been moving forward. The project team engaged on offshore wind issues - giving presentations, organizing sessions for conferences, and facilitating regional discussions - as the BOEM efforts advanced in the state. Utility and transmission issues will continue to be an important issue for onshore and offshore wind in North Carolina. The onshore wind projects have yet to secure a power purchase agreement with a utility in the state and policies to create a market for the electricity produced by offshore wind projects will be necessary. Additionally, in a regulated utility market like North Carolina, the utilities will be a key component for offshore wind development in the state and a new model, other than the power purchase agreement, may need to be created to bring the utilities on board. These issues form the basis of the next phase of utility related discussions in North Carolina.

Appendices

Appendix A – NC/SC Press Release

MEDIA RELEASE

NORTH CAROLINA & SOUTH CAROLINA COLLABORATE TO ACCELERATE OFFSHORE WIND ENERGY PROJECTS

RALEIGH, NC & Charleston, SC – July 7, 2011 – Representatives from South Carolina and North Carolina met in Charlotte in June to discuss opportunities for collaborating to accelerate the development of offshore wind energy on the south Atlantic seaboard. The meeting is being heralded as a significant first step towards regional collaboration for offshore wind in the Southeast.

The objective of the two-state meeting was to explore ways to leverage each state's unique experience, knowledge, and resources to accelerate the deployment of offshore wind energy in a way that is mutually beneficial to both states. "Our states are uniquely positioned with strengths and advantages that complement each other." said Elizabeth Colbert-Busch of the Clemson University Restoration Institute. Some of the initial opportunities that were discussed included enabling various research institutions to collaborate on future research projects and exploring the possibility of an offshore wind energy project along the NC/SC border.

Represented organizations included U.S. Department of Energy Savannah River National Laboratory, Santee Cooper, N.C. Offshore Wind Coalition, N.C. Department of Commerce, N.C. Solar Center, N.C. Energy Office, N.C. Sustainable Energy Association, S.C. Energy Office, Clemson University Restoration Institute, Coastal Carolina University, S.C. Coastal Conservation League, North Strand Coastal Wind Team, and City of North Myrtle Beach.

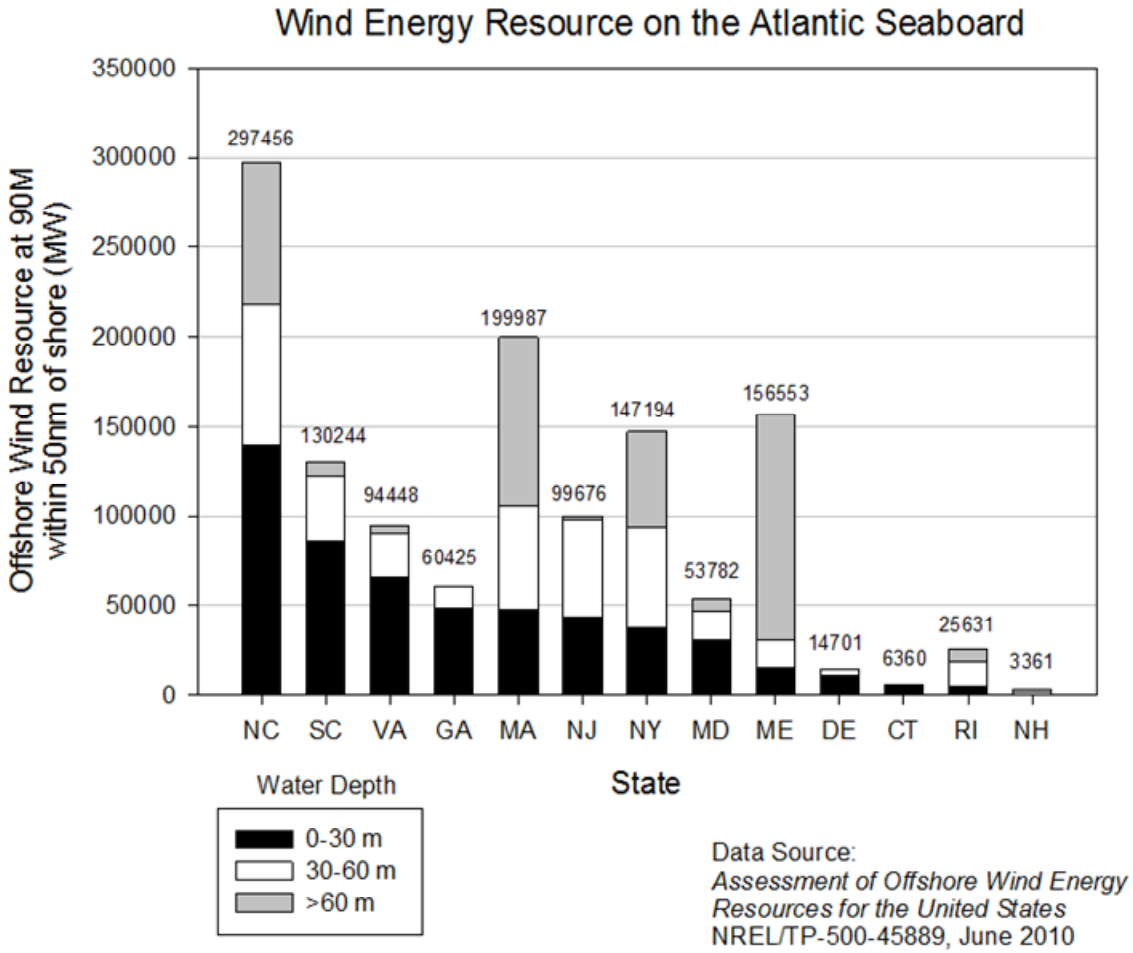
An Impressive Resource

According to a report by the National Renewable Energy Laboratory, 33 percent of the total East Coast offshore wind potential within 50 miles of the shoreline is located off the coast of North and South Carolina and both states have offshore wind energy resources that exceed their current installed electricity generation capacity. "Based on the report, North Carolina and South Carolina have the largest offshore wind energy resources in shallow water on the Atlantic Seaboard," said Ralph Nichols Wind Energy Program Manager at the Savannah River National Laboratory. Indeed, if one looks at wind potential in shallow water (less than 30 meters) and more than 12 miles from the shore, an important consideration in limiting visual impacts, the figures are even more impressive, with the Carolinas alone holding more than half of East Coast resource. Adding Virginia and Georgia bumps that figure to over 82 percent. "This excellent wind resource, combined with outstanding port facilities in the region, should attract investment by utilities and the offshore wind industry," said Nichols.

Other Advantages

The Carolinas not only have an impressive energy resource, but may also have some distinct business advantages. "This is an industry where about 10 percent of the cost is materials and 90 percent is labor, and that represents a significant advantage for the lower-cost labor markets of the Southeast to attract manufacturing," said Jen Banks of the N.C. Solar Center. That dynamic helps to explain why there are currently over three thousand people in the Carolinas already employed in the wind industry supply chain despite not having a single utility-scale wind farm operating in either of the two states.

While the Carolinas have already started to explore options for collaboration, the groups are also open to talking with neighboring states. "Regional solutions are ultimately what make sense for the United States offshore wind industry", said Brian O'Hara, President of the NC Offshore Wind Coalition. Hamilton Davis of the SC Coastal Conservation League agrees. "This is a great first step in organizing the Southeastern states and working together towards some common goals."



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Hamilton Davis, S.C. Coastal Conservation League, 843.810.4178, hamiltond@scccl.org

Elizabeth Colbert-Busch, Clemson University Restoration Institute, (843) 437-9095, ebusch@exchange.clemson.edu

ABOUT THE NORTH CAROLINA SOLAR CENTER

Created in 1988, the North Carolina Solar Center, as part of the College of Engineering at North Carolina State University (NCSU), works closely with state and local government and the renewable energy industry. It manages and maintains the NCSU Solar House and serves as a resource for innovative, green energy technologies through research and demonstration, technical assistance, education, outreach and training. It also administers the Database of Incentives for Renewables & Efficiency (DSIRE), a resource providing financial incentives and policies. For more information please visit: www.ncsc.ncsu.edu.

ABOUT THE SOUTH CAROLINA COASTAL CONSERVATION LEAGUE

The South Carolina Coastal Conservation League's mission is to protect the natural environment of the South Carolina coastal plain and to enhance the quality of our life of our communities by working with individuals, businesses and government to ensure balanced solutions.

ABOUT THE NORTH CAROLINA OFFSHORE WIND COALITION

The North Carolina Offshore Wind Coalition is a non-profit organization dedicated to promoting the responsible development of offshore wind energy in North Carolina through policy, education, and outreach efforts. The Coalition receives broad support from a variety of non-profits, economic development groups, and industry members.

ABOUT THE SOUTH CAROLINA ENERGY OFFICE

The South Carolina Energy Office (SCEO) provides a broad range of resources designed to help citizens, businesses and public entities save energy and money. In recent years, the SCEO has helped save South Carolina over $250 million through public and private energy-saving measures and new energy technologies. The SCEO is a unit of the South Carolina Budget and Control Board. Additional information can be found at www.energy.sc.gov.

ABOUT THE CITY OF NORTH MYRTLE BEACH

North Myrtle Beach serves as a demonstration city in building the local economy and developing energy independence using livable, sustainable principles through projects, plans, and policy. Sponsored by Partners for Livable Communities, the American Chambers of Commerce Executives, and the Institute for Sustainable Development, the City of North Myrtle Beach is recipient of the 2011 Green Plus Small Community of the Year Award for exceptional leadership in sustainable economic development and is recognized for their public-private partnerships to advance a sustainable economy. The City will host the second annual Southern Wind conference in December 2011. For more information please visit: http://www.nmb.us/

ABOUT THE NORTH CAROLINA SUSTAINABLE ENERGY ASSOCIATION

Founded in 1978, the NC Sustainable Energy Association (NCSEA) is a 501(c)3 non-profit membership organization of individuals, businesses, government and non-profits working to ensure a sustainable future by promoting renewable energy and energy efficiency in North Carolina through education, public policy and economic development. NCSEA has been the "go-to" leader in shaping North Carolina's commitment to renewable energy, energy efficiency, high performance building and smart grid jobs and economic opportunities in communities all across our state. Learn more at www.energync.org.

ABOUT THE NORTH STRAND COASTAL WIND TEAM

The vision of the North Strand Coastal Wind Team is to establish a community-based wind energy program and sustainable energy plan in the City of North Myrtle Beach in collaboration with the city and other strategic partners. The North Strand Coastal Wind Team will seek to develop wind energy resources for the City of North Myrtle Beach, to facilitate this initiative, and partner with other organizations. This is being be accomplished by: introducing the campaign to the community through educational programs and research; developing the economy to create a conducive environment for wind industry; acting as a liaison to attract wind energy businesses; representing North Myrtle Beach on the subject of offshore wind farms; and working to ensure maximum economic impact from wind energy development for the region. For more information please visit: www.northstrandcoastalwindteam.org.

ABOUT THE CLEMSON UNIVERSITY RESTORATION INSTITUTE

The Clemson University Restoration Institute was established in 2004 to drive economic growth by creating, developing and fostering restoration industries and environmentally sustainable technologies in South Carolina. Now, the Restoration Institute is attracting world-renowned faculty, students and staff dedicated to creating a knowledge-based, export-oriented industry cluster that will partner with other institutions and the private sector to position South Carolina as the premier home of restoration knowledge and expertise.

ABOUT COASTAL CAROLINA UNIVERSITY

Coastal Carolina University's Burroughs and Chapin Center for Marine and Wetland Studies has been an active participant in exploring South Carolina offshore wind resource potential in collaboration with other state and regional partners. Center staff have served on the state's Regulatory Task for on Clean Energy, the SC Climate, Energy and Commerce Advisory Committee and other wind and natural marine resource advisory panels and studies. The Center recently completed the "Palmetto Wind" study in concert with North Carolina State University deploying six ocean/atmospheric observational buoys for one-year to gather physical measurements of the cross-shore gradient in the coastal wind fields as well as waves and currents along two transects off the northern SC coast from the beach out to 12 miles.

ABOUT THE SOUTHERN ALLIANCE FOR CLEAN ENERGY

Southern Alliance for Clean Energy promotes responsible energy choices that create global warming solutions and ensure clean, safe and healthy communities throughout the Southeast.

ABOUT THE SAVANNAH RIVER NATIONAL LABORATORY

The Savannah River National Laboratory (SRNL) is the Department of Energy (DOE) - Office of Environmental Management's national laboratory at the Savannah River Site (SRS). SRNL puts science to work to support DOE and the nation in the areas of environmental management, national and homeland security, and clean energy. The management and operating contractor for SRS and SRNL is Savannah River Nuclear Solutions, LLC.

ABOUT SANTEE COOPER

Santee Cooper is South Carolina's state-owned electric and water utility, the state's largest power producer and also its leader in renewable energy. The ultimate source of electricity for 2 million South Carolinians, Santee Cooper is dedicated to being the state's leading resource for improving the quality of life for the people of South Carolina. For more information, visit www.santeecooper.com.

Appendix B – University Research Topic Areas

Offshore Wind Research Topic Areas – September 2011

John Bane, UNC-Chapel Hill Marine Sciences Program

- Research areas include coastal physical oceanography and meteorology, air-sea interactions, aircraft-based ocean/atmosphere observing systems
- Presently a scientific advisor for Apex Wind Energy, a Virginia corporation interested in offshore and coastal wind energy along the eastern US.

Patrick Jodice, Ph.D., Leader, South Carolina Cooperative Fish & Wildlife Research Unit & Associate Professor - Clemson University

- Primary research focus is on the ecology of marine birds
- Ongoing projects focused on tracking of both nearshore and pelagic seabirds in the region
- Just completed a synthesis of information and data needs for seabirds in the South Atlantic Bight.

Liz Kress, Santee Cooper - Renewable Energy

- Transmission interconnection options and capacity
- Electric load seasonal and diurnal peak coincidence with offshore wind generation
- Marine spatial planning and environmental study needs for offshore wind
- Cost of offshore wind generation including forecasting of trends related to increasing marine environmental knowledge, improving regulatory process, availability of construction equipment & vessels, and effect of installation learning curve.

CH Pete Peterson, UNC-CH - Marine Sciences Program

- Participant in UNC Offshore Wind Power Feasibility study - led environmental impacts and human use conflicts group
- Conducted year-long surveys of bird, sea turtle, and marine mammal abundances and distributions in eastern Pamlico Sound and shorter surveys on the NC shelf in Raleigh Bay and Onslow Bay
- Currently a participant in a hydrokinetic energy feasibility study, focusing on environmental impacts and human use conflicts

Morgan Gopnik, Nicholas Institute for Environmental Policy Solutions and Duke Marine Lab, Duke University

- 2-year project to bring ocean stakeholders from industry and ENGOs together to learn about, and explore common ground, related to marine spatial planning
- Numerous meetings and presentations about the pros and cons of marine spatial planning for offshore renewables
- Research on the history of multiple-use planning for public space

George Voulgaris, USC – Geological Sciences

- Coastal Physical Oceanography
- Wind Driven Circulation
- Acoustic Backscatterrance for Env Measurements
- Ocean Radar System for surface currents, wind and wave measurements

Nick Rigas, Clemson University Restoration Institute

- Wind development
- Wind monitoring
- Turbine testing

Anantha Aiyyer, NCSU - Department of Marine, Earth, and Atmospheric Sciences

- Research mainly focuses on weather and climate with a focus on hurricanes. Ongoing research projects include:
  - Wind forecasts associated with near shore hurricanes
  - Hurricane formation from precursor storms
  - High resolution numerical modeling of hurricanes.

Billy Edge, NCSU – Department of Civil, Construction, and Environmental Engineering

- We are developing a 20 year hindcast of wind and wave along the full NC coastline at a high resolution and along SC and Virginia to a lesser resolution
- We are also involved in research on compressed air energy storage in deep water to create dependable and reliable power for peaking needs from the grid
- Our group is also working with magnetic gearing that would benefit both wind and wave turbines or pto's.
- We are starting an effort to evaluate NC ports for wind farm construction and long term maintenance.

Harvey Seim, UNC-CH – Marine Sciences Program

- Participant in UNC Offshore wind power feasibility study - led wind resource assessment and synthesis.
- Continuing wind resource assessment off NC with combined field and modeling program

Sukanta Basu, NCSU - Department of Marine, Earth, and Atmospheric Sciences

- Micro-siting of wind turbines over complex terrains utilizing the OpenFOAM CFD toolbox and the Weather Research and Forecasting (WRF) model, Renaissance Computing Institute (RENCI), 2011-2013.
- Modeling the stable atmospheric boundary layer with computational fluid dynamics for wind energy applications, National Renewable Energy Lab, 2011-2012.
- Enhancing short term wind energy forecasting for improved utility operations, U.S. Department of Energy, 2010-2012.
- On turbine loads assessment for ultimate and fatigue limit states for different atmospheric boundary layer stability conditions, NSF: CBET Energy for Sustainability, 2010-2012
- Towards better representation of the nocturnal low-level jets in new generation large-eddy and mesoscale models, NSF: CAREER Award, 2008-2013.
- Atmospheric stability considerations in design of wind turbines against fatigue, Norman Hackerman Advanced Research (Texas), 2008-2010.
- Understanding, parameterizing and modeling the strongly stratified atmospheric boundary layer processes over the Antarctic Plateau, NSF: Polar Science Program, 2006-2010.
- Characterization and simulation of turbulence in stably stratified atmospheric boundary layers, Texas Advance Research Program, 2006-2009.

Dennis M. Allen, Univ of South Carolina, Baruch Marine Lab, Georgetown

- Primary research focus on behavioral ecology of zooplankton and nekton; migrations, larval recruitment, habitat use, trophic dynamics
- Ongoing long-term monitoring (1980- present) in North Inlet and Winyah Bay estuaries, SC; effects of environmental and climate change
- Affiliated with NOAA funded NI-WB NERR (North Inlet- Winyah Bay National Estuarine Research Reserve)
- Interested in potential impact evaluation, development of minimal impact strategies, and habitat enhancements associated with wind energy infrastructure

Appendix C – WINDPOWER 2012 Presentation

NC STATE UNIVERSITY

North Carolina's Wind Industry Supply Chain Assets

Jen Banks

Wind Energy Project Coordinator

North Carolina Solar Center

NORTH CAROLINA Solar Center

North Carolina Solar Center

Mission Statement

to advance the use of renewable energy resources to ensure a sustainable economy that protects our natural environment, encourages energy independence, and lowers energy costs for consumers. The Center will safeguard this sustainable energy future through programs to educate the public, share research and technical expertise, guide industry's energy decisions, and shape government policy.

NORTH CAROLINA
Solar Center

NC Wind Energy Development

- Small wind as of 2010
  - 202 kW in NC
  - 33 turbines
  - 2011 additions include Wind for Schools turbines
- Utility Scale
  - 2 projects approved by NC Utilities Commission
  - Several projects proposed
    - Iberdrola
    - Invenergy
    - Wind Capital Group

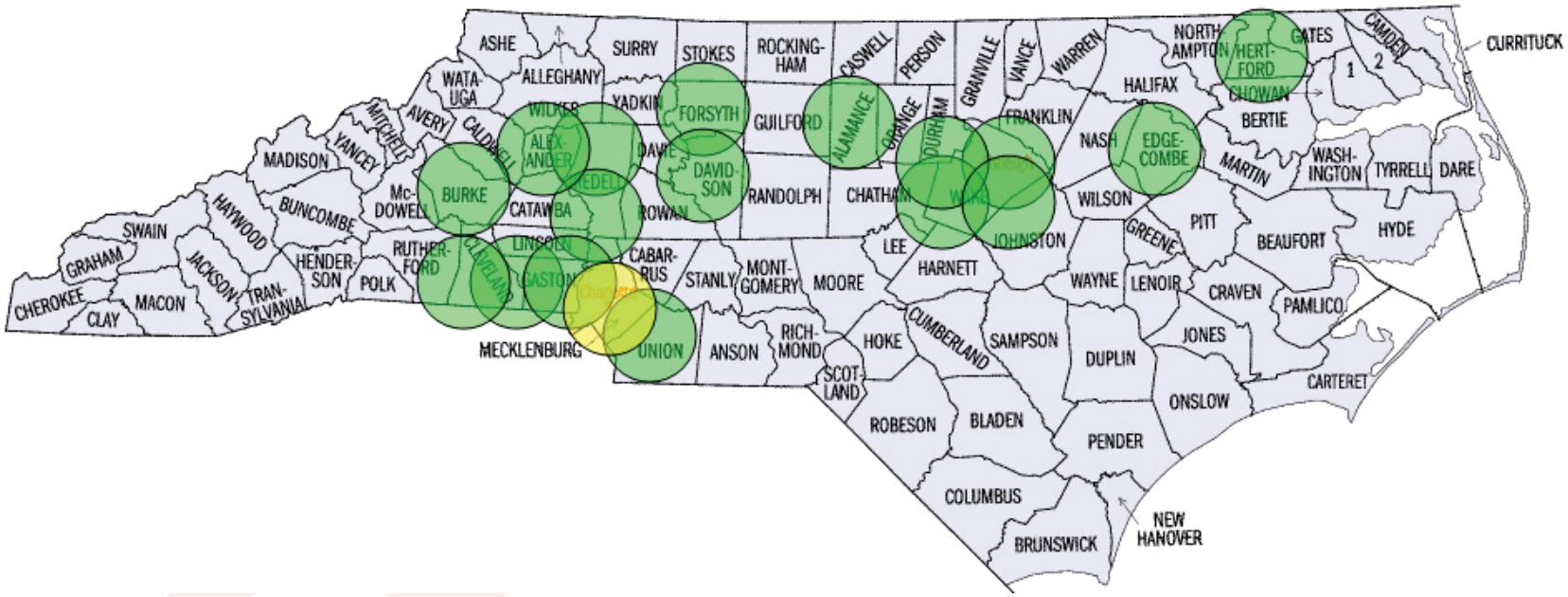
NC Wind Ordinances

- NC Wind Working Group created NC Model Wind Ordinance in 2008
- Currently 13 local wind ordinances in NC:
  - Ashe County
  - Camden County
  - Carteret County
  - Currituck County
  - Hyde County
  - Perquimans County
  - Brunswick County
  - Madison County
  - Pitt County
  - Town of Kill Devil Hills
  - Tyrrell County
  - Watauga County
  - Pasquotank County

Financial Incentives / Policy

- NC Corporate Tax Credit
  - 35%, to max of $2.5 million/installation
  - Credit can be taken over 5 years
  - Expires 12/31/2015
- NC Renewable Energy Manufacturer Tax Credit
  - 25%, no limit
  - Credit taken in equal installments over 5 years
  - Expires 12/31/2013
- NC Renewable Energy and Energy Efficiency Portfolio Standard
  - Passed in 2007
  - 12.5% by 2020 for investor owned utilities
  - 10% by 2018 for electric cooperatives and municipal utilities

North Carolina Manufacturing



Source: AWEA

- North Carolina
  - 2000-3000 direct and indirect jobs

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NC Supply Chain - Manufacturers

Company	Location(s)	Product/Activity
3A Composites/Baltek	High Point	Conversion of foam and balsa core materials used in wind turbine blade production
ABB Inc.	Cary	Corporate Headquarters
	Pinetops	Instrument transformers, cutouts and disconnect switches
	Huntersville (under construction)	HVAC and HVDC cables up to 500 kV
-Baldor	King Mountain	Motors and generators
	Shelby	Motors and generators
AKG of America	Mebane	Designs and manufactures heat exchangers
American Roller Bearing	Hickory	Corporate Headquarters
	Morganton	Roller bearings
	Hiddenite	Roller bearings
Armacell	Mebane - Corporate HQ and plant	Engineered foams
Comm Scope	Hickory	Corporate Headquarters
	Claremont Facility	Fiber optic cables
	Statesville Facility	Grounding solutions
LORD Corporation	Cary	World Headquarters
Machine Specialties Inc	Whitsett	Precision parts
MTS Sensors Corporation	Cary	Linear-position feedback for turbine safety and control applications
Nederman	Thomasville	Process equipment

NC Supply Chain

Company	Location(s)	Product/Activity
Nucor Steel	Hertford County	Plate steel
Okuma America Corporation	Charlotte - Corporate HQ and plant	Machining
Pioneer Motor Bearings	Kings Mountain	Fluid film bearings and seals
PPG Industries	Shelby	Fiber glass for composites
	Lexington	Fiber glass for composites
RP Machine Enterprises	Statesville	Machinery
Saertex	Huntersville	Multiaxial fabrics
Sandvik Coromant	Mebane	Machining
TDM Corporation	Fletcher	Precision machining services
Raychem - TE Connectivity	Fuquay Varina	Transmission - cable accessories, insulators, etc

NC Suppliers/Distributors

Company	Location(s)	Equipment
Atec Coatings	Advance	Distributor of coatings used for blades, towers, etc
Bijur Delimon	Morrisville - Corporate HQ	Lubrication Systems
	Kinston - BDI North America Offices	Lubrication Systems
HAWE Hydraulics	Charlotte - North American HQ	Active and passive hydraulic control systems for yaw and rotor brakes
SL-Laser Systems LP	Charlotte	NA distribution facility - laser projection equipment for manufacturing
Wind Energy Supply	Shelby	Supplies/products for transportation, erection, protection, maintenance, and connection for wind energy

◊ Nucor's Hertford facility provides ~30-35% of all plate steel supplied in the U.S. onshore wind market

- Wind activities
  - Supplies plate steel for wind turbines
- Corporate HQ in Charlotte – approx. 550 people employed in NC

    - Hertford County Facility
      - 462 employees
      - Main source is scrap metal
        - Largest recycling facility in the US

- Nucor plans to supply plate steel to the future US offshore wind industry

NORTH CAROLINA Solar Center

NC STATE UNIVERSITY

◊ ABB equipment is installed in over 40,000 wind turbines around the world

- Wind activities
  - Components to OEMs
  - Engineering studies for siting
  - Turnkey grid interconnection
  - Robotic paint systems for blade finishing
- North American HQ in Cary and ~1600 people employed in NC at 8 facilities

Huntersville Facility

- Will employee ~120
- HVAC and HVDC cables up to 500 kV

Baldor Electric Facilities

- Kings Mtn and Shelby
- Motors and generators

Pinetops Facility

- 268 employees
- Instrument transformers, cutouts and disconnect switches

NORTH CAROLINA Solar Center

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PPG Fiber Glass

Expertise you trust. Solutions you demand.™

◊ PPG has over 1700 North American employees in its fiber glass business.

- Major supplier of fiberglass to the wind industry
  - NC and SC facilities supply fiberglass to fabric customers throughout North America
  - Resulting fiberglass fabrics are used to make composite wind blades in the US, Canada and South America
  - Also used in the offshore wind industry in Europe and will supply the future U.S. offshore wind industry

Shelby Facility
- Over 700 employees

Lexington Facility
- Over 600 employees

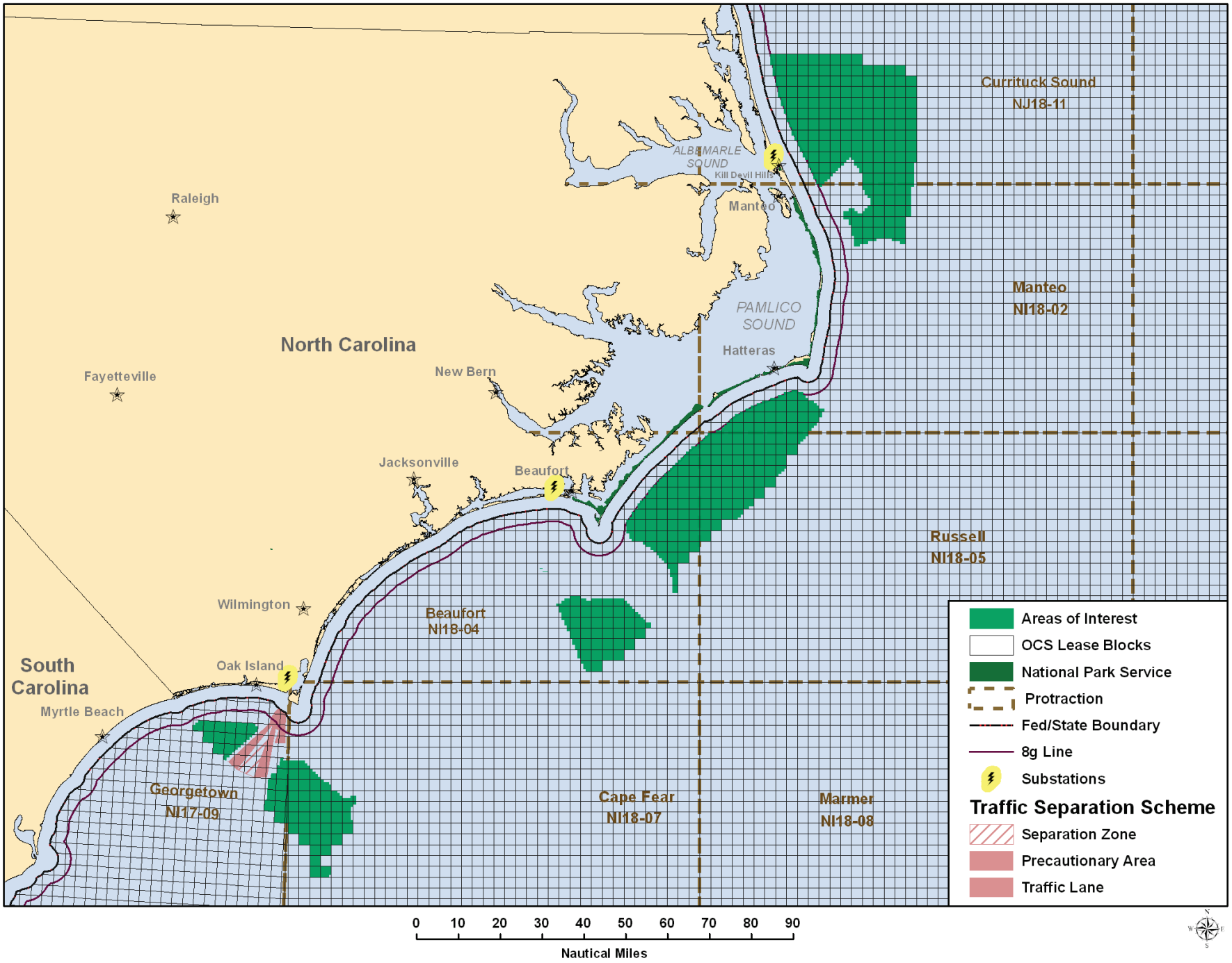
- PPG Fiber Glass products
  - HYBON® fiber glass is specified and used at all major wind turbine companies
  - Introduced INNOFIBER® XM specialty glass composition fiber in 2012, which allows for longer wind blades, used in on and offshore wind turbines

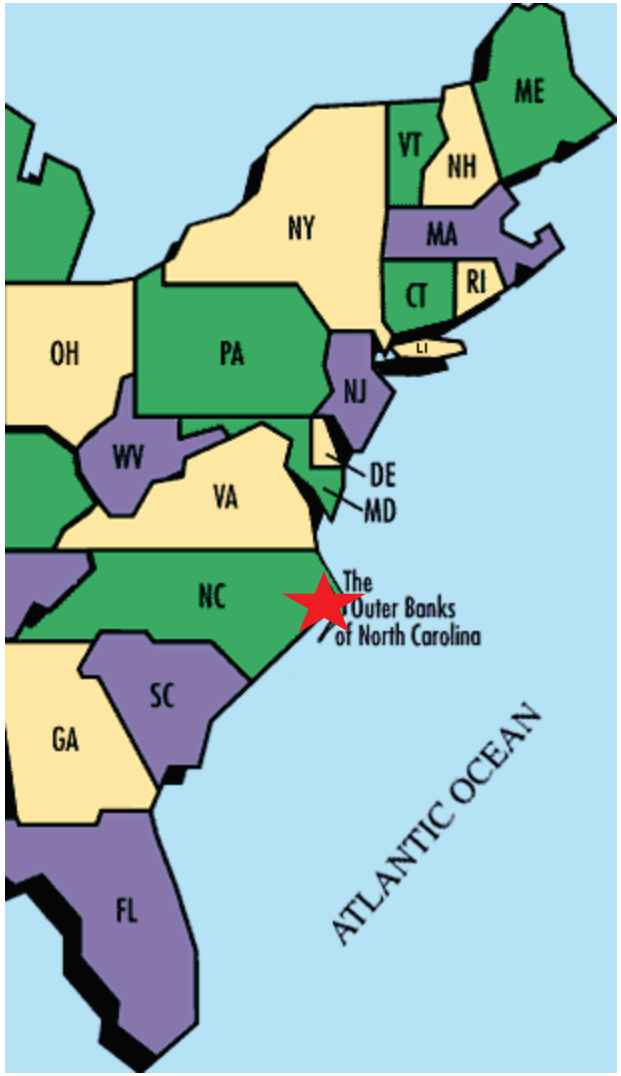
NORTH CAROLINA Solar Center

NC STATE UNIVERSITY

Offshore Wind in North Carolina

- 2009 UNC Study and 2012 Feasibility Study
- NC BOEM State Task Force
  - ~500 lease blocks under consideration after constraints
  - NC Visualization Study to be completed late summer
- Governor's Scientific Advisory Panel on Offshore Energy
  - Report released February 2012
  - Recommends that the state engage with the offshore wind industry to attract associated supply chain facilities and jobs
- Ming Yang Wind Power Group Limited
  - Opened R&D facility on NC State University's Centennial Campus March 2012


Currituck Sound
NJ18-11
ALBEMARLE SOUND
Kill Devil Hills
Manteo
Raleigh
Manteo
NI18-02
PAMLICO SOUND
North Carolina
Hatteras
Fayetteville
New Bern
Jacksonville
Beaufort
Russell
NI18-05
Wilmington
Beaufort
NI18-04
South Carolina
Oak Island
Myrtle Beach
Georgetown
NI17-09
Cape Fear
NI18-07
Marmer
NI18-08
Areas of Interest
OCS Lease Blocks
National Park Service
Protraction
Fed/State Boundary
8g Line
Substations
Traffic Separation Scheme
Separation Zone
Precautionary Area
Traffic Lane
0 10 20 30 40 50 60 70 80 90
Nautical Miles



Excellent Port Potential

Port of Morehead City

- Deep draft
- No height or width constraints
- Area with road/rail access available for expansion
- ~3 miles to open ocean
- Little competition with container shipping/traffic
- Potential lay down area – Radio Island
- Constraint – lifting capacity

Slide Source: NC Offshore Wind Coalition

Thank you!

Jen Banks
Wind Energy Project Coordinator
North Carolina Solar Center
jen_banks@ncsu.edu

NORTH CAROLINA Solar Center

NC STATE UNIVERSITY

Appendix D – Offshore WINDPOWER 2012 Poster

Southeastern Offshore Wind
Accepting and Building on our Differences

Brian O'Hara
Southeastern Coastal Wind Coalition

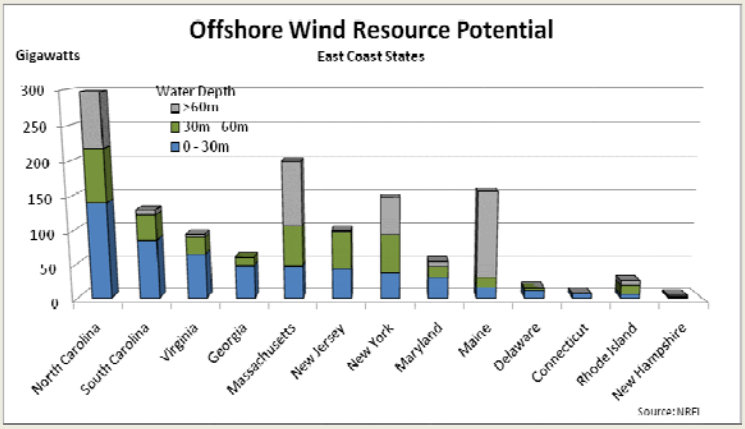
Jen Banks
North Carolina Solar Center
Southeastern Coastal Wind Coalition

The offshore wind industry in the United States will grow from the efforts and assets of all Eastern states. The Southeastern coastal states have the potential to become major contributors to the U.S. offshore wind industry based on their outstanding resource, but a closer look reveals many distinct characteristics that will shape this region's role in the industry.

RESOURCE

A shallow water resource farther from shore allows commercially proven technology to be sited at more broadly accepted distances:

- **VA, NC, SC & GA**:
  - **63%** of the total shallow water offshore wind resource on the East Coast
  - **82%** of the shallow water resource more than 12 miles offshore
- **NC:**
  - #1 East Coast offshore wind resource potential

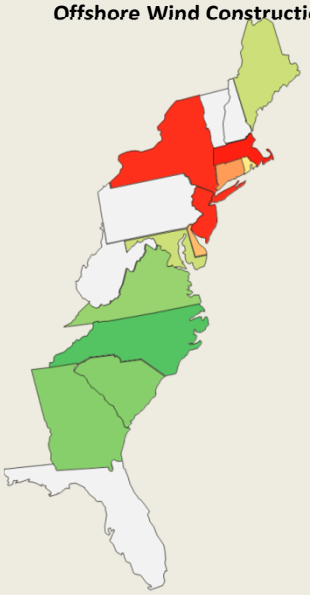


SUPPLY CHAIN

Extensive onshore wind manufacturing provides a base on which to build the offshore wind supply chain:

- Over 60 wind industry manufacturing facilities from Virginia to Florida
- The U.S. Energy Information Administration estimates that Virginia, North Carolina, South Carolina and Georgia will have the lowest offshore wind construction costs on the East Coast
  - Based on 400 MW wind farm with $5,975/kW capital cost (2010$)

Offshore Wind Construction Cost vs. EIA Benchmark Estimate



NC	-9.3%
GA	-7.0%
SC	-6.5%
VA	-5.7%
ME	-2.6%
MD	-2.1%
RI	+0.8%
DE	+3.1%
CT	+5.7%
NY	+12.7%
NJ	+12.7%
MA	+13.2%

Data Source: EIA

PORTS

Several ports in the Southeast, each with their own strengths, are well suited for offshore wind manufacturing, construction and ongoing O&M activities:

Virginia
- Hampton Roads—50' channels, 3rd largest port on the East Coast, 2.5 hours to open sea

North Carolina
- Morehead City—45' channel, no vertical restrictions, ~3 miles to open ocean, expansion capable
- Wilmington—readily available berths, storage areas for containers/cargo

South Carolina
- Charleston—one of the top 10 seaports in dollars generated, 45' harbor channel and dockside, 47' entrance channel, virtually no air draft restrictions

Georgia
- Savannah—number one export port on the East Coast, 5 deepwater berths, 73 acres of open storage, additional laydown space available
- Brunswick—improved infrastructure, expanded capacity to accommodate new business

BUREAU OF OCEAN ENERGY MANAGEMENT STATE TASK FORCES

BOEM State Task Forces are underway in three of the Southeastern states:

Virginia
- Call for Information and Nominations released February 2012
  - 19 whole and 13 partial OCS lease blocks (133 nm^2)
  - Eight nominations of interest received

North Carolina
- Plans for a Call to go out late 2012
- Nearly 500 lease blocks still under consideration

South Carolina
- First state task force meeting held in March 2012

Additionally, the existing (and rapidly growing) population in the region provides a large electricity market that is capable of creating the demand necessary for offshore wind developments. When considered together, these and the other many strengths of the Southeast create a solid platform for the region's involvement in the growth of the U.S. offshore wind industry.

Appendix E – December 2011 Public Forum Presentations

NC STATE UNIVERSITY

Offshore Wind Basics

Jen Banks
North Carolina Solar Center
North Carolina State University

December 12, 2011

NORTH CAROLINA Solar Center

NC STATE UNIVERSITY

North Carolina Solar Center

Mission Statement

to advance the use of renewable energy resources to ensure a sustainable economy that protects our natural environment, encourages energy independence, and lowers energy costs for consumers. The Center will safeguard this sustainable energy future through programs to educate the public, share research and technical expertise, guide industry's energy decisions, and shape government policy.

NORTH CAROLINA Solar Center

Offshore Wind in North Carolina

- Basics of Offshore Wind
- Benefits of Offshore Wind
- Offshore Wind Permitting
- NC Offshore Wind Resource
- NC Ports

NORTH CAROLINA Solar Center

NC STATE UNIVERSITY

Source: Garden State Offshore Energy

- State/federal waters
- 8(g) Zone
- Visibility impacted by current conditions

NORTH CAROLINA Solar Center

NC STATE UNIVERSITY

Benefits of Offshore Wind

- Clean, stable priced generation
- Proximity to coastal load centers
- Stronger and steadier offshore winds
  - Coincide with daytime electricity demands
- Not constrained by onshore transportation limitations
  - Larger turbines can be installed
- Opportunity for coastal states to meet renewable energy targets
- Economic Development

NORTH CAROLINA Solar Center

NC STATE UNIVERSITY

Existing Offshore Wind Projects: 3294 MW

- First project – Vindeby, 1991
- 2010
  - Europe cumulative: 2,946 MW in 45 projects
  - China: Shanghai Donghai Bridge Project
- 1st half of 2011
  - Europe: 348.1 MW additional capacity
    - 101 turbines
    - Average turbine capacity of 3.4 MW
- Renewable Energy Targets

NORTH CAROLINA Solar Center

NC STATE UNIVERSITY

Offshore Wind in the US

20% Wind Scenario

- One scenario for reaching 20% wind by 2030
- Would require 300 GW of wind generation
  - Includes 54 GW of offshore wind

DOE Goal

- 54 GW of offshore wind by 2030
  - At a cost of 7 – 9 cents per kilowatt-hour
  - Interim goal: 10 GW by 2020 at cost of 10 – 13 cents per kilowatt-hour

NORTH CAROLINA Solar Center

NC STATE UNIVERSITY

Offshore Wind Permitting

- **Federal Permitting Focus**
  - 4-2009: Final Rule for projects on the OCS
  - 5-2010: Creation of the Bureau of Ocean Energy Management, Regulation and Enforcement
  - 8-2010: DOE's *Creating an Offshore Wind Industry in the United States: A National Vision and Call to Action*
  - 11-2010: DOI's Smart from the Start Initiative
    - 2-2011: Wind Energy Areas announced
  - 2-2011:National Offshore Wind Strategy
  - 5-2011: 2nd notice of competitive interest eliminated
  - 9-2011: BOEMRE restructured into 2 agencies

NORTH CAROLINA Solar Center

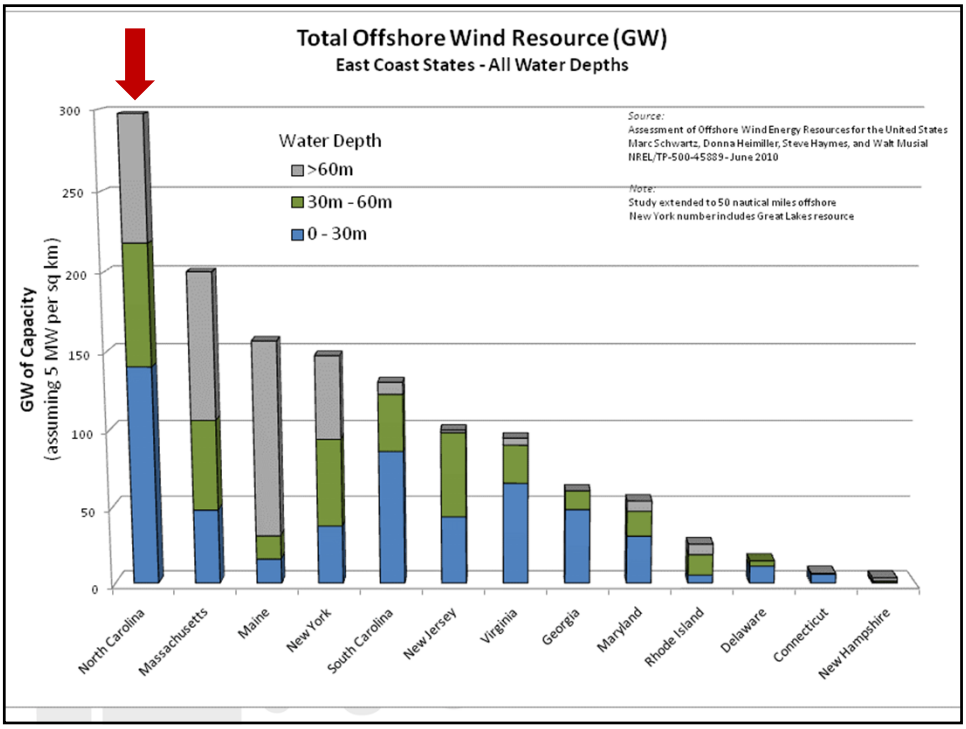
NC STATE UNIVERSITY

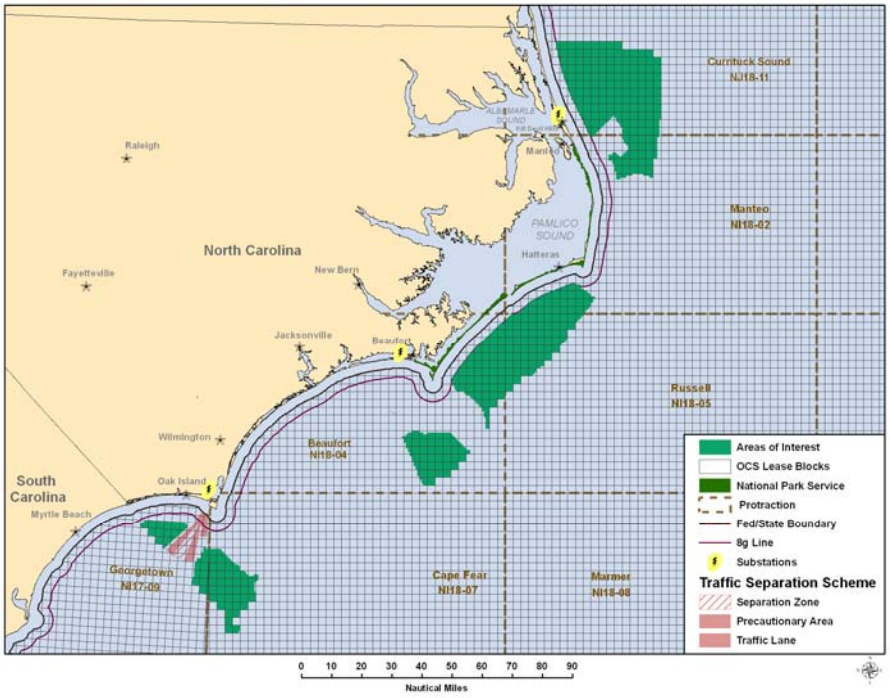
NC Offshore Wind Resource

- #1 East Coast potential: 297.5 GW
  - Areas within 50 nautical miles from shore and wind speeds greater than 7 m/s.
  - Massachusetts is #2 with 200 GW
- Virginia, North Carolina, South Carolina, and Georgia:
  - **63%** of the total shallow water offshore wind resource on the East Coast
  - **82%** of the shallow water resource more than 12 miles offshore

NORTH CAROLINA Solar Center

NC STATE UNIVERSITY





Jobs from Offshore Wind

Example – **2,500 MW**

Manufacturing & Construction Jobs	Permanent O&M Jobs
10,350 jobs (5 years each)	**2,000 jobs** (permanent)

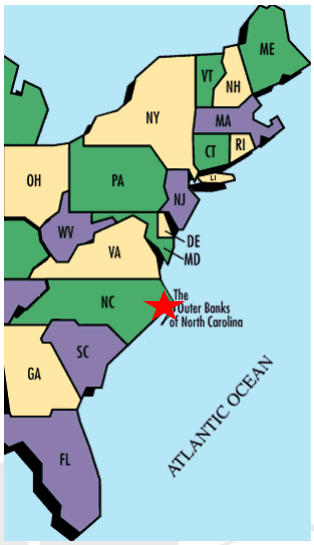
NC's Developable Resource:

25,000 – 50,000 MW

(*after* use constraints but *not* including water >40m deep)

NORTH CAROLINA Solar Center

NC STATE UNIVERSITY



Excellent Port Potential

Port of Morehead City

- Deep draft
- No height or width constraints
- Area with road/rail access available for expansion
- ~3 miles to open ocean
- Little competition with container shipping/traffic
- Potential lay down area – Radio Island
- Constraint – lifting capacity

NORTH CAROLINA Solar Center

NC STATE UNIVERSITY

Summary of Opportunity

- Offshore Wind represents a very large, long-term business opportunity
- There is a limited window of opportunity and other states are moving aggressively
- NC has some distinct advantages

NORTH CAROLINA Solar Center

NC STATE UNIVERSITY

North Carolina Wind Working Group

- North Carolina wind stakeholder group
  - Over 130 active members
  - Listserv has over 200 members
- Created NC Model Wind Ordinance in 2008
  - 10 local wind ordinances in NC
- Email jen_banks@ncsu.edu to become involved

NORTH CAROLINA Solar Center

NC STATE UNIVERSITY

Thank you!

Jen Banks
Wind Energy Project Coordinator
North Carolina Solar Center
jen_banks@ncsu.edu

NORTH CAROLINA Solar Center

NC STATE UNIVERSITY

North Carolina & Offshore Wind

Jacksonville, NC
December 13, 2011

Presented by: Brian O'Hara
NC Offshore Wind Coalition

NORTH CAROLINA OFFSHORE WIND COALITION

Our Mission:
To promote a sustainable offshore wind industry that delivers clean, domestic, affordable, and stable-priced energy while creating well-paying jobs.

Who We Are:
- 501(c)(6) non-profit
- Industry, Non-Profits, Regional Economic Developers

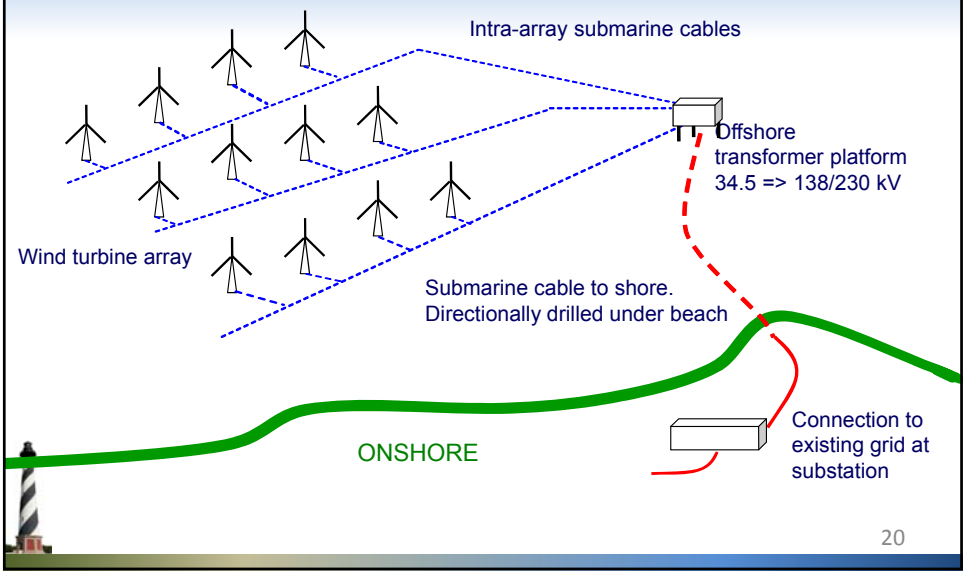
What We Do:
- Policy
- Education & Outreach
- Regional Collaboration

http://www.ncoffshorewind.org

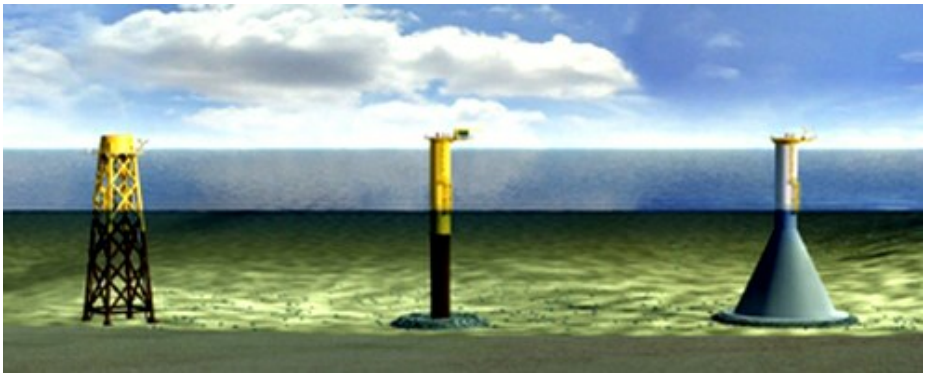
THE TECHNOLOGY

What is offshore wind
and how does it work?

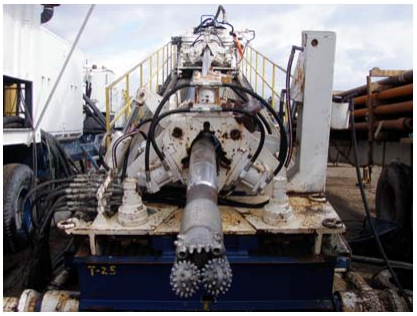
Offshore Wind Layout



Foundation Types



Cable Comes Ashore Under Beach



Bore can emerge several thousand feet offshore

State of the Offshore Industry

- 3,294 MW installed as of June 2011
- 49 wind farms in 9 countries, 1,247 turbines
- Europe is leading, China is ramping *fast*
- Another 3,000 MW are under construction
- 19,000 MW are fully consented
- UK alone has plans for over 34,000 MW

THE OPPORTUNITY

What's in it for North Carolina?

The Assumption:

There are political, economic, and environmental issues with our energy production that we need to address to achieve sustainability.

Does offshore wind make sense as an important part of NC's energy future?

~~Is offshore wind the "silver bullet"?~~

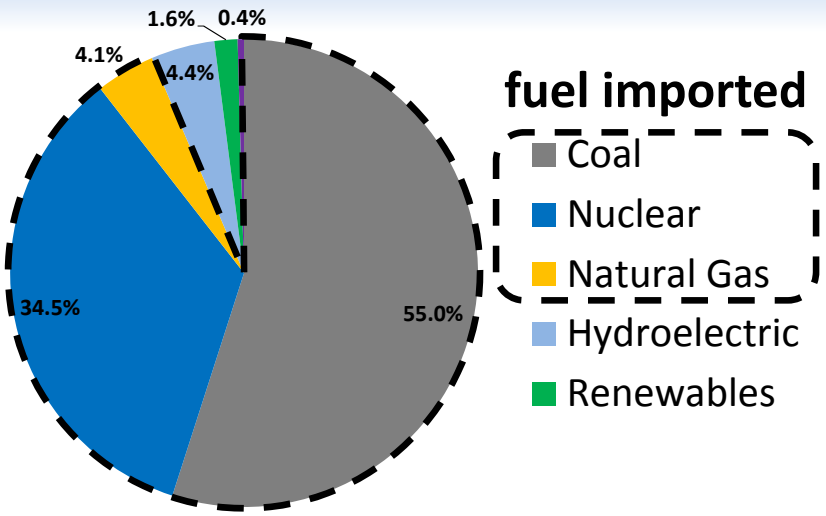
~~No.~~ No. There are no silver bullets.

YES. It delivers clean energy with significant economic and environmental benefits.

Offshore Wind Benefits

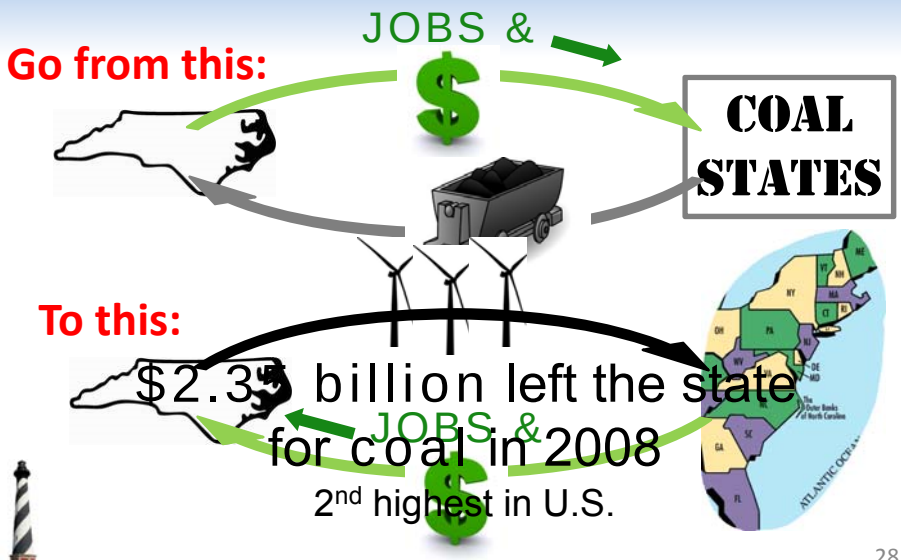
- Clean energy with near zero emissions
- Provides well-paying local jobs
- Proven technology, operating since 1991
- Stable priced energy, no fuel price volatility
- Wind is stronger and steadier offshore
- Can be sited with minimal visual impact
- Uses no water to produce electricity

2009 NC Electricity By Source



Source: US Energy Information Administration

The Opportunity



$2.3 billion left the state for coal in 2008

2nd highest in U.S.

Jobs from Offshore Wind

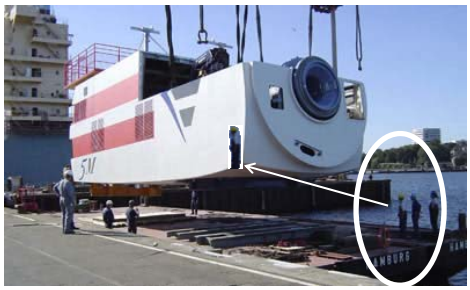
Example – **2,500 MW**

Manufacturing & Construction Jobs	Permanent O&M Jobs
10,350 jobs (5 years each)	**2,000 jobs** (permanent)

NC's Developable Resource:
***at least* 25,000 – 50,000 MW**
(*much more in deeper water*)

Local Supply Chain Creates NC Jobs

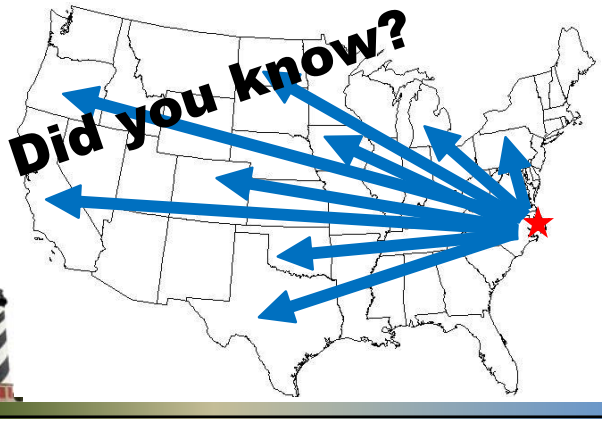
- Components are large, expensive to ship
- In wind, **supply chain follows the projects**
  - EU onshore, US onshore, EU offshore…

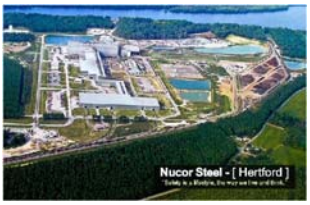


North Carolina Working in Wind

<u>Over half</u> of the plate steel for the U.S. Wind Industry comes from Hertford, NC.

Source: Leeco Steel





NUCOR
PLATE MILL

North Carolina Working in Wind

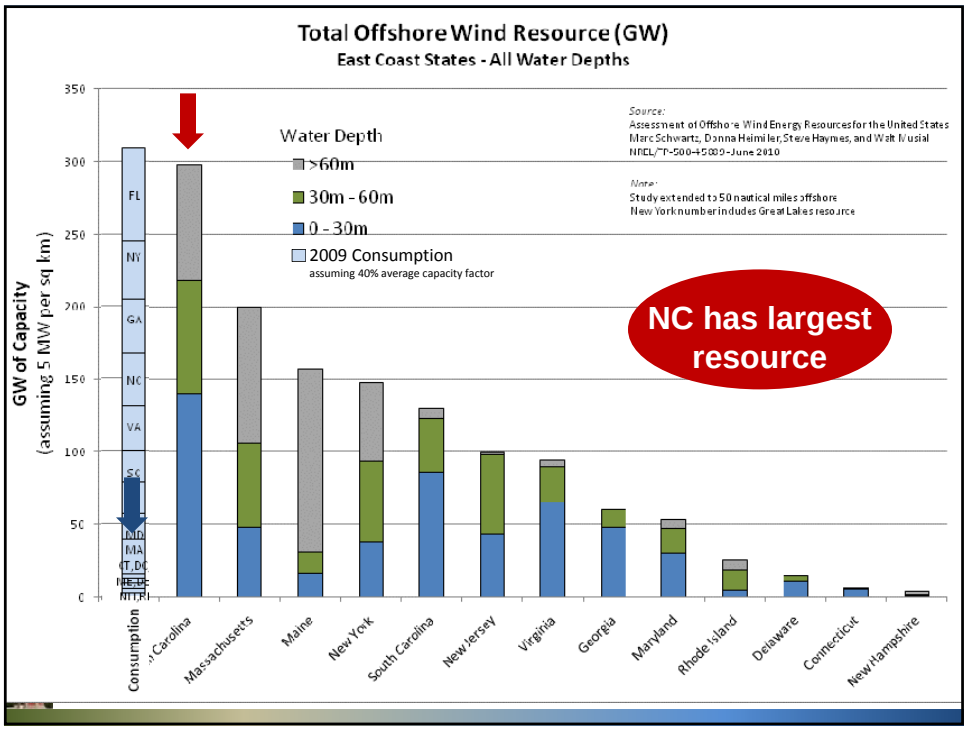
PPG Industries has manufacturing plants in Shelby, NC and Lexington, NC that make, among other things, fiberglass for the wind industry.

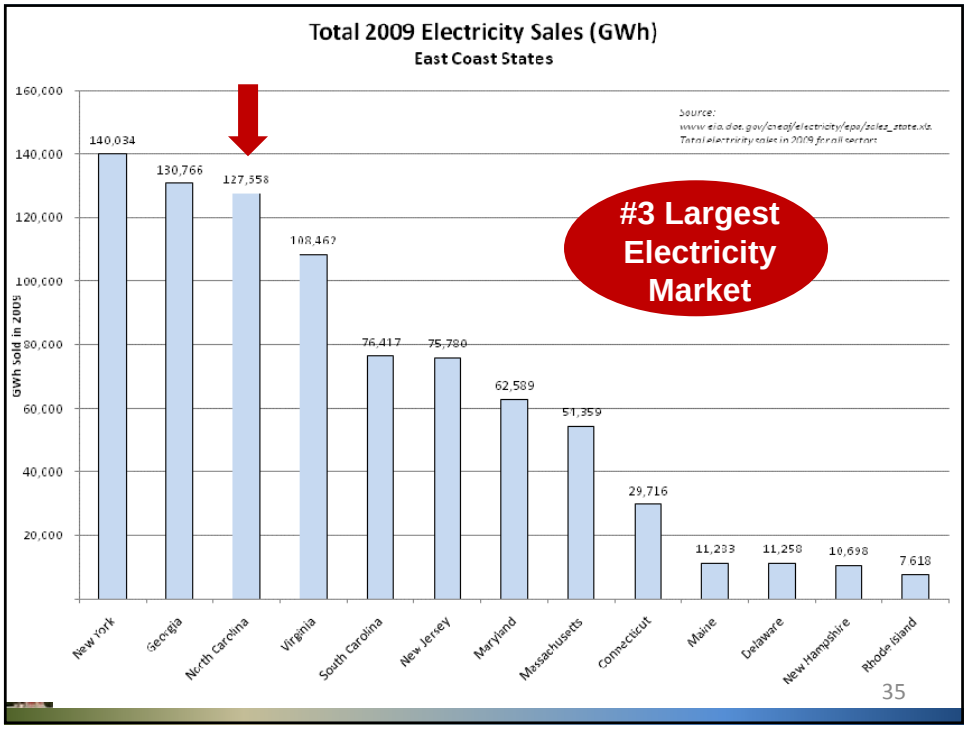
These plants employ close to 1,000 people.

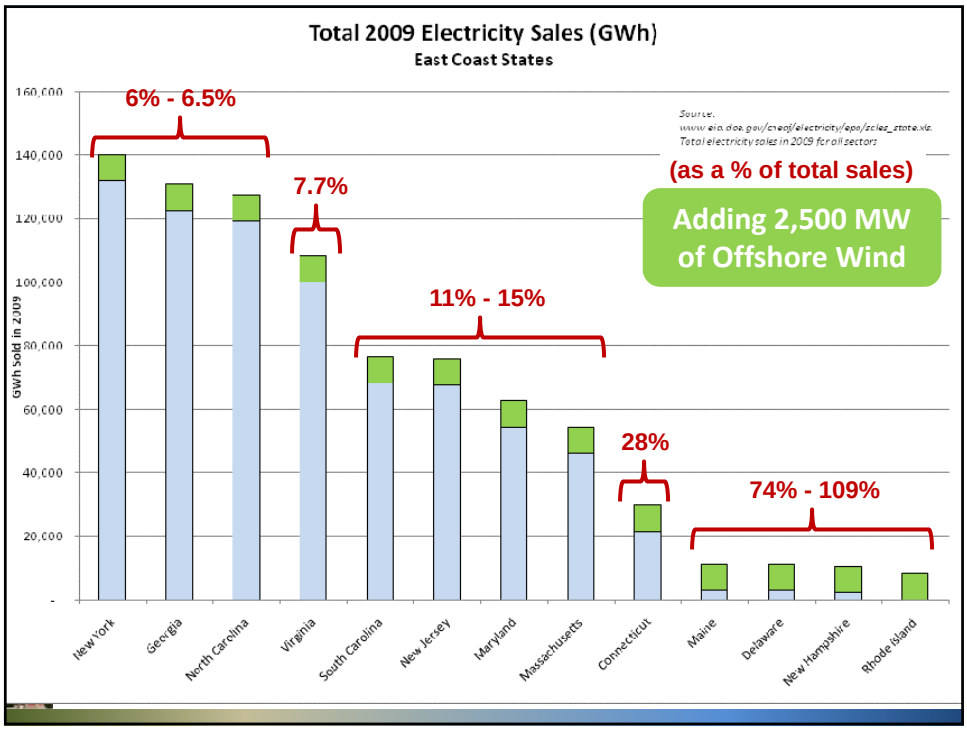
PPG
INDUSTRIES

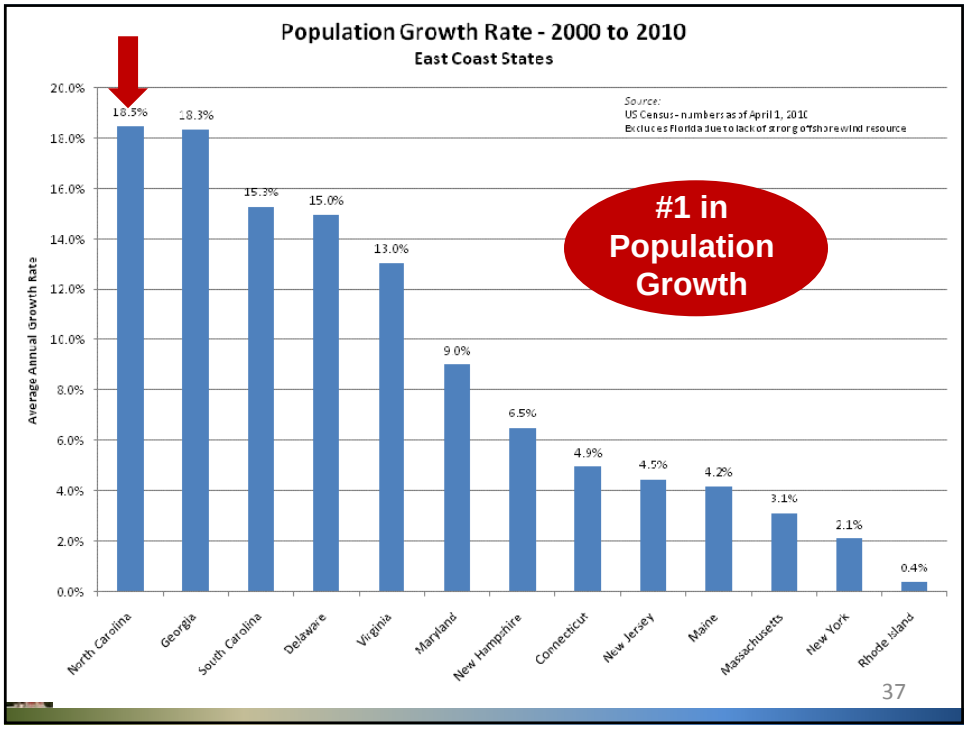
NC's ADVANTAGES

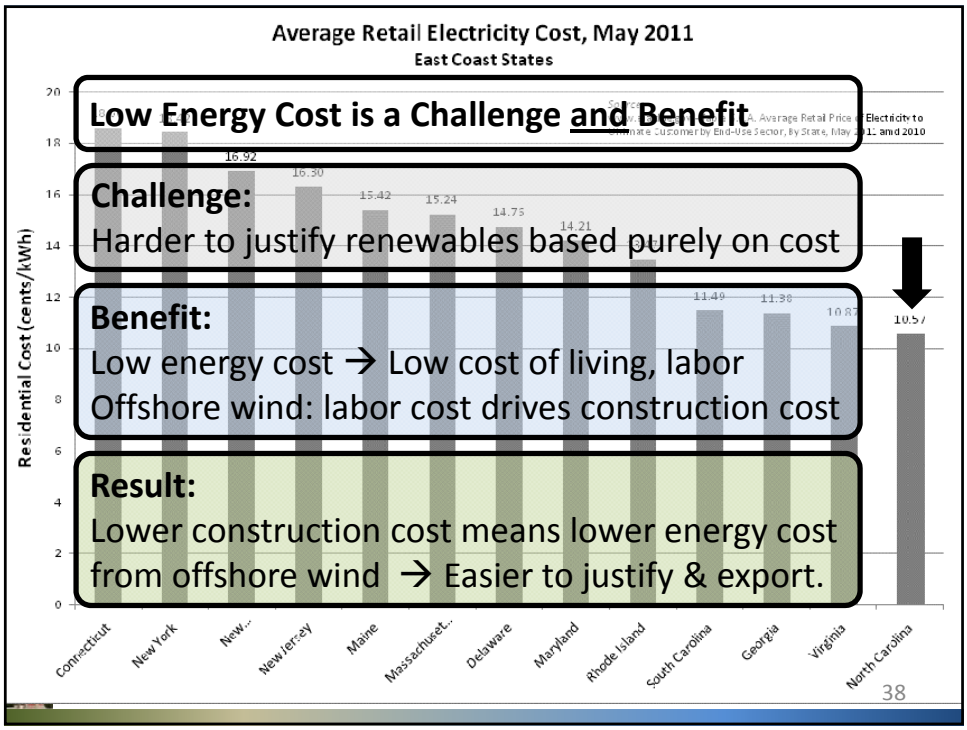
Why does Offshore Wind make sense here?

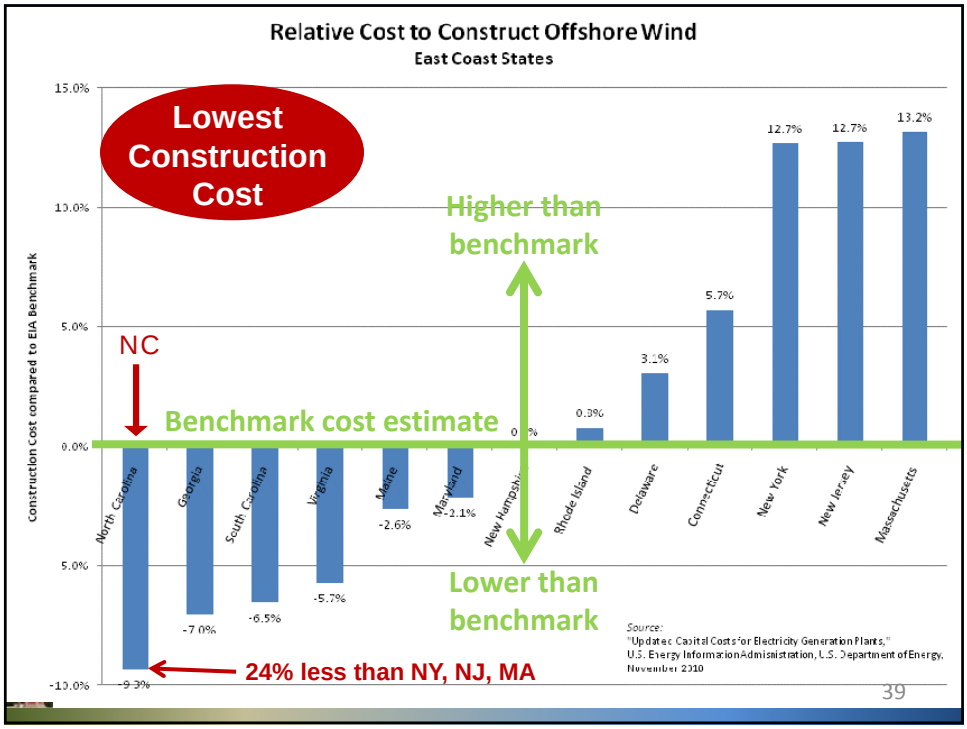



Total 2009 Electricity Sales (GWh)
East Coast States
GWh Sold in 2009
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
140,034
130,766
127,558
108,462
76,417
75,780
62,589
51,359
29,716
11,233
11,258
10,698
7,618
New York
Georgia
North Carolina
Virginia
South Carolina
New Jersey
Maryland
Massachusetts
Connecticut
Maine
Delaware
New Hampshire
Rhode Island
#3 Largest Electricity Market


Total 2009 Electricity Sales (GWh)
East Coast States
GWh Sold in 2009
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
-
6% - 6.5%
7.7%
11% - 15%
28%
74% - 109%
(as a % of total sales)
Adding 2,500 MW of Offshore Wind
New York
Georgia
North Carolina
Virginia
South Carolina
New Jersey
Maryland
Massachusetts
Connecticut
Maine
Delaware
New Hampshire
Rhode Island


Population Growth Rate - 2000 to 2010
East Coast States
Source:
US Census - numbers as of April 1, 2010
Excluces Florida due to lack of strong offshore wind resource
#1 in Population Growth
Average Annual Growth Rate
20.0%
18.0%
16.0%
14.0%
12.0%
10.0%
8.0%
6.0%
4.0%
2.0%
0.0%
18.3%
18.3%
15.3%
15.0%
13.0%
9.0%
6.5%
4.9%
4.5%
4.2%
3.1%
2.1%
0.4%
North Carolina
Georgia
South Carolina
Delaware
Virginia
Maryland
New Hampshire
Connecticut
New Jersey
Maine
Massachusetts
New York
Rhode Island


Average Retail Electricity Cost, May 2011
East Coast States
Low Energy Cost is a Challenge and Benefit
Challenge:
Harder to justify renewables based purely on cost
Benefit:
Low energy cost → Low cost of living, labor
Offshore wind: labor cost drives construction cost
Result:
Lower construction cost means lower energy cost from offshore wind → Easier to justify & export.
Residential Cost (cents/kWh)
20
18
16
14
12
10
8
6
4
2
0
16.92
16.30
15.42
15.24
14.75
14.21
11.49
11.38
10.87
10.57
Connecticut
New York
New...
New Jersey
Maine
Massachuset...
Delaware
Maryland
Rhode Island
South Carolina
Georgia
Virginia
North Carolina



In Summary, North Carolina Has:

- The largest resource
- The lowest construction cost
- #3 largest electricity market
- The fastest growing population
- Only state in the Southeast with RPS
- A supportive public and leadership
- **An enormous clean energy, jobs, and economic development opportunity.**

What Can You Do?

- Educate yourself about offshore wind.
- Educate your community about offshore wind.
- Call your state legislators.
- Write your state legislators.
- Visit your state legislators.

Meteorological Towers

Energy Price Negotiation

Contract

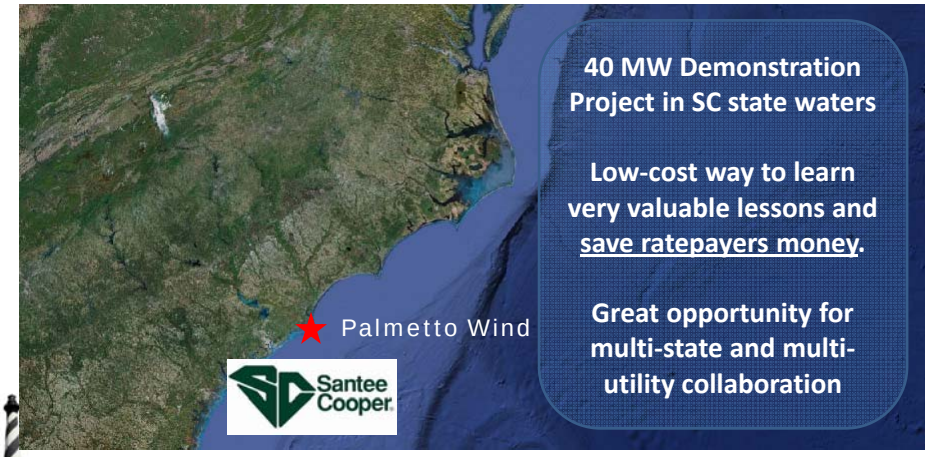
Met Tower Installed & Data Collected

Construction

Data is publicly available.

Reduced uncertainty = reduced risk = reduced price

A Carolina Collaboration?



40 MW Demonstration Project in SC state waters

Low-cost way to learn very valuable lessons and save ratepayers money.

Great opportunity for multi-state and multi-utility collaboration

NORTH CAROLINA OFFSHORE WIND COALITION

For more information:

Brian O'Hara
briano@ncoffshorewind.org
(252) 506-9463

North Carolina Offshore Wind Efforts

Bob Leker
Renewables Program Director
State Energy Office, NC Commerce Department
December 12, 2011

North Carolina Energy Office energync.net

Outline

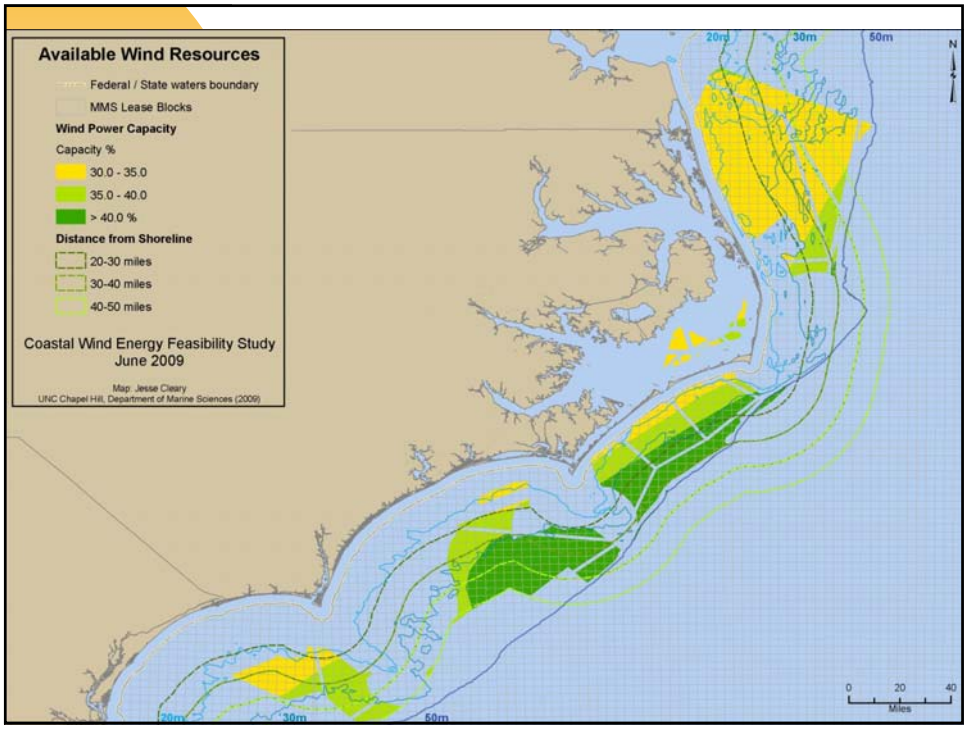
- 2009 UNC Study
- Ongoing North Carolina Research
- Bureau of Ocean Energy Management – NC Task Force
- Offshore Wind Economic Development Task Force
- North Carolina Transmission Planning Collaborative
- Southeast Offshore Wind Farms – Hypothetical Study
- North Carolina organizations involved in Offshore Wind

North Carolina Energy Office energync.net

UNC Study: Coastal Wind – Energy for NC's Future

- Released 2009
- Considered waters less than 50m deep and within 50 nautical miles from shore
  - » Considered the following constraints - very conservative
    - › Wildlife, Fishing, Navigation, Transmission, Military, Cultural
- 55,000 MW potential
  - » Average output = 130% of 2007 NC electricity use

North Carolina Energy Office energync.net



NC Dept of Commerce – Offshore Wind Study Efforts

- Builds on UNC Coastal Winds Study
- Covers
  - » Economic impacts
  - » Environmental concerns
  - » Ports capabilities
  - » Local attitudes on viewshed
  - » Review of European experience
  - » Educational outreach to stakeholders
  - » Wind resource data collection (tall tower, buoy, DOD platform)
- Final report expected Spring 2012

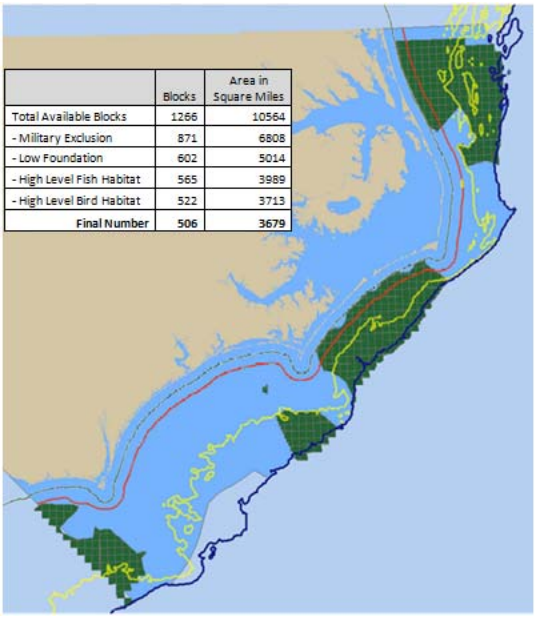
North Carolina Energy Office energync.net

Bureau of Ocean Energy Management NC Task Force

- BOEM will determine lease areas on Outer Continental Shelf with input from NC Task Force
  - » Mapping exclusions out to 40 meter depth (may expand out to 50 meter depth)
  - » Latest map: approx. 500 lease blocks after exclusions
- Future efforts:
  - » Review feedback from NOAA, NPS, USCG
  - » Visual Simulation Study (addresses NPS viewshed issues)
  - » Call for Information and/or request for interest
  - » Additional State Task Force Meetings

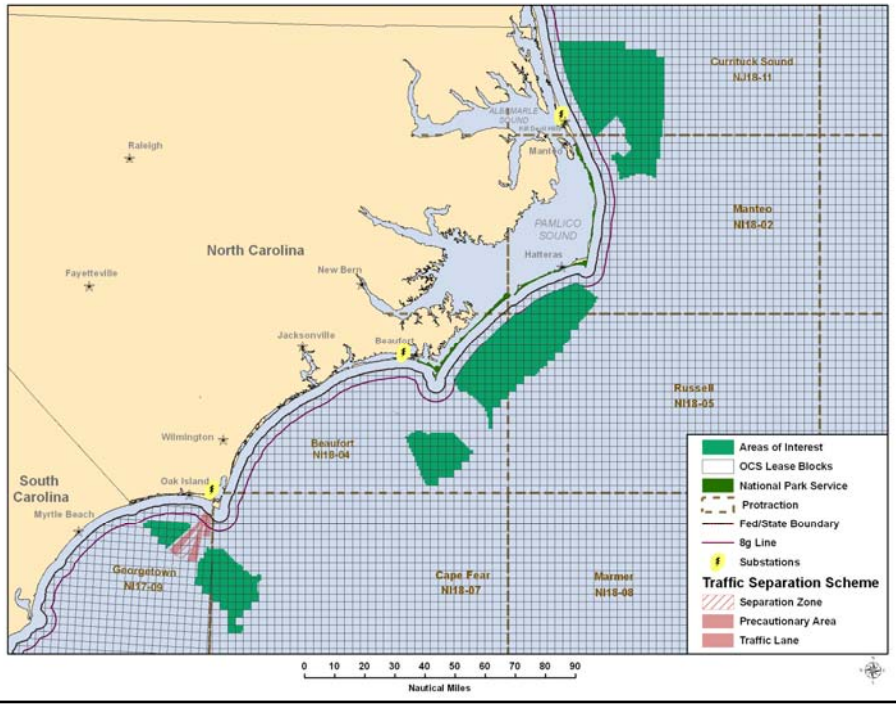
North Carolina Energy Office energync.net

Current Lease Blocks Under Consideration



	Blocks	Area in Square Miles
Total Available Blocks	1266	10564
- Military Exclusion	871	6808
- Low Foundation	602	5014
- High Level Fish Habitat	565	3989
- High Level Bird Habitat	522	3713
Final Number	**506**	**3679**

Source: NC Dept of Commerce PRSP



Offshore Wind Economic Development Task Force

- Executive Order 96, issued June 2011
- 15 members, appointed by the Governor
- Study the potential for offshore wind in the state
  - » economic costs/benefits
  - » necessary policy framework
  - » potential incentives for communities
  - » paths to ensure a positive net economic benefit
  - » guidelines to assist developers in project siting
- Investigate the benefits of creating a non-binding goal for 5000 MW of offshore wind by 2030
- Report due to Governor Spring 2012

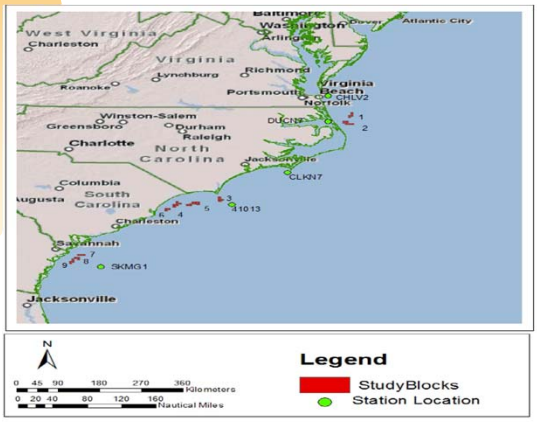
North Carolina Energy Office energync.net

NC Transmission Planning Collaborative

- Created by NC Utilities
  - » Duke Energy, ElectriCities of NC, NC Electric Membership Corporation, Progress Energy Carolinas
- 2010 Study released January 2011
  - » Impacts of 3000MW of offshore wind
  - » Onshore injection sites of Bayboro, Morehead and Southport
- 2011 Study
  - » Impacts of 5000MW of offshore wind

North Carolina Energy Office energync.net

Hypothetical Southeast Offshore Wind Study – Produced By EnerNex for Southern Alliance for Clean Energy and NC, GA, & SC



Study found that a HVDC loop transmission line connecting sites was lower cost than radial HVAC lines from each site

North Carolina Energy Office energync.net

North Carolina Organizations

- **North Carolina Offshore Wind Coalition**
  - » Brian O'Hara, President - briano@ncoffshorewind.org
- **North Carolina Solar Center**
  - » Jen Banks, Wind Energy Project Coordinator, jen_banks@ncsu.edu
- **North Carolina State Energy Office**
  - » Bob Leker, Renewables Program Manager – bleker@nccommerce.com
- **North Carolina Sustainable Energy Association**
  - » Paul Quinlan, Managing Director – paul@energync.org
- **North Carolina State Ports**
  - » Lance Kenworthy, Account Executive, Business & Economic Development - lance.kenworthy@ncports.com
- **North Carolina Sierra Club**
  - » Carina Barnett-Loro, Conservation Program Coordinator - carina.barnett-loro@sierraclub.org

North Carolina Energy Office energync.net

Thank You

North Carolina Energy Office energync.net

North Carolina Transmission Planning Collaborative

Brunswick County Public Forum
Calabash, *NC – 12/12/11*
Jacksonville, NC – 12/13/11

Summary of NC Transmission Planning Collaborative (NCTPC) Wind Studies

Mark Byrd , PE
Progress Energy Carolinas

Outline

1. **Who is NCTPC?**
2. **2010 Study Results**
3. **2011 Study Results**
4. **Current Proposed Wind Connections on Progress Energy Transmission System**

Who is NCTPC?

NC Transmission Planning Collaborative (NCTPC) was formed in 2005 by **NCEMC, Duke, Progress and ElectriCities** to:

-Provide Participants and other stakeholders opportunity to participate in transmission planning process

-Develop single transmission plan that includes reliability and enhanced access while appropriately balancing costs, benefits and risks

NCTPC Roles

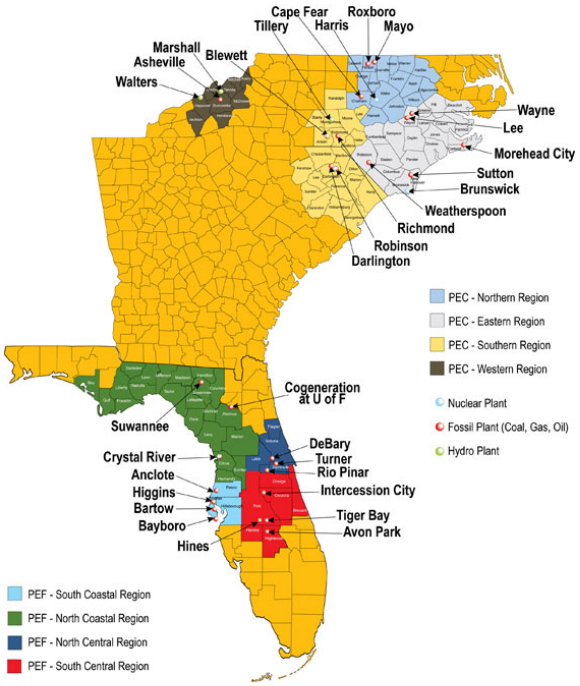
Oversight Steering Committee (OSC) – overall responsibility for managing the process

Planning Working Group (PWG) – support development of the Process and coordinate study development

Transmission Advisory Group (TAG) – stakeholders that provide advice and recommendations on Process and study results

Independent Third Party (ITP) – Process facilitator and liaison to TAG

www.nctpc.net/nctpc



Progress Energy Service Areas

2010 NCTPC Wind Study

Coastal NC wind sensitivity with wind injections in the following locations, based on information obtained from the **UNC "Coastal Wind: Energy for North Carolina's Future" report (see link below):**

http://www.climate.unc.edu/coastal-wind/Coastal%20Wind-%20Energy%20for%20NC2019s%20Future.pdf

2015 case, on peak:
– Wilmington (30% capacity factor): 125 MW
– Morehead City (40% capacity factor): 675 MW
– Bayboro (35% capacity factor): 425 MW

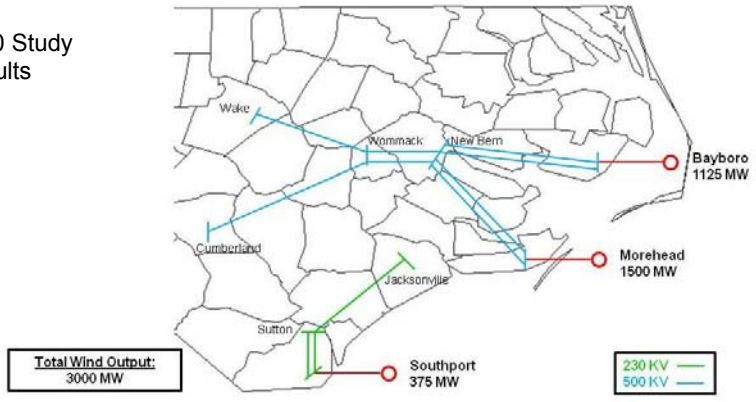
Total : 1225 MW

2015 case, off-peak:
– Wilmington (90% capacity factor): 375 MW
– Morehead City (90% capacity factor): 1,500 MW
– Bayboro (90% capacity factor): 1,125 MW

Total: 3000 MW

Offshore Wind: Option 1B

2010 Study Results



2010 NC Offshore Wind Results Review

Summary of 2010 Study

Accommodate 3,000 MW's into PEC Transmission network

- Four options were studied.
  - Option 1A – via 230 kV Network (Est. cost: $1.195B)
  - Option 1B – via 500 kV Network (Est. cost: $1.310B)
  - Option 2 – Accommodate 2,500 MW's (Est. cost: $1.155B)
  - Option 3 – Accommodate 2,000 MW's (Est. cost: $0.525B)

- **Last year** - Option 1B was considered to be the best option if considering a long-term build out of off-shore wind that might exceed the 3,000 MW test level.

2011 Off Shore Wind Study

- **Approximately 5,000 MW total capacity**
- **Injected at two locations on Progress system**

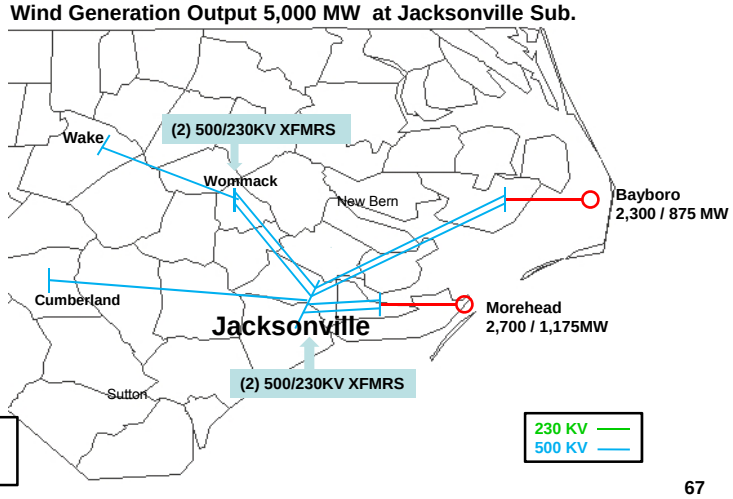
Injection Point	On-peak MW (35-40% CF)	Off-peak MW (90% CF)
Morehead City	1,175	2,700
Bayboro	875	2,300
TOTAL	2,050	5,000

- **MW allocation – 40% SOCO, 36% Duke, 24% Progress**

North Carolina Transmission Planning Collaborative

2011 PWG Offshore Wind Study Results – Progress Energy

Wind Generation Output 5,000 MW at Jacksonville Sub.



Total Wind Output:
5,000 MW Off Peak
2,050 MW On Peak

North Carolina Transmission Planning Collaborative

2011 PWG Offshore Wind Study Results – Progress Energy

Offshore Wind Scenario Estimated Cost Summary

Wind Output MW	Cost Estimate at Jacksonville Substation (Billions)	Cost Estimate at New Bern Substation (Billions)	Comment
Up to 5,000	$1.239	Not feasible	Additional infrastructure upgrades required at Jacksonville substation compared to New Bern substation.
Up to 3,500	Not evaluated	$1.115	Option 1B cost Is $1.31B with Southport
Up to 3,000	$1.029	$1.115	Do not need to build the 500 kV line between Jacksonville and Cumberland 500 kV substations.
Up to 2,000	$0.430	$0.525	Significant breakpoint in transmission upgrades. Removed 500 kV infrastructure.

Proposed Wind Connections on the Progress Energy Transmission System

Q277 Carteret Co. 900 MW Off shore (250 generators)

Q281 Pamlico Co. 200 MW On shore (111 generators)

http://www.oatioasis.com/CPL/CPLdocs/CPL_Gen_Interconn_Queue_Since2006.pdf

Carolinas Offshore Wind Integration Case Study

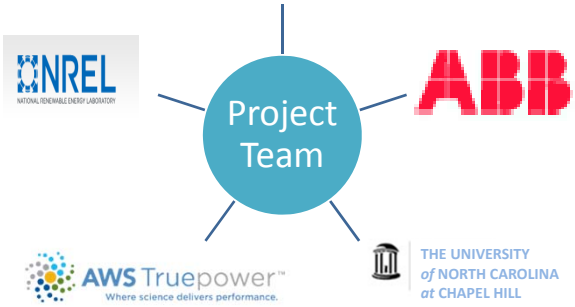
Chris Fallon
Duke Energy

Agenda

- Introduction
- Project Team
- DOE - FOA 414
- Study Overview
- Schedule

Project Team

Duke Energy - Lead Organization



DOE Vision

54 GW of offshore wind by 2030

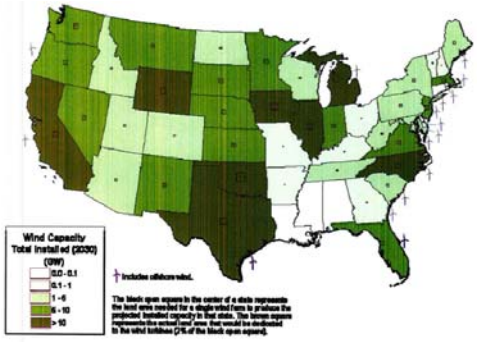
Wind energy cost - $0.07/kWhr

DE Funding Opportunity Announcement (FOA) 414 - US Offshore Wind Removing Market Barriers

- Topic Area 1: Offshore Wind Market and Economic Analysis
- Topic Area 2: Environmental Risk Reduction
- Topic Area 3: Manufacturing and Supply Chain Development
- ***Topic Area 4: Transmission Planning and Interconnection Studies***
- Topic Area 5: Optimized Infrastructure and Operations
- Topic Area 6: Resource Characterization and Design Conditions
- Topic Area 7: Impact on Electronic Equipment in the Marine Environment

Why Offshore Wind in the Carolinas?

- NC REPS Requirement
  - By 2021, 12.5% of all energy must come from renewable resources or EE
  - ~ 17,000 GWHRs needed by 2021
  - Limited options
    - Biomass
    - Ridge law
    - Solar

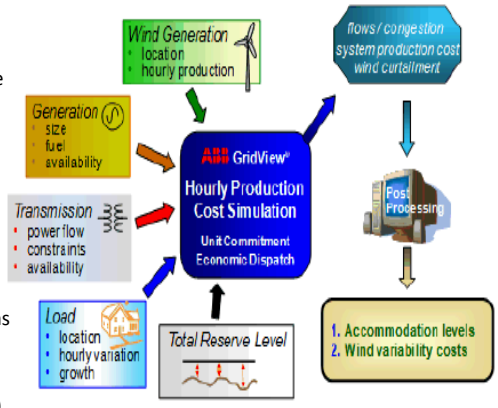


Study Overview

- Wind Energy Levels
  - 1000 MW
  - 3000 MW
  - 5600 MW
- Primary Activities
  - Site selection
  - Capacity and energy profiles
  - Interconnection and delivery assessment
  - Operating and reliability impacts
  - Production costs impacts

Study Overview

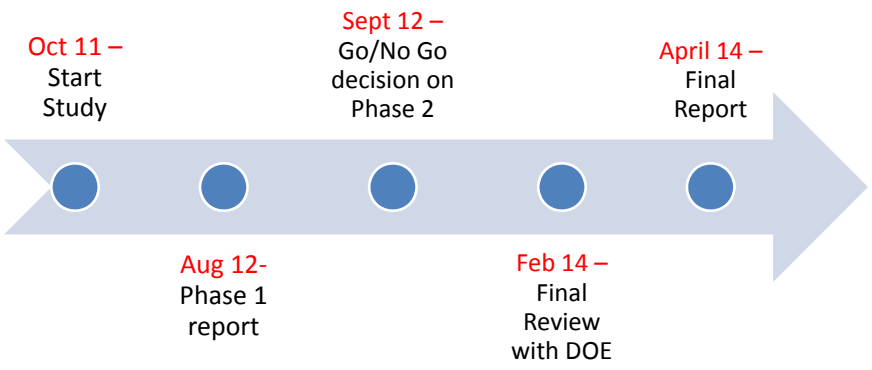
- Phase 1
  - Develop capacity and energy profiles
  - Evaluate different methods for interconnecting wind resources to the grid
    - Radial connections
    - DC grid connecting multiple plants
  - Identify necessary transmission upgrades to reliably integrate various wind levels (steady-state analysis)
- Phase 2
  - Evaluate dynamic stability issues
  - Evaluate voltage stability issues
  - Identify problematic system conditions (e.g. high wind generation and low thermal generation scenarios)
  - Evaluate operating reliability impacts (e.g. impact on reserve requirements)
  - Evaluate production cost impacts



Target Audiences

- Legislators
- Policy makers
- Regulators
- Industry participants

Schedule



Appendix F – Guide to Wind Energy in North Carolina

Guide to Wind Energy in North Carolina

With volatile energy prices, concerns about increasing electricity demand and uncertain supply, and a greater awareness of environmental threats, energy issues in the United States are under greater scrutiny now than at any other time in our nation's history. As citizens and policy makers become more cognizant of these energy challenges, more attention is being paid to the increasing role of renewable sources of electricity.

In addition to national attention, there has been an increase in statewide consideration of renewable electricity generation in recent years. In August 2007 the North Carolina General Assembly acknowledged the benefits of renewable energy when it officially passed Senate Bill 3, creating a Renewable Energy and Energy Efficiency Portfolio Standard (REPS). The North Carolina REPS requires state electric utilities to gradually increase the portion of their electricity that comes from renewable sources or energy efficiency measures. By 2021, the investor-owned utilities operating in the state - Duke Energy Carolinas, Progress Energy Carolinas, and Dominion North Carolina Power - must derive at least 12.5% of the electricity they deliver from renewable sources or make equivalent consumption reductions through efficiency programs. Smaller electricity providers such as municipal utilities and electric membership cooperatives must generate at least 10% of their electricity from similar sources by 2018.[1]

One such renewable source - wind power - is attracting particular attention due to its abundance and cost-competitiveness. In fact, to examine the potential role of wind power in the future of the national electricity portfolio, the U.S. Department of Energy produced a detailed analysis of how the U.S. could derive 20% of its electricity from wind energy.[2] The report, produced in July 2008, highlights North Carolina as possessing significant wind resource potential, estimating the state could install 12,000 MW of onshore and offshore wind energy capacity by the year 2030. Based on 2010 estimates from the National Renewable Energy Laboratory, North Carolina has an onshore wind resource of 1500 megawatts (MW) for sites with potential capacity factors of 30 percent or greater.[3] North Carolina also has exceptional offshore wind resources – National Renewable Energy Laboratory estimates show that N.C.'s offshore wind potential is higher than any other East Coast state.[4]

- Wind Energy Overview
- Wind Farm Development and Lifespan
- Benefits of Wind Energy
- Responsible Community Integration
- Utility and Transmission Toolbox

[1] North Carolina Sustainable Energy Association. *A Citizen's Guide: The North Carolina Renewable Energy and Energy Efficiency Portfolio Standard*. June 2012. http://energync.org/assets/files/podcast_episodes/a-citizens-guide-to-the-nc-reps/a-citizens-guide-north-carolina-renewable-energy-energy-efficiency-portfolio-standard.pdf

[2] U.S. Department of Energy. *20% Wind Energy by 2030.* July 2008. http://www1.eere.energy.gov/windandhydro/wind_2030.html

[3] National Renewable Energy Laboratory. *Estimates of Windy Land Area and Wind Energy Potential by State.* February 2010. http://www.windpoweringamerica.gov/pdfs/wind_maps/wind_potential.pdf

[4] National Renewable Energy Laboratory. *Assessment of offshore wind energy resources for the United States.* June 2010. http://www.nrel.gov/docs/fy10osti/45889.pdf

Guide to Wind Energy in North Carolina

Wind Energy Overview

Wind in North Carolina

The Department of Energy's (DOE) potential scenario for reaching 20% of the U.S. electricity needs with wind by 2030 includes North Carolina as one of only eight states with over 10 gigawatts (GW) of wind energy capacity installed. This capacity would include both offshore and land-based wind, but the reality of this scenario happening in North Carolina will be based on land-use decisions and policies for wind development over the next 20 years. Based on 2010 estimates from the National Renewable Energy Laboratory, North Carolina has a land-based wind resource of 1500 megawatts (MW) for sites with potential capacity factors of 30% or greater. North Carolina's wind resources were overlooked for many years, but with technological developments for low wind speed turbines and with the low-hanging fruit of wind development sites in the US gone – many developers are now looking seriously at North Carolina.

Over the last several years, two wind companies have filed applications for a Certificate of Public Convenience and Necessity with the North Carolina Utilities Commission for land-based wind energy facilities. In May 2011, the Utilities Commission approved the 300 MW Desert Wind Project proposed by Atlantic Wind, LLC - this project is currently on hold after discussions with utilities failed to result in a Power Purchase Agreement. In March 2012, the Utilities Commission approved the Pantego Wind Energy, LLC, application for an 80 MW project in Beaufort County. Several other land-based wind projects are being pursued in coastal counties but have not yet filed with the Utilities Commission. There is an ongoing need to provide accurate information to North Carolina citizens and policy-makers so that they can make educated decisions on the future use of low carbon renewable energy alternatives in the state.

The United States does not currently have any offshore wind projects in place, but approximately 5,000 megawatts (MW) are proposed in the oceans and in the Great Lakes. Nearly 78% of the U.S. population lives in the 28 coastal states, so the proximity to this demand makes offshore wind an excellent option for these states. With the sea breeze effect, in which the winds over the ocean blow during the daytime, offshore wind can line up with daytime peak electricity demands. The U.S. can learn from the European experience of installing over 3200 MW of offshore wind in the last 20 years. In February 2011, the Department of Energy and the Department of the Interior announced a National Offshore Wind Strategy, which is designed to support offshore wind deployment of 10 GW by 2020 and 54 GW by 2030. Of that 54 GW, nearly 10 GW is projected to be offshore from North Carolina.

North Carolina has exceptional offshore wind resources – in fact, National Renewable Energy Laboratory estimates show that N.C.'s potential is higher than any other East Coast state. North Carolina is moving forward with efforts to bring offshore wind to the state through the Bureau of Ocean Energy Management's (BOEM) North Carolina Offshore Renewable Energy Task Force. The Task Force, which has held 4 meetings since January 2011, consists of state, federal, local and tribal government representatives coordinating efforts to facilitate commercial leasing for renewable energy on the Outer Continental Shelf offshore from North Carolina.

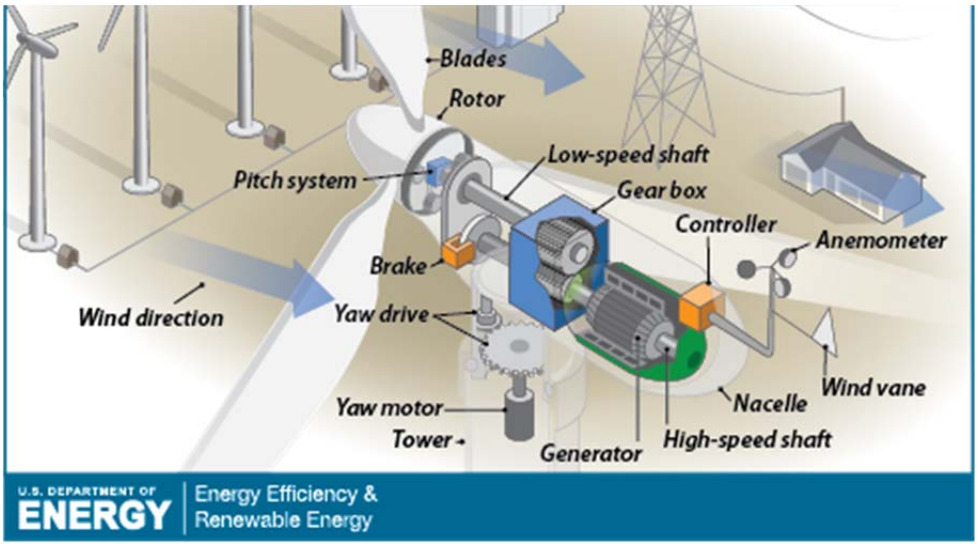
The Bureau of Ocean Energy Management (BOEM) announced the release of the Call for Information and Nominations for potential offshore wind leasing areas offshore from North Carolina. The call covers three offshore areas - Call Area Kitty Hawk, Call Area Wilmington East and Call Area Wilmington West (see map here). Additionally, the Notice of Intent (NOI) to Prepare an Environmental Assessment covering these areas was released. This is an important step forward for offshore wind in North Carolina. The areas will continue to be refined based on comments received on the Call and NOI and results of ongoing working groups organized by BOEM.

Small-scale vs. utility-scale wind power

Modern wind turbines come in many sizes, from small kilowatt-scale turbines to multi-megawatt utility-scale turbines. This guide will primarily consider issues regarding utility-scale wind facilities, which typically consist of multiple large turbines rated at 1.5 MW or more.

Wind turbine basics

Utility-scale wind turbines have four main components: rotor, nacelle, tower, and base. The rotor consists of a rotating hub and typically three blades facing the incoming wind. The blades capture the energy of the wind and turn the rotor, converting it to mechanical energy. The rotor is attached to the nacelle, which contains the gearbox, generator, controller, and brake. These components work together to convert the mechanical energy from the rotor to electricity.



Source: http://www1.eere.energy.gov/wind/inside_a_wind_turbine.html

When the wind blows, sensors located in the nacelle determine the speed and direction. In order to maximize generating capacity, the yaw drive rotates the nacelle and rotor to face directly perpendicular to the wind. If the wind speed is too high, the controller may also feather the blades completely to stop the rotor from spinning, protecting the turbine components from damage. Essentially, these components change the yaw and blade pitch in order to optimize the speed of the shaft as it enters the generator. This in turn maximizes the overall power output of the turbine.[5]

Turbine size

As wind technology matures, turbine sizes are continually growing larger. The reason for this is twofold. First, energy in the wind increases with the third power of the wind speed. This means that a 10% increase in wind speed is equivalent to a 33% increase in available energy in the wind. Since wind speed generally increases with height above the ground, the higher the turbine hub is, the more electricity can be generated. Second, the amount of energy captured is a function of the amount of area swept by the blades, as determined by the radius of the rotor. Therefore, the longer the blades, the higher the potential for generation.[6] As of 2011, the average turbine size was 1.97 MW and the most common turbine installed was the GE 1.5 MW.[7]

[5] U.S. Department of Energy. *20% Wind Energy by 2030.* July 2008. p. 26-27
[6] U.S. Department of Energy. *20% Wind Energy by 2030.* July 2008. p. 25-30
[7] American Wind Energy Association. *AWEA US Wind Industry Annual Market Report – Year Ending 2011*. 2012.

Guide to Wind Energy in North Carolina

Wind Project Development and Lifespan

The process of developing a utility-scale wind farm varies greatly depending on the site and scale of the project. This section is intended to give a general overview of the steps involved from the community perspective and an outlook on the impacts over the course of the project's lifespan.

Site selection

The first step of the development process is site selection. Developers identify suitable sites for wind turbines based on a number of factors which contribute to the project's profitability and general feasibility.

The principle site selection factor is the quality of the wind resource. Although turbines can operate at lower speeds, a general guideline used by developers is that sites become economically viable with an average wind speed of 5 meters per second (~11 mph). Before committing to land agreements at a particular site, developers typically erect meteorological towers and gather wind and weather data for several months or even years to ensure sufficient wind resources exist.

Another factor with an impact on the economic feasibility of a potential site is the distance to high voltage transmission lines. Connecting to the grid can be very costly and it is the responsibility of the developer to build any new transmission lines needed to connect the turbines to the grid. In order to minimize capital costs developers build wind facilities as near as possible to existing transmission. Additionally, land availability is a key issue for developers. Acquiring the use rights to large areas of land can be difficult and expensive, so determining the potential for securing these rights is an early stage in the site selection process.

Land use agreements

Once a high potential, economically feasible site has been identified by developers, the next phase is acquiring land rights. Generally, wind facilities are constructed on publicly or privately owned land that is leased by the project owner for a period of 20 to 50 years. A typical wind turbine lifespan is approximately 20 to 30 years. If the developer and landowners enter an agreement for a longer period, it may cover multiple project cycles. In this case, the developer would operate the turbines for their full lifespan and then replace them with new turbines at the same location and continue operation. Wind project developers are much more likely to lease land, rather than purchase it, in order to avoid an additional expense for an already capital-intensive project. Also, many land uses, such as agriculture, can continue despite the presence of the turbines.

Permitting

Once a developer has identified an ideal site and has acquired land use rights and determined a viable wind resource is present, the next stage is permitting. Depending on the size of the project, its location, and the surrounding landscape, there will be a variety of permits from the different levels of government that must be acquired prior to construction. The American Wind Energy Association provides a thorough account of potential permitting authorities in its *Wind Energy Siting Handbook*.

Federal agencies engaged in the permitting process as permitting or consulting agencies include the Federal Aviation Administration, the US Army Corps of Engineers, the US Fish and Wildlife Service, Environmental Protection Agency and the Bureau of Ocean Energy Management (for offshore wind).

State and local permitting

There is currently no state-wide wind permitting rule in North Carolina so the majority of permitting happens at the local level. Any electricity generating facility larger than two megawatts must obtain a certificate of public convenience and necessity from the North Carolina Utilities Commission, as required under the N.C. General Statutes §62-110.1(a). Local authorities can require various permits depending on zoning and land use

regulations. Generally, communities can influence the future development of any wind power facilities by issuing a wind ordinance. For more information on local wind ordinances in North Carolina, see the Responsible Community Integration page.

Construction process

Once the permitting process is complete, the wind facility construction will begin. The duration and complexity of the construction of the project, as with other phases of the process, depends largely on its scope and location, though it can typically be completed in under a year. In most cases, the first step will be to build or update roads to the site. Wind turbine construction requires large equipment such as bulldozers, flat bed trucks, and large cranes - all of which in turn require adequate roads. Once suitable roads are in place, depending on the area, land may need to be prepared for concrete foundations to be poured for the turbine towers. This will be followed by the digging of trenches for the underground electrical and communication cables. Finally, the towers will be raised and the nacelles and rotors will be mounted.[8]

Grid interconnection

As the electricity is generated, it must be fed into the grid so it can be delivered to consumers. The interconnection process varies depending on the scale of the generation. For small residential systems, the turbine can be connected directly to the distribution system and the electricity is sold to the utility company through net-metering. Net-metering is a system by which the electricity generated offsets consumption and the customer's utility bill is reduced appropriately. The North Carolina Utilities Commission requires the investor owned utilities in the state to offer net-metering for systems up to 1 MW.

At the utility scale, interconnection can be a complicated and expensive process, depending on the project's size. Large projects have a power substation that then connects the project to the larger electric grid through high voltage transmission lines. In some cases, the distribution or transmission lines need to be upgraded to increase capacity in order to accommodate the new generation from the wind farm.

Operation and maintenance

After the initial wind facility construction, there are minimal operation and maintenance (O&M) requirements to keep the turbines running. An average wind turbine requires about 40 hours of routine maintenance per year. Small wind farms may not have full time O&M crews at all, whereas larger facilities will typically have a two person crew for every 20-30 turbines.

Repowering or Decommissioning

When the turbines reach the end of their lifespan (typically 20-30 years), the site will either be 'repowered' with new turbines or the project will be decommissioned. Decommissioning includes removing all equipment and other evidence of the project. This includes turbines, towers, foundations, above- and underground cables, O&M buildings, and possibly roads. There may be other site restoration requirements of the developer, depending on the permits issued or individual land agreements. This could include replanting any vegetation that was cleared for roads, turbines, or O&M buildings. Most decommissioning requirements are included within land use agreements. However, local governments may include supplementary requirements within the local wind ordinance.

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[8] National Wind Coordinating Committee. *Permitting of Wind Energy Facilities.* 2002. p. 12 http://www.nationalwind.org/publications/siting/permitting2002.pdf

Guide to Wind Energy in North Carolina

Benefits of Wind Energy

Economic benefits

In addition to the many environmental benefits of wind energy – including improved air quality and water savings from the energy sector - communities across the country are excited about wind energy's economic development potential. As of 2011, the wind industry supported 30,000 manufacturing jobs in 470 facilities for wind energy components across all 50 states. North Carolina's share of this supply chain includes over 25 facilities and several thousand jobs. It is important to note that this supply chain exists without any utility scale wind development in the state. Among the companies involved in NC's wind energy supply chain are ABB, with four manufacturing facilities in the state; American Roller Bearing, with two manufacturing facilities in the state; and CommScope with two manufacturing facilities in the state. Many of these facilities have been expanded in recent years - the potential for greater expansion and more NC jobs rises as land-based wind projects become a reality in the state. Manufacturing for offshore wind also provides a similar opportunity for supply chain growth in the state. Additionally, the Port of Morehead City is ideally suited for the offshore wind industry – with no overhead restrictions, a deep draft, only three miles to open ocean and the potential for an offshore wind lay-down area on Radio Island.

The development of wind facilities generates many direct, indirect, and induced economic benefits to both communities and individuals. Direct impacts are those resulting from the planning, construction and operation of the project, such as jobs at the wind farm, lease payments, and tax revenues. Indirect economic impacts derive from activities that support the wind farm, such as component manufacturers and project financiers. Finally, induced impacts are part of the ripple effect of the direct and indirect sources, such as the local economic activity that naturally increases when unemployment decreases and residents have more disposable income. The U.S. Department of Energy has produced a short study of the economic impact of the first 1,000 MW of wind developed in Colorado, as well as a separate analysis of potential benefits if 1,000 MW were installed in North Carolina. The results of both studies will be included in the discussion here.

Land leases

On the most local level, land leases can provide a significant source of income for landowners and municipalities. Typical land use agreements between the wind development company and the landowners can last between 20 and 50 years and provide consistent annual income for the land owners. The land use agreements can come in several different forms, from revenue sharing to constant annual use fees. The study of Colorado's wind development found that the most common agreements gave the landowners a percentage of the wind developer's revenue for that site. The royalty amounts in Colorado typically begin at 2.5% - 3.5% and increase annually, peaking at 6% of revenue.

Aside from hosting turbines, there are other opportunities for landowners to benefit from wind power development, including land easements for road access and land leases for wind farm O&M buildings or power substations. All told, for the 1,000 MW studied in Colorado, landowners were receiving more than $2.5 million per year. Similarly, the DOE study for North Carolina concluded that landowners in the state could receive payments of up to $2.7 million per year if 1,000 MW were installed in the state. The optimal areas for wind development in the state are in rural areas, which are frequently the most economically depressed.

Property taxes

Another direct economic benefit of wind power is the revenue from increased property taxes. With the land use change that comes with wind power development there is typically a substantial increase in the local property tax base. Land use agreements typically stipulate that the developer is responsible for all increases in property taxes. This new tax revenue can help communities expand public services such as police and fire departments, improve area schools, build parks, or repair roads. In Colorado, the projects making up the state's first 1,000 MW of wind power generated a total of $23.8 million in property tax revenue and continue to add approximately $9.6 million each year to local community budgets. DOE estimates, based on local tax structures, that local communities in North Carolina would receive a total of approximately $10.7 million from the development of 1,000 MW of wind power in the state.

Jobs

Perhaps the greatest benefit seen by communities hosting wind developments is the introduction of new jobs that come with them. While the development and construction of wind farms is a very labor-intensive process, the operation phase requires minimal personnel, a quality which contributes to its cost competitiveness. It is therefore necessary to consider the jobs gained during the construction phase separately from those gained during the operational phase.

Construction phase

Normally lasting from 1 to 2 years, the construction phase is the most labor intensive stage of a wind farm's development. Between turbine assembly, grid connection, road construction, and building the operations and maintenance facilities, wind project are typically a source of jobs of varying levels of expertise. The study completed on Colorado's expanding wind industry found that while there was the necessity for some highly specialized labor from out of state, approximately 75-85% construction workers were Colorado residents. In fact, the use of local labor was often written into the wind project development contract, so local governments were able to ensure that the benefits of the wind farm would reach as many of the area residents as possible. In terms of numbers, the Colorado study found that the construction phase of the 1,000 MW of wind power directly created the equivalent of 912 full-time-equivalent jobs in the state.

In addition to the jobs created by the wind farms directly, there are the "indirect impacts" that derive from the projects. These include the companies that provide equipment, materials, and other services for the projects. The Colorado study found that during the construction phase, there were 382 jobs created in these related, "indirect" industries.

Finally, the economic activity generated in local economies by the direct and indirect workers can create a significant number of new "induced" jobs at local restaurants and other businesses. During the construction phase of Colorado's first 1,000 MW, the Department of Energy found that there were 425 new full-time-equivalent jobs statewide that were "induced" by the wind farm development.

In the U.S. Department of Energy's analysis of the potential impacts of the development of wind energy in North Carolina, it employed the same distinctions outlined above, evaluating the potential direct, indirect, and induced job gains for local economies. The study concluded that the construction phase of the development of 1,000 MW of wind power in the state could potentially provide 1,628 new direct jobs and 1,361 new indirect and induced jobs.

Operational phase

Jobs gained during the operational phase of a wind project can be broken down into the same designations (direct, indirect, induced) as those outlined in the preceding section. Wind farms require minimal personnel to remain operational. While this is one of the keys to its cost-competitiveness, it also means that once the construction phase concludes, many of the jobs are eliminated. The jobs that remain, however, are typically stable, high paying positions that last throughout the lifetime of the turbine.

The study of Colorado's new wind power industry found that the first 1,000 MW directly created 181 permanent jobs. The industry's development also created 46 "indirect" local jobs in supporting industries. The study also noted that if the O&M jobs were not filled by people who were already residents of the state, the O&M employees typically relocated to Colorado, further boosting the local economy. As a result, 83 new "induced" jobs were created as a result of the new economic activity.

In North Carolina, the DOE study projects that 1,000 MW of wind power would generate 243 new long term jobs. It also concludes that there would be approximately 214 new indirect and induced jobs in the operational phase of the wind farms.

Economic activity

The final type of economic benefit from wind power comes from the increase in economic activity as a result of added jobs, land lease revenues, and tax revenues. From rental properties occupied by the temporary construction workers to the new retail and other commercial activity initiated by newly employed residents.

The state of Colorado benefited of a total of $225 million in economic activities during the construction phase and $35 million in annual revenue during the operational phase.

The potential benefits of additional economic activity North Carolina from 1,000 MW of wind power are summarized in the table below.

	Construction Phase *(1-2 Years)*	Operational Phase *(20+ years)*
Direct economic activity	$188.5 Million	$124.1 Million/year
Indirect/induced economic activity	$21.2 Million	$20.4 Million/year

Environmental benefits

Beyond the economic benefits afforded by the development of wind power, there are significant benefits to the state, national, and global environments. The following section provides an overview of the principle environmental benefits that can be expected with the development of wind farms in North Carolina

Water savings

The threat of drought is a constant reality in North Carolina and throughout the Southeastern United States. Regional droughts can cause severe damage to ecosystems, agriculture, and state and local economies. Wind power uses only a negligible amount of water and therefore its development in North Carolina would help save some of this precious resource. In fact, the Department of Energy analysis estimates that the development of 1000 MW of new wind power would result in an annual savings of 1,558 million gallons of water.

Improved air quality

One of the principle negative environmental impacts inherent in conventional electricity generation is the pollutants that are emitted from their smokestacks. Wind power does not produce any of the emissions discussed below and with the installation of substantial capacity for wind and other renewable electricity generation, the state could reduce the use of the conventional generation plans and improve North Carolina's air quality.

Guide to Wind Energy in North Carolina

Responsible Community Integration

As with any new development, wind projects have the potential for impacts on the surrounding community. The following section outlines the most common siting considerations for wind projects to ensure the responsible and appropriate incorporation of wind power into a community. For a complete guide to wind siting, see the AWEA Siting Handbook.

Wind turbine visibility

The visual impact of turbines is often a concern for communities, though this is a very subjective issue. While some people may find the turbines to be intrusive, others see them as elegant features. Local conditions of the project site have significant influence on the visibility of wind turbines and the degree to which area residents will be impacted. The local topography (e.g. hilly, flat agricultural, etc.) can impact visibility, as can the land cover (e.g. forest, grassland, cropland, etc.). Turbine size can have a mixed influence on the visual impact, as a project with larger turbines will have fewer, but more visible towers and rotors.

Due to the multitude of variables that affect visibility, wind developers perform visual impact assessments for proposed locations. Using digital imagery, the appearance of the proposed project in various seasons and at various times of day can be modeled and presented to community members prior to construction.[9]

Another potential visual impact is known as shadow flicker, which occurs when the sun is at such an angle that the shadow of the rotating turbine blades is cast on a building, road, or other area occupied by people. Wind siting software can model the exact dates and times that shadow flicker will occur at a specific site and, if necessary, this can be mitigated by setbacks or vegetative screening.

Wind Turbine Sound

The sounds heard by wind turbines can vary based on many factors including the meteorological conditions in the area, whether the receptor is upwind or downwind from the turbines, distance from the turbines, and vegetation or other obstructions near the receptor. The sound commonly heard from utility scale wind turbines is a "whooshing" sound that is created as the wind turns the turbine blades. The sound impacts from wind projects can also be modeled as the project is being planned to ensure that the sound levels will fall within the limits set by local ordinance.

Radar

Wind turbines can have an impact on radar systems, including weather radar, military radar and aviation radar. As with other large objects, wind turbines can appear on radar screens as "clutter," which is a reflected signal that can make the identification of targets of interest more difficult. The Federal Aviation Administration (FAA) performs an obstruction evaluation for structures over 200 feet tall, including wind turbines. Once a developer submits the required 7460-1 form, other agencies are informed of the location of proposed wind turbine and they provide feedback to the FAA on potential impacts as well. The Department of Defense Siting Clearinghouse evaluates the impact of energy projects on its military test, training, and operational missions and has found over 20 Gigawatts of projects to be mission-compatible.

North Carolina Model Wind Ordinance

The North Carolina Wind Working Group developed the Model Wind Ordinance for Wind Energy Facilities in North Carolina in 2008 as a resource for communities considering wind energy development. The ordinance

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[9] NYSERDA. *Power Naturally - Wind Energy Toolkit: Other Potential Environmental Impacts.* October 2005. http://www.powernaturally.org/programs/wind/toolkit/5_otherpotenviroimpactsrevised.pdf

was developed in a collaborative effort that included federal and state agencies, wind industry professionals, non- profit organizations, and other stakeholders interested in responsible wind energy development.

The model ordinance is intended to provide assistance to communities designing a local wind ordinance. The North Carolina Wind Working Group encourages each community to modify the model ordinance to meet their needs. However, it is important to note that the setbacks are minimum requirements, designed to protect public safety and mitigate the impacts of noise and shadow flicker. By addressing these concerns through minimum setback requirements, the model wind ordinance omits lot size requirements and height restrictions – which can be found in several North Carolina ordinances.

While North Carolina's primary wind resources are located in mountain and coastal counties, the model ordinance does not consider or account for regional variations – such as hurricanes. Therefore, the Wind Working Group encourages communities to consider important local factors when crafting a wind ordinance. Finally, communities should also understand that the adoption of a local wind ordinance will not preclude a wind energy facility from the requirements of applicable state and federal regulations.

As of early 2013, over 10 local wind ordinances are in place in North Carolina – including several counties that have wind projects proposed. See the Database of State Incentives for Renewables and Efficiency for more information.

Guide to Wind Energy in North Carolina

Utility and Transmission Toolbox

North Carolina has a regulated utility market where utilities make profits by earning a regulated return on capital investments. In July 2012, Duke Energy and Progress Energy merged – making Duke Energy the largest utility in the country. North Carolina's two investor owned utilities are now Duke Energy and Dominion NC Power, which has service territory in the northeastern part of the state. There are also 26 electric membership corporations and over 70 municipally owned electric systems, which are known as NC Public Power.

North Carolina's electricity mix comes from mostly coal (51% in 2011) that is imported from West Virginia and Kentucky. North Carolina passed a Renewable Energy and Energy Efficiency Portfolio Standard in 2007 that requires investor owned utilities to get 12.5% of their electricity from renewables in 2021 (5% of this can be met through efficiency). In February 2013, a report commissioned by the North Carolina Sustainable Energy Association, titled *The Economic, Utility Portfolio, and Rate Impact of Clean Energy Development in North Carolina*, was released. The report found that the state's clean energy programs and policies generated $1.4 billion in investments since 2007 and that the state's electricity costs will be lower than if these policies were never implemented. Currently North Carolina has no utility scale wind projects, but renewables (including hydroelectric and biomass) accounted for 5.3% of the state's electricity generation.

In 2012, wind energy accounted for 3.4% of the US electricity mix and was the number one source of new electricity generation (42%) according to the Energy Information Administration. Many states are reaching high levels of wind energy integration – with 9 states generating more than 10% of their electricity from wind in 2012. The top two states are Iowa, with 24.5% wind, and South Dakota, with 23.9% of its electricity from wind energy in 2012. Wind generation records have also been set recently – in January 2013, Xcel reached over 1,900 megawatts of wind on their system for an hour (over 51% of all electricity on their grid at the time). In December 2012, the Texas grid operator (ERCOT) set a record of 8,638 megawatts of wind generation – accounting for 26% of the electricity on its grid. Earlier in 2012, ERCOT's wind generation also helped keep the lights on for some customers when a number of conventional power plants went offline suddenly.

North Carolina Transmission Planning Collaborative

In 2005, the North Carolina Transmission Planning Collaborative (NCTPC) was created by North Carolina utilities - Duke Energy, ElectriCities of NC, NC Electric Membership Corporation and Progress Energy Carolinas as a forum to aid in transmission planning. A Transmission Advisory Group (TAG) was formed to allow any interested stakeholders to provide input to the NCTPC. Each year the TAG provides guidance on what scenarios will be considered in the NCTPC yearly study.

- 2012 study found that $1-$2 billion in transmission system upgrades would be necessary to add 3,000MW – 10,000MW of offshore wind to the grid in North Carolina and Virginia.

NC Solar Center Forums

In December 2011, the North Carolina Solar Center organized forums in Jacksonville (Onslow County) and Calabash (Brunswick County). Local government officials, Legislators and the public from these areas were invited to attend the meetings, which had a utility and transmission focus. The speakers and their presentation topics are listed below and presentations can be found here.

- Brian O'Hara, NC Offshore Wind Coalition, and Jen Banks, NCSC – offshore wind 101 and why NC is suited for offshore wind
- Larry Shirley and Bob Leker, NC Department of Commerce – BOEM NC state task force and other state efforts for offshore wind
- Tate Johnson, Governor's Office – Presented a letter from the Governor about recent offshore wind

efforts
- Mark Byrd, Progress Energy – NC Transmission Planning Collaborative studies
- Christopher Fallon, Duke Energy – Duke's DOE funded transmission and interconnection study

Utility and Transmission News

- In June 2012, Duke Energy and Progress Energy's merger was approved by the North Carolina Utilities Commission. Following the immediate CEO change from Progress's Bill Johnson to Duke's Jim Rogers, the Utilities Commission began an investigation of Duke Energy. In December 2012, the Utilities Commission closed the investigation and approved a settlement that includes requirements for CEO Jim Rogers to retire at the end of 2013 and for an additional $25 million in savings to be passed on to customers.
- In March 2012, the North Carolina Utilities Commission approved Invenergy's Application for a Certificate of Public Convenience and Necessity.
- Duke Energy Carolinas announced a request for proposals on September 22, 2011, for energy and associated Renewable Energy Credits (RECs) generated from wind projects. The energy was required to be from projects between 50 and 300 megawatts in size and it must be delivered to the Duke Energy Carolinas transmission grid. Proposals were accepted for the RECS only, but the associated wind development must be in North Carolina. Proposals were due October 2011 and the projects must be placed in service by December 2014. The NC Renewable Energy and Energy Efficiency Portfolio Standard, passed in 2007, is the catalyst for this RFP.
- On September 8, 2011, the Department of Energy announced funding awards of $43 million to spur offshore wind development in the US. Forty-one projects were funded, many of which will provide relevant data for North Carolina - including several of particular interest.
    - Dominion received $500,000 to analyze performance and cost-of-energy estimates of a hypothetical 600 megawatt offshore wind project for a variety of sites on the U.S. Atlantic coastline in water depths up to 60 meters.
    - Duke Energy received $530,000 to examine the effects of offshore wind development on the Duke Energy Carolinas system by determining the cost of upgrading the transmission system, and assessing system impacts and changes in the generation dispatch needed for integration.
- September 2, 2011: Pantego Wind Energy LLC filed an Application for a Certificate of Public Convenience and Necessity with the North Carolina Utilities Commission for a wind energy facility in Beaufort County. Pantego Wind's parent company is Invenergy Wind North America LLC. The 80 MW facility will be located on approximately 11,000 acres of private land near Terra Ceia and Pantego, with construction planned for 2012. The project, as currently proposed, will have forty-nine 1.6 megawatt turbines - though the turbine selection has not been finalized.
- On June 30, 2011, Progress Energy issued a request for proposals for wind energy facilities of 5 MW or greater to be counted toward the utilities' requirements under the NC Renewable Energy and Energy Efficiency Portfolio standard. Wind projects do not have to be located in North Carolina to be considered, though that is preferred, but they must deliver the power to the Progress grid. Proposals were due July 25, 2011, with planned short list notification in August 2011 and power purchase agreement execution in October 2011.
- In May 2011, the North Carolina Utilities Commission approved Iberdrola Renewables Application for a Certificate of Public Convenience and Necessity for the Desert Wind project. The 300 MW project, which would be located in Pasquotank and Perquimans Counties, is expected to provide enough electricity to power 55,000 to 70,000 homes. Since the project will be sited on 20,000 acres of private

land, the lease payments to local landowners could be up to $1 million per year for the next 20 – 25 years. In addition to these lease payments, the landowners will be able to continue to farm the land around the turbines. The construction of the project is anticipated to begin in late 2011 or early 2012 and would create over 400 jobs for the local community.

Appendix G – NCSC Wind Fact Sheets

Wind Energy in North Carolina

U.S. Wind Industry

Wind energy development is growing rapidly in the United States, with utility scale projects installed in 38 states as of 2011. The U.S. wind energy industry had a record setting year in 2009 with the installation of 10,000 megawatts (MW) to bring the cumulative capacity to over 35,000 MW by the end of that year. Due to the lack of national long term policies supporting wind energy, the installations for 2010 and 2011 dropped down to approximately 5200 MW and 6800 MW installed respectively. Despite this drop in installations, there are nearly 47,000 MW of wind energy projects in the U.S. as of the end of 2011, and five states receive more than 10% of their electricity from wind.

Currently, wind energy accounts for about 3% of the overall U.S. electricity production, but the potential is much larger. The National Renewable Energy Laboratory (NREL) estimates that the U.S. onshore wind potential is over 10,000 gigawatts (GW) in areas with capacity factors at or above 30 percent. For offshore wind, the Department of Interior estimates that over 4,000 GW of offshore wind potential exist in the oceans and Great Lakes. Only a portion of this potential will be necessary for wind energy to supply a substantial part of the U.S.'s electricity needs. The Department of Energy's 20% Wind Energy by 2030 report determined that it would require approximately 300 GW of wind development, including 54 GW of offshore wind, to supply 20% of the U.S. electricity needs in the year 2030.

Aside from the many environmental benefits of wind energy – including improved air quality and water savings from the energy sector - communities across the country are excited about wind energy's economic development potential. As of 2011, the wind industry supported 30,000 manufacturing jobs in 470 facilities for wind energy components across all 50 states.

Middelgrunden offshore wind farm - Copenhagen, Denmark

North Carolina Wind Industry

North Carolina has great onshore wind resources - both in the mountains and at the coast. The Department of Energy's (DOE) potential scenario for reaching 20% of the U.S. electricity needs with wind by 2030 includes North Carolina as one of only eight states with over 10 gigawatts (GW) of wind energy capacity installed. This capacity would include both offshore and onshore wind, but the reality of this scenario happening in North Carolina will be based on land-use decisions and policies for wind development over the next 20 years. Based on 2010 estimates from the National Renewable Energy Laboratory, North Carolina has an onshore wind resource of 1500 megawatts (MW) for sites with potential capacity factors of 30% or greater.

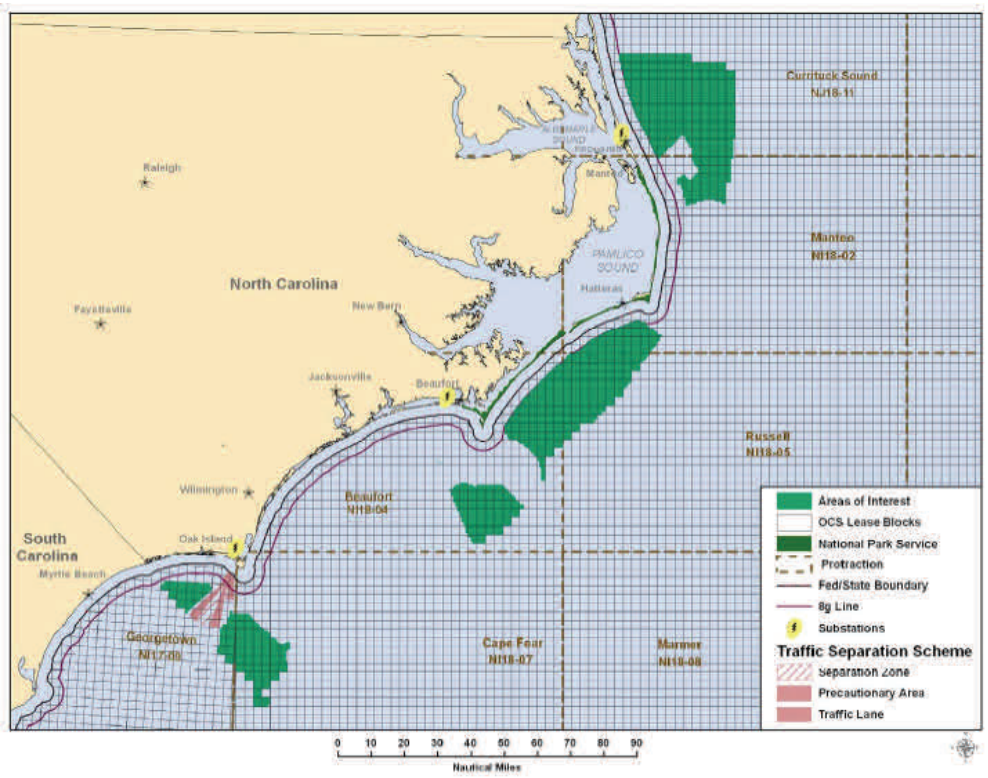
The economic development potential from onshore wind for North Carolina is substantial. Based on DOE estimates, if N.C. were to have just 1,000 MW of wind development, it would create 1,628 direct jobs during the construction phase and then 243 new direct long term jobs. The cumulative economic benefit to N.C. for construction and 20 years of operation for this wind energy would be $1.1 billion from jobs, lease payments, increased tax revenue, indirect benefits (for example – revenue for companies that support the wind development) and induced benefits (for example - in-

(Continued from page 1)
creased spending in the surrounding community). North Carolina has the potential to increase these benefits if North Carolina manufacturing facilities were to supply the turbine components. As of 2011, 19 North Carolina manufacturing facilities provide components for the wind industry.

Two companies have filed applications for a Certificate of Public Convenience and Necessity with the North Carolina Utilities Commission for onshore wind energy facilities. In May 2011, the Utilities Commission approved the 300 MW Desert Wind Project proposed by Atlantic Wind, LLC - this project is currently on hold after discussions with utilities failed to result in a Power Purchase Agreement. In March 2012, the Utilities Commission approved the Pantego Wind Energy, LLC application for an 80 MW project in Beaufort County. Several other onshore wind projects are being pursued in coastal counties but have not yet filed with the Utilities Commission.

Offshore Wind in North Carolina

The United States does not currently have any offshore wind projects in place, but approximately 5,000 megawatts (MW) are proposed in the oceans and in the Great Lakes. Nearly 78% of the U.S. population lives in the 28 coastal states, so the proximity to this demand makes offshore wind an excellent option for these states. With the sea breeze effect, in which the winds over the ocean blow during the daytime, offshore wind can line up with daytime peak electricity demands. The U.S. can learn from the European experience of installing over 3200 MW of offshore wind in the last 20 years. In February 2011, the Department of Energy and the Department of the Interior announced a National Offshore Wind Strategy, which is designed to support offshore wind deployment of 10 GW by 2020 and 54 GW by 2030. Of that 54 GW, 10 GW is projected to be offshore from North Carolina.



North Carolina has exceptional offshore wind resources – in fact, National Renewable Energy Laboratory estimates show that N.C.'s potential is higher than any other East Coast state. North Carolina is moving forward with efforts to bring offshore wind to the state through the Bureau of Ocean Energy Management's North Carolina Offshore Renewable Energy Task Force. The Task Force consists of state, federal, local and tribal government representatives coordinating efforts to facilitate commercial leasing for renewable energy on the Outer Continental Shelf offshore from North Carolina. The Task Force had three meetings in 2011 to identify suitable lease sites and efforts are underway to prepare a Call for Interest for selected leasing sites. The map above shows the lease blocks, nearly 500, that are still under consideration for potential offshore wind development in North Carolina.

N.C. Wind Working Group

The North Carolina Solar Center coordinates the North Carolina Wind Working Group (NCWWG), an open forum for collaboration and education on the benefits of wind development in the region. In 2008, the NCWWG created a model wind ordinance (can be found at www.dsireusa.org) for North Carolina counties that are interested in creating policies to promote responsible wind energy development. Many North Carolina counties have since used the model ordinance as a guide for their own, including the counties in which the proposed Desert Wind project is located – Perquimans County and Pasquotank County.

For more information contact Jen Banks, jen_banks@ncsu.edu, Wind Energy Project Coordinator at the NC Solar Center

Appendix H – NC Presentations from BOEM Meetings January 2013

NC STATE UNIVERSITY

Jen Banks

Wind Energy Project Coordinator

North Carolina Solar Center

NORTH CAROLINA Solar Center

NC STATE UNIVERSITY

North Carolina Solar Center

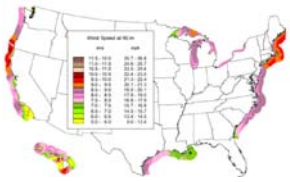
Mission Statement

to advance the use of renewable energy resources to ensure a sustainable economy that protects our natural environment, encourages energy independence, and lowers energy costs for consumers. The Center will safeguard this sustainable energy future through programs to educate the public, share research and technical expertise, guide industry's energy decisions, and shape government policy.

NORTH CAROLINA Solar Center

Offshore Wind Basics

U.S. Offshore Wind Resource at 90m



Source: NREL Assessment of offshore wind energy resources for the United States, 2010

- First project – Vindeby in 1991
- ~3800 MW installed in Europe (end of 2011)
  - Avg turbine size installed in 2011: 3.6 MW
- No offshore wind in the US
- DOE goal for 54 GW by 2030
- No offshore wind in the US
- DOE goal for 54 GW by 2030
  - At a cost of 7 – 9 cents per kilowatt-hour
  - Interim goal: 10 GW by 2020 at cost of 10 – 13 cents per kilowatt-hour

NORTH CAROLINA Solar Center

NC STATE UNIVERSITY

Benefits of Offshore Wind

- Clean, stable priced generation
- Proximity to coastal load centers
- Stronger and steadier offshore winds
  - Coincide with daytime electricity demands
- Not constrained by onshore transportation limitations
  - Larger turbines can be installed
- Opportunity for coastal states to meet renewable energy targets
- Economic Development

NORTH CAROLINA Solar Center

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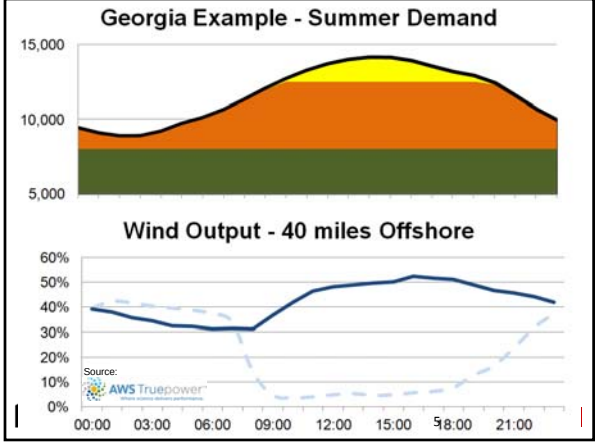


Offshore Wind Permitting

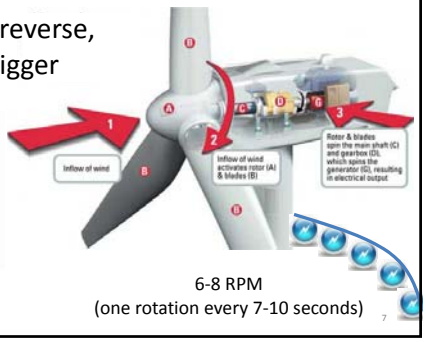
- **Federal Permitting Focus**
  - 4-2009: Final Rule for projects on the OCS
  - 5-2010: Creation of the Bureau of Ocean Energy Management, Regulation and Enforcement
  - 8-2010: DOE's *Creating an Offshore Wind Industry in the United States: A National Vision and Call to Action*
  - 11-2010: DOI's Smart from the Start Initiative
    - 2-2011: Wind Energy Areas announced
  - 2-2011:National Offshore Wind Strategy
  - 5-2011: 2nd notice of competitive interest eliminated
  - 9-2011: BOEMRE restructured into multiple agencies
    - Bureau of Ocean Energy Management
    - Bureau of Safety and Environmental Enforcement
    - Office of Natural Resources Revenue

NORTH CAROLINA Solar Center

NC STATE UNIVERSITY

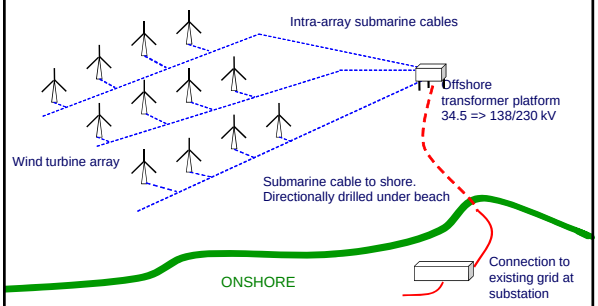
How Wind Turbines Work

Like a fan in reverse, but MUCH bigger and slower.

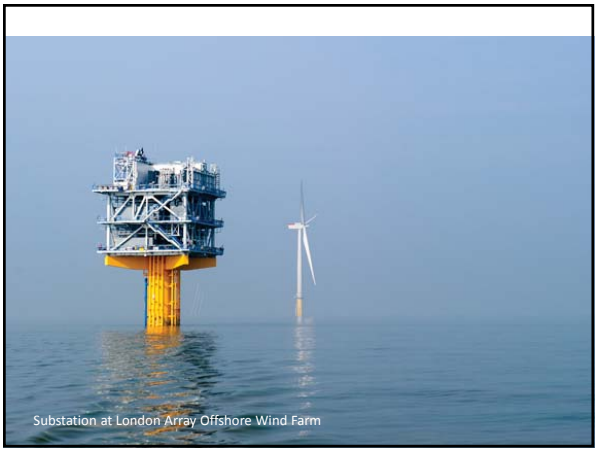


6-8 RPM
(one rotation every 7-10 seconds)

Offshore Wind Layout



Sherringham Shoal Offshore Wind Farm



Substation at London Array Offshore Wind Farm

Major Components

Foundation Types

Jacket Monopile Gravity Base

Cable Comes Ashore Under Beach

Bore can emerge several thousand feet offshore

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Thank you!

Jen Banks
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North Carolina Solar Center
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NORTH CAROLINA Solar Center

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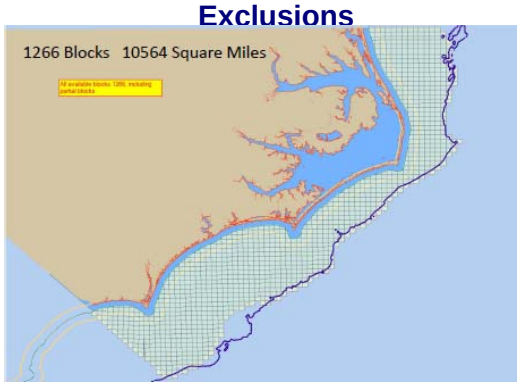
Background for NC Offshore Wind
Foundation for BOEM

BOEM Public Meetings - January 7 & 9, 2013

Bob Leker
Renewables Program Director
State Energy Office, NC Commerce Dept

North Carolina Energy Office energync.net ENERGY

All NC Lease Blocks Before Exclusions



Source: NC Dept of Commerce PRSP

UNC CH Coastal Wind Study

- Released 2009
- Covered waters less than 50m deep and within 50 nautical miles from shore
  - » Considered the following constraints - very conservative
    - › Wildlife, Fishing, Navigation, Transmission, Military, Cultural
- 55,000 MW potential
  - » Average output = 130% of 2007 NC electricity use

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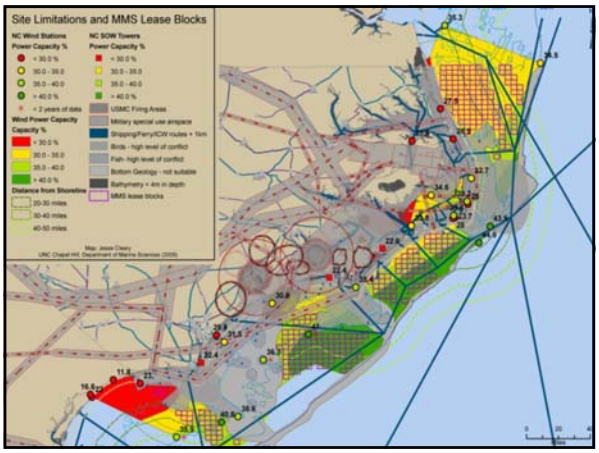

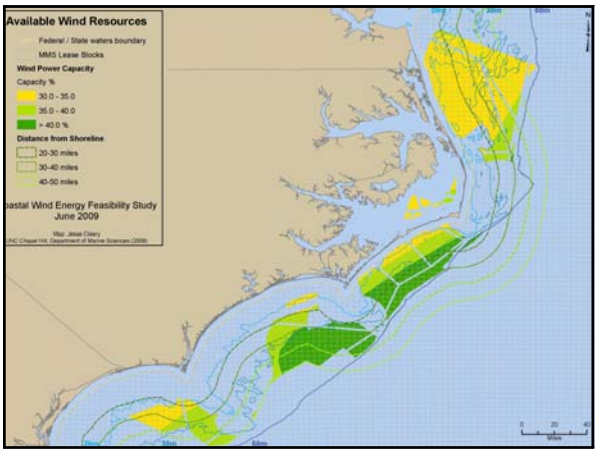

Bureau of Ocean Energy Management NC Task Force

- BOEM determines lease areas on Outer Continental Shelf with input from NC Task Force
- Recent efforts:
  - » Analyzing feedback from NOAA, NPS, USCG
  - » Completed a Visual Simulation – summer 2012
  - » Call for Information for 3 NC wind areas

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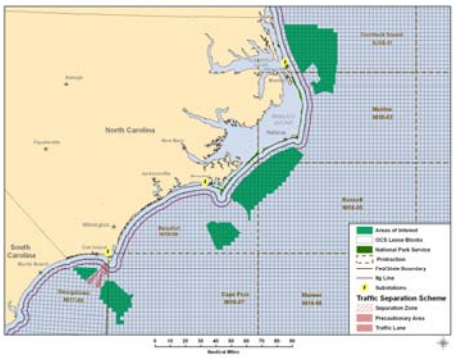
Current Lease Blocks Under Consideration



NC Dept of Commerce - Offshore Wind – additional study efforts

- Builds on 2009 UNC Coastal Wind Study
- Major efforts included:
  - Environmental concerns (UNC CH – Institute of Marine Sciences)
  - Ports capabilities (NCSU Dept of Civil, Const., Env. Eng.)
  - Wind resource analysis (UNC CH – Marine Sciences Dept)
  - Educational outreach (NC Solar Center & NC Commerce)

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Additional Environmental Work

- Analysis of data covering birds, marine mammals, sea turtles, and fish habitat
- Evaluated BOEM wind areas for conflicts – made recommendations to modify area 3

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Wildlife habitats offshore NC

Morehead Port – case study
600 MW using a 5 MW turbine

Green – tower sections
Red – blades
Blue - nacelles

Wind Resource Analysis

- Two buoys were deployed in the Atlantic
- A wind profiler (SODAR) was also used
- Results confirm significant winds for power production and that complex low level flows change estimated wind speeds in different areas offshore

Outreach to Stakeholders

- Coastal NC Cities & Counties
- Coastal Associations, NGOs, fishery groups, NC Ports Authority, Wind Developers
- Participation in national and regional conferences
- NC Solar Center also completed a summary of EU offshore policies

NC Transmission Planning Collaborative

Created by NC Utilities - Duke Energy, ElectriCities of NC, NC Electric Membership Corporation, Progress Energy Carolinas – looks at NC upgrades to transmission grid

- 2010 Study - impacts of 3000 MW of offshore wind in NC grid
- 2011 Study - Impacts of 5000 MW of offshore wind in NC grid
- 2012 Study – Impacts of 10,000 MW of offshore wind injected in Virginia and NC

NC Advantages

- Largest offshore wind resource on east coast in shallow water
- Strategically located Ports that could support offshore windfarm development and operation
- Renewable energy manufacturing tax credit (25%) & low cost of manufacturing

Thank You

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North Carolina Energy Office energync.net
ENERGY

Why North Carolina and the Southeast?

Offshore Wind Energy
BOEM Public Hearing
Jan 7, 2013 (Kitty Hawk)
Jan 9, 2013 (Wilmington)

Brian O'Hara
Southeastern Coastal Wind Coalition
briano@secoastalwind.org

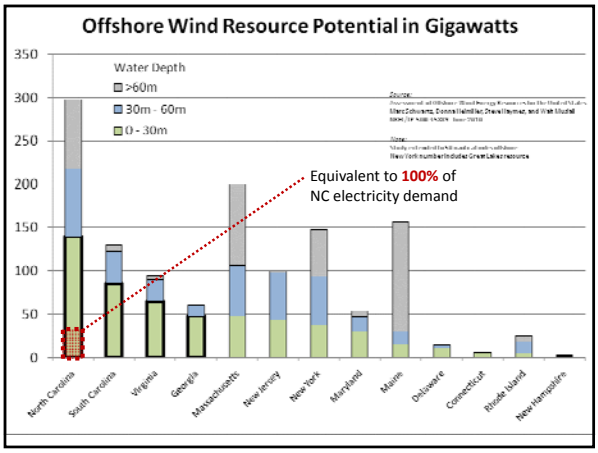
SOUTHEASTERN COASTAL WIND COALITION

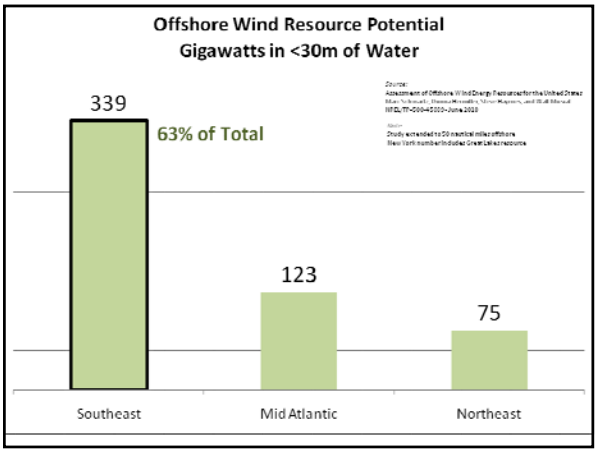
NC and the Southeast Have:

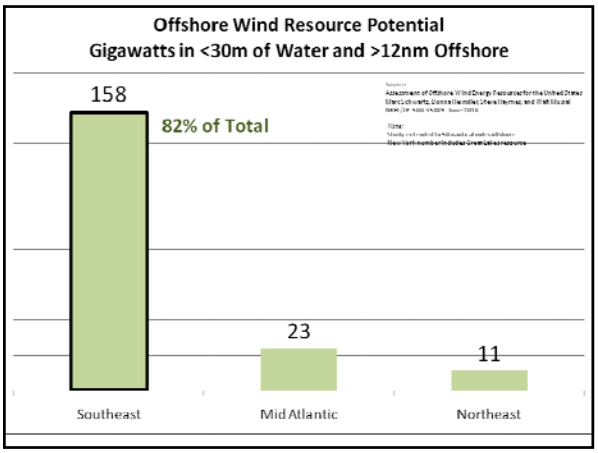
- ✓ Great wind resource
- ✓ Big electricity markets
- ✓ Low costs

Great Wind Resource

There is a lot of offshore wind potential in the Southeast, especially in shallow water.

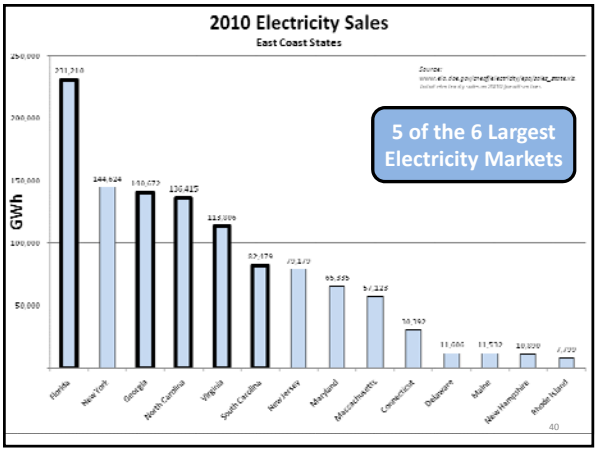


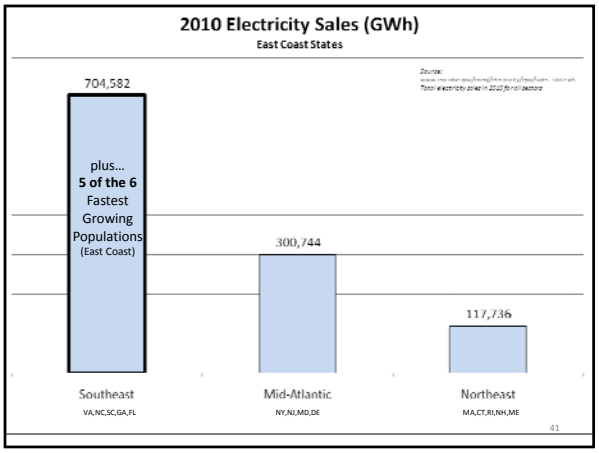




Big Electricity Markets

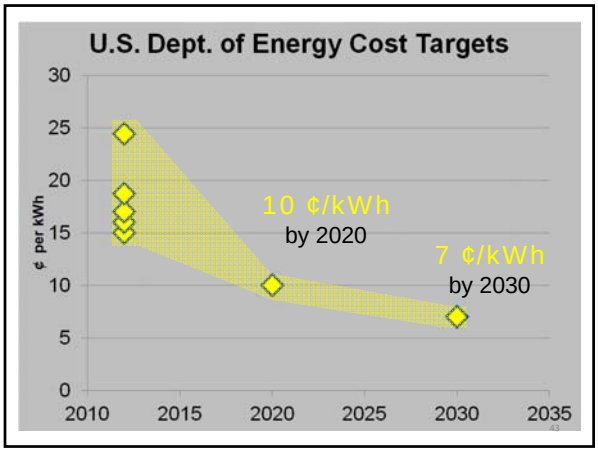
We use a lot of electricity in the Southeast

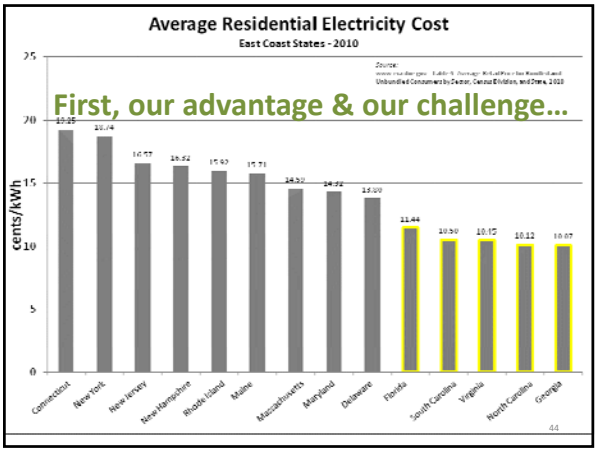


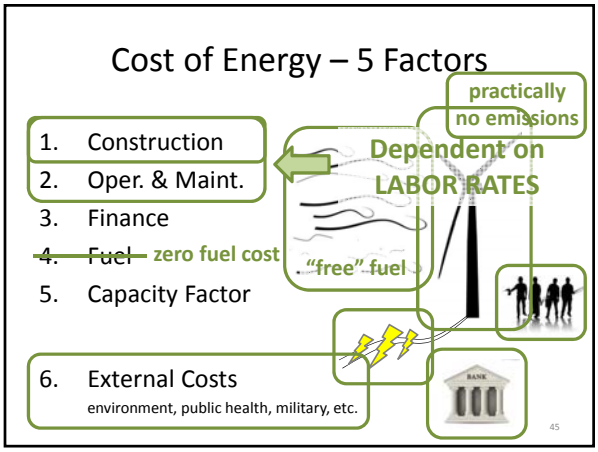


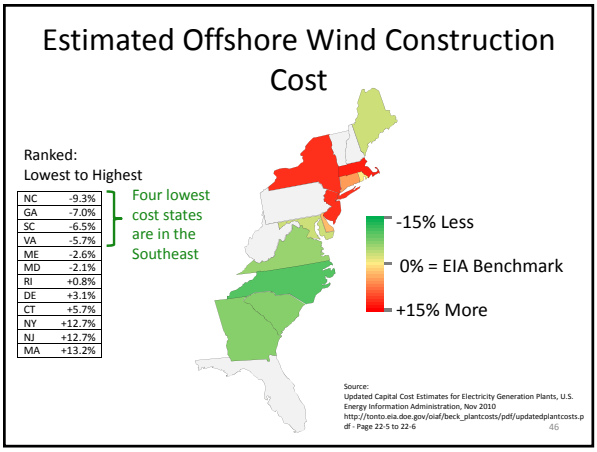
Low Cost

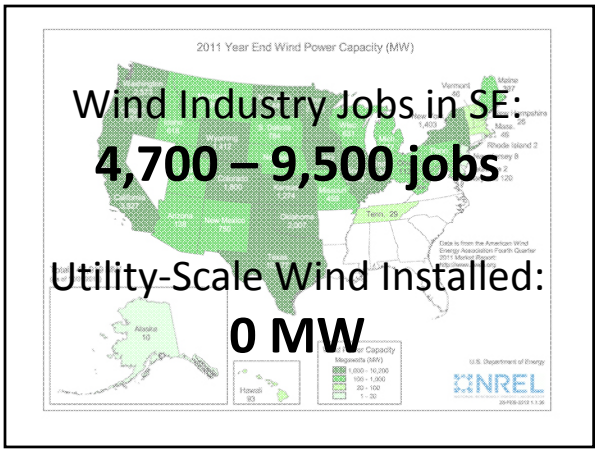
It is cheaper to build things in the Southeast.







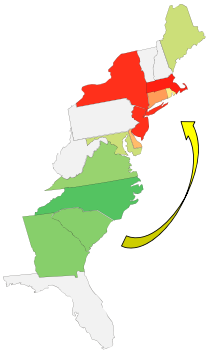




Ratepayer Impact
Southeast vs. Other Regions

The Southeast Has…	Effect on $/month Impact	Why?
Large Market Size	↓	Wider base to spread the cost
Low Construction Cost	↓	proxy for per kWh Energy Cost
Low Electricity Rates	↑	higher premium per kWh

Future Energy Exporter?



Thank You.

SOUTHEASTERN COASTAL WIND COALITION

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briano@secoastalwind.org