NC TASKFORCE FOR OFFSHORE WIND ECONOMIC RESOURCE STRATEGIES (NC TOWERS)

THURSDAY FEBRUARY 3, 2022

Key Findings and Recommendations from the 2021 NC Offshore Wind Supply Chain Report

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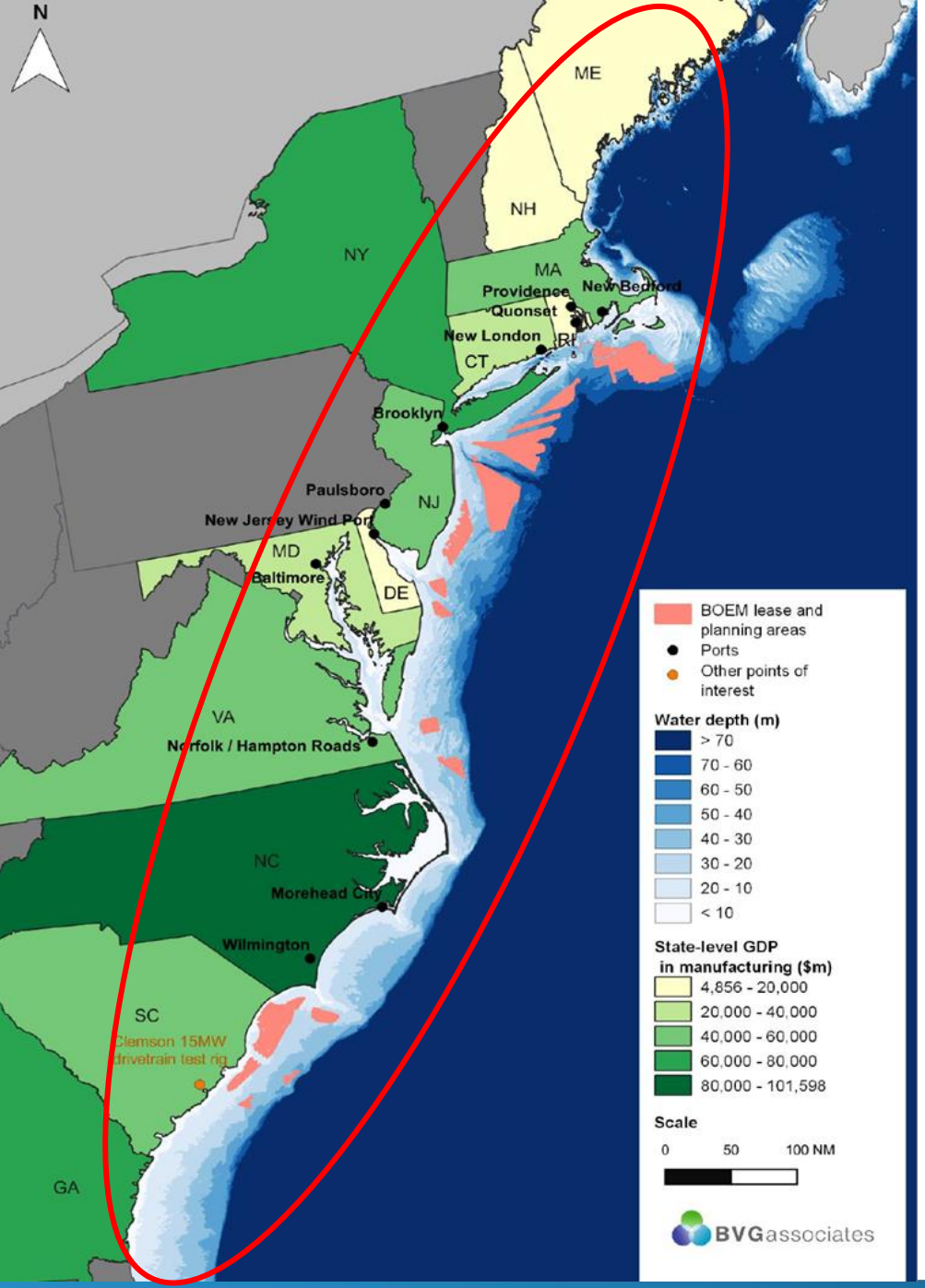
Overview

- Background
- Identifying the NC opportunity
  - NC infrastructure
  - Supply chain
  - Workforce
  - Key recommendations
- Cost-Benefit Analysis
- Next steps



OSW Provides An Opportunity for NC:

- Billions of dollars in **economic development**
- Thousands of **new jobs**
- Significant increase in **renewable energy generation**

U.S. OSW Development

- State driven OSW targets reaching 40 GW
- About 20 GW of active projects in procurement phase
- 1 GW OSW powers about 380,000 homes/year

Projected Growth, Scale & Potential

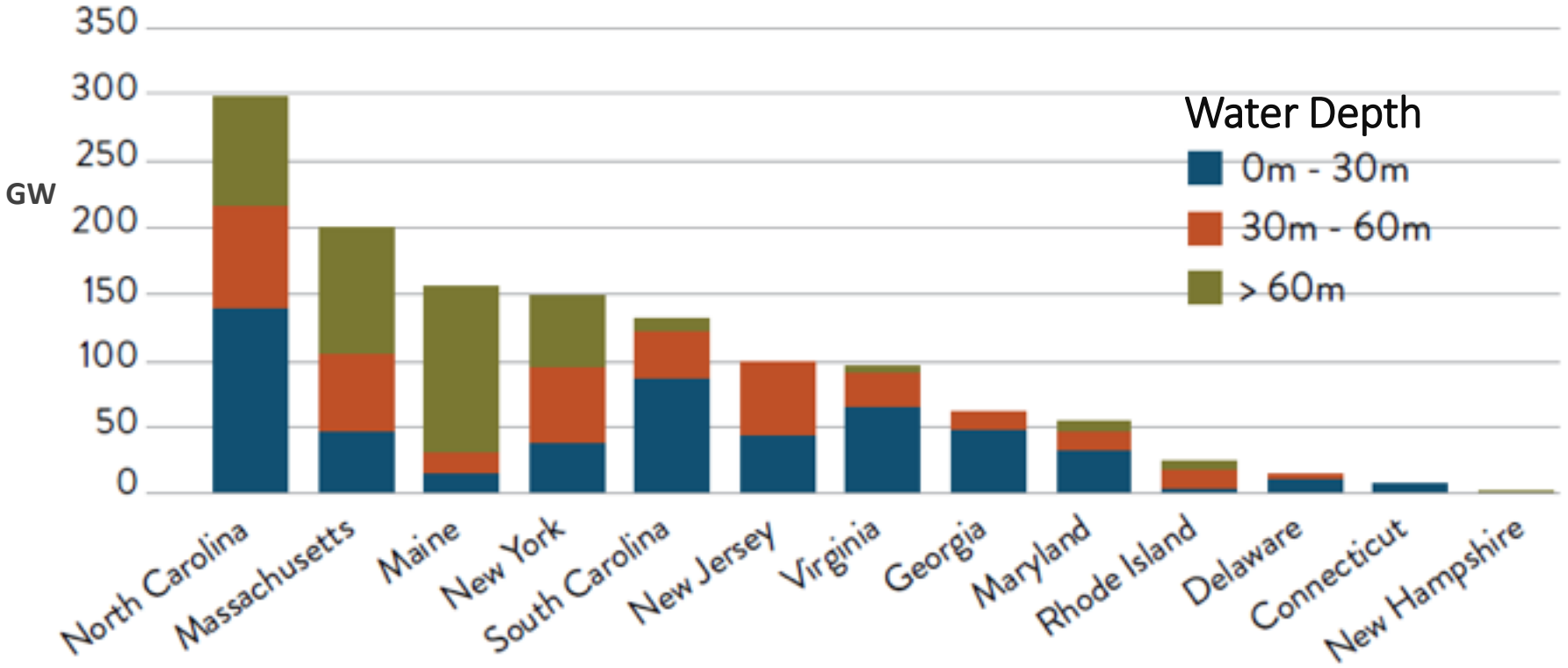
- Global market for OSW has grown by 24% annually since 2013 and is projected to grow at more than 20% per year across the next 5 years.

~2021, BVG Associates

- In the UK:
  - In 2020, OSW accounted for 13% of energy generated
  - From 2015 to 2019, 7,200 OSW FTEs added to economy
  - In 2021, $1.3 billion invested in ports
- The total U.S. offshore wind *technical resource potential* (or the amount of energy it is physically possible to produce) is approximately double the total electricity use in the U.S.

~2016, Office of Renewable Energy & Energy Efficiency, U.S. Department of Energy

Offshore Wind Potential



Source: National Renewable Energy Laboratory (NREL).

The technical potential along the coasts of Southeast states is significant, almost double that of the Northeast in shallow waters. As technology evolves and prices continue to decline, the Southeast Atlantic is positioned to become a long-term leader in the industry. North Carolina's geographic location is favorable to serve all markets along the East coast, for both immediate and future demand.

U.S. Offshore Wind Project Pipeline

Project pipeline with executed offtake agreements

=award in Dec Dec-21

Developer	Project	State	MW	Installation	MW by developer
Orsted / Eversource	South Fork	NY	130	2024	
Orsted	Skipjack	MD	120	2025	
Orsted	Skipjack (2)	MD	800	2027	
Orsted / Eversource	Revolution Wind	RI	400	2024	
Orsted / Eversource	Revolution Wind	CT	200	2024	4,878
Orsted / Eversource	Revolution Wind	CT	100	2024	
Orsted/Eversource	Sunrise Wind	NY	880	2025	
Orsted / PSEG	Ocean Wind 1	NJ	1100	2025	
Orsted	Ocean Wind 2	NJ	1148	2028	
Atlantic Shores (Shell/EDF)	Atlantic Shores	NJ	1509.6	2027	1,510
Equinor / BP	Empire Wind 1	NY	816	2026	
Equinor / BP	Empire Wind 2	NY	1260	2026	3,306
Equinor / BP	Beacon Wind 1	NY	1230	2027	
Mayflower (Shell/EDPR)	Mayflower Wind	MA	804	2025	1,204
OW/Shell	Mayflower Wind (2)	MA	400	2027	
Vineyard Wind (CIP/Avangrid)	Vineyard Wind	MA	800	2024	
Avangrid	Park City Wind	CT	804	2025	2,804
Avangrid	Commonwealth Wind	MA	1200	2028	
US Wind / Apollo	MarWind	MD	270	2024	1,070
US Wind / Apollo	Momentum Wind	MD	800	2027	
LeedCo / Fred Olsen	Icebreaker	OH	21	TBD	
UMaine / Diamond OSW / RWE	Aqua Ventus I	ME	12	2023	
Dominion	Coastal Virginia OSW	VA	12	2020	
Total - active [MW]			**14,817**		

Project pipeline with committed offtake agreements

Developer	Project	State	MW	COD*
Dominion		VA	880	2024
Dominion		VA	880	2025
Dominion		VA	880	2026
Total - Committed [MW]			**2,640**	

Project pipeline with well progressing offtake agreements

Developer	Project	State	MW	COD*
Avangrid	Kitty Hawk	NC	800	2026
Avangrid	Kitty Hawk	NC	1700	2027
Total - "progressing" [MW]			**2,500**	

Grand Total - Projects procuring components & service **19,957**

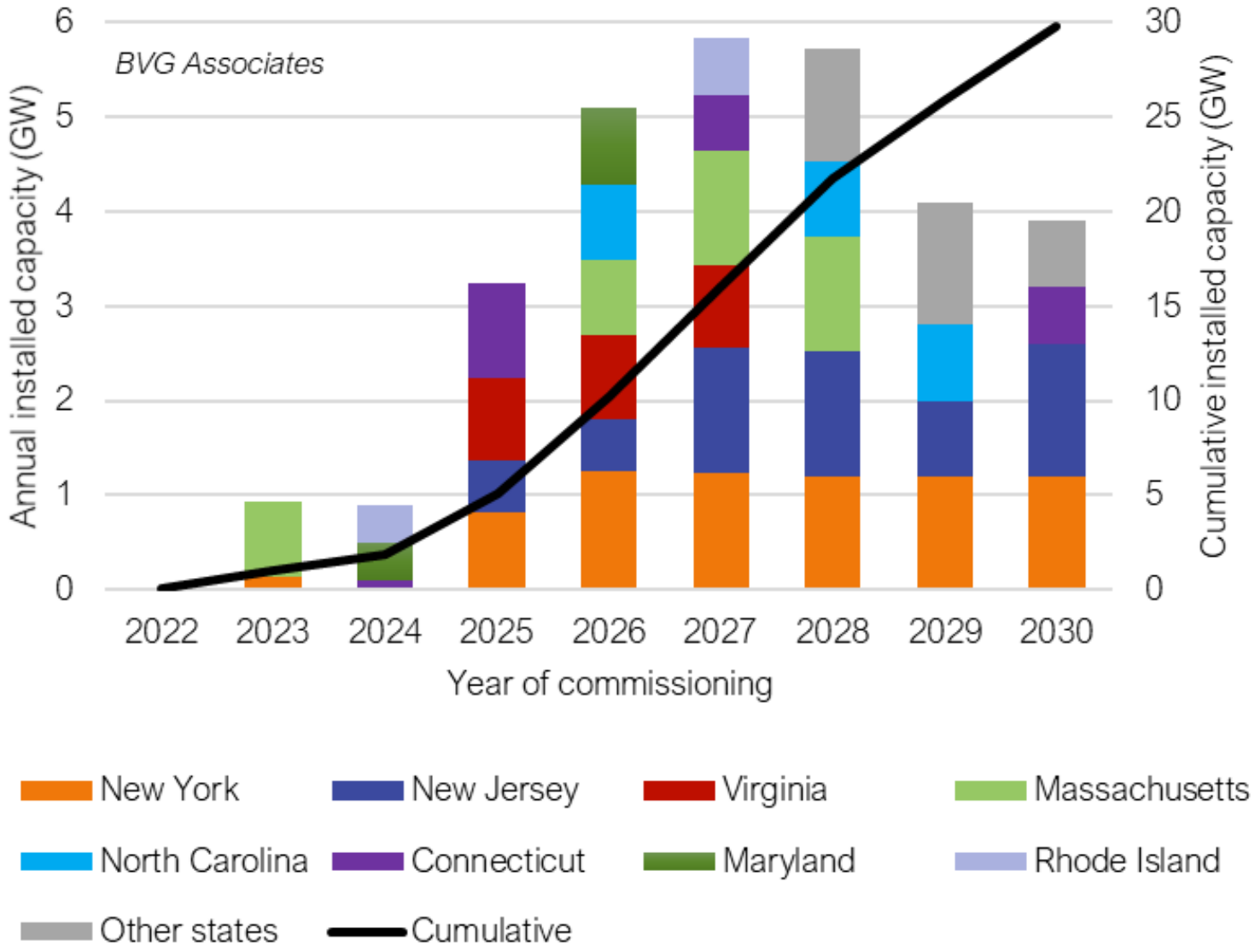
~ 20 GW of active projects in procurement phase

~ 1300 turbines and foundations

~ 25 substations & foundations

Source: RRI

Projected OSW Capacity by 2030



NC Mobilizing for Success

October 2018: Governor Cooper announced:
Executive Order 80: NC's Commitment to Address Climate Change & Transition to a Clean Energy Economy

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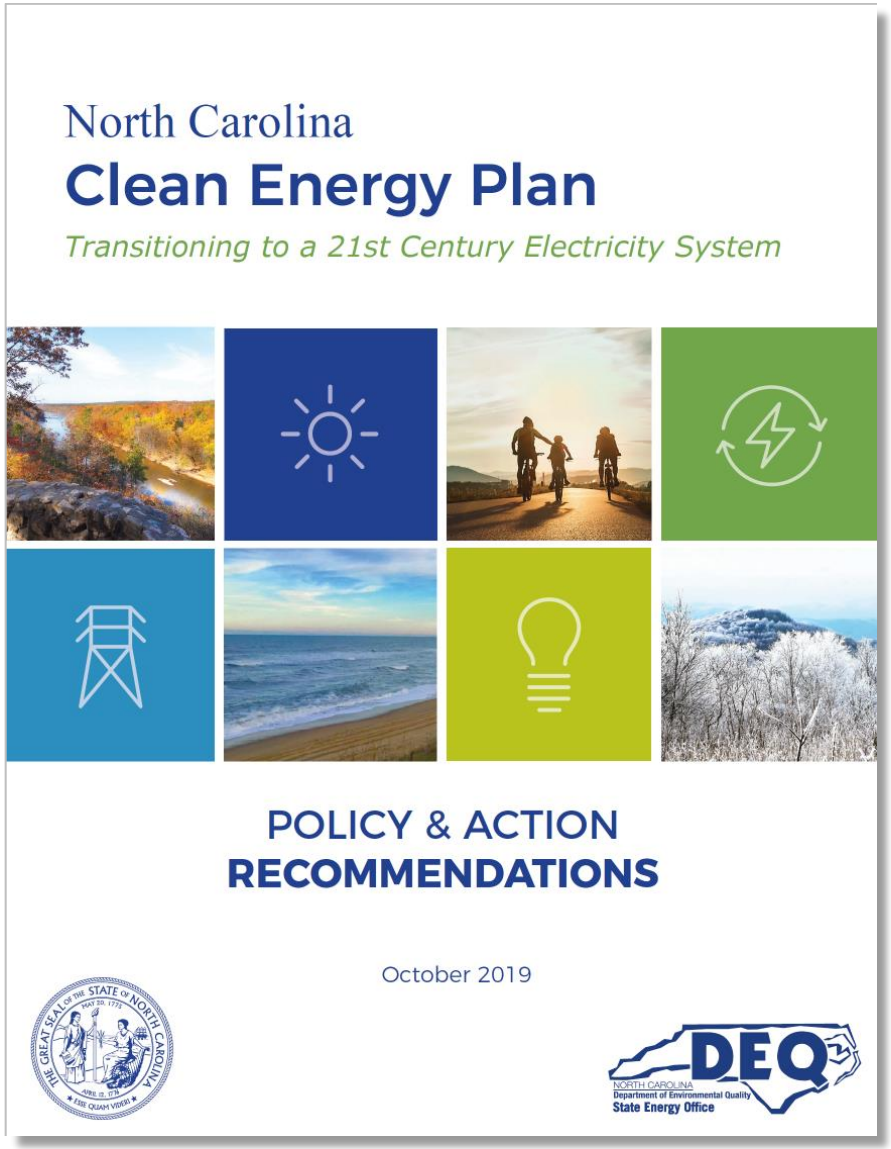
Under EO 80, NCDEQ developed & released (in 2019):
NC Clean Energy Plan →

- Includes recommendations supporting **effort with regional states to develop robust OSW industry & energy market**
- October 29, 2020: NC, VA & MD signed memorandum of understanding (MOU) forming:

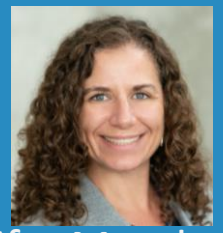
  SMART-POWER: ***S**outheast & **M**id-**A**tlantic **R**egional **T**ransformative **P**artnership for **O**ffshore **W**ind **E**nergy **R**esources*



NC State Leadership & Coordination

Dept. of Commerce

Policy Analysis, Engagement with Energy Providers & Federal Agencies, Workforce & Business Development



Jennifer Mundt, Asst. Sec. Clean Energy ED

Governor's Office

Overall Leadership & Coordination

Jeremy Tarr, Senior Advisor for Climate Change Policy

Dept. of Commerce

Supply Chain, Infrastructure, & Economic Impacts Analysis, Engagement with Public & Communities

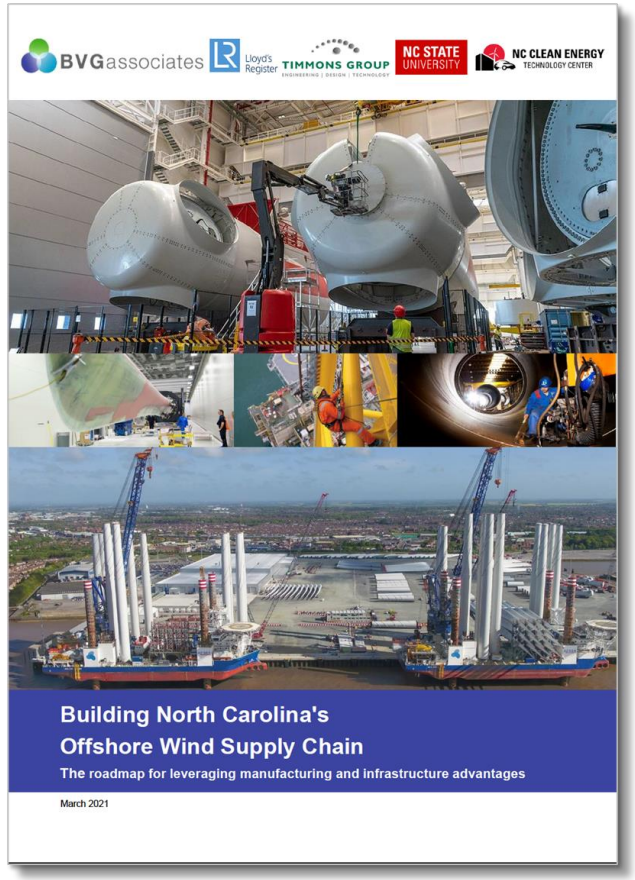
John Hardin, Exec. Dir., Science, Tech. & Innov.

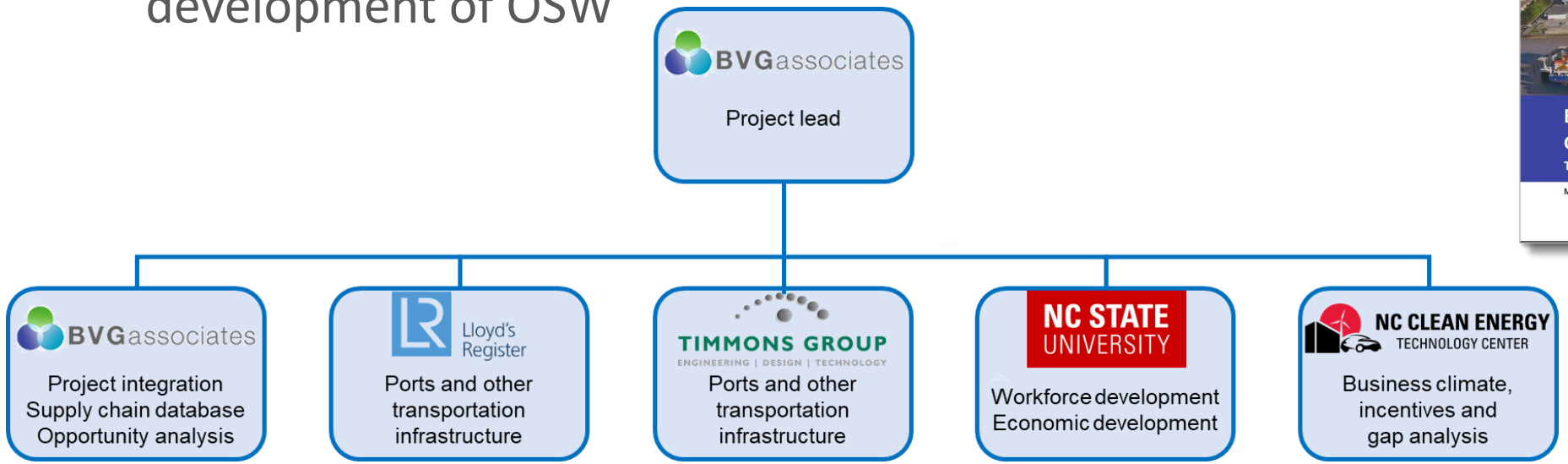
OSW Interagency Leadership Team: Agencies above **+** NC Department of Transportation, NC Ports, NC Department of Environmental Quality, Economic Development Partnership of NC, and NC Department of Military & Veterans Affairs

NC Offshore Wind Supply Chain Assessment

Purpose

1. Characterize the economic OSW opportunity for NC
2. Assess NC's advantages in existing assets, business potential, and infrastructure (e.g., ports)
3. Recommend several options to support the growth and development of OSW

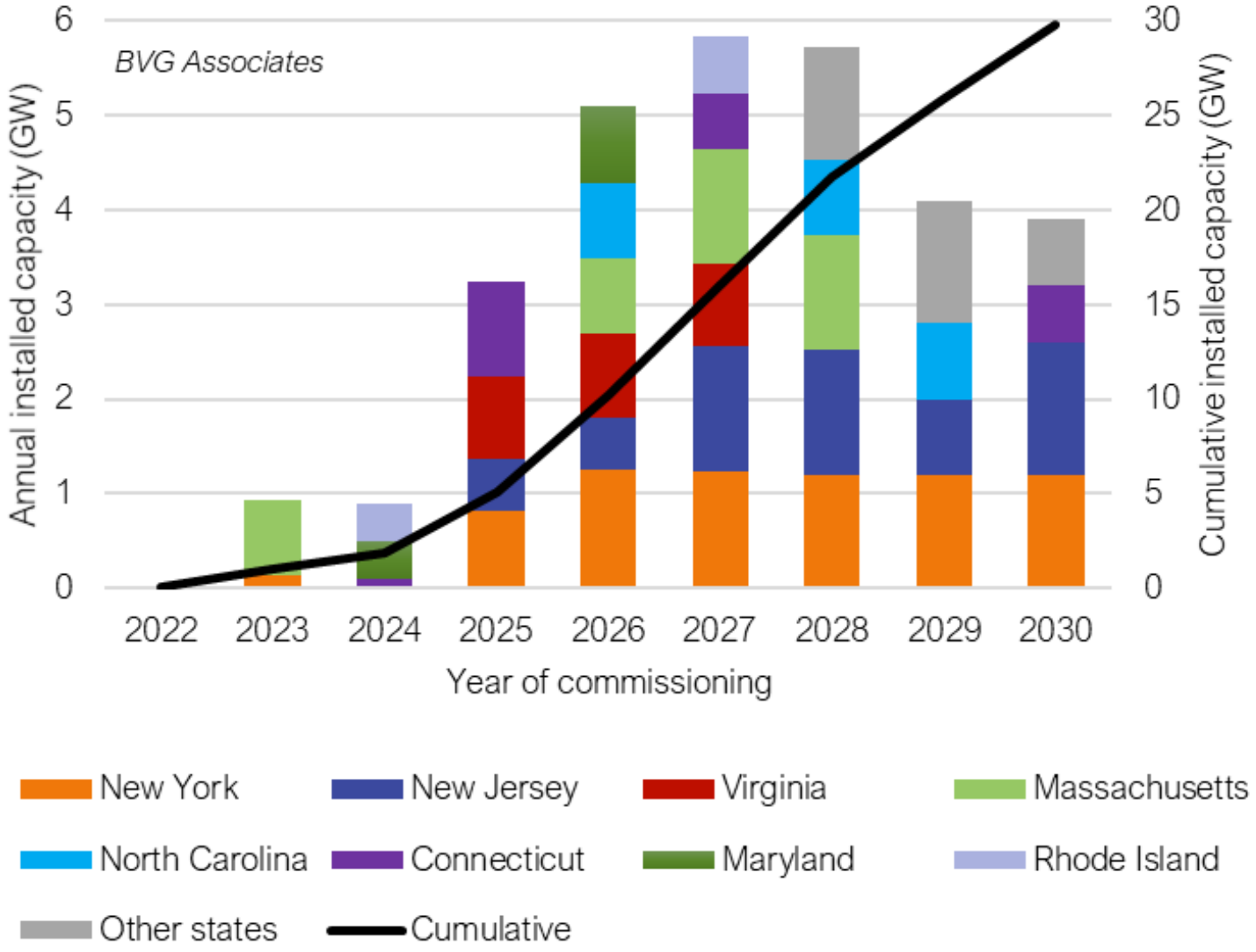




Includes 48 specific recommendations

https://files.nc.gov/nccommerce/documents/Policymaker-Reports/Report_North-Carolina-OSW-Supply-Chain-Assessment_BVGAssociates_asPublished-Mar3-2021.pdf

Projected installation for east coast OSW Development – all “anticipated” installations



Turbine Size: Nacelle and Rotor

Thousands of component parts make up the manufacturing, fabrication, and construction of OSW structures & facilities

GE Haliade-X nacelle: 13 MW, 220m rotor, ~600 tons

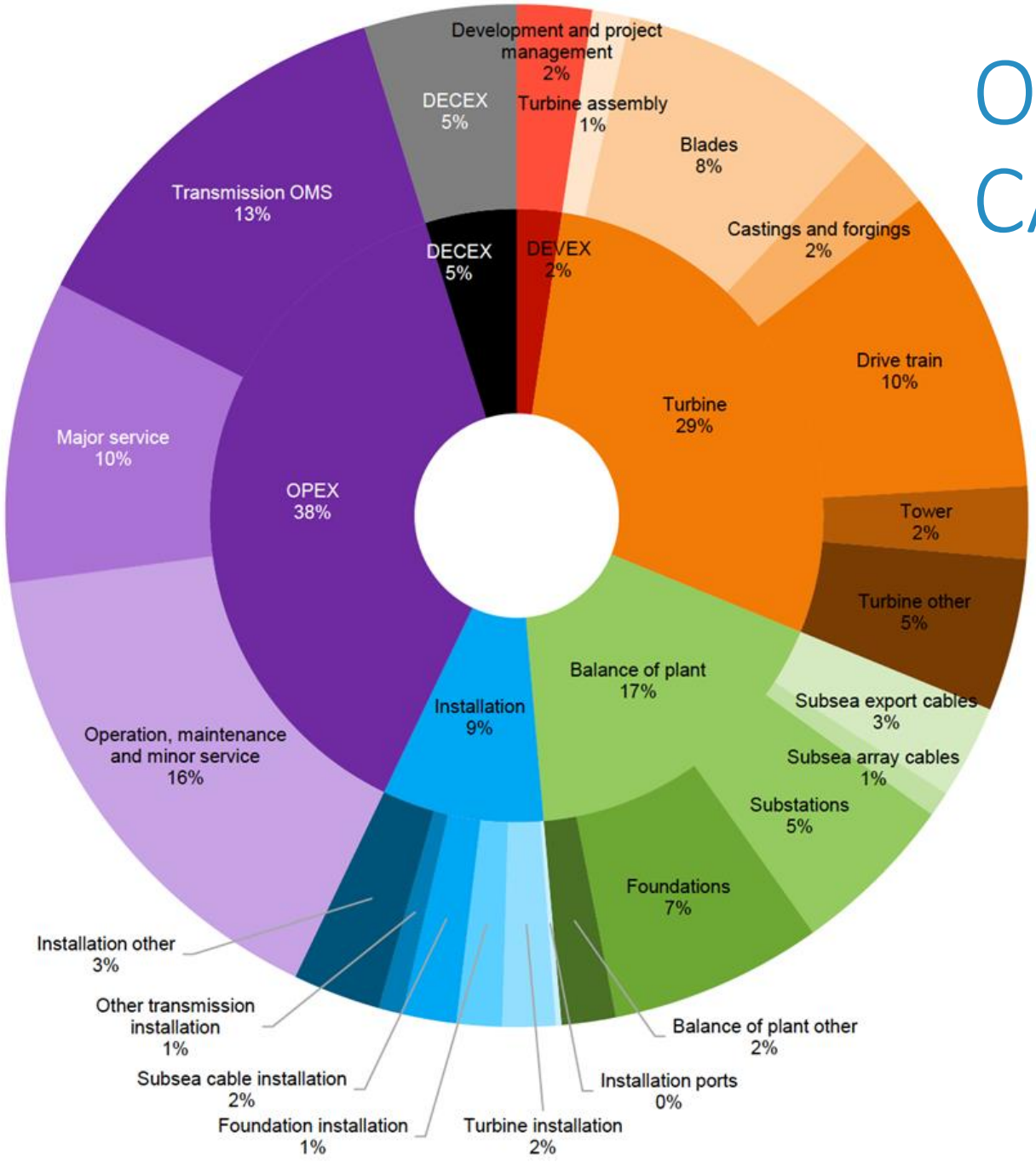
With its long history and strong foundation in manufacturing, NC is well positioned to lead in these activities

Blade Size

GE Haliade-X: each blade is 107m (351ft) long, ~55 tons.

Major component parts—e.g., blades, towers, steel plates—are too large to be transferred by rail or truck and must be manufactured/assembled close to the coast/ports or staging areas.

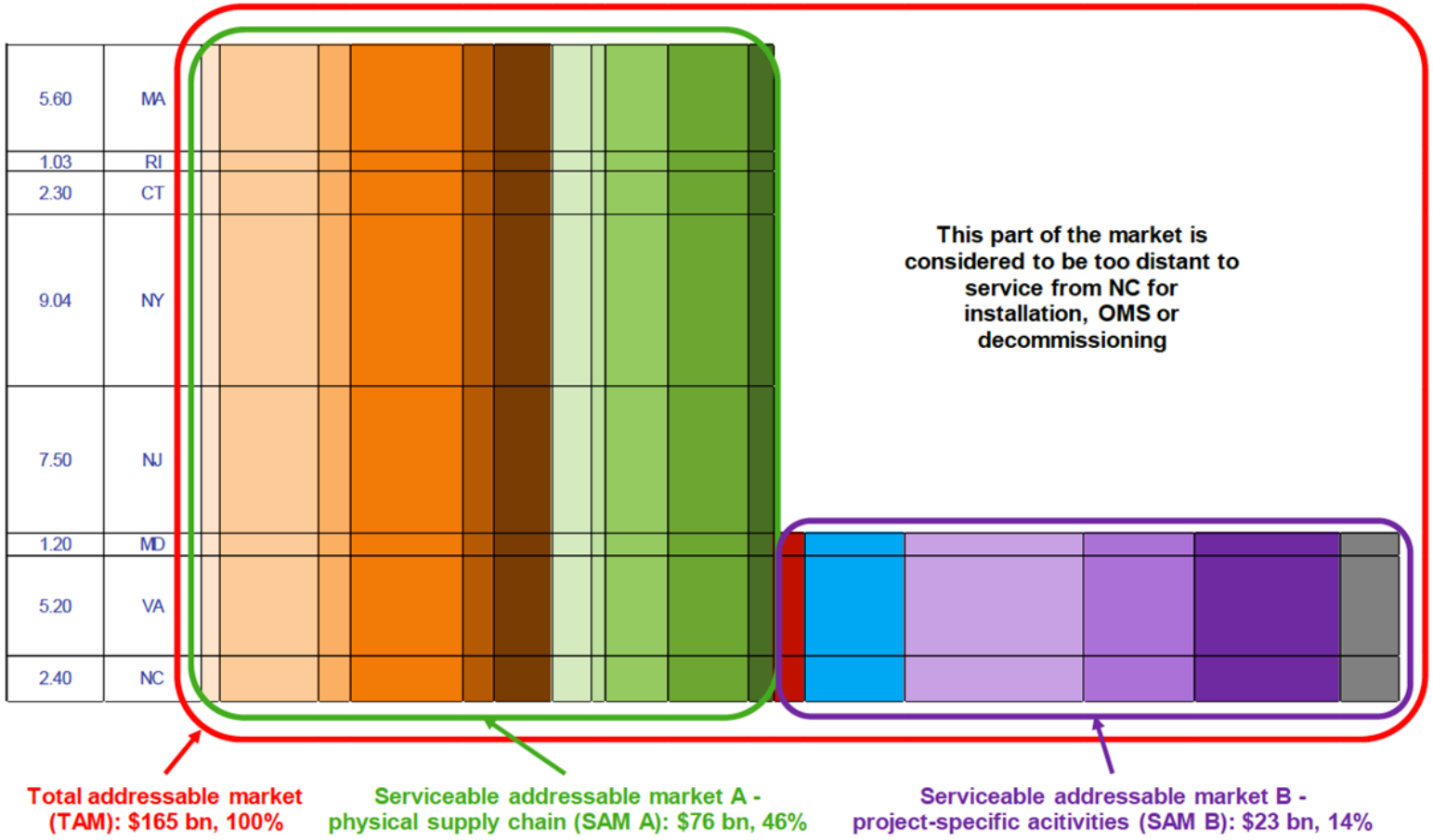
OSW Project Components: CAPEX and OPEX



Lifetime Expenditure by Component

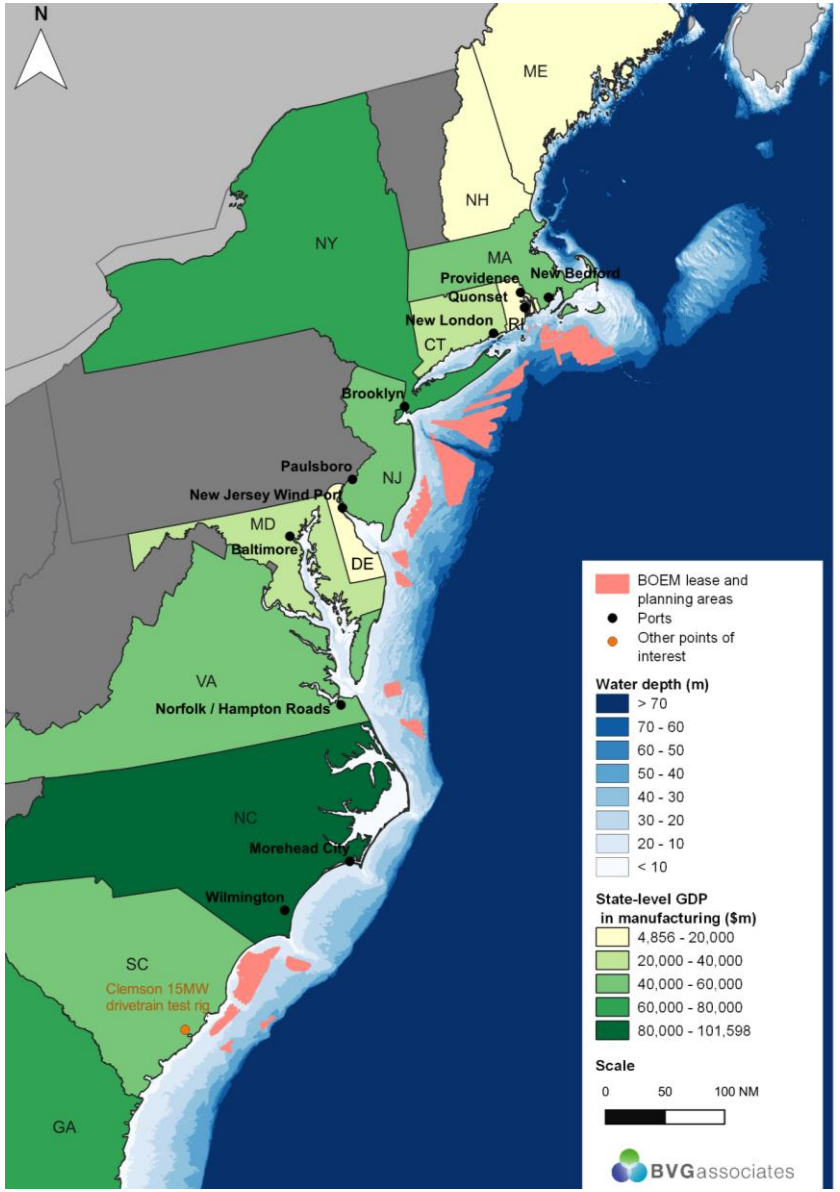
Developer and state target (GW)	State (north to south)	Lifetime expenditure (in proportion to $/MW)															
		Turbine assembly	Blades	Castings and forgings	Drive train	Tower	Turbine other	Subsea export cables	Subsea array cables	Substations	Foundations	Balance of plant other	Dev't and project mgt	Installation	Operation, maintenance and minor service	Major service	Transmission OMS	DECEX

Source: BVG Associates



- By state and not including the "anticipated" installations
- Approximately $100B in capital investment and operating expenditures along the Atlantic Coast are available to NC.
- As the OSW market and development grows along the Atlantic Coast and NC coast, NC's economic opportunities increase.

Active offshore wind projects



- NC leading in manufacturing GDP
- Supply chain to focus on “Active OSW Projects”
- 30% of active East Coast projects in MD, VA, NC
- Sub-components to serve full East Coast market

"Active Projects" US East Coast by State and anticipated installation (snapshot Q4 2021)

State	2024	2025	2026	2027	2028	Total [MW]
Massachusetts	800	804	804	400	1,200	4,008
Rhode Island	400					400
Connecticut	300	804				1,104
New York	130	880	2,076	1,230		4,316
New Jersey		1,100		1,510	1,148	3,758
Maryland		120		800		920
Virginia	880	880	880			2,640
North Carolina			800	1,700		2,500
Total market	2,510	4,588	4,560	5,640	2,348	**19,646**
MD/VA/NC market	880	1,000	1,680	2,500	0	**6,060**

North Carolina Supply Chain Directory

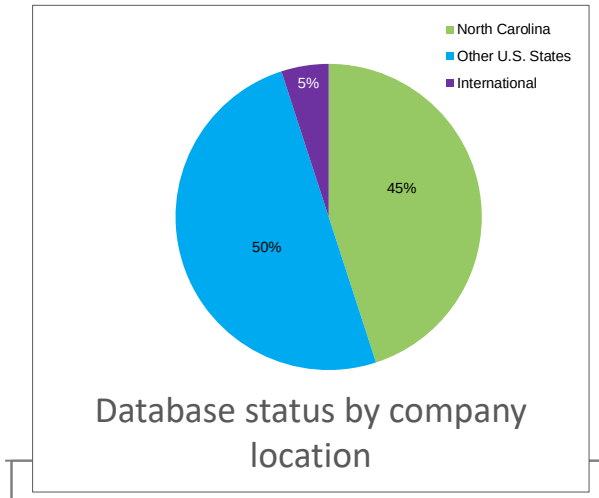
NORTH CAROLINA DEPARTMENT of COMMERCE

North Carolina Offshore Wind Supply Chain Registry

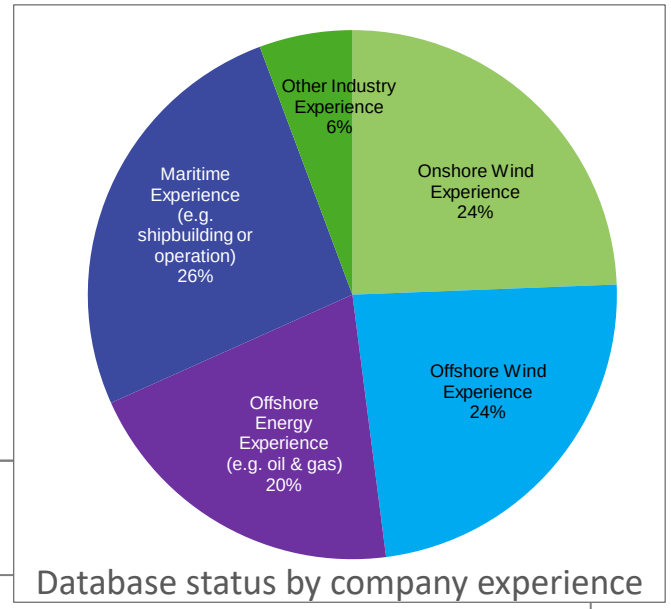
North Carolina Supply Chain Directory

Public registry as a first step to build visibility for companies serving or transitioning into the OSW industry.

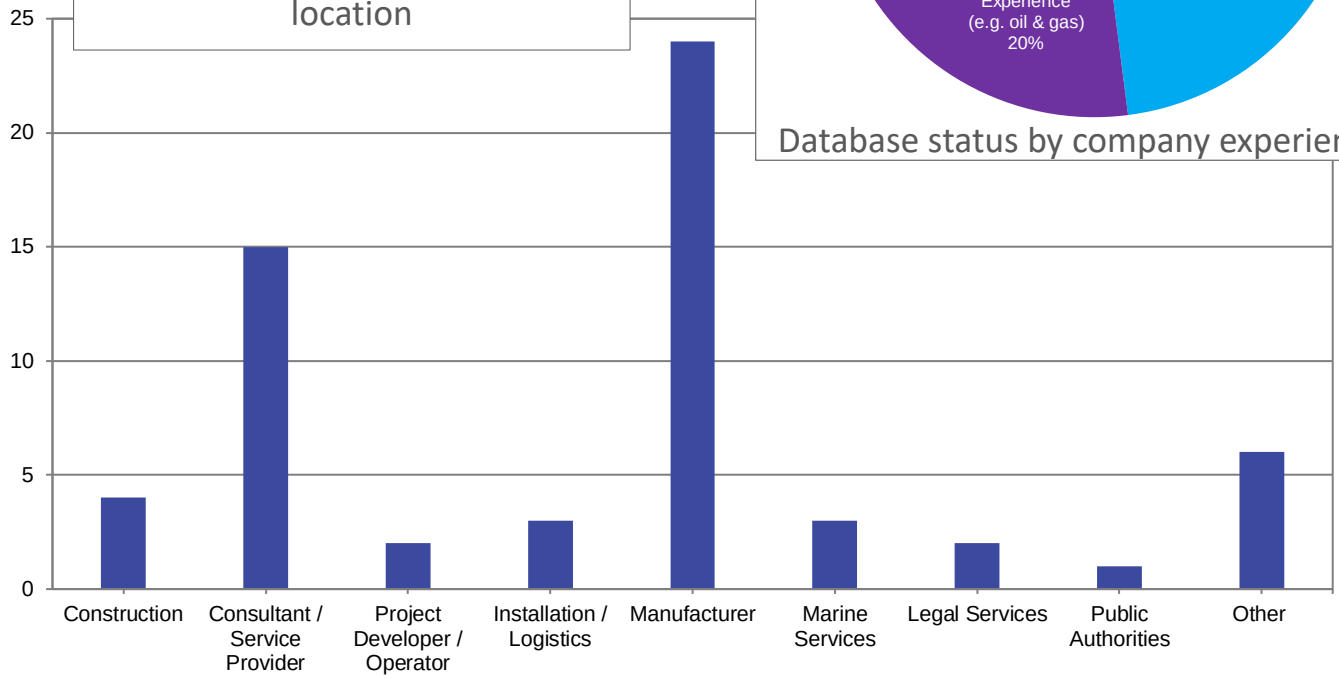
*__80__ firms signed up to date.



Database status by company location

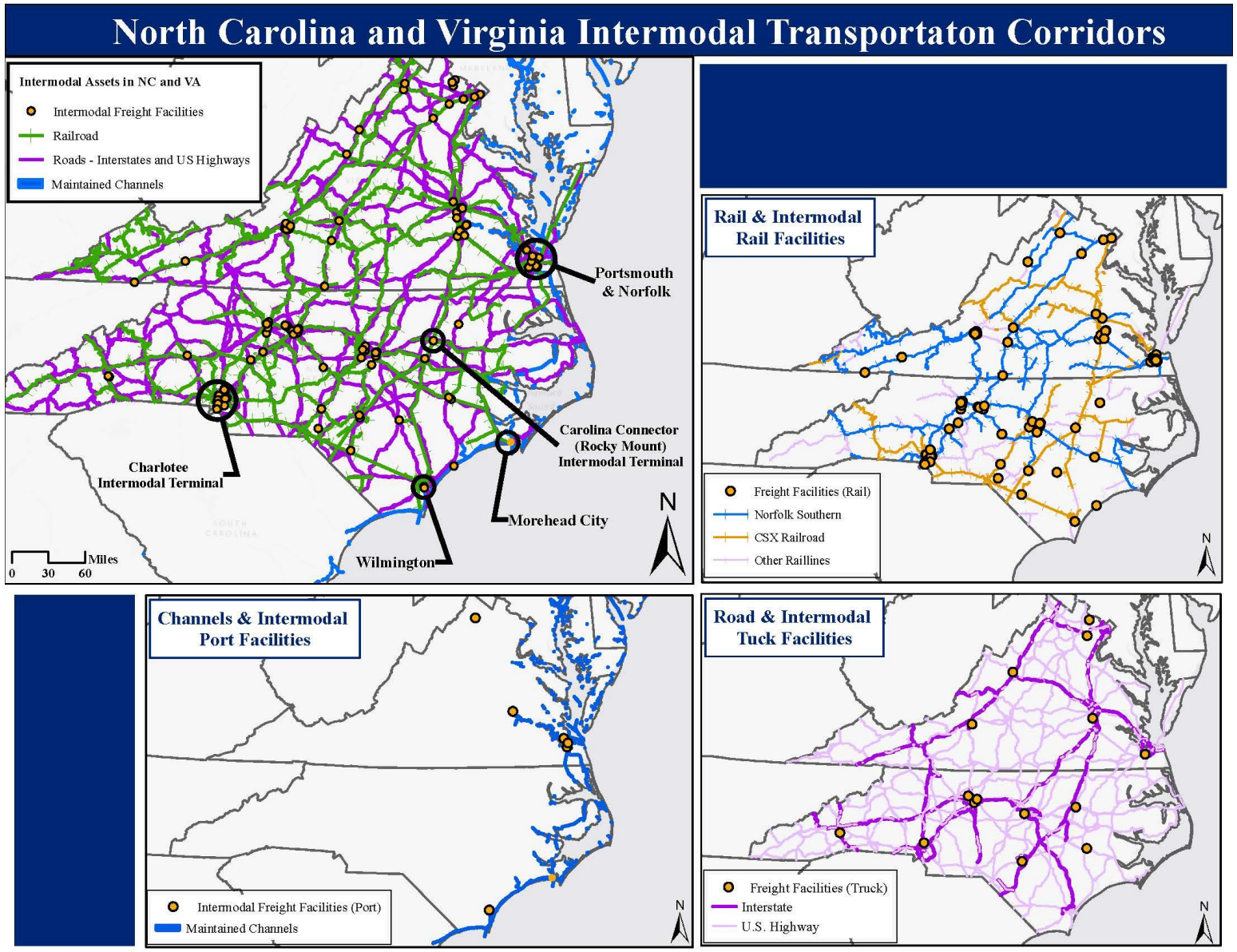


Database status by company experience



Database status by company sector

Intermodal Infrastructure Overview



- Not just Ports – Manufacturing is NC's Edge
- Intermodal – Fully Integrated Marine, Rail and Road System
- Connects State Manufactures to Product End-Users
- Ready Now to Support First Wave Projects
- Both Intra- and Interstate Connections, Including to Virginia OSW Support Facilities

Port Facilities

- Evaluated Multiple NC Existing/Potential OSW Port Facilities
- Predominately Associated with Port of Morehead City and Port of Wilmington Areas for Large-scale Operations
- Integrate First Wave Projects with Virginia
- Future Opportunities for Second and Third Waver Projects off of the Carolinas

NC State Ports

Port of Morehead City, NC

Port of Wilmington, NC

NC has several other port and water-front properties well-suited to support the OSW industry currently developing off the US East Coast

Relative potential to the main east coast ports

Facility	State	Score
Portsmouth Marine Terminal	VA	60
Norfolk Southern Lamberts Point	VA	60
South Brooklyn Marine Terminal	NY	60
Port of Providence	RI	57
Port of Wilmington	NC	53
New Bedford Marine Commerce Terminal	MA	53
Morehead City	NC	52
Port of Davisville (Quonset)	RI	52
Sunny Point Marine Terminal	NC	52
Bridgeport	CT	49
Radio Island	NC	49
Wilmington Business Park/Vertex Property	NC	47
North Property	NC	46
New Jersey OSW Port	NJ	45
Southport/NC International Terminal	NC	42
Eagle Island	NC	39
Raleigh Street Property	NC	37

- Tier 1 manufacturing SWOT analysis of existing facilities
- Wilmington scores well but Portsmouth and Norfolk score better – good to avoid unnecessary competition
- Leverage existing NC Manufacturing Strengths with Virginia for First Wave Projects
- Leverage NC Port Assets for Second and Third Wave Projects

Occupational Needs

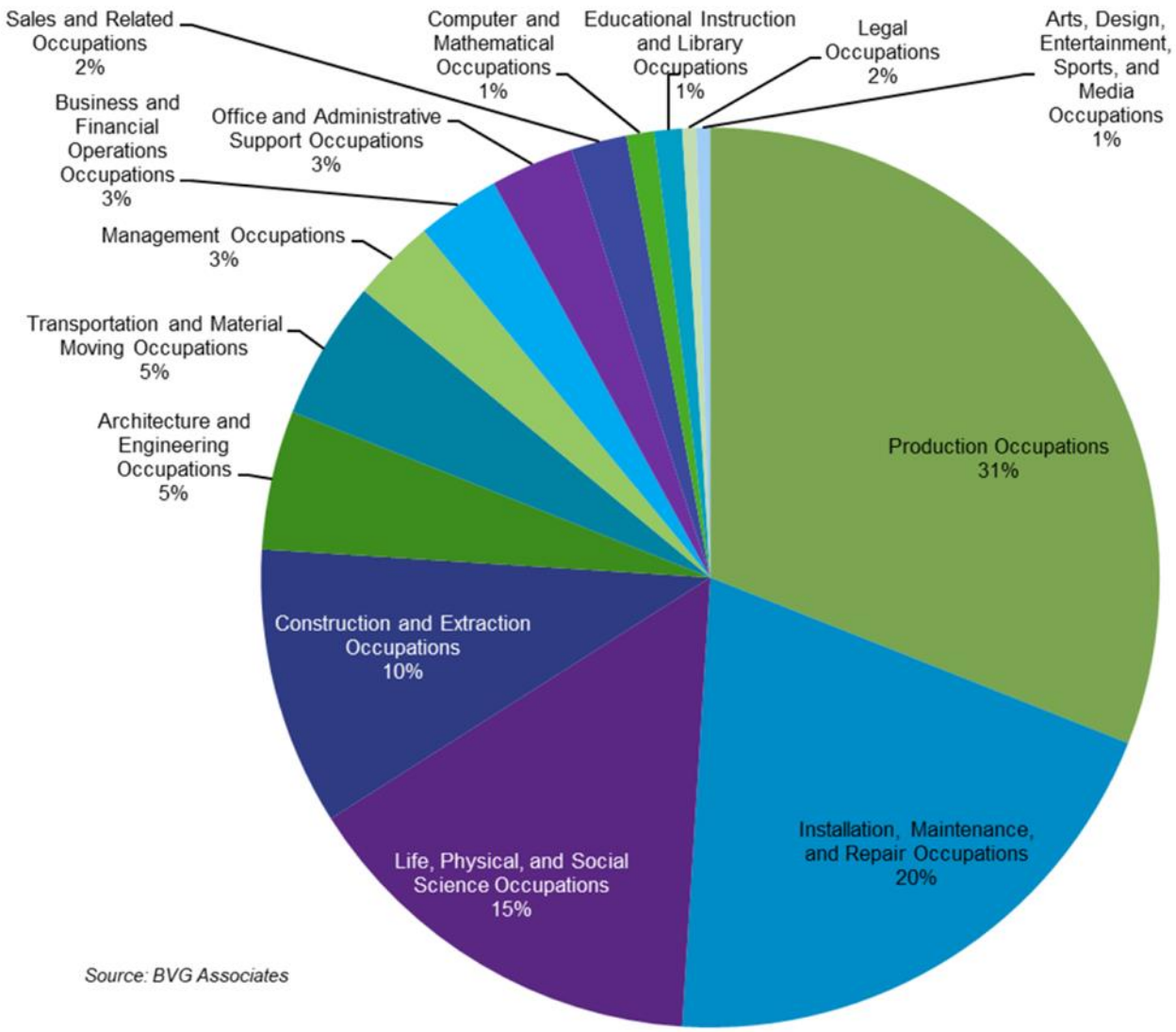


Figure 44 Breakdown of occupations in the total offshore wind supply chain

North Carolina's Business Climate: Strengths, Gaps and Implications for Offshore Wind

North Carolina competitive edge:

- MANUFACTURING
  - Continue and amplify traditional industrial recruitment and retention strategies to attract and expand opportunities for OSW component suppliers
- History as a LEADER in CLEAN ENERGY MARKET DEVELOPMENT
  - Synergistic benefit of expanding the total east-coast market opportunity
  - Promote shifting the nexus of market development south and closer to the NC labor market

The policy options and recommendations include a mix of best practices demonstrated by other states, and new ideas incorporate NC's inherent strengths and are grouped as follows:

Recommendations Framework

- NC has many options to support the growth and development of OSW. The recommendations identified are categorized into three categories of increasing level of state activity:
  - **"Prepare"** recommendations focus on information-gathering and formation of policy frameworks.
  - **"Facilitate"** recommendations aim to create conditions conducive to the expansion of OSW through removal of policy barriers and development of favorable infrastructure.
  - **"Accelerate"** recommendations directly support deployment of OSW through incentives and state/utility procurements.
- These categories are not mutually exclusive, and NC may adopt policies and programs from multiple levels in the different areas of recommendations at any one time.

Example Key Recommendations

Economic Opportunity and Business Development

Prepare	Continue to promote and develop the NC OSW Supply Chain Registry.
Facilitate	Actively support existing high-tier NC-based companies to pivot to the domestic OSW market, especially where they already have relevant skills and experience, or supply to the domestic onshore wind market.
Accelerate	Provide targeted incentive support to OSW-related firms.

Infrastructure, Environmental Justice & Inclusion

Prepare	Identify interested stakeholders and organizations for ongoing engagement and outreach.
Facilitate	Identify permitting and regulatory requirements for onshoring transmission and land-based infrastructure.
Accelerate	Champion, and advocate for implementation of best practices that foster environmental justice and equitable access.

Example Key Recommendations (cont'd)

Workforce, Education, and Training

Prepare	Develop an inventory of industry-relevant training already available.
Facilitate	Establish training partnership with the Mid-Atlantic Wind Training Alliance.
Accelerate	Provide funding for new infrastructure, equipment and curriculum.

Outreach and Engagement

Prepare	Establish year-round schedule of regular outreach events – virtual or in person.
Facilitate	Organize "fact finding" visits to wind installations for local and state policymakers and business leaders.
Accelerate	Promote and advocate for recommendations from Taskforce to stakeholders and policymakers.

NC Continuing to Mobilize for Success

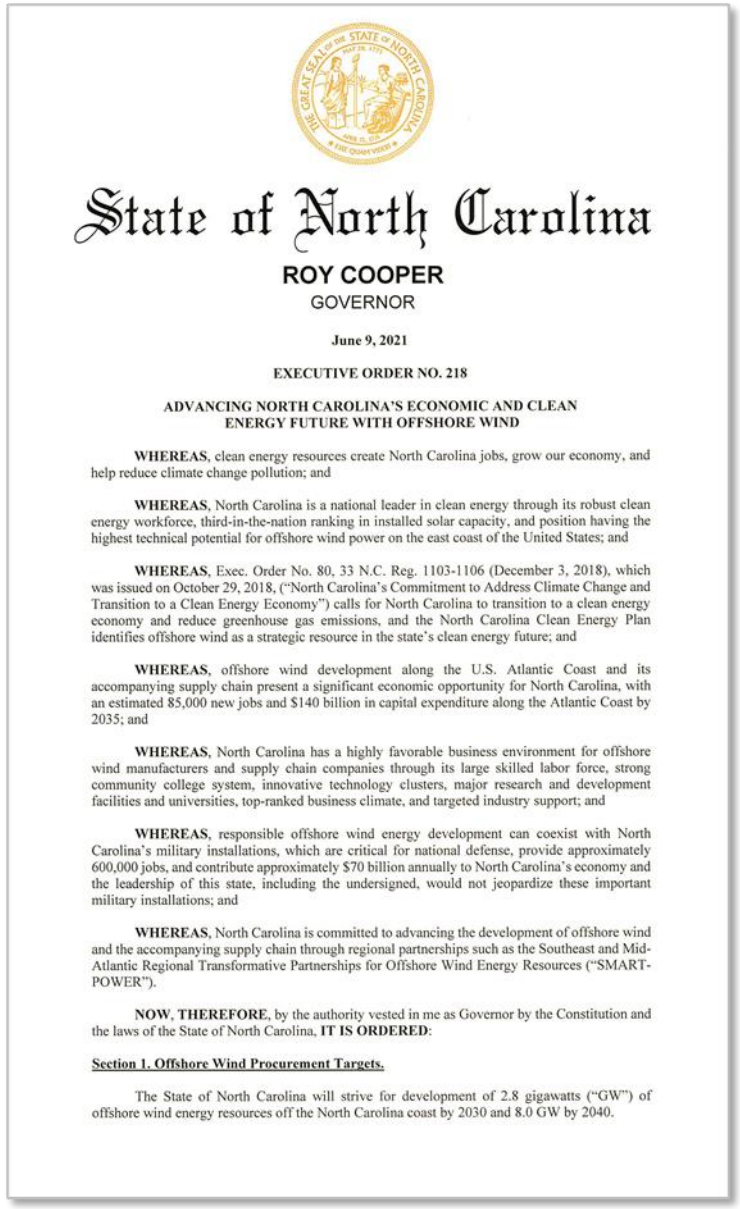
June 2021: Governor Cooper announced:

Executive Order 218: Advancing North Carolina's Economic Clean Energy Future with Offshore Wind

1. Establishes OSW development goals of **2.8 gigawatts off the NC coast by 2030 and 8.0 GW by 2040**

2. Establishes the **NC Taskforce for Offshore Wind Economic Resource Strategies (NC TOWERS)** to provide expert advice for advancing NC OSW energy projects, economic development, and job creation

3. Directs key agencies to designate OSW leads:
   - **Department of Commerce** a clean energy econ. dev. coordinator
   - **Department of Military & Veterans Affairs** an OSW coordinator
   - **Department of Environmental Quality** an OSW coordinator



State of North Carolina

ROY COOPER
GOVERNOR

June 9, 2021

EXECUTIVE ORDER NO. 218

ADVANCING NORTH CAROLINA'S ECONOMIC AND CLEAN ENERGY FUTURE WITH OFFSHORE WIND

WHEREAS, clean energy resources create North Carolina jobs, grow our economy, and help reduce climate change pollution; and

WHEREAS, North Carolina is a national leader in clean energy through its robust clean energy workforce, third-in-the-nation ranking in installed solar capacity, and position having the highest technical potential for offshore wind power on the east coast of the United States; and

WHEREAS, Exec. Order No. 80, 33 N.C. Reg. 1103-1106 (December 3, 2018), which was issued on October 29, 2018, ("North Carolina's Commitment to Address Climate Change and Transition to a Clean Energy Economy") calls for North Carolina to transition to a clean energy economy and reduce greenhouse gas emissions, and the North Carolina Clean Energy Plan identifies offshore wind as a strategic resource in the state's clean energy future; and

WHEREAS, offshore wind development along the U.S. Atlantic Coast and its accompanying supply chain present a significant economic opportunity for North Carolina, with an estimated 85,000 new jobs and $140 billion in capital expenditure along the Atlantic Coast by 2035; and

WHEREAS, North Carolina has a highly favorable business environment for offshore wind manufacturers and supply chain companies through its large skilled labor force, strong community college system, innovative technology clusters, major research and development facilities and universities, top-ranked business climate, and targeted industry support; and

WHEREAS, responsible offshore wind energy development can coexist with North Carolina's military installations, which are critical for national defense, provide approximately 600,000 jobs, and contribute approximately $70 billion annually to North Carolina's economy and the leadership of this state, including the undersigned, would not jeopardize these important military installations; and

WHEREAS, North Carolina is committed to advancing the development of offshore wind and the accompanying supply chain through regional partnerships such as the Southeast and Mid-Atlantic Regional Transformative Partnerships for Offshore Wind Energy Resources ("SMART-POWER").

NOW, THEREFORE, by the authority vested in me as Governor by the Constitution and the laws of the State of North Carolina, **IT IS ORDERED**:

Section 1. Offshore Wind Procurement Targets.

The State of North Carolina will strive for development of 2.8 gigawatts ("GW") of offshore wind energy resources off the North Carolina coast by 2030 and 8.0 GW by 2040.

Dept. of Commerce & NC TOWERS Coordination

Emily Roach,
Director of Policy and Strategic Planning

Marqueta Welton,
Chief of Staff and
NC TOWERS Chair

Lex Janes,
Director of Legislative Affairs

Our mission is to improve the economic well-being and quality of life for all North Carolinians. We work closely with local, regional, national and international organizations to propel economic, community and workforce development for the state.

- **Division of Employment Security**
- **Labor & Economic Analysis Division**
- **Rural Economic Development Division**
- **Office of Science, Technology & Innovation**
- **Division of Workforce Solutions**

Potential Scale of Economic Impact: 2.8GW OSW Project

	2030 – Base Scenario	2030 – High Scenario
NET Economic Impact	$3.781B	$4.581B
Jobs – Construction (job years)	27,621	30,990
Jobs – Operations (annual)	923	923

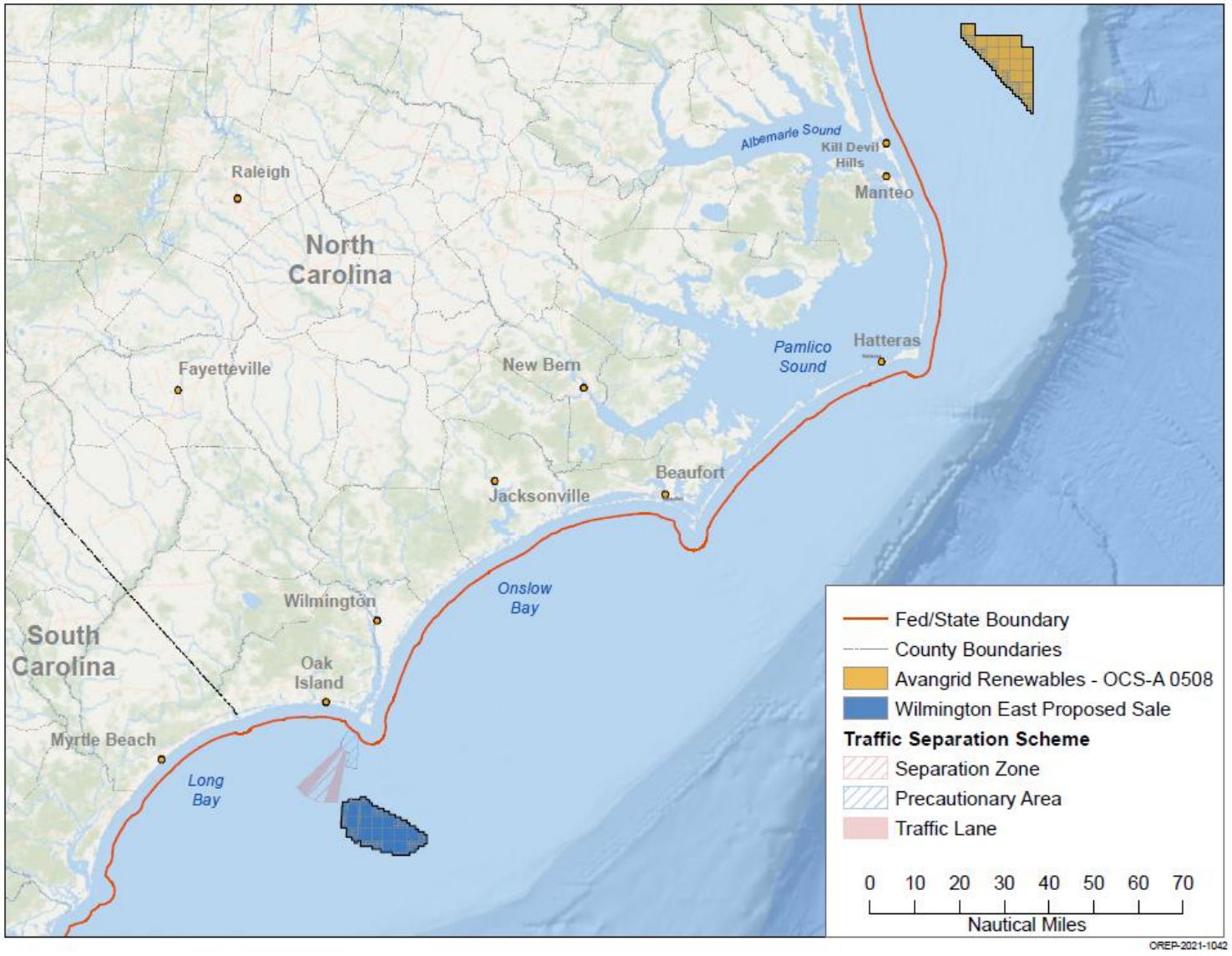
Base Scenario: Standard assumptions derived from 2021 *OSW Supply Chain Assessment*

High Scenario: Local share assumptions at 100% for blades and offshore substations

SOUTHEASTERN WIND COALITION

Southeastern Wind Coalition and E2. *North Carolina Offshore Wind Cost/Benefit Analysis*. Jan 19, 2022. https://www.sewind.org/images/fact_sheets/NC_Offshore_Wind_Cost-Benefit_Analysis_FINAL.pdf

North Carolina's Wind Energy Areas



Current Status

- Kitty Hawk: leased
- Wilmington East: pending lease auction, Spring 2022
  - Total approximate energy generation capacity: **4.0 GW**

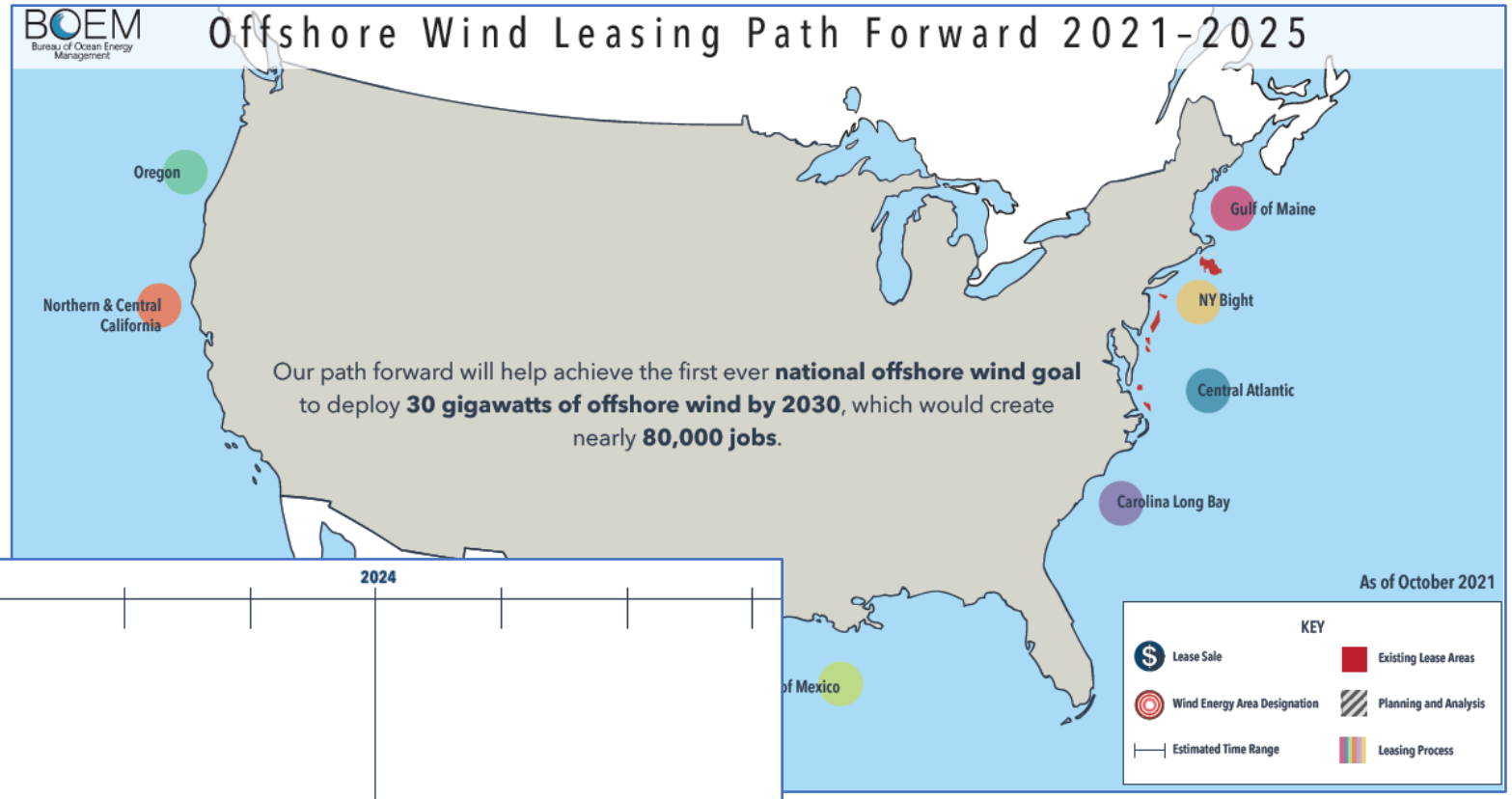
Mobilizing to Develop 8.0GW OSW by 2040

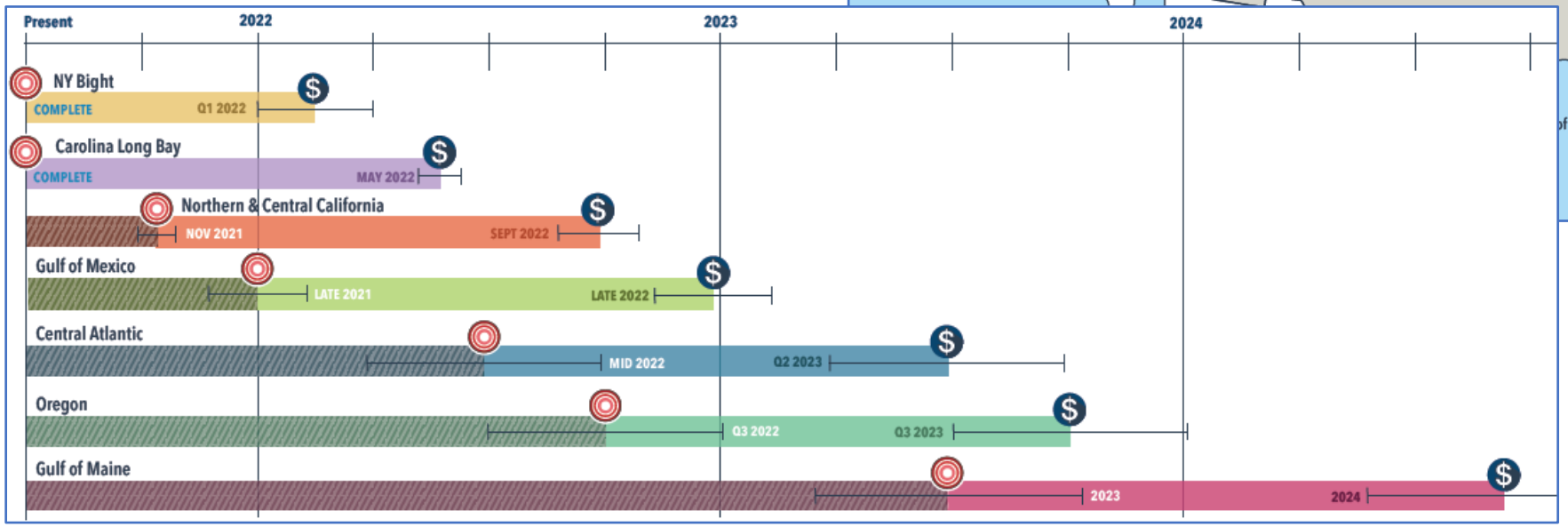
Lease & Develop WEAs

- Kitty Hawk (under lease)
- Wilmington East

Identify new WEAs

- Central Atlantic Call Area





Discussion and Questions

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