WINDS OF PROSPERITY

A Climate and Jobs Strategy for Offshore Wind in Southern New England

Climate Jobs Rhode Island
Climate Jobs Massachusetts
Connecticut Roundtable on Climate and Jobs
Climate Jobs National Resource Center

2024

CLIMATE JOBS Rhode Island

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CLIMATE JOBS NATIONAL RESOURCE CENTER

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A Report by

Climate Jobs Rhode Island
Climate Jobs Massachusetts
Connecticut Roundtable on Climate and Jobs
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Climate Jobs Rhode Island

Climate Jobs Rhode Island is a broad and growing coalition of labor, environmental, and community partners committed to a just transition to an equitable, pro-worker, pro-climate green economy. With grounding principles in economic, environmental, racial, and social justice we can simultaneously address climate change, create thousands of good union jobs, and advance racial and economic equity throughout the state.

Climate Jobs Massachusetts

Climate Jobs Massachusetts is a coalition of labor unions and partners who represent workers and residents from Gloucester to Cape Cod, and from Boston to the Berkshires.

Connecticut Roundtable on Climate and Jobs

The Connecticut Roundtable on Climate and Jobs builds alliances among diverse constituencies to combat climate change, create jobs and promote racial, economic and environmental justice.

Climate Jobs National Resource Center

The Climate Jobs National Resource Center (CJNRC) supports state climate jobs coalitions and labor organizations that are working to combat climate change, support investment in new renewable energy production, create good union jobs, and address economic and racial inequality. CJNRC provides strategic and technical support to unions organizing for worker-centered climate action.

Contents

Foreword

– Patrick Crowley, President, Rhode Island AFL-CIO

As the President of the Rhode Island AFL-CIO and co-chair of Climate Jobs Rhode Island, I'm proud of the active role our labor movement has taken in climate action. We are leading the way in many ways. First, workers from the unions that make up the Rhode Island Building and Construction Trades Council helped build the country's first offshore wind project, Block Island Wind. Then, the Rhode Island AFL-CIO joined with our partners in the environmental movement to pass the State's groundbreaking Act on Climate and worked with leaders in our capital city to declare Providence the nation's first Climate Jobs City. And now we are working together to get our elected officials to take aggressive action on offshore wind – Rhode Island's single best answer for climate change.

We are pleased to partner with Climate Jobs Massachusetts and the Connecticut Roundtable on Climate and Jobs on developing a regional offshore wind industry that provides both climate and economic benefits for Southern New England. Rhode Island, Massachusetts, and Connecticut's state governments have already started to collaborate on offshore wind, issuing a joint procurement in October 2023, and awarding a record number of megawatts to three projects on September 6, 2024. These projects are expected to expand regional benefits and reduce overall project costs. In addition, the three states, in coalition with Maine, New Hampshire, and Vermont, have been awarded a $389 million grant from the U.S. Department of Energy for their joint proposal to invest in regional offshore wind transmission infrastructure.

To build on our present achievements and develop the high-road clean energy industry of the future, we must remember our region's rich past. Nearly 200 years ago, most Southern New Englanders lived as subsistence farmers. People lived where they worked, ate what they grew, died, and were buried in the same communities in which they spent their whole lives. However, throughout the 1800s, the region transformed rapidly into an industrial powerhouse. The transformation didn't always benefit workers, often enriching a few at the expense of many. The mill owners who set up small shops along the Blackstone River within two generations turned into the robber barons whose Newport Mansions were paid for by exploiting workers and poisoning the environment.

We know the lessons of the past – the question is will we learn anything from them? This report answers with a resounding "yes." We are on the verge of a new environmental industrial revolution that can correct the mistakes of the past – one that can lift workers into the middle class and protect the environment. But we need to be bold, even daring. We need to turn again to the Atlantic Ocean as a key resource that will allow us to decarbonize the economy. Massachusetts, Connecticut, and Rhode Island don't have a lot of land on which to build solar and onshore wind farms, but they do have unparalleled access to the North Atlantic, where the nation's highest quality offshore wind resources are located. There is no reason why these three states can't set a regional goal of 30 gigawatts (GW) by 2040 and 60 GW by 2050. This report argues that to reach these goals, Southern New England needs a climate and jobs strategy that prioritizes building a new high-road green industry.

A climate and jobs strategy coordinates investments in offshore wind's four cornerstones – ports, manufacturing, transmission, and vessels – and puts workers at the center of this energy transition. With the help of the federal Inflation Reduction Act, Massachusetts, Rhode Island, and Connecticut have an opportunity to work together to develop a world-class offshore wind industry that exports energy, technology, and know-how around the country, and that achieves economies of scale to reduce consumer energy bills. Through the efforts of organized labor, the tremendous returns generated by this industry can be equitably distributed throughout the region.

I've lived in New England my whole life. I grew up in a beach community in Massachusetts and now I live with my family next to a beautiful state park in Rhode Island. I've hiked throughout the White Mountains of New Hampshire, hunted in the woods of Vermont, camped in the wild north of Maine, and fished along the Connecticut coast; so, it is with a deep affinity for this place I call home that I believe in its possibility to be a leader in the offshore wind industry. It is too precious of a place to lose to the ravages of climate change and too precarious to leave its future in the hands of those who would exploit its resources solely for profit. We need a new environmental industrial policy, one that places offshore wind at its core and is driven forward by working-class New Englanders.

Along with my colleagues in Climate Jobs Massachusetts and Connecticut Roundtable on Climate and Jobs, I'm calling on the governors of Massachusetts, Rhode Island, and Connecticut, along with the leaders of each states' legislatures, to join us in a discussion on this report's findings and recommendations. In 2025, let's build on the joint procurement for offshore wind projects and start soliciting regional supply chain investments as well. Let's implement the Power Up New England transmission proposal, investing the $500 million in matching funds that the Grid Innovation Program grant is contingent upon. Let's get project labor agreements for construction work across ports, manufacturing, vessels, and transmission construction, and labor peace agreements for the operation and maintenance work. Let's get to work on a climate and jobs strategy for 30 GW by 2040 and 60 GW by 2050, building a world-class offshore wind industry and bringing a new era of prosperity for Southern New England.

Introduction

– Eric Hines, Professor of Practice, Civil and Environmental Engineering at Tufts University

In our lifetimes, we have not encountered an opportunity as great or a mission as urgent as the transition of our energy system to electricity powered by clean energy. As we rebuild New England's electricity generation capacity and add even more capacity to meet our future heating, transportation, and data center demands, we need a strategy that is well suited for our current situation.

Faced with the threat of catastrophic climate change, the moral imperative to protect our planet, the practical necessity to build new infrastructure, and the opportunity to advance a new industrial revolution that prioritizes environmental and social justice, offshore wind and land-based solar have emerged within state legislation and regional transmission planning as our clean energies of choice. These two sources of power complement one another and offer building blocks from which we can develop a new system. Of the two, offshore wind is truly suited to New England's outer continental shelf, our exceptional offshore wind resource, our retiring coastal power plants, our maritime history, and our world-class ocean, atmospheric, and environmental research assets.

As this report makes clear, our opportunity to build offshore wind is also our opportunity to reshore American manufacturing and transform this growing global industry through Yankee ingenuity.

The prospect of large-scale development in our oceans should be taken seriously. The U.S. Atlantic Coast is home to some of the world's best beaches and to four hundred years of fishing, recreation, and commerce. From the Gulf of Maine to Cape Cod, from Long Island to the Jersey Shore, from the Delmarva Peninsula to the Carolina Outer Banks, and from the Southern Tidelands to the Florida Keys, we treasure the grandeur of our ocean and the sense of endless possibility we feel when we look to the horizon. Families come to our shores to relax, reconnect, and experience the wonders of nature.

As boundless as our ocean feels, however, it is also finite. Centuries of use have created a crowded space sorely in need of careful management, and global warming has not only begun to decimate fishing stocks but threatens to swallow our precious coastline whole with rising sea levels. What if we could build offshore wind in a way that makes the ocean healthier? What if we could build in a way that realizes our ideals of social and environmental justice? These are not idle questions. The science and engineering of “nature-inclusive design” are well within reach, and it is up to us to decide how we want to move forward. We are fortunate to have many of the scientific resources already in place to lead the world in this area. We can build offshore wind turbine foundations that act as artificial reefs, enhance biodiversity, revive fishing stocks, last for over 100 years, create 10x more jobs, and revolutionize installation techniques. The cost of making this happen would be pennies on the dollar, and very low compared to the recent price hikes due to global supply chain constraints and spiking interest rates.

Similar to our great economic successes of the past, establishing this new market requires long-term investments in people, infrastructure, factories, and innovation. Based on lessons learned over the past 40 years, we are moving away from fantasies of magical markets that emerge spontaneously and run perfectly, and toward realistic markets that are built on wise, long-term investments. These markets must be regulated with the health and safety of our people and our environment in mind.

To date, the U.S. has not established a supply chain that can develop our own offshore wind resource, and we have incorrectly assumed that the global supply chain could meet our growing demands. This has resulted in project setbacks and higher offshore wind prices. It has also reinforced the importance of industrial policy and infrastructure-scale financing for the long-term. As an example, global leadership in the emerging high-voltage direct current (HVDC) electricity transmission market is up for grabs. When we order these components from Europe, current wait times extend into the early 2030s. Why wouldn’t we see this as a golden opportunity to build our own?

The success of the 2022 CHIPS and Science Act (CHIPS) in reshoring semiconductor manufacturing offers a roadmap for advancing energy development and manufacturing through the 2021 Infrastructure Investment and Jobs Act (IIJA) and the Inflation Reduction Act of 2022 (IRA). These bipartisan federal initiatives have established a language for the creation of next-generation industries. Coupled with New England’s organized labor community, one of the strongest in the United States, future laws and policies can help refine this language and grow an industry that is safe for workers, provides high-quality jobs, improves our environment, and becomes a beacon to other regions.

When Francis Lowell returned from the cotton mills of Manchester and Birmingham, England in the early 19th century, he brought a vision to improve not only their designs but also their working conditions. To this day, New Englanders carry the conviction that social and environmental justice are essential ingredients for long-term economic success. As we stand at this threshold of our future, it is ours to choose how to advance a new industrial revolution that is worthy of our values.

Executive Summary

Since the beginning of the 20th century, Southern New England has experienced the most severe rise in average temperatures in the continental U.S.,[1] resulting in more frequent and destructive storms, floods, and freezes that have killed many people and caused billions of dollars in damages. To address these climate change impacts, Rhode Island, Massachusetts, and Connecticut have committed to developing significant amounts of clean energy to reduce greenhouse gas emissions.

To address climate change and secure its future, Southern New England must turn to the Atlantic Ocean. Southern New England has access to the highest quality offshore wind resources in the continental U.S, providing an extraordinary opportunity to develop a world-class offshore wind industry.

Southern New England is already a pioneer in the development of offshore wind, leading the nation with several "firsts." Rhode Island completed the nation's first offshore wind farm, Block Island Wind, in 2016. Since then, Southern New England started construction on Vineyard Wind and Revolution Wind, which will provide a combined 1,510 megawatts (MW) of capacity upon completion in 2026. **To expand its offshore wind portfolio, Massachusetts, Connecticut, and Rhode Island executed the nation's first multistate offshore wind procurement – with Massachusetts and Rhode Island securing 2,878 MW from three developers in 2024.** To support the industry's development, Southern New England states have invested in significant port infrastructure, including the nation's first offshore wind port (New Bedford Marine Commerce Terminal), a heavy-lift deepwater port (New London State Pier), and have plans to develop more port infrastructure across the region.

In their early efforts to develop offshore wind, Southern New England's government officials prioritized contracts with developers for large amounts of clean electricity. They did not give equal emphasis to building many of the components necessary for a robust industry – the supply chain of manufactured components, specialized ships, and transmission networks. Lacking a network of local suppliers, offshore wind developers were left vulnerable to global market turmoil and the specter of rising prices for utility ratepayers. Rising interest rates and global shortages for key components prompted three offshore wind developers in Southern New England to back out of their previously awarded contracts in 2023. The timing was unfortunate – just as the states' efforts encountered market headwinds, the federal government laid the groundwork for building an American offshore wind industry with the enactment of generous long-term tax incentives under the Inflation Reduction Act (IRA) and strong engagement from the U.S. Departments of Energy and Interior. The IRA is transforming America's energy supply by providing robust long-term support for clean energy generation,

[1] Temperatures in Rhode Island have risen by almost 4°F, while Connecticut and Massachusetts have warmed by nearly 3.5°F. In contrast, temperatures in IL and TX have risen 1.5°F.

manufacturing, and infrastructure investments.

Looking forward, Southern New England's states have the opportunity to leverage IRA incentives and apply the lessons learned from their first offshore wind contracts. They are positioned to raise their offshore wind capacity goals and embark on coordinating a large-scale offshore wind development plan that will over time lower average costs per megawatt of new capacity. A larger scale of development is also needed to meet the region's rising demand for electricity while protecting the public from unnecessary rate increases. Using the IRA's incentives, Southern New England can build out its regional offshore wind industry to achieve economies of scale that will drive down project costs for developers while reducing costs for consumers. The U.S. Department of Energy and National Renewable Energy Laboratory project that, with the development of the industry, prices will halve within a decade.[2]

Our vision for Southern New England's offshore wind development is based on what we call a *climate and jobs* strategy, built around new investments, active government facilitation of industry growth, and reliance on a skilled union workforce. Under a climate and jobs strategy, governments aim to develop an industry, not just individual projects, by taking an active role in partnering with private sector developers and suppliers to prioritize investment in the four cornerstones of the industry – offshore wind ports, manufacturing, transmission, and vessels. Underlying each cornerstone is a commitment to good-paying union jobs and equity. By placing union workers at the forefront of its approach, the region can attract highly skilled individuals to the industry and retain them for the long term. Additionally, labor organizations will be indispensable for distributing offshore wind's economic benefits widely, such that the industry can sustain its momentum with enduring public support. Listed below are the major areas of investment in a climate and jobs strategy.

1. **Ports:** Port upgrades are necessary for offshore wind construction, manufacturing, and operations and maintenance. The region's state governments have led the nation in developing ports to support construction, and can build on these successes by expanding ports to support additional needs, such as manufacturing and operations and maintenance.
2. **Component manufacturing:** Rather than shipping large components across the Atlantic – some of which are hundreds of feet long and weigh thousands of tons – developing regional manufacturers would deliver these components efficiently while driving local job creation.
3. **Vessels:** Without specialized domestic installation vessels, the industry has had to rely on intermediary barges to carry components to European ships that traveled over 4,000 miles to assemble American offshore wind turbines. Under a climate and jobs strategy, federal and state governments, along with the shipbuilding industry, would work together to assess their capacity to construct vessels needed for offshore wind installations.

[2] See section 2.5 for more.

4. **Transmission:** Today's uncoordinated transmission approach requires each project to build its own line connecting to the onshore grid. Under a climate and jobs strategy, state governments would invest in a planned regional transmission system that eliminates these redundancies, resulting in lower customer bills and a more resilient electricity system.
5. **Labor standards and equity:** A climate and jobs strategy includes robust labor standards and protections, including Project Labor Agreements (PLAs) and card check neutrality agreements or Community Benefits Agreements, throughout the supply chain, not just on steel-in-the-water construction projects. Additionally, states, labor organizations, and businesses would work together to invest in union pre-apprenticeship and apprenticeship programs to ensure the supply of trained, skilled, and diverse workforce to meet industry demand.

As it builds out its offshore wind industry, Southern New England can draw upon local and global experiences, including Massachusetts' thriving biotechnology industry and Denmark's internationally renowned offshore wind industry. Massachusetts is well known for its flourishing Route 128 high-technology sector that began in the 1980s and subsequent evolution into a world-renowned biotechnology hub in the 2010s. Massachusetts lawmakers recognized their region's exceptional intellectual resources and developed complementary assets. Similarly, Denmark recognized abundant wind resources in the North Sea and invested in the port infrastructure, supply chain, and workforce to become an industry leader. Denmark now hosts innovative offshore wind transmission infrastructure owned by the public sector and a mature supply chain comprised of over 500 private companies.

Southern New England can become a national leader in offshore wind, exporting offshore wind energy, technologies, and industry standards. The region can generate enormous economic benefits by developing an industry that not only supports its own clean energy goals but also helps adjacent states meet their energy needs. At the same time, it can export offshore wind components and know-how while setting the standard for a clean energy industry that creates good-paying union jobs.

The federal government and Southern New England states have already laid the groundwork for a climate and jobs strategy. The region's state governments have invested significantly in developing four marshaling ports. Regional coordination is beginning to formalize, as indicated by an innovative multistate offshore wind procurement, along with nascent collaborations on transmission and supply chain development. Additionally, through the Inflation Reduction Act (IRA) of 2022 and Infrastructure Investment and Jobs Act (IIJA) of 2021 , the federal government is providing powerful financial tools for offshore wind projects, manufacturing, and infrastructure.

By building on existing state and federal initiatives, governments can embark on the next stage of a climate and jobs strategy. A climate and jobs strategy has three stages:

Stage One – from 2015 to the present day (Pre-IRA): Southern New England states set Renewable Portfolio Standards (RPS) and planned to meet a significant portion of their RPS with 9 GW of offshore wind capacity by 2030. To achieve its 2030 offshore wind goals, the region began developing port infrastructure, establishing procurement practices, and constructing its first set of offshore wind projects – Block Island Wind, Vineyard Wind, and Revolution Wind.

Stage Two – over the next decade (IRA in effect): Southern New England sets a goal of at least 30 GW by 2040 to build an industry that meets 100 percent of the region's retail electricity demand. State governments, developers, and suppliers partner to develop regional ports, manufacturing, vessels, and transmission while working with unions to set labor standards across the industry. In doing so, the region ensures the 9 GW by 2030 goal is met on time, while also building the foundation for its 2040 goals.

Stage Three – After 2035 and entering 2040 (Post-IRA): As the region closes in on its 2040 goals, Southern New England strengthens its position as a leading exporter of offshore wind energy, while supplying offshore wind components to developers across the country. Southern New England can set a new goal of 60 GW by 2050, so that the region not only matches its own electricity demand with offshore wind energy, but also trade clean energy with its neighbors.

Stages of a Climate and Jobs Strategy[3]

Stage	Timeline	Developmental Goals	Associated OSW Capacity Goals
Stage 1	2015-now	Marshaling port infrastructure, new procurement practices, and early Atlantic transmission infrastructure.	9 GW by 2030
Stage 2	The next decade	Manufacturing ports, manufacturing facilities, vessels, transmission infrastructure, labor standards for the industry.	30 GW by 2040
Stage 3	Beyond 2035	'Atlantic Backbone', transmission lines to the West, research hub for technological exports and advanced manufacturing.	60 GW by 2050

The climate and jobs strategy requires state and federal action. Massachusetts, Rhode Island, and Connecticut's governors would convene stakeholders across government, private sector, and labor to set a goal of 30 GW by 2040 and develop a plan to invest in ports, manufacturing,

[3] Timelines for each Stage are set roughly five years in advance of their associated capacity goal's target year, in recognition that meeting each capacity goal will require prior development.

transmission, and vessels with strong labor standards. The federal government would engage the states, reviewing Bureau of Ocean Energy Management leasing policy to determine how it can support a faster pace of offshore wind development. Bringing increased federal investment to the offshore wind supply chain and transmission projects will also be vital for the program's success. We also need to explore opportunities for nuclear power, hydroelectric, and thermal energy networks.

The heat wave of the summer of 2024 reminds us that the stakes for Southern New England are high. Climate change is a relentless threat to the people of Southern New England**.** The region must build and deploy clean energy at the scale and speed that climate science demands to curb greenhouse gas emissions. Fortunately, repeatedly in its history, Southern New England has made dramatic changes to secure its economic future. Whether it was the commitment to a maritime industry in the 17th century or the push to be a leader in new technologies in the 20th, the public and private sectors have come together many times to embrace new opportunities. Now, Southern New England must meet its greatest challenge yet.

However, just as the scale of the climate challenge is immense, so too are the opportunities to benefit workers and communities through the buildout of a clean energy economy. Southern New England can start by focusing on one of the region's greatest natural resources – offshore wind. Animating this collective effort is a climate and jobs strategy that asks government, the private sector, and workers, through their unions, to work together. And if we embrace this approach, Southern New England can transform the winds that blow from the East into the winds of prosperity for the region's people and communities.

Chapter 1. The Most Severe Temperature Increases in the Nation

1.1: Southern New England has witnessed an above-average rise in temperatures and sea levels as well as increasingly frequent and severe storms, flooding, and freezes. These climate disasters have killed many people and caused billions of dollars in damages.

Temperatures are rising faster in Southern New England than anywhere else in the continental U.S.; they already exceed at a local level the Paris Agreement target of keeping warming below 1.5°C.[4] Temperatures in Rhode Island have risen by almost 2.2°C (4°F) since the beginning of the 20th century. Connecticut and Massachusetts are close behind, warming by nearly 1.9°C (3.5°F) over the last 120 years. In contrast, temperatures in Illinois and Texas have risen 0.8°C (1.5°F).[5] The region's heatwaves are lasting longer and are more severe.[6]

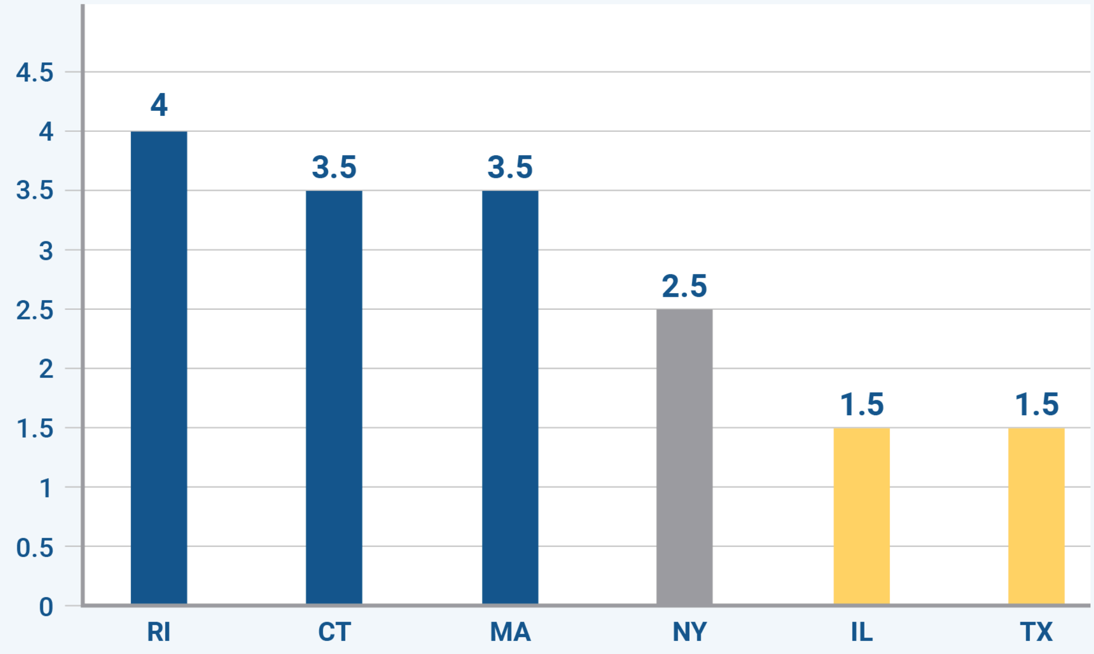

Figure 1. Temperature increases by state since the beginning of the 20th century[7]

[4] UNFCCC, "Key Aspects of the Paris Agreement."
[5] Kunkel, "State Climate Summaries for the United States 2022. NOAA Technical Report NESDIS 150."
[6] Mecray et al., "Fifth National Climate Assessment, Chapter 21: Northeast."
[7] Kunkel, "State Climate Summaries for the United States 2022. NOAA Technical Report NESDIS 150."

Additionally, sea levels in the region have risen more than nine inches since 1930[8], much higher than the U.S. average of about six inches.[9] The combination of warming temperatures and sea level rise causes increasingly frequent and severe storm surges and flooding that reach much further inland.[10] Extreme precipitation events – events within the top one percent of daily precipitation accumulations – are becoming much more common as well and can cause severe flooding. The Northeast has experienced a 60 percent increase in extreme precipitation events since the 1950s, the greatest increase in the U.S.[11]

Climate change has been felt by the millions of people who live in Southern New England. These events disrupt the day-to-day lives of everyone in the region but disproportionately affect low-income and disadvantaged communities. These communities are often located in areas with high exposure to climate impacts and lack the resources to build resilience and repair damages to poorly maintained or aging infrastructure.[12]

According to the National Oceanic and Atmospheric Administration (NOAA) database of "billion-dollar climate events," in the past five years, there have been 13 in Southern New England, nearly 2.5x the historical average. Historically, the region has averaged one event per year over the past 44 years. **Hurricanes have been exceptionally costly, with Ida and Sandy each causing over $80 billion in damages.** In addition to hurricanes, there has been an unprecedented slew of severe storms in the winter and flooding in the summer. In April 2020, a tornado – rare in New England – tore across the states, costing $4.2 billion in damages and killing 35. In December 2022, a severe storm and cold snap cost $8.8 billion, killing 87.

Table 1. Southern New England's Billion-Dollar Climate Events, 2019-2024[13]

Severe Weather Events	Date	Cost (Billions)	Deaths	States Affected
Southeast, Ohio Valley and Northeast Severe Weather (Winter Storm)	Feb 2019	$1.50	2	MA, CT
South, East and Northeast Severe Weather (Tornados and High Winds)	Feb 2020	$1.50	3	MA, RI
Southeast and Eastern Tornado Outbreak	Apr 2020	$4.20	35	MA, RI, CT
Hurricane Isaias	Aug 2020	$5.70	16	MA, RI, CT

8 Mecray et al., "Fifth National Climate Assessment, Chapter 21: Northeast."
9 US EPA, "Climate Change Indicators."
10 NOAA, "2022 Sea Level Rise Technical Report."
11 Mecray et al., "Fifth National Climate Assessment, Chapter 21: Northeast."
12 US EPA, "Climate Change and the Health of Socially Vulnerable People."
13 NOAA National Centers for Environmental Information (NCEI), "U.S. Billion-Dollar Weather and Climate Disasters."

Tropical Storm Elsa	Jul 2021	$1.40	1	MA, RI, CT
Tropical Storm Fred	Aug 2021	$1.50	7	MA, CT
Hurricane Ida	Aug 2021	$83.10	96	MA, RI, CT
Central and Eastern Winter Storm and Cold Wave	Dec 2022	$8.80	87	MA, RI, CT
Northeastern Winter Storm / Cold Wave	Feb 2023	$1.80	1	MA, RI, CT
Northeastern Flooding and North Central Severe Weather	Jul 2023	$2.20	10	MA
Northeastern and Eastern Severe Weather	Aug 2023	$1.70	4	MA
East Coast Storm and Flooding	Dec 2023	$1.30	5	MA, RI, CT
Southern Tornado Outbreak and East Coast Storm	Jan 2024	$1.80	3	MA, RI, CT

1.2: To address climate change, Southern New England state governments have committed to developing significant amounts of clean energy to support the electrification of key sectors of the economy. Each state has established goals for clean energy development, called Renewable Portfolio Standards.

Southern New England's strategy to address climate change is twofold: First, the states need to increase the relative amount of clean electricity in their generation mix. Second, they need to increase the absolute amount of electricity to power currently electrifying sectors such as transportation and buildings as well as emerging industries such as data centers, artificial intelligence, and cryptocurrency.[14] Electricity demand is projected to increase by 33 percent between now and 2040.[15]

Currently, New England's generation mix includes 55 percent gas, 23 percent nuclear, 12 percent renewables, and 10 percent hydro. Of the 12 percent renewables, four percent is from wind, four percent is from solar, and four percent is from wood and waste.[16] To meet increasing demand

[14] IEA, "Executive Summary – Electricity 2024."
[15] See Methodology Section: 2030, 2040, 2050 Electricity Demand and Offshore Wind Capacity Goals.
[16] ISO-NE, "Resource Mix."

for clean electricity, Southern New England must significantly expand its development of renewable energy, especially solar and wind.

To implement this strategy, Southern New England states have adopted Renewable Portfolio Standards (RPS) and Clean Energy Standards (CES), types of energy policy that require a minimum percentage of electricity in a state to come from clean and renewable energy resources. Typically, that minimum percentage increases yearly, with a goal such as 100 percent clean energy by 2050. These programs vary widely in terms of program structure, but they generally place the responsibility for meeting goals on retail electricity suppliers, the companies that sell electricity to customers.

Table 2. RPS/CES Goals by State[17]

State	RPS/CES Goal (%)	Year
MA	80%	2050
RI	100%	2033
CT	100%	2040

Within each RPS/CES, there is a mix of clean energy resources, such as offshore and onshore wind, solar, nuclear, and hydropower.[18] To meet their RPS/CES goals by the target years and keep pace with increasing electricity demand thereafter, Massachusetts, Rhode Island, and Connecticut – states with high population densities and small amounts of available land to build solar and onshore wind – should take advantage of their world-class offshore wind resources.

[17] Note: MA and CT have CES or clean energy goals while RI has a RPS or renewable energy goal; CES typically expands eligible technologies to include resources such as nuclear, hydro, types of biomass, and carbon capture and storage. In this report, we use "clean energy goals or targets" to refer to all state targets.
[18] Some states have RECs that are specific to a technology such as for offshore wind (OREC) or solar (SREC).

Chapter 2. Turning to the Atlantic

Southern New England faces natural constraints on developing land-based renewable energy: there isn't enough land to build enough onshore solar and wind to meet Southern New England's clean energy goals. Fortunately, the North Atlantic is home to world-class offshore wind resources, providing the region with an extraordinary opportunity to turn once again to the sea and build a high-road offshore wind industry.

2.1: The North Atlantic is home to the highest quality offshore wind resources in the continental U.S.

According to National Renewable Energy Laboratory data, the highest quality offshore wind energy resources are in the North Atlantic region, with a capacity factor of 47 percent. Capacity factor is the ratio of actual energy production during a year to the hypothetical maximum capacity. In other words, capacity factor quantifies how the same 15 MW wind turbine – where 15 MW represents the turbine's hypothetical maximum capacity – would actually produce different amounts of energy depending on its location and the speed of the winds at that location. That turbine would produce much more energy during a year if it were constructed in the North Atlantic than if it were constructed in any other region in the country.

Table 3. U.S. offshore wind capacity factor region[19]

Region	Capacity Factor (%)
North Atlantic	47%
Mid + South Atlantic	37%
Pacific	32%
Gulf of Mexico	29%

The maximum amount of fixed-bottom offshore wind that could be built in the North Atlantic is gargantuan – 264 GW of offshore wind that could produce 1,081,000 GWh of electricity annually. Putting that in context, 1,081,000 GWh is equal to about 27 percent of current U.S. annual electricity consumption.

[19] Lopez et al., "Offshore Wind Energy Technical Potential for the Contiguous United States."

To take advantage of the world-class renewable resources just off their coasts, Massachusetts, Rhode Island, and Connecticut have begun implementing plans to develop 9 GW of offshore wind by 2027 (MA) and 2030 (RI and CT).

Table 4. Offshore Wind Goals for MA, RI, and CT

State	Current Offshore Wind Goals (GW)	Year
MA	5.6	2027
RI	1.4	2030
CT	2	2030
Total	***9***	**2030**

Building 9 GW of offshore wind would be a promising start for the region's clean energy goals. In 2030, 9 GW of offshore wind would provide 37 percent of electricity demand – a sizeable contribution to each state's RPS/CES goals.[20] However, with expected electricity demand growth due to electrification and the expansion of new electricity-intensive industries, Massachusetts, Rhode Island, and Connecticut will need to build more offshore wind in the 2030s. To keep up with rising demand and establish itself as a national leader in offshore wind, Southern New England could develop a total of 30 GW by 2040 (Section 3.4).

[20] See Methodology Section: 2030, 2040, 2050 Electricity Demand and Offshore Wind Capacity Goals.

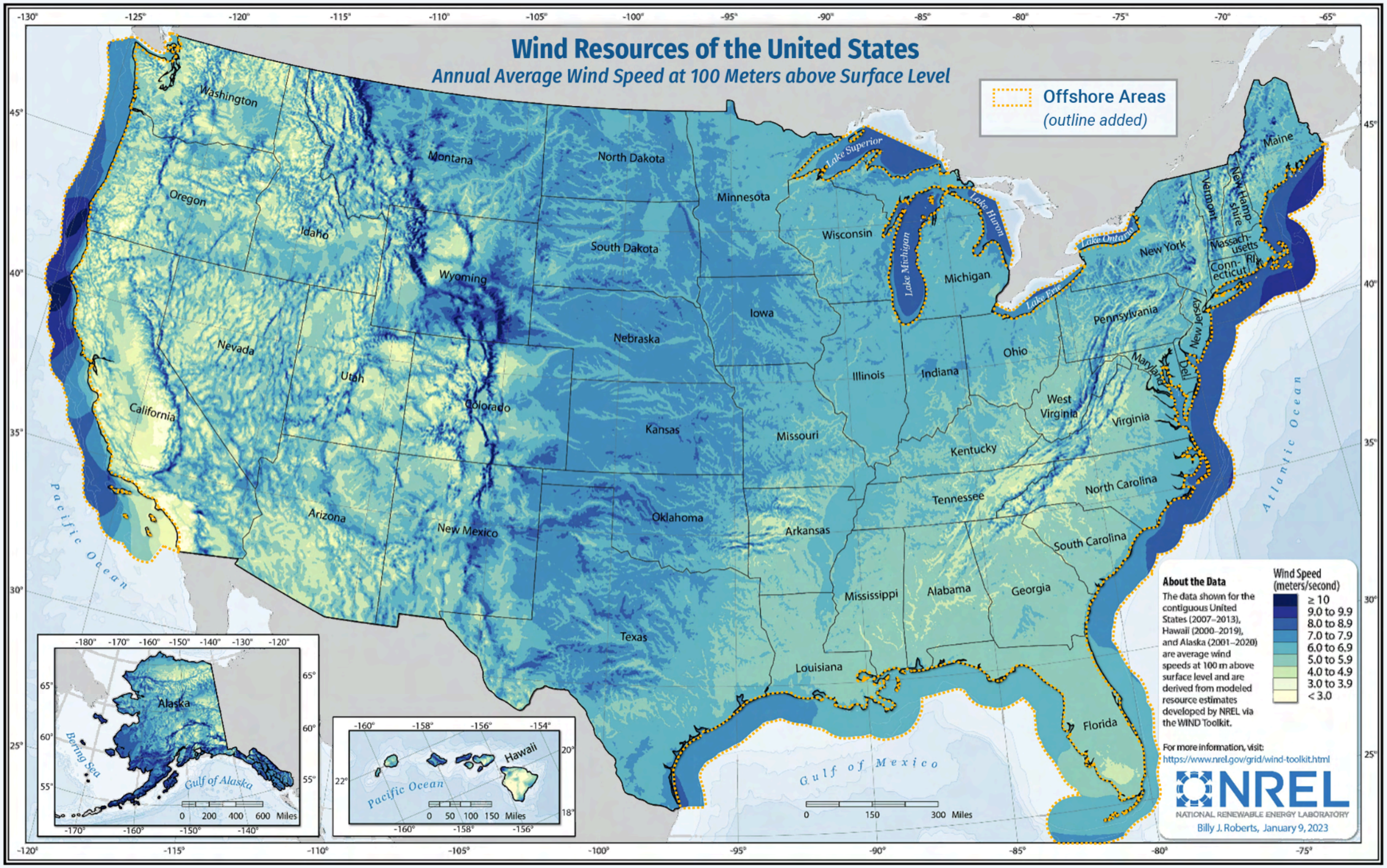

Figure 2. U.S. offshore wind potential[21]

[21] NREL, "U.S. Wind Power Resource at 100-Meter Hub Height." Note: Added yellow outline to show offshore wind areas.

2.2: Offshore wind is a well-established clean energy technology with important advantages for Southern New England over land-based solar and wind.

Offshore wind is a well-established clean energy technology with already about 70 GW deployed globally. The global market has increased by more than 10x in the past decade and is expected to grow greater than 5x in the next decade. In the U.S., 174 MW of offshore wind is in operation and about 4 GW is under construction as of May 31, 2024.[22]

Offshore wind has a variety of advantages:

a. **Strong wind conditions, high capacity factor**: Compared to wind over land, wind over water is generally higher speed, more consistent, and less turbulent.[23] Accordingly, onshore wind in Southern New England has a capacity factor of about 30 percent, while offshore wind has a capacity factor of about 47 percent.[24]

b. **Close proximity to centers of energy demand:** Offshore wind resources in the Atlantic are adjacent to coastal population centers with high energy demand in Southern New England, making it much easier and cheaper to build transmission connecting generation to consumers.[25]

c. **Improves the clean energy grid:** Offshore wind supports grid reliability and complements land-based solar and wind. It generates a relatively constant amount of electricity throughout the day, with its highest output in the afternoon and evening when electricity demand is at its peak. As a result, offshore wind's daily generation profile complements solar, which peaks early in the day, and onshore wind, which often peaks at night when electricity demand is low.[26] Furthermore, offshore wind has high production during the winter months (around 50 percent net capacity factor from November to April versus about 40 percent from May to October) – of particular value to the Northeast, which gets significantly less sunlight during those months.[27]

One of the key advantages of offshore wind is that it provides near-term deliverability of clean energy resources at a significant scale while offering even greater long-term potential. On top of the 264 GW of potential fixed-bottom offshore wind capacity in the North Atlantic, there is

[22] McCoy et al., "Offshore Wind Market Report: 2024 Edition."
[23] Ury, Brett, and Philipp, "Pathways to Commercial Liftoff: Offshore Wind." Page 9
[24] Desalegn et al., "Onshore versus Offshore Wind Power Trends and Recent Study Practices in Modeling of Wind Turbines' Life-Cycle Impact Assessments."
[25] Hartman, "Top 10 Things You Didn't Know About Offshore Wind Energy."
[26] Hartman.
[27] Ury, Brett, and Philipp, "Pathways to Commercial Liftoff: Offshore Wind." Page 11

approximately 442 GW of floating offshore wind capacity that will be available for development in the long run, with timelines dependent on the speed of commercialization.[28]

Near-term deliverability is of particular importance due to the currently increasing demand from the electrification of key sectors and the growth of new energy-intensive industries. With offshore wind, Massachusetts, Connecticut, and Rhode Island can deploy 9 GW of clean energy to Southern New England population centers this decade and, building on those developments, 30 GW by 2040.

2.3: Offshore wind resources in the North Atlantic are critical to addressing climate change in Southern New England because of its lack of land and high population density.

If Massachusetts, Rhode Island, and Connecticut were to maximize their onshore wind buildout, they would only be able to build approximately 6.6 GW. In contrast, if Texas were to maximize its onshore wind buildout, it would be able to host over 200x the amount of onshore wind as Southern New England – 1,348 GW compared to 6.6 GW.[29] This is because Texas has much more land with good qualities for onshore wind development. Onshore wind requires a lot of land; one square mile can host about 7.7 MW of wind.[30] This means building 6.6 GW of onshore wind would require 850 square miles – six percent of the land in Southern New England.[31] Utility-scale solar also faces land constraints, although to a lesser degree – one square mile can host about 80 MW of solar.[32,33]

Table 5. Onshore wind capacity and generation potential in Southern New England[34]

State	Potential Onshore Wind Capacity (GW)	Capacity Factor (%)
MA	4.7	29%
CT	1.7	28%
RI	0.2	31%
Total	**6.6**	

[28] Lopez et al., "Offshore Wind Energy Technical Potential for the Contiguous United States."
[29] See Methodology Section: Onshore Wind and Solar Buildout and Land Requirements.
[30] Denholm et al., "Land Use Requirements of Modern Wind Power Plants in the United States." Page 22
[31] Bureau, "State Area Measurements and Internal Point Coordinates."
[32] For the purposes of this study, distributed solar capacity potential is considered a decrease in building energy demand rather than a source of utility-scale renewable energy.
[33] Ong et al., "Land-Use Requirements for Solar Power Plants in the United States." Page 17
[34] See Methodology Section: Onshore Wind and Solar Buildout and Land Requirements.

Meeting RPS/CES goals and rising electricity demand with only utility-scale onshore solar and wind is especially challenging in Southern New England states because they have both relatively small amounts of land and high population densities. Rhode Island, Massachusetts, and Connecticut rank 50th, 44th, and 48th in total square miles[35] and 2nd, 3rd, and 4th in population per square mile.[36] In large part due to these factors, Southern New England lags behind much of the South, West, and Midwest with regards to renewable energy as a share of their grid's electricity.[37] With an abundance of favorable sites, the South, West, and Midwest have developed large-scale wind and solar farms that would be impractical to build in Southern New England.

Due to the region's size and large population centers, it is not feasible for Southern New England to meet its climate targets only with onshore wind and solar; such a strategy would escalate siting challenges and local opposition to development. Fortunately, Southern New England has access to the best offshore wind resources in the country and it is available immediately for large-scale deployment. Offshore wind is uniquely valuable to Southern New England – Massachusetts, Rhode Island, and Connecticut can meet their RPS/CES goals on time while keeping up with rising electricity demand if they prioritize offshore wind development.

2.4: According to recent studies, offshore wind helps customers in Southern New England by reducing electricity bills, stabilizing market prices, and increasing grid reliability.

Southern New England residents already face some of the highest electricity prices in the nation – more than double the national average in monthly electricity bills. Without a significant rise in supply from low-cost generators like clean energy, rising electricity demand in Southern New England is expected to push electricity prices even higher. ISO New England projects that electricity demand will increase by 17 percent by 2033, as sectors such as transportation and buildings transition to all-electric technologies with the rise of heat pumps and electric vehicles.[38] In addition, energy-intensive data centers are rapidly expanding to support the development of artificial intelligence and cryptocurrency.[39]

[35] Bureau, "State Area Measurements and Internal Point Coordinates."
[36] U.S. Census Bureau, "Census Population Clock."
[37] Kirk, "Which State Is Winning at Renewable Energy Production?"
[38] ISO-NE, "Electricity Use."
[39] IEA, "Executive Summary – Electricity 2024."

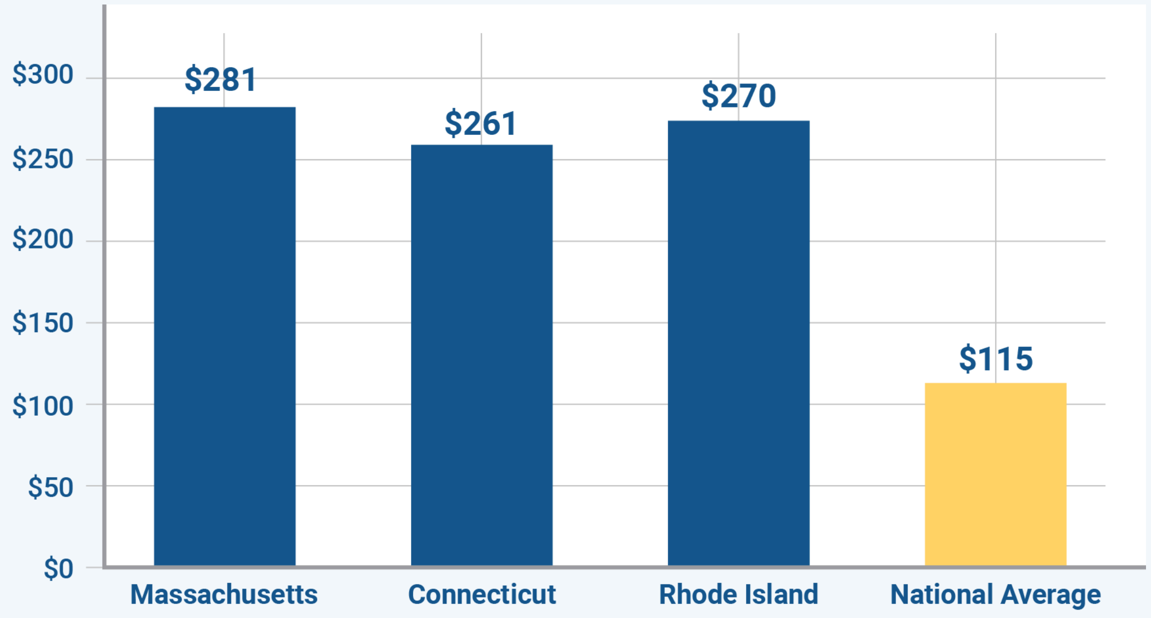

Figure 3. Southern New England vs National Average Electricity Bills (June 2024)[40]

In Southern New England, electricity prices are volatile – prices spiked during severe weather events such as the 2014 Polar Vortex and the 2018 Bomb Cyclone. Moreover, severe weather events are projected to increase in frequency and severity during the next decade. Geopolitical crises can cause dramatic spikes in electricity prices as well; the war in Ukraine caused monthly electricity bills to increase by about 47-65 percent across Southern New England, prompting Massachusetts, Rhode Island, and Connecticut to implement relief programs.[41]

Recent energy studies show that injecting significant amounts of offshore wind resources can help reduce customer bills, stabilize electricity prices, and improve reliability.

Synapse, an energy research and consulting firm, estimates that building 9 GW of offshore wind by 2030 will reduce New England customers' electricity bills by $33.48 to $55.32 annually, adding up to $630 million in annual savings.[42] The study estimates that adding 9 GW of offshore wind to Southern New England's energy markets extends the wholesale market supply curve, exerting downward pressure on power system operating costs and reducing electricity costs for households and businesses across New England.

Offshore wind's pronounced downward pressure on customer bills is particularly significant in the face of rapid electricity rate increases over the past decade caused by exogenous factors in

[40] "Electricity Cost in Massachusetts"; "Electricity Cost in Rhode Island"; "Electricity Cost in Connecticut." Accessed June, 2024
[41] Fortin, "Some Mass. Residents See Utility Bills Triple. Here's Why Rates Are Skyrocketing"; Smollen, "Rhode Islanders See 47% Increase in Their Electricity Bills"; DeBenedictis, Brown, and Phaneuf, "Eversource, UI Increase Rates in CT."
[42] Whited et al., "Charting the Wind: Quantifying the Ratepayer, Climate, and Public Health Benefits of Offshore Wind in New England."

the electric industry. In Massachusetts, the average cost per kWh for residential customers almost doubled from 2013 to 2023 – from 16 cents to 30 cents per kWh.[43] Connecticut and Rhode Island customers have experienced similar increases.

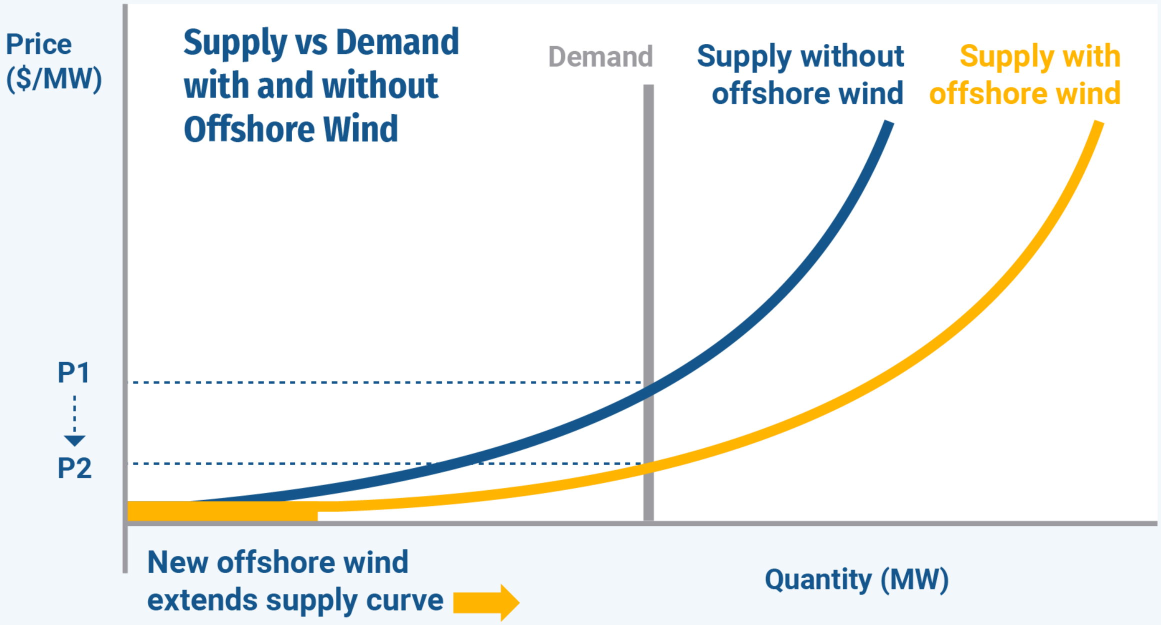

Figure 4. Supply vs Demand with and without Offshore Wind[44]

According to a study by the Union of Concerned Scientists, offshore wind can reduce the risk of blackouts by increasing energy supply during key times of the year. The study determined that if the Vineyard Wind and Revolution Wind projects had been online during the past 20 years, they would have reduced the number of days in New England with elevated blackout risk by 42 percent. Moreover, with an increasing incidence of extreme cold, Southern New England has seen higher risks of energy shortfall – periods when there are risks that supply will fail to meet electricity demand. Offshore wind helps mitigate that risk because, as multiple ISO New England studies show, it produces above-average output during extreme cold.[45]

New York and New Jersey developed first generation offshore wind projects at the high end of this price range because they recognized the short and long-term benefits of the investments: immediately expanding their clean energy portfolio and jump starting the industry, setting the stage for further projects at even lower costs (see Section 2.5). As prices fall in the next few years, new projects will help further reduce electricity bills.

[43] EIA, "Electricity Data Browser - Net Generation for All Sectors."
[44] *Synapse, Charting the Wind, June 3, 2024*
[45] Muller and Union of Concerned Scientists, "Request for Information Regarding Maine Offshore Wind Renewable Energy and Economic Development Program," May 30, 2024.

2.5: Despite recent interruptions to project development due to cost increases, the future of the offshore wind industry remains bright.

In 2024, Massachusetts and Rhode Island secured 2,878 MW of offshore wind through a joint procurement process.[46] While the full details of the awards have not been released yet,[47] the prices are expected to be higher than in previous years. In New York's most recent solicitation, project developers won contracts that contained strike prices close to $150/MWh, whereas previous contracts were in the range of $110-120.[48]

Offshore wind projects may be costlier in the short term, but the Department of U.S. Energy (DOE) and the National Renewable Energy Laboratory (NREL) expect lower interest rates, supply chain maturation, and the Inflation Reduction Act to drive costs back down to pre-pandemic levels by 2030.[49, 50] As Figure 9 shows, the DOE projects that levelized prices will decline from $140/MWh to $84/MWh by 2030 while NREL projects a decline to $76/MWh by 2035 in the moderate scenario or even $68/MWh in the advanced scenario.

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[46] "Massachusetts and Rhode Island Announce Largest Offshore Wind Selection in New England History."
[47] A recent study by Daymark Energy Advisors estimated the impact on electricity bills under three different power purchase agreement price scenarios – $140/MWh, $160/MWh, and $180/MWh – demonstrating that the projects would have minimal impact on customers' monthly bills ("Review of Daymark Ratepayer Impact Analysis for 3,600 Megawatts of Offshore Wind").
[48] French, "Offshore Wind Costs Double for Consumers as New York Keeps Early Projects on Track."
[49] Ury, Brett, and Philipp, "Pathways to Commercial Liftoff: Offshore Wind."
[50] McCoy et al., "Offshore Wind Market Report: 2024 Edition."

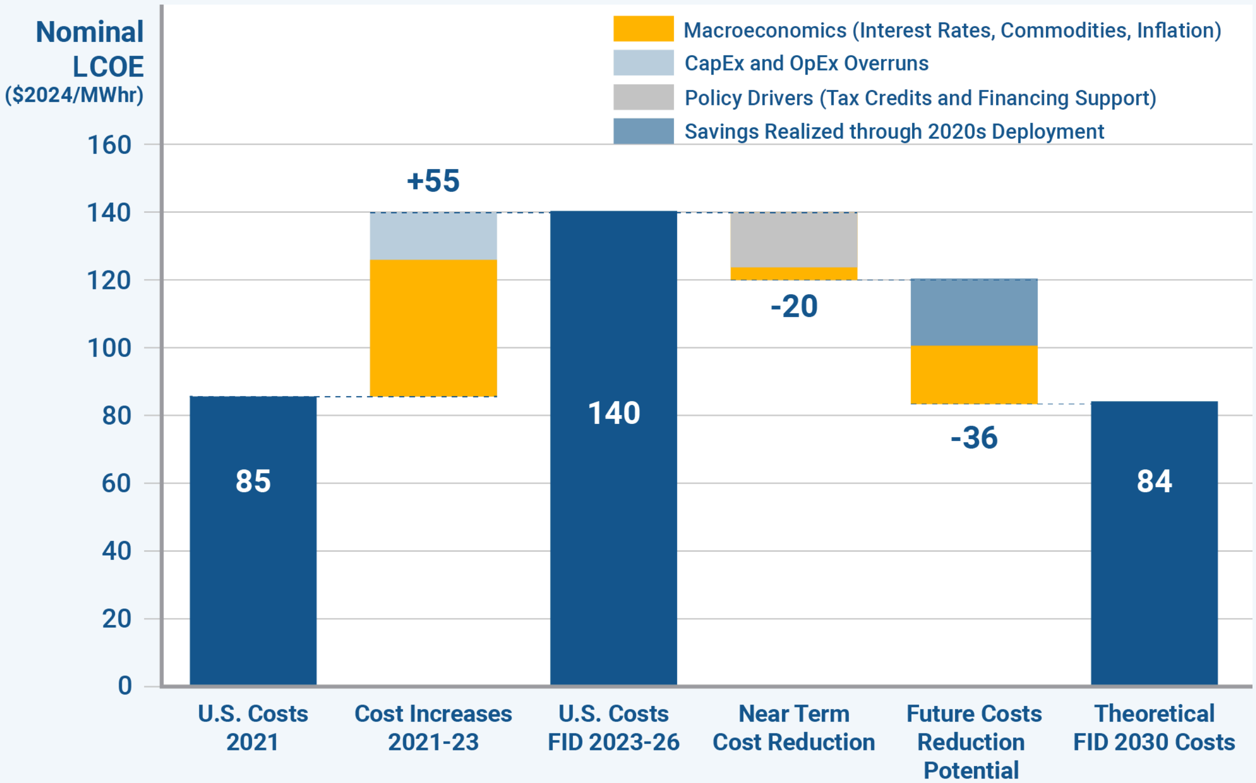

Figure 5. Costs Reductions are Expected for Future Projects due to Policy Drivers, Supply Chain Maturation, and Lower Interest Rates[51]

Because offshore wind projects are capital-intensive, the high interest rates of the past few years have had a substantial impact on offshore wind development. However, as macroeconomic conditions improve and interest rates decline, offshore wind project costs will decline accordingly, as Figure 9 shows. Additionally, current investments in ports, vessels, manufacturing, and transmission will drive cost reductions in the next stage of offshore wind development; a new study by the maritime industry advisor DNV suggests that these investments, kickstarting a maturation of the supply chain, could result in a 14% decline in costs by the early 2030s.[52] Lastly, sustained implementation of new tax credits from the Inflation Reduction Act are also projected to reduce costs. The IRA's Investment and Production Tax Credits provide significant support to offshore wind projects, especially if those projects meet prevailing wage and apprenticeship requirements. There are additional bonus credits if those developers use U.S.-manufactured products or locate land-based power conditioning in energy communities. These tax credits provide certainty to investors and allow projects to recover up to 40-50 percent of projects costs as tax credits[53]

[51] Ury, Brett, and Philipp, "Pathways to Commercial Liftoff: Offshore Wind."
[52] DNV, "Second Wind: The Impact of Current U.S. Offshore Wind Investments on Future Costs."
[53] Martin, Burton, and Hilary, "Simpler Domestic Content Calculations."

Globally, onshore and offshore wind development costs have significantly declined as the technology has scaled and industries have developed. From 2011 to 2021, offshore wind capacity increased from 3 GW to 33 GW, leading to an approximately 60 percent reduction in the average Levelized Cost of Energy (LCOE) for offshore wind.[54] During the same period, onshore wind capacity increased by 3x, leading to an approximately 84 percent reduction in LCOE.[55]

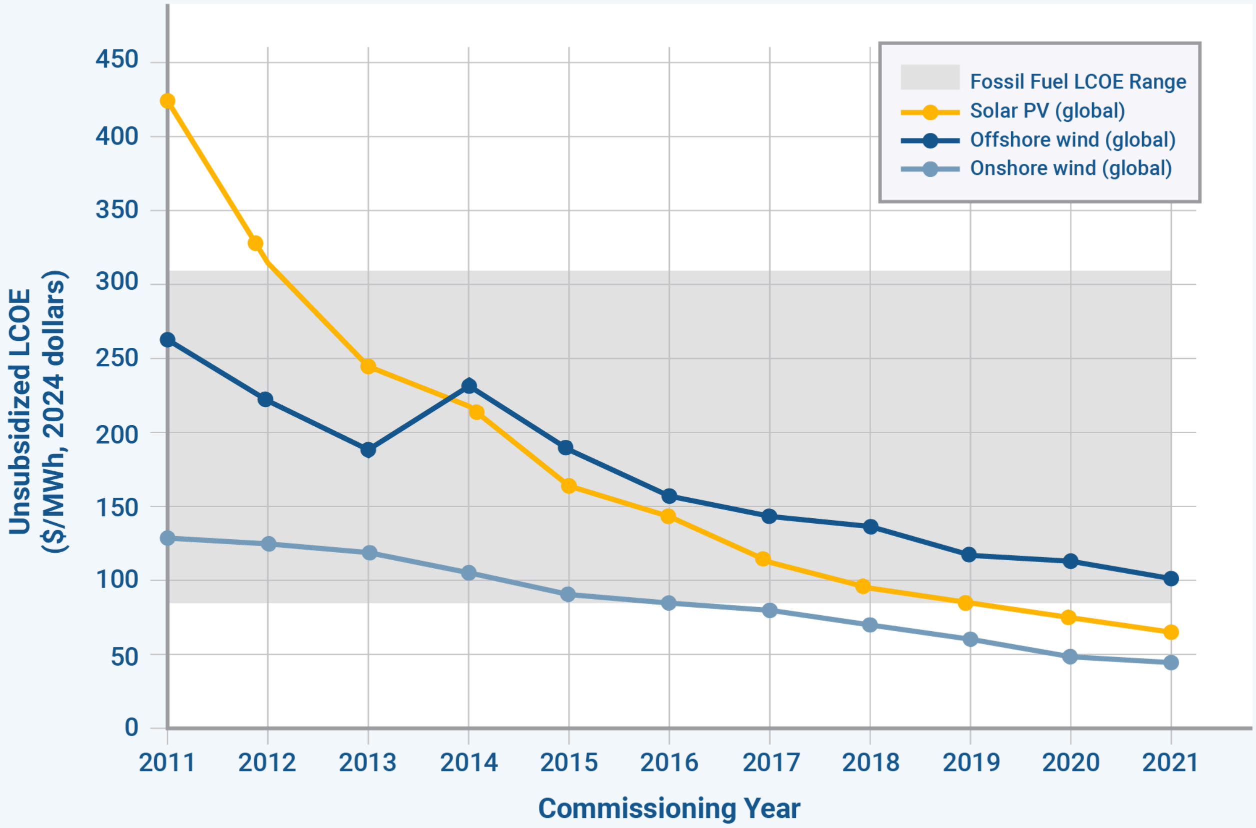

Figure 6. Declining LCOE of Offshore Wind Tracks Declining LCOE of Onshore Wind and Solar

As the industry develops and grows in capacity, the decreasing cost of offshore wind will allow Southern New England to more easily address its energy challenges while meeting its clean energy goals.

Southern New England faces critical challenges in its energy markets: higher prices than most of the U.S. and increasing demand that will drive those prices even higher. To reduce upward pressure on already high prices, Southern New England needs to build as much clean energy as possible, as fast as possible. If it doesn't, it could see skyrocketing prices due to the electrification of key sectors and the development of new power-hungry industries. But due to its shortage of land, it can't build enough onshore solar and wind. Instead, it must look to the Atlantic and start by deploying 9 GW of offshore wind by 2030.

[54] Ury, Brett, and Philipp. Page 20
[55] Aflaki, Atasu, and Wassenhove, "The Long-Term Costs of Wind Turbines."

If the region were to invest in developing the industry and its supply chain, costs would decline, positioning offshore wind as a low-cost, abundant, and immediately dispatchable source of new clean energy. Offshore wind is Southern New England's best hope to provide more stable and lower-cost electricity bills to customers while meeting its clean energy goals.

Chapter 3. Setting the Standard for Offshore Wind Leadership with a Climate and Jobs Strategy

Over the past decade, Southern New England has become a pioneer in offshore wind. However, state initiatives that prioritize buying clean energy – not building an industry – have left developers vulnerable to market turmoil. With the passage of the Inflation Reduction Act (IRA), Southern New England now has an opportunity to undertake a climate and jobs strategy, building a robust regional offshore wind industry that can meet the current commitment of 9 gigawatts (GW), while also laying the foundations for 30 GW by 2040.

To successfully develop a regional offshore wind industry that generates economic benefits and good union jobs, Massachusetts, Rhode Island, and Connecticut should adopt a climate and jobs strategy. A climate and jobs strategy emphasizes investment in new offshore wind capacity through an active role for government in partnership with private developers and suppliers, alongside a deep commitment to local union jobs through the development of a domestic supply chain. It also prioritizes strong labor standards across the industry that encourage union participation. Lastly, a climate and jobs strategy for offshore wind should include a coordinated transmission approach that will cut costs and support the long-term growth of the industry. In other words, a climate and jobs strategy:

1. **Prioritizes investment:** By tackling climate change with an investment-led approach, Southern New England can ensure that the supply of clean energy is sufficient for an energy transition while exerting downward pressure on energy prices. Market policies such as carbon taxes won't necessarily encourage the development of clean energy – they may just increase customers' energy bills.

2. **Develops an industry, not just individual energy projects:** A climate and jobs approach to offshore wind emphasizes regional coordination of investments across the supply chain and allocation of development responsibilities to state and local agencies rather than placing the whole burden on developers. Defaulting to European ships and components may seem like an expedient way to build 9 GW of offshore wind turbines in the North Atlantic, but doing so would create inefficiencies and hamper local industry growth while causing economic benefits to flow overseas.

3. **Distributes benefits:** Incorporating common standards of conduct and strong labor standards throughout the offshore wind industry will support on-time and on-budget project development while generating economic benefits for communities and workers in the region. With the U.S. offshore wind industry still in its early stages, now is a critical time to set standards that will support the industry's long-term growth. The strength and experience of Southern New England's organized labor community make this region an

ideal location to develop and demonstrate labor standards that can be emulated worldwide.

Southern New England is no stranger to building successful industries, with Massachusetts particularly well known for its development of technology enterprises along the Route 128 corridor in the 1980s. Massachusetts then became a biotechnology hub, with over 430 biotech companies.[56] Lawmakers facilitated the state economy's evolution, recognizing their region's exceptional intellectual resources and developing elements to complement those resources. In 2008, Massachusetts committed one billion dollars to incentivize life science companies, upgrade infrastructure to support industry needs, build research facilities, and train a skilled workforce.[57]

3.1: Southern New England's offshore wind industry is off to a promising start, but recent cost increases and project delays highlight the importance of establishing a strong foundation for long-term growth through a climate and jobs strategy.

With three offshore wind projects complete or under construction, Southern New England's offshore wind industry has already made remarkable progress. In 2016, Rhode Island completed the first offshore wind farm in the U.S., the 30 megawatt (MW) Block Island Wind project. Massachusetts' 806 MW Vineyard Wind project broke ground five years later,[58] followed by Connecticut and Rhode Island's 704 MW Revolution Wind, which reported "steel-in-the-water" during the summer of 2024.[59]

[56] "How Massachusetts Built A Booming Biotech Ecosystem."
[57] Patrick and Murray, "FY2010 House 1 Budget Recommendation: Policy Brief.""
[58] Vineyard Wind, "Vineyard Wind Breaks Ground on First-in-the-Nation Commercial Scale Offshore Windfarm."
[59] Kuffner, "Revolution Wind Offshore Wind Farm Project Hits Major Milestone off RI Coast. What to Know."

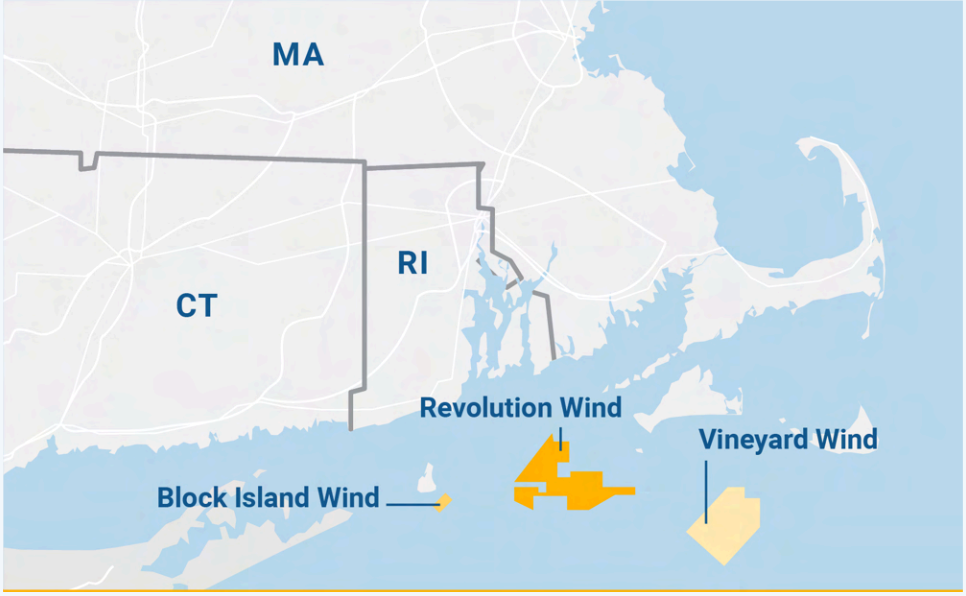

Figure 7. Complete and Under Construction Offshore Wind Projects in Southern New England

However, recent setbacks to Southern New England's offshore wind portfolio illustrate the industry's vulnerability to global market conditions. In 2023, Park City Wind (now New England Wind I),[60] Commonwealth Wind (now New England Wind II),[61] and SouthCoast Wind[62] canceled their contracts with Southern New England's utilities, reducing the region's offshore wind portfolio by 3,632 MW. Faced with global shortages for key components and high interest rates, developers were willing to pay tens of millions of dollars to utilities in penalties for prematurely terminating their agreements.

[60] Soule, "Avangrid Avoids $1 Billion Write-off after Ending Plans to Build CT's Park City Wind Farm."
[61] Lisinski, "Utilities Agree to Let Commonwealth Wind out of Contracts for $48 Million."
[62] Penrod, "Avangrid Moves to Cancel Park City Offshore Wind Contracts on Heels of SouthCoast Termination."

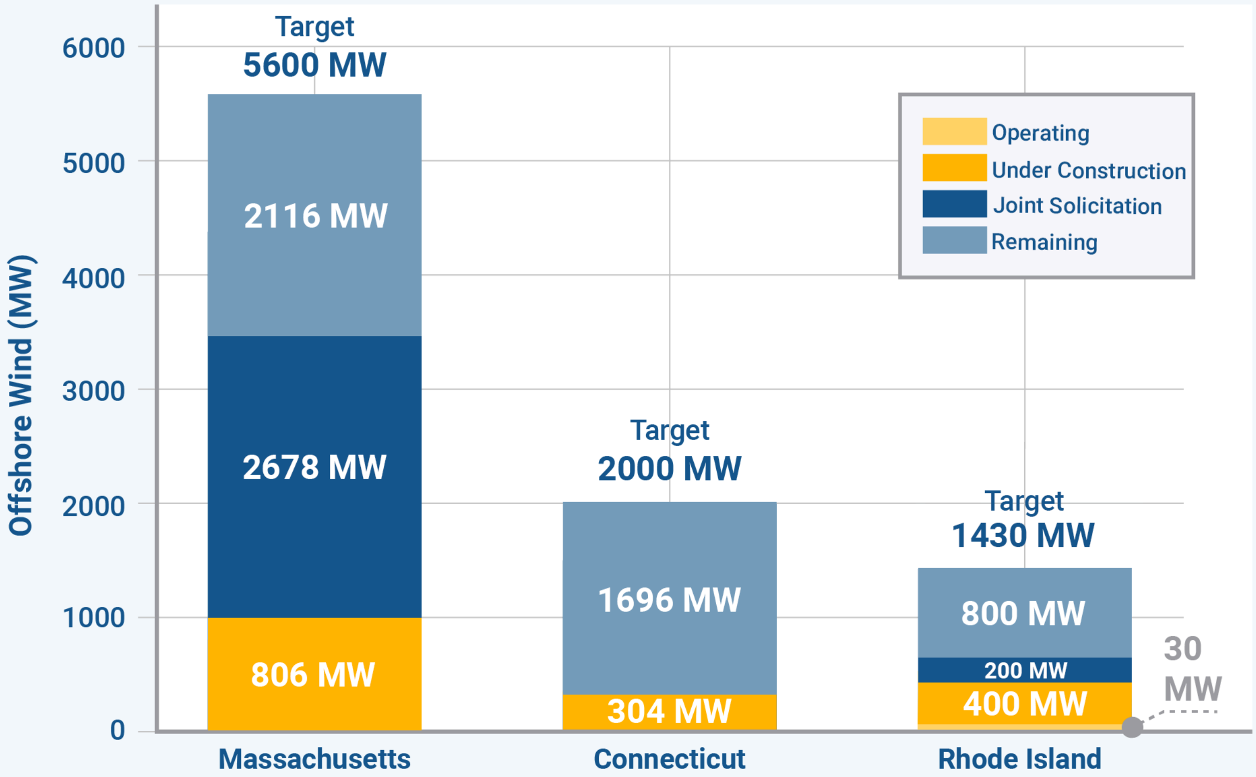

Figure 8. Progress towards OSW targets in Southern New England States

While Southern New England's setbacks were activated by global macroeconomic events, its seeds were planted years earlier with the region's uneven supply chain development. Offshore wind's supply chain – the businesses and infrastructure needed to produce and distribute offshore wind power – consists of ports, manufacturing, vessels, and transmission. Wind ports and specialized vessels are essential for offshore wind farm construction, manufacturing facilities supply projects with the parts that they need to begin construction on schedule, and transmission infrastructure takes the energy developed by offshore wind turbines and delivers it in the form of electricity to consumers.

Southern New England's lack of wind turbine installation vessels or component manufacturing capacity magnified the impacts of global supply disruptions. When Massachusetts, Connecticut, and Rhode Island set ambitious procurement targets for offshore wind, the states did not coordinate within the region and with neighboring states to secure offshore wind vessels (Section 4.3) or establish a domestic manufacturing base (Section 4.2). Faced with insufficient regional and domestic capacity, project developers were left to source components and vessels globally.[63] However, Europe's component manufacturing capacity hasn't been able to keep up

[63] Storrow, "Not Made in America."

with increasing demand[64] and offshore wind installation vessels are in short supply as well.[65] As a result, the global offshore wind supply chain has come under immense strain.

Other issues the industry faces, such as high interest rates, were magnified by Southern New England's uncoordinated transmission strategy. In the absence of regional grid planning (Section 4.4), developers shoulder both the high costs of grid connection, typically comprising 15-30 percent of offshore wind construction costs,[66] and the costs of borrowing money to cover this capital expenditure. When interest rates are high, as has been the case with exceptionally high U.S. interest rates following the economic disruptions caused by COVID-19, the cost of borrowing money increases such that already significant grid connection costs become even more burdensome.

Figure 9. Substation of London Array offshore wind farm[67]

[64] Ainger, "Europe's Offshore Wind Ambitions Face Huge Supply Chain Challenge."
[65] Paulsson, "Offshore Wind's Next Big Problem."
[66] IRENA Secretariat, "Renewable Energy Technologies: Cost Analysis Series." Page 19
[67] Pshab, *Substation of London Array Offshore Wind Farm*.

3.2 Despite uneven development, notable achievements in Southern New England's offshore wind industry highlight the benefits of a climate and jobs strategy.

While the development of Southern New England's offshore wind industry has been uneven, the region has also seen many successes that point the way forward. **In particular, Massachusetts, Connecticut, and Rhode Island have drawn significant investment into offshore wind ports.** Each state has independently recognized the critical role that ports play in the offshore wind sector, and in total the states have drawn at least $700 million in public funds into port development (Table 10). As a result, there are four operational and in-development marshaling ports in Southern New England.

All three states incentivize offshore wind developers to develop in-state supply chain assets. An analysis of Massachusetts, Connecticut, and Rhode Island's most recent offshore wind solicitations illustrates that supply chain investments are considered economic benefits which – alongside environmental impacts, reliability benefits, public participation, and project viability considerations – comprise 25-30 percent of a project's evaluation (Appendix A, Table 8: Comparison of evaluation criteria in MA, RI, and CT's most recent OSW RFPs). However, while each solicitation encourages in-state supply chain development, none incentivizes regional investments outside the issuing state. In other words, a project that bids on Rhode Island's Request for Proposal (RFP) will not receive evaluation points for investing in a Connecticut-based nacelle factory.

Table 6. Enabling infrastructure investments encouraged in MA, RI, and CT's OSW RFPs

Economic Benefits Evaluation	*Massachusetts (08/23 RFP)*	*Connecticut (02/24 RFP)*	*Rhode Island (10/23 RFP)*
Domestic manufacturing	Yes	No	No
Regional manufacturing	No	No	No
In-state manufacturing	Yes	Yes	Yes
Port infrastructure	Yes	Yes	Yes
Vessels	No	No	No

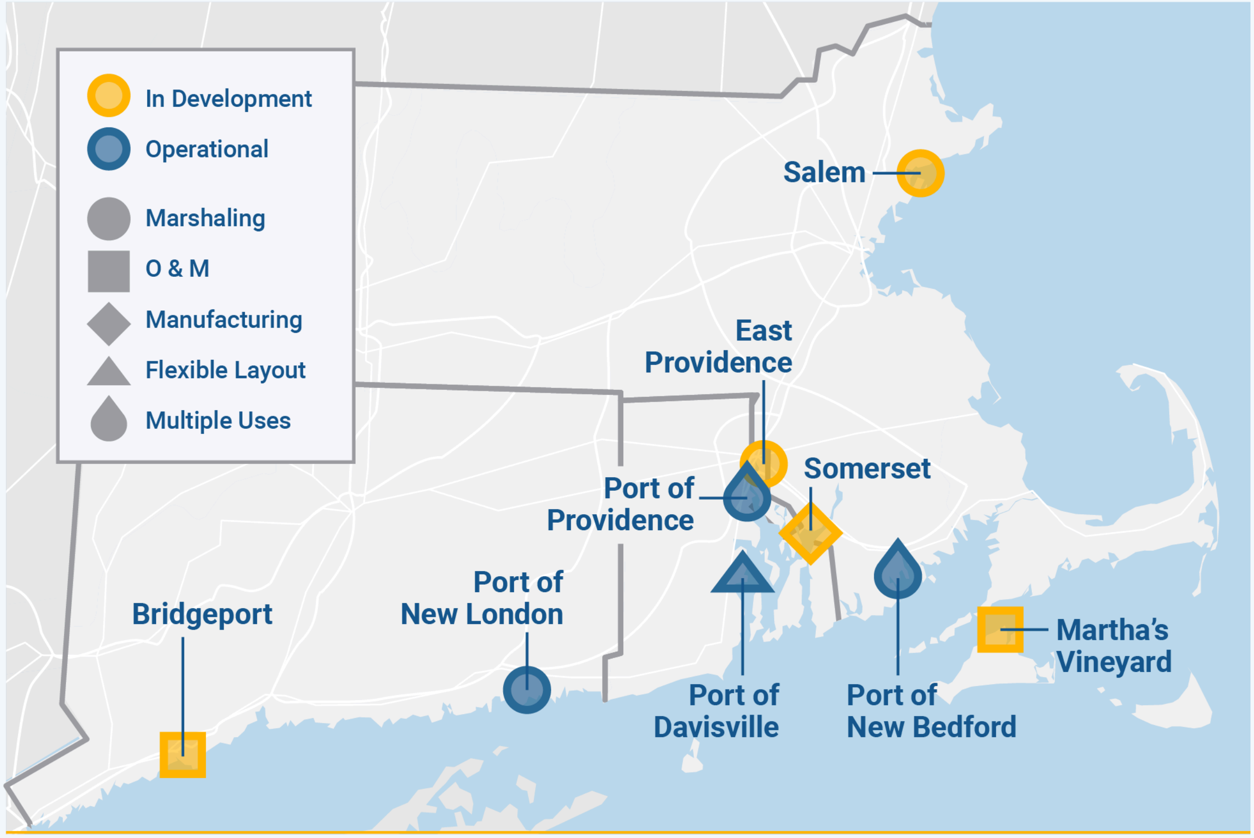

Figure 10. Offshore Wind Ports in Southern New England

In a first for the nation, Southern New England joined together for a multistate offshore wind procurement, signaling a promising road ahead for regional collaboration. To meet offshore wind goals, states typically undertake a procurement process in which they request proposals from developers for offshore wind projects and then select winning proposals based on a multi-stage evaluation process. The state, or its utilities, then negotiates long-term fixed-price contracts with the solicitation's winners. Until recently, states across the East Coast have solicited offshore wind projects separately.

However, in response to the wave of offshore wind cancellations in 2023, Massachusetts, Connecticut, and Rhode Island began to develop a 6,000 MW joint procurement process. By coordinating, Southern New England's state governments expect to amplify economic development benefits and minimize costs to ratepayers. Although the states received four bids in March 2024, including rebids from developers who previously canceled their contracts, the result was mostly a missed opportunity.[68]

Awards were announced In September 2024, and Massachusetts went big by selecting 2,678 MW, while Rhode Island awarded just 200 MW. However, as of the writing of this report,

[68] Mohl, "4 Developers Submit Offshore Wind Bids in Multistate Procurement."

Massachusetts has only purchased 800 MW of the 1200 Vineyard Wind 2 project, raising concerns that the project will stall, and Connecticut has yet to make any awards.[69,70] While this joint procurement process was a historic first step, states secured less than 50 percent of their original procurement target. The announcement left Connecticut no closer to their 2,000 MW goal. These solicitations could have ensured that states had there are enough projects under contract to meet state offshore wind goals (Figure 12).

3.3: The offshore wind buildouts in Denmark, Taiwan, and Scotland illustrate the potential for a climate and jobs strategy in Southern New England to build offshore wind power while capturing local economic benefits and creating high-quality jobs.

Due to its early and long-term commitment to offshore wind investment, Denmark has become a leader in offshore wind and hosts a mature supply chain. In response to the 1970s oil crisis, the Danish government began to focus on developing a variety of alternative energy technologies, including wind power.[71] The government subsidized research and development in wind turbines and set a goal to build 1 GW of wind power by 2000. By 1991, these efforts led to Denmark hosting the first offshore wind farm in the world, a 5 MW demonstration project off the coast of Lolland.[72]

The world's first large-scale offshore wind farm, Horns Rev I (160 MW), was built in 2001 out of Denmark's Port of Esbjerg. Since then, the port has been involved in more than 50 offshore wind installations to date and hosts more than 250 offshore wind companies.[73] Overall, there are 500 Danish companies across the supply chain, providing a range of goods and services as manufacturers, component suppliers, installation providers, and more.

Denmark is also a pioneer in advanced offshore transmission infrastructure, under the leadership of the Danish Transmission System Operator (TSO), which builds and owns transmission infrastructure with a long-term outlook. Until 2018, the Danish TSO planned, procured, installed, operated, and funded grid connections to offshore wind farms, rather than leaving those tasks to the developer. The onshore transmission grid has been extended to offshore grid infrastructure, carefully planned to reduce development costs and minimize impact on the environment. In 2020, Denmark became the first country to begin developing offshore wind energy islands, which will gather electricity from multiple offshore wind farms for

[69] "Massachusetts and Rhode Island Announce Largest Offshore Wind Selection in New England History."
[70] There are reports that Connecticut may buy the remaining 400 MW of capacity from the Vineyard Wind 2 project, in exchange for Massachusetts purchasing nuclear power from Connecticut's Millstone Nuclear Power Plant via the passage of a proposed climate bill (Lisinski, "MA Energy Bill Provision to Solicit Nuclear Power May Be Tied to Vineyard Wind Project").
[71] UNESCAP, "Wind Power Takes Flight in Denmark: Denmark's Renewable Energy Policies."
[72] Danish Energy Agency, "Offshore Wind Development."
[73] Danish Energy Agency.

distribution to Denmark and neighboring countries.[74]

Figure 11. Wind turbine blades ready for shipping at the Vestas factory[75]

Despite a later start, Taiwan's offshore wind investment-led policies have resulted in 2.25 GW of offshore wind capacity, comparable to Denmark's 2.7 GW, with substantial local economic benefits. Taiwan's government announced the Four-Year Wind Power Promotion Plan in 2017, targeting 5.6 GW of offshore wind capacity by 2025 and 20.6 GW by 2035 while strongly emphasizing local manufacturing and infrastructure. To advance its mission, the Ministry of Economic Affairs conditioned offshore wind development opportunities on local content rules, while offering attractive long-term price-setting contracts (Feed-in-Tariffs) to ensure that developers have the resources to ramp up the local supply chain.[76] In its first auction ("Round 3-1"), the Ministry awarded 3 GW to developers, requiring developers to achieve 60 percent local sourcing for key development items such as turbine components and electrical equipment.[77] In addition to local content requirements for developers, Taiwan has invested in increasing operations and maintenance capacity, developing port infrastructure, building vessels, and upgrading the transmission grid.[78]

[74] Danish Energy Agency.
[75] Plougmann, *Massive Wind Turbine Blades Ready for Shipping at the Vestas Factory*.
[76] Kristensen, "Green Energy for Taiwan: Powered by People." Page 7
[77] InfoLink, "Taiwan Finalizes Directions of IRP Policy for Offshore Wind Energy Zonal Development."
[78] The British Chamber of Commerce in Taipei, "The Supply Chain Study of Offshore Wind Industry in Taiwan." Page I

Nearly complete as of April 2024, Ørsted's Changhua 1 & 2a wind farms (900 MW) mark a tipping point in the industry.[79] All 333 of the project's tower sections were 100 percent produced in Taiwan, as were the majority of its nacelles and pin piles – a crucial foundation subcomponent – and six of the project's jacket foundations.[80] Additionally, the project invested in constructing a world-class transmission hub, with local companies supplying high-voltage switchgears and transformers, power distribution panels, and the world's first-ever Taiwan-flagged bespoke service operation vessel (SOV). In total, Ørsted generated 1,100 jobs directly through construction and operations and maintenance work, along with 7,200 indirect jobs associated with its local supplier and sub-supplier contracting strategy.[81]

In contrast, Scotland has successfully built 2.1 GW of offshore wind, but the country's approach of developing energy projects – rather than an industry – has resulted in lower domestic job creation than the government promised. Scotland's largest operational offshore wind project came under scrutiny in 2020 for sourcing turbine jackets from Chinese manufacturing facilities rather than investing in BiFab – a local manufacturer. BiFab's union, General, Municipal, Boilermakers and Allied Trade Union (GMB Scotland), criticized the Scottish government, asserting that "the public have been consistently lied to for the last decade over the prospects for green jobs in Scotland and across the rest of the U.K."[82] The government once projected that offshore wind would create 28,000 jobs in Scotland by the early 2020s, but only a tenth of those jobs have materialized so far.[83]

Scotland's policies to catalyze offshore wind development have not been accompanied by successful policies to develop the local supply chain, a primary driver for job creation. The government's most recent auction awarded 27.6 GW of offshore wind capacity across 20 sites,[84] requiring developers to submit Supply Chain Development Statements (SCDS) that indicate commitments to invest in Scotland and the U.K. However, an analysis of published SCDS documents estimates that only around one third of the offshore wind developers' investments across development, manufacturing, installation, and operations will be made in Scotland.[85] Offshore wind developers have broken supply chain commitments in the past – Hornsea Two Offshore Wind Farm included commitments to invest in a tower factory based in Campbeltown, Scotland, but the project's developers gave up on the plant by the time they broke ground.[86] For the 2022 ScotWind leasing round, the Scottish government will only revoke licenses if developers fail to meet 25 percent of their commitments, and have capped fines for smaller infractions at £250,000 ($317,550 USD).[87]

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[79] Memija, "All Turbines Up at Ørsted's Greater Changhua 1 & 2a Offshore Wind Farms."
[80] Kristensen, "Green Energy for Taiwan: Powered by People." Page 6
[81] Kristensen. Page 8
[82] McLaren, "Anger as Fife's BiFab Overlooked for Work on Neighbouring Wind Farm in Favour of Chinese Company."
[83] Williams, "'Embarrassment.'"
[84] "ScotWind Leasing Round Sites and Developers | Offshore Wind Scotland."
[85] Dalzell, "Scotwind: One Year On."
[86] Meek, "Who Holds the Welding Rod?"
[87] Crown Estate Scotland, "ScotWind Leasing: Engagement Document on Supply Chain Development Statement."

The experiences of three international offshore wind markets demonstrate that government policies for developing the supply chain yield substantial benefits. Early and long-term commitment to wind technology allowed Denmark to establish its supply chain and become a hub for offshore wind goods, services, and innovation. A relative latecomer to offshore wind, Taiwan lacked Denmark's first-mover advantage but achieved a robust industry through effective and disciplined supply chain policies. Scotland's policies have prioritized offshore wind farm construction without accompanying supply chain development policies, and as a result, the industry has not driven significant job creation.

Due to Southern New England's unique circumstances, the region can draw lessons from, but cannot simply replicate policies from abroad. Denmark has a thirty-year head start, Taiwan's strict local content requirements may not work under U.S. law, and Scotland's geography impacts the relative advantages of developing local manufacturing. However, Southern New England can draw on the experiences of Denmark, Taiwan, and Scotland to undertake a climate and jobs strategy for offshore wind; Southern New England's governments, businesses, and labor organizations must work in partnership and build upon existing federal and state policies in three stages.

Figure 12. Painter for Block Island Wind Farm project, member of International Union of Painters and Allied Trades District Council 11, Local 195[88]

[88] *Offshore Wind Is a "Win-Win."*

3.4 A climate and jobs strategy for Southern New England's offshore wind industry would develop in three stages, with each stage leading to greater economic opportunity.

Stage 1: From 2015 to the present, the states have implemented successful initiatives to build offshore wind projects and ports. Stage one began when states established Renewable Portfolio Standards and started committing to offshore wind goals, which to date total about 9 GW by 2030. In response, private developers and state governments have established Southern New England as an offshore wind pioneer, leading the nation with several "firsts." Massachusetts developed the nation's first offshore wind port in 2015, Rhode Island completed the nation's first offshore wind farm in 2016, and Massachusetts and Rhode Island collaborated to award three developers in the nation's first multi-state offshore wind procurement in 2024.

Stage one has been characterized by strong labor standards for offshore wind's construction workers. Each state government's offshore wind procurement process supports pre-hire collective bargaining agreements. Massachusetts' RFP gives preference to offshore wind developers that enter into a project labor agreement (PLA) with an appropriate labor organization,[89] Connecticut's RFP requires that selected bidders engage in good faith negotiations towards a project labor agreement,[90] and Rhode Island's RFP requires bidders to submit a plan outlining their intentions with respect to negotiating PLAs.[91]

Stage 2: The Inflation Reduction Act unlocks stage two of the offshore wind industry's development – a 30 GW by 2040 target, accompanied by investments across the supply chain to ensure its success.

To launch stage two, Southern New England would announce a plan to build 30 GW of offshore wind energy, enough to meet 100 percent of regional electricity consumption by 2040 with offshore wind alone.[92] When combined with the additional energy resources in the region,[93] Southern New England would produce more electricity than it consumes in 2040, allowing the region to export surplus energy to neighboring states.

In addition to coordinating to procure 30 GW of offshore wind by 2040, state governments, developers, and suppliers would partner to develop regional ports, manufacturing, vessels, and transmission assets, while working with unions to set labor standards across the industry. These investments will generate significant benefits to the regional economy (Section 4.2) and support customers by reducing electricity bills, stabilizing market prices, and increasing grid reliability (Section 2.4, Section 4.4).

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[89] Mass. Gen. Laws ch. 179, § 61(c).
[90] Conn. Gen. Stat. Ann. § 16a-3n (a)(2).
[91] R.I. Gen. Laws § 39-31-10(a).
[92] See Methodology Section: 2030, 2040, 2050 Electricity Demand and Offshore Wind Capacity Goals.
[93] Projections of the total energy resource mix in Southern New England by 2040 is beyond the scope of this report.

Southern New England's stage two goals are made possible by the passage of the Inflation Reduction Act (IRA) and complementary federal actions, which have produced a favorable environment for investments across the offshore wind industry. The IRA provides significant incentives to wind projects under the Investment and Production Tax Credits if those projects meet prevailing wage and apprenticeship requirements, with attractive bonus credits if those projects use U.S.-manufactured products or include land-based power conditioning located in energy communities.[94] The law also directly supports clean energy technology manufacturing facilities through the Advanced Manufacturing Production Tax Credit and Advanced Energy Project Tax Credit.[95]

In addition to the Inflation Reduction Act, recent actions from federal government agencies have supported investments in the offshore wind industry as well. For example, the Federal Energy Regulatory Commission's (FERC) Order No. 1920 requires that transmission providers conduct long-term planning for regional transmission and determine how those projects will be funded. Order No. 1920 helps advance the transmission projects needed to deliver offshore wind power. In addition to FERC, the federal Bureau of Ocean Energy Management (BOEM) has responded to state and federal offshore wind goals with a leasing schedule that has opened up offshore wind areas in a timely manner.[96]

Stage 3: Stage three of the industry's development represents Southern New England's transition from offshore wind pioneer to national leadership, exporting offshore wind power, manufactured components, and know-how.

After 2040, when the region is generating enough offshore wind electricity to match its electricity consumption, Southern New England states can use their first mover advantage to become a leading exporter to surrounding states. As consumers and businesses continue to demand more electricity, states that waited to deploy offshore wind, or that do not have access to the abundant resources of the Atlantic Ocean seaboard, will look to fill the gaps in their energy supply. Having already met its own rising electricity needs, Southern New England can build an excess supply of offshore wind generation, along with technological and industrial capacity, for export to neighboring states.

In that spirit, Southern New England would set out to build 60 GW of generating capacity by 2050.[97] Infrastructure developments such as the "Atlantic Backbone" (explored in detail below) could open electricity markets further south and provide a larger potential customer base for New England's wind power exports. The offshore wind energy export model will allow policymakers to fully capitalize on early investment in the offshore wind industry.

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[94] Martin, Burton, and Hilary, "Simpler Domestic Content Calculations."
[95] IRS, "Advanced Energy Project Credit"; IRS, "Treasury, IRS Issue Guidance for the Advanced Manufacturing Production Credit."
[96] BOEM, "Renewable Energy Leasing Schedule."
[97] See Methodology Section: 2030, 2040, 2050 Electricity Demand and Offshore Wind Capacity Goals.

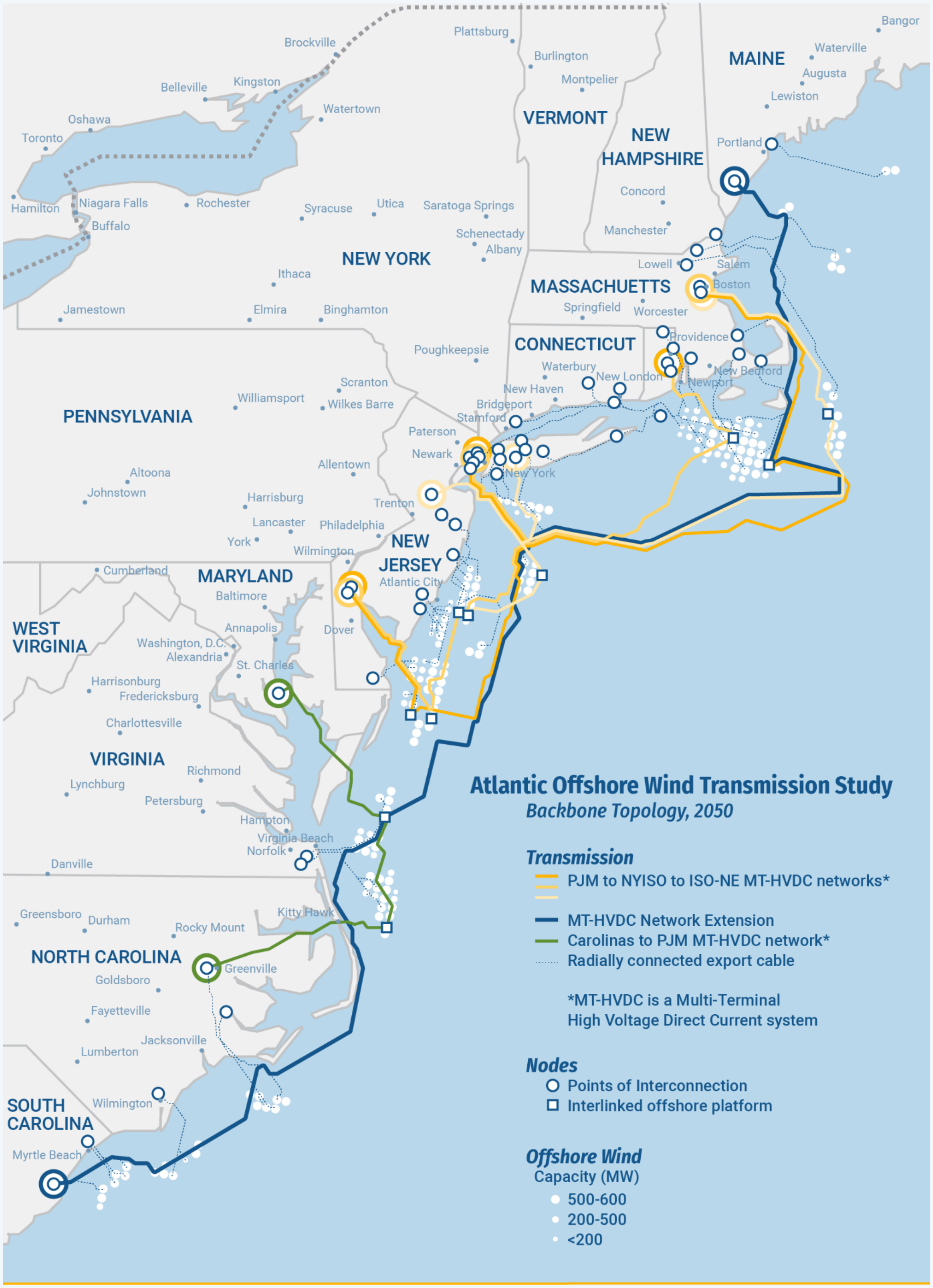

Figure 13. Atlantic Offshore Wind Transmission Study, Backbone Typology, 2050[98]

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[98] Brinkman et al., "Atlantic Offshore Wind Transmission Study." Page 51, Figure 20

Chapter 4. The Four Cornerstones of an Offshore Wind Strategy

By building on existing state and federal initiatives, governments can embark on the second stage of a climate and jobs offshore wind strategy. Over the next decade, with the Inflation Reduction Act (IRA) in effect, Southern New England can set a goal of at least 30 GW of offshore wind capacity by 2040, while making complementary investments in the industry's four cornerstones: offshore wind ports, manufacturing, transmission, and vessels. Investments across the industry include strong labor standards that encourage union participation.

To launch the strategy, it will be vital for Massachusetts, Rhode Island, and Connecticut's governors to convene a climate and jobs strategy committee that includes representatives from Governors' offices and relevant agencies involved in energy regulation, research, and economic development. Additionally, the governors should invite private sector stakeholders, including private developers and component suppliers, and labor organizations that represent construction, operations, maintenance, and manufacturing workers across the four cornerstones of the industry.

The climate and jobs strategy committee would be tasked with developing a plan to invest in ports, manufacturing, transmission, and vessels to a) ensure that 30 GW by 2040 is met, b) reduce costs for offshore wind developers, and c) create regional jobs and economic benefits. It would also analyze and make recommendations on job training programs and labor standards to advance local job creation and equitable distribution of the industry's economic benefits. This chapter is a preliminary analysis of the offshore wind industry's four cornerstones, identifying opportunities for further research by a Southern New England climate and jobs strategy committee convened by the three states.

4.1: Southern New England is making significant headway in upgrading offshore wind port infrastructure.

To support offshore wind manufacturing, marshaling, construction, and operations and maintenance, Southern New England's ports must be upgraded to meet precise specifications.

Home to the nation's first offshore wind port facility, Southern New England has a head start on completing marshaling port infrastructure. In 2001, Cape Wind Associates, LLC (CWA) proposed the first offshore wind energy project in the U.S. After 16 years and a variety of political and economic setbacks, the project was canceled.[99] However, the human capital, legal framework, and physical infrastructure built by this first mover project are now helping catalyze a new industry in the US. In 2010, Massachusetts Clean Energy Center (MassCEC) published an analysis of potential locations for an offshore wind port facility.[100] Based on the study's results, the state spent $133 million to construct the New Bedford Marine Commerce Terminal and completed the project in 2015, expecting Cape Wind as its first tenant.[101] Though Cape Wind was canceled, the terminal found other uses for its cargo and shipping capacities until 2023, when the port began work on its first offshore wind project, Vineyard Wind 1.[102]

Figure 14. Offshore wind port in New Bedford[103]

Connecticut followed suit with an ambitious port development of its own, investing $210 million into the Port of New London's State Pier Terminal. Revolution Wind (Ørsted / Global Infrastructure Partners)[104] also contributed $100 million to the project. Connecticut's State Pier Terminal is the first operational heavy-lift deepwater port in the U.S, and has hosted three offshore wind projects – South Fork Wind, Sunrise Wind, and Revolution Wind.[105]

[99] Seelye, "After 16 Years, Hopes for Cape Cod Wind Farm Float Away."
[100] MassCEC, "History of New Bedford Marine Commerce Terminal."
[101] Hines et al., "Powerful Upgrade."
[102] Lennon, "What's next for New Bedford's Offshore Wind Terminal?"
[103] Wosketomp, *New Bedford Marine Commerce Terminal*.
[104] State Pier New London, "State Pier Infrastructure Improvements Project."
[105] State Pier New London.

State and federal investments in Southern New England's offshore wind ports total nearly $700 million, more than 75 percent of which have been dedicated to marshaling activities (Table 10). The largest grant program, MassCEC's Offshore Wind Ports Infrastructure Investment Challenge,[106] granted $180 million to offshore wind ports development (Table 10).

Based on the National Renewable Energy Laboratory's (NREL) *Supply Chain Road Map for Offshore Wind Energy in the United States*, Southern New England likely has enough operational and under-development marshaling port capacity to support its current offshore wind goals of 9 GW by 2030.[107] Including the New Bedford Marine Commerce Terminal, Southern New England has four operational and under-development marshaling ports, along with additional port sites designed to support manufacturing, operations and maintenance, and flexible laydown operations (Figure 14). Further analysis is needed to determine the port capacity needed for the region to meet 30 GW by 2040 and 50 GW by 2050 offshore wind goals.

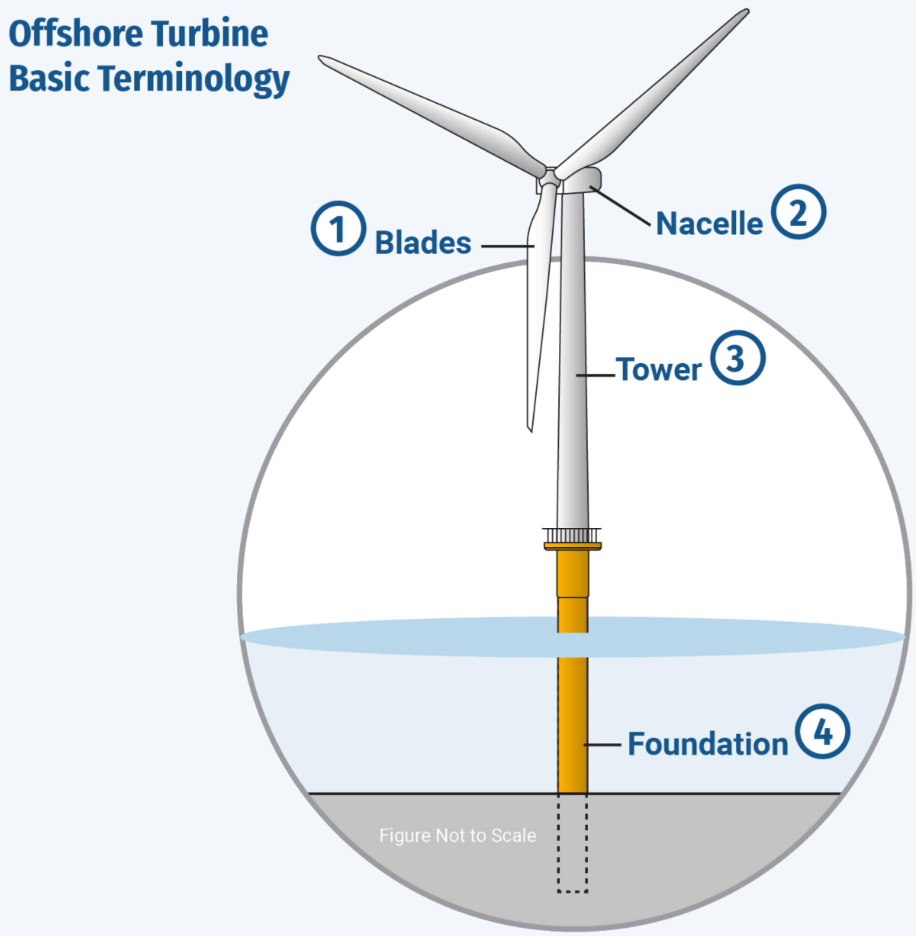
4.2: Investments in regional manufacturing capacity can multiply offshore wind job creation by four while ensuring efficient delivery of necessary components.

Global supply disruptions have played a significant role in offshore wind contract cancellations, illustrating the importance of building regional manufacturing capacity. In October 2023, Park City Wind (now New England Wind I) canceled its contracts with Connecticut Electric Distribution Companies, referencing a variety of economic challenges, including global supply shortages.[108] New England Wind I was not alone – when SouthCoast Wind and Commonwealth Wind (now New England Wind II) canceled their contracts, the projects also cited global supply disruptions as a major factor.[109] With regional capacity to supply the components needed by offshore wind projects, developers would be better positioned to meet their agreements with states and utility companies.

Onshoring manufacturing facilities is also a cost-effective solution for global supply chain disruptions, as importing large components from overseas adds high transportation costs and tariffs. A study by NREL demonstrates that domestic suppliers can be cost-competitive with their overseas counterparts when those factors are taken into account.[110]

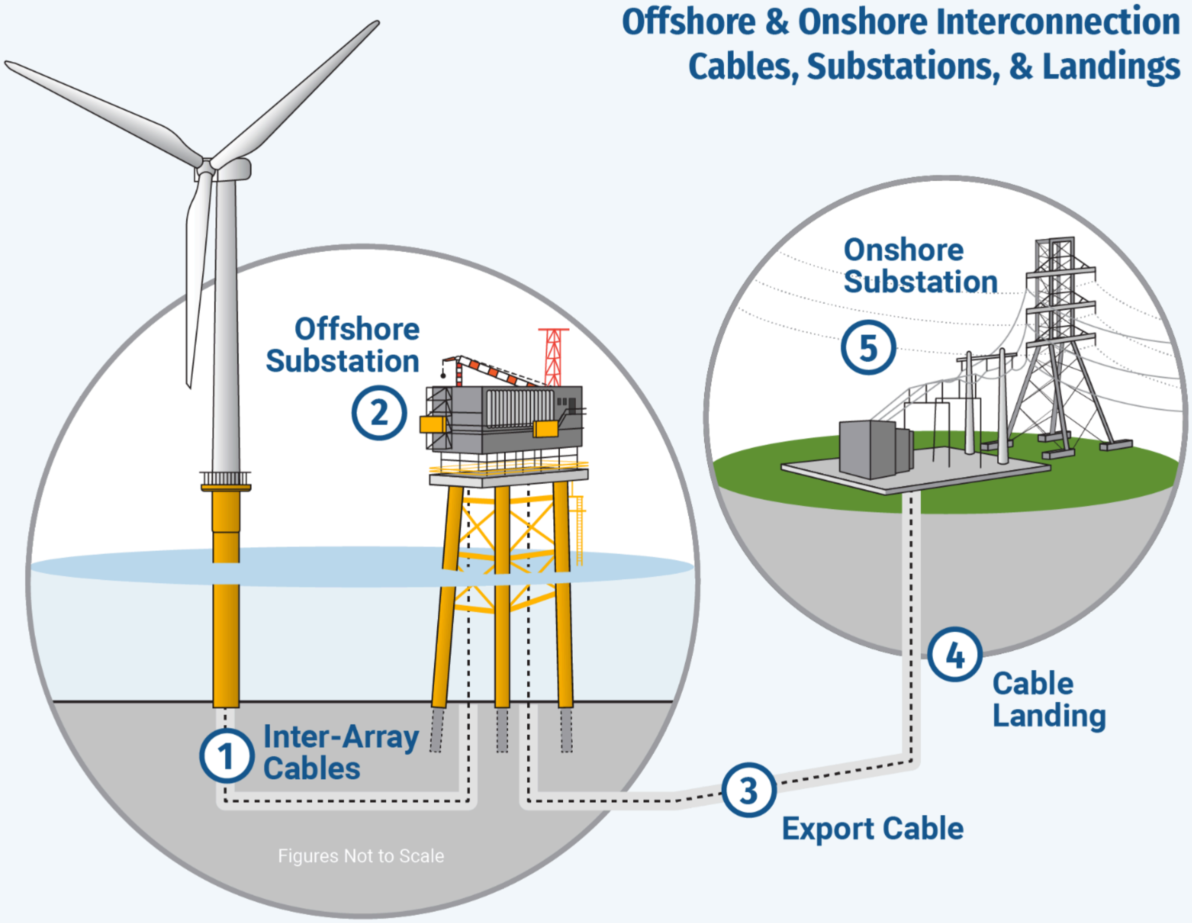
[106] MassCEC, "Massachusetts Offshore Wind Ports & Infrastructure."
[107] Shields et al., "A Supply Chain Road Map for Offshore Wind Energy in the United States."
[108] Avangrid, "Avangrid Statement on Park City Wind Offshore Project."
[109] Jenkinson, "Shell and Oceans Winds JV Moves to Cancel PPAs for 1.2GW Massachusetts Offshore Wind Farm"; Mohl, "DPU Approves Termination of Offshore Wind Contract."
[110] Shields et al., "A Supply Chain Road Map for Offshore Wind Energy in the United States."

Panel 1. Offshore wind's major components



1. **Blades:** Spins with the wind, converting wind energy into mechanical energy.
2. **Nacelle:** Holds the machinery that uses the spinning movement of the blades to generate electricity.
3. **Tower:** Elevates the rotor and nacelle to capture stronger wind speeds at higher altitudes.
4. **Foundations:** Supports the above-water components with a stable base. There are a variety of foundation structures, including monopiles, jackets, and gravity-based foundations.

Offshore & Onshore Interconnection Cables, Substations, & Landings



1. **Array cables:** Link offshore wind turbines to each other and to the substation.
2. **Offshore substation:** Collects power generated by turbines and prepares it for transmission to the onshore substation.
3. **Export cable:** Transmits power from the offshore substation to the onshore substation.
4. **Cable landing:** The point where cables from the offshore wind farm reach the shore.
5. **Onshore substation:** An electrical facility that processes power from the offshore wind farm so that it can be transmitted to the rest of the onshore grid, after which it can be distributed to homes and businesses.

To ensure that there are enough domestic major component manufacturers to start meeting the annual demand for major components by 2030,[111] the U.S. offshore wind industry would need to invest $11.4 billion to build 34 major component manufacturing facilities over the next six years.[112] With advanced research and manufacturing capabilities, Southern New England would be uniquely positioned to contribute to domestic supply chain buildout. For example, CT Wind Collaborative, a non-profit, has pointed out that Connecticut's excellence in defense and aerospace sectors lend to manufacturing offshore wind farm components. The organization is in the process of identifying and drawing funding to offshore wind supply chain opportunities.[113]

With Southern New England's 2030 target representing about 30 percent of the national goal, the region would need to invest a proportional $3.4 billion for 10 major component facilities to meet its share of domestic content investment. **However, only two major component manufacturing facilities and one input supplier have been announced in the region so far, representing $404 million investment** (Table 7)**.** Of these facilities, only Prysmian's offshore wind cable manufacturing facility in Somerset, Massachusetts is linked to a policy incentive, with $20 million in property tax relief provided by the municipality.[114]

Table 7. Announced investments in offshore wind manufacturing

Description	Type	State	Port Site	Status	Investor	Investment Amt (M)
Advanced foundation components	Input supplier	RI	Provport	Operational	Ørsted, Eversource	$100
Transmission cables	Major component	MA	Brayton Point	Announced	Prysmian Group	$300
Transmission cables	Major component	CT	NA*	Operational	Marmon Utility Group	$4

**Located inland, at the Town of Seymour*

In contrast, New Jersey has committed significant resources into drawing offshore wind manufacturers to the state. The New Jersey Economic Development Authority (NJEDA) is developing a $685 million purpose-built offshore wind port,[115] and is planning to dedicate 60-70

[111] Under this scenario, projects built before 2025 would import most major components from abroad, but they could begin purchasing all major components domestically by 2030.
[112] Shields et al., "A Supply Chain Road Map for Offshore Wind Energy in the United States."
[113] Connecticut Wind Collaborative, "Supply Chain."
[114] Mohl, "Brayton Point Offshore Wind Plant Hits Snag."
[115] Powers and Rubin, "NJ Awards 3.74 GW of New Offshore Wind to Replace Pulled Projects | Engineering News-Record."

acres for manufacturers.[116] New Jersey also announced a $250 million investment in EEW Group's monopile manufacturing facility at the Port of Paulsboro.[117] The state's recent offshore wind procurement resulted in two wind projects that are committed to purchasing from the Paulsboro facility and a future tower manufacturing facility at the NJ Wind Port.[118]

New York is investing in offshore wind manufacturing facilities as well. In New York's third offshore wind solicitation, the state encouraged partnerships between offshore wind developers and in-state manufacturers, provisionally awarding $300 million to GE Vernova and LM Wind Power for nacelle and blade manufacturing facilities. The third solicitation did not result in any final awards, leaving those manufacturing facilities in flux. However, New York's rebid of that solicitation, known as the fifth solicitation, includes $500 million for offshore wind supply chain investments, offering $200 million for manufacturing, ports, or associated infrastructure above the $300 million already committed.[119]

Notably, in 2022, the White House joined eleven governors on the East Coast, including those of Southern New England, to launch a Federal-State Offshore Wind Implementation Partnership.[120] The parties signed a memorandum of understanding to support "the development of a coordinated, resilient, and sustainable regional offshore wind supply chain along the East Coast." While the federal partnership is a promising initiative, it's unclear how those coordination efforts will ensure sufficient domestic manufacturing capacity while managing competition between states.

States are already investing in offshore wind manufacturing capacity because it is a jobs multiplier that is critical for capturing economic benefits locally. Work in development, operations and maintenance, maritime construction, and ports typically takes place near the offshore wind project site, but more than 80 percent of all jobs created by offshore wind are in manufacturing (Figure 19), which can be performed thousands of miles away. **In other words, if all manufacturing activities are conducted within the U.S., offshore wind could create four times more domestic jobs,** compared to a scenario where all offshore wind components are outsourced.

[116] "About the New Jersey Wind Port."
[117] Office of the Governor of New Jersey, "Governor Murphy Announces $250 Million Total Investment in State-of-the-Art Manufacturing Facility to Build Wind Turbine Components to Serve Entire U.S. Offshore Wind Industry."
[118] Powers and Rubin, "NJ Awards 3.74 GW of New Offshore Wind to Replace Pulled Projects | Engineering News-Record."
[119] "$500 Million Supply Chain Investment."
[120] United States Department of Energy et al., "MOU."

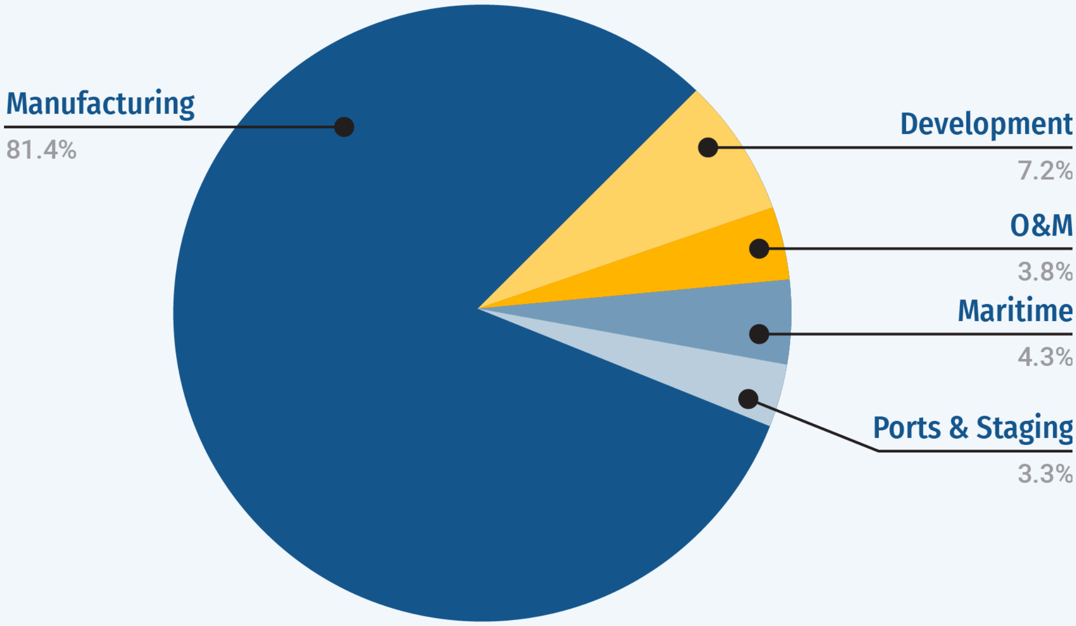


Figure 15. Potential Offshore wind industry jobs

Estimates include employment at both major component manufacturing facilities and at the supplier facilities producing the subcomponents, parts, and materials used as inputs for major component manufacturing. With input supplier jobs representing almost two-thirds of the supply chain's job creation potential, investments in supplier facilities are critical for regional job creation.[121]

4.3: Solving the offshore wind vessels bottleneck will prevent costly delays.

Offshore wind construction requires wind turbine installation vessels (WTIVs), large-scale ships that assemble turbines at sea. These vessels can transport components from the marshaling port to the offshore wind site if they are U.S.-flagged, but foreign-flagged WTIVs must follow the Jones Act – a policy that benefits national security and U.S. workers by requiring that any vessel carrying cargo from a port to an offshore wind site must be U.S.-built and flagged, majority-owned by U.S.entities, and crewed by Americans.[122]

[121] Shields et al., "The Demand for a Domestic Offshore Wind Energy Supply Chain."
[122] Congressman John Garamendi, "Congress Passes Garamendi Amendment Requiring Jones Act Enforcement in Offshore Wind."

Figure 16. Vole au Vent Installation Vessel[123]

In other words, projects with U.S.-flagged wind turbine installation vessels can directly load components onto the WTIV at the marshaling port before proceeding to the offshore wind site for construction activities. **However, when U.S.-flagged wind turbine installation vessels are unavailable, projects deploy U.S.-flagged cargo feeder barges to transport components from the marshaling port to foreign-flagged WTIVs waiting at the offshore wind construction site, which have had to cross the Atlantic.[124]** The components are then transferred from feeder barges to the wind turbine installation vessel so that the WTIV can be used to install the turbines.

There is only one U.S.-flagged WTIV under construction in the U.S., Dominion Energy's *Charybdis*. Southern New England's Revolution Wind project had a contract with *Charybdis*, but the contract was canceled in May 2024, leaving the Revolution Wind likely to seek the feeder route.[125] Even the feeder barge method may prove insufficient in the coming years, as there is a

[123] Hans Hillewaert, *Vole Au Vent*.
[124] WorkBoat Staff, "Barge Master Completes First Feeder Operation for Vineyard Wind 1."
[125] Smith, "A Massive Offshore Wind Vessel Will Not Work in CT. Contract Was Canceled."

looming shortage in global WTIVs. As of NREL's most recent assessment, there were only five European WTIVs in operation or under construction that could be used for U.S. projects, but the U.S. offshore wind industry must compete with European projects to contract those vessels, and more WTIVs are likely needed to meet demand through 2030.[126]

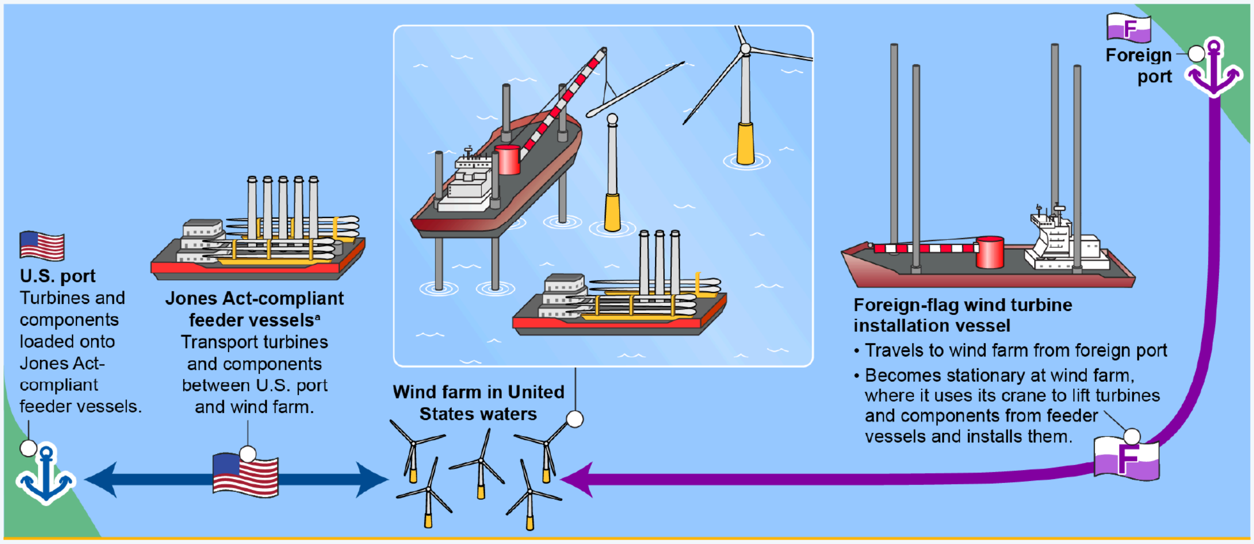


Figure 17. Feeder barge strategy for offshore wind construction[127]

Despite the severity of the offshore wind vessel shortage, Southern New England governments have yet to take action to secure WTIVs dedicated to the region's offshore wind projects. To date, the region has only drawn public investment to shipyards that build smaller offshore wind vessels. In 2023, J. Goodison Company and Senesco Marine received close to $1.5 million in Small Shipyard grants from the federal Department of Transportation.[128] These grants will fund equipment and infrastructure upgrades for fabricating and servicing Crew Transfer Vessels (CTVs), Crew Transfer Vessels (CTV), Service Operation Vessels (SOV), Offshore Support Vessels (OSV), and Feeder Barges – not WTIVs.

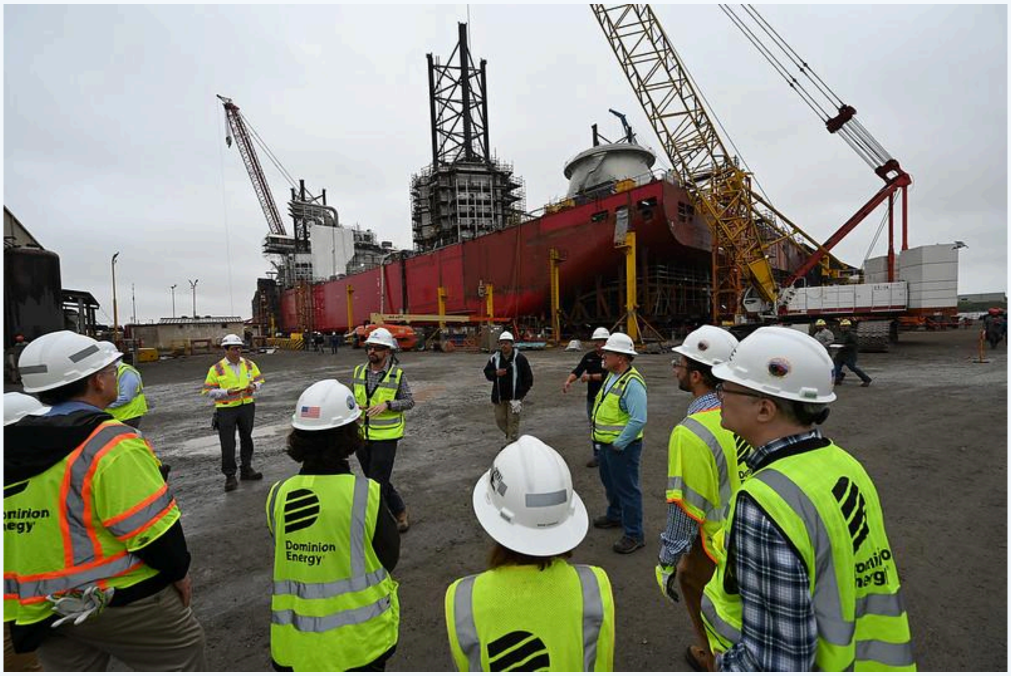
Instead of relying on the construction of new WTIVs to develop offshore wind projects, states could procure projects with a different type of foundation that doesn't require WTIVs – gravity base foundations (GBFs), rather than monopiles.[129] GBF offshore wind projects don't require WTIVs. Instead, barges carry the GBFs to a floating crane vessel, which lifts, transports, and places them at their sites. Furthermore, a newer approach only requires tugboats that tow the foundation and drop it at its site, submerging it while ballasting it with water and sand. Following the installation of the foundation, jack-up barges can assemble the turbines, allowing projects to proceed without waiting on the development of domestic WTIVs or without contracting European WTIVs.

[126] Shields et al., "A Supply Chain Road Map for Offshore Wind Energy in the United States."
[127] U.S. GAO, "Offshore Wind Energy."
[128] U.S. Senator Jack Reed of Rhode Island, "Rising Tides."
[129] Bocklet et al., "Wind Turbine Installation Vessels."

Dominion Energy Builds the first Wind Turbine Installation Vessel in the US

Dominion Energy advanced the offshore wind industry when it announced it was moving forward with its 2.6 GW Coastal Virginia Offshore Wind installation in 2020. During development, Dominion faced a challenge all offshore wind developers face – transporting the nacelles, turbine blades, workers, and foundational equipment from the port to the project.

At the time, the U.S. had no domestically produced vessels capable of the task, and Dominion was prevented from importing wind turbine installation vessels due to the Jones Act. The Jones Act mandates that ships carrying goods between American ports must be made in the U.S., flagged in the U.S., owned by a majority-owned U.S. entity, and staffed by an American workforce. To ensure that the project will have a Jones Act-compliant offshore wind vessel, Dominion began building its own. A 472-foot, $715 million dollar vessel, *Charybdis* will enter service in late 2024 or early 2025.[130]



[131]

[130] "Cost of US-built WTIV Charybdis Balloons to $715 Million."
[131] BOEM, "Charybdis."

4.4: To deliver on a climate and jobs strategy that brings low-cost offshore wind energy to customers, Southern New England must participate in the buildout of a North Atlantic transmission system.

The outdated power grid on the Atlantic coast is a significant obstacle to reaching offshore wind goals. If the entire Atlantic Coast builds just 30 GW of offshore wind by 2030, the grid would already experience strain; an NREL study on offshore wind transmission projects found that 14 out of 24 considered points of interconnection (POI) would experience weak grid strength conditions.[132]

Southern New England can play a leading role in building an Atlantic Backbone transmission project to integrate offshore wind power while enhancing offshore wind project economics and providing significant savings to the public. To provide the greatest benefits to developers and consumers, states should collaborate to upgrade that transmission system according to a three-leg buildout strategy.

Leg 1 (Grid to Shore) projects will upgrade the onshore grid to handle significantly increased capacity at strategic points of interconnection (POI) and extend these lines to the shore; **Leg 2 (Shore to OSW Site)** projects will link offshore wind farms and energy islands to onshore facilities; and **Leg 3 (OSW Site to OSW Site)** projects will link energy islands together to improve grid reliability.

[132] Brinkman et al., "Atlantic Offshore Wind Transmission Study."

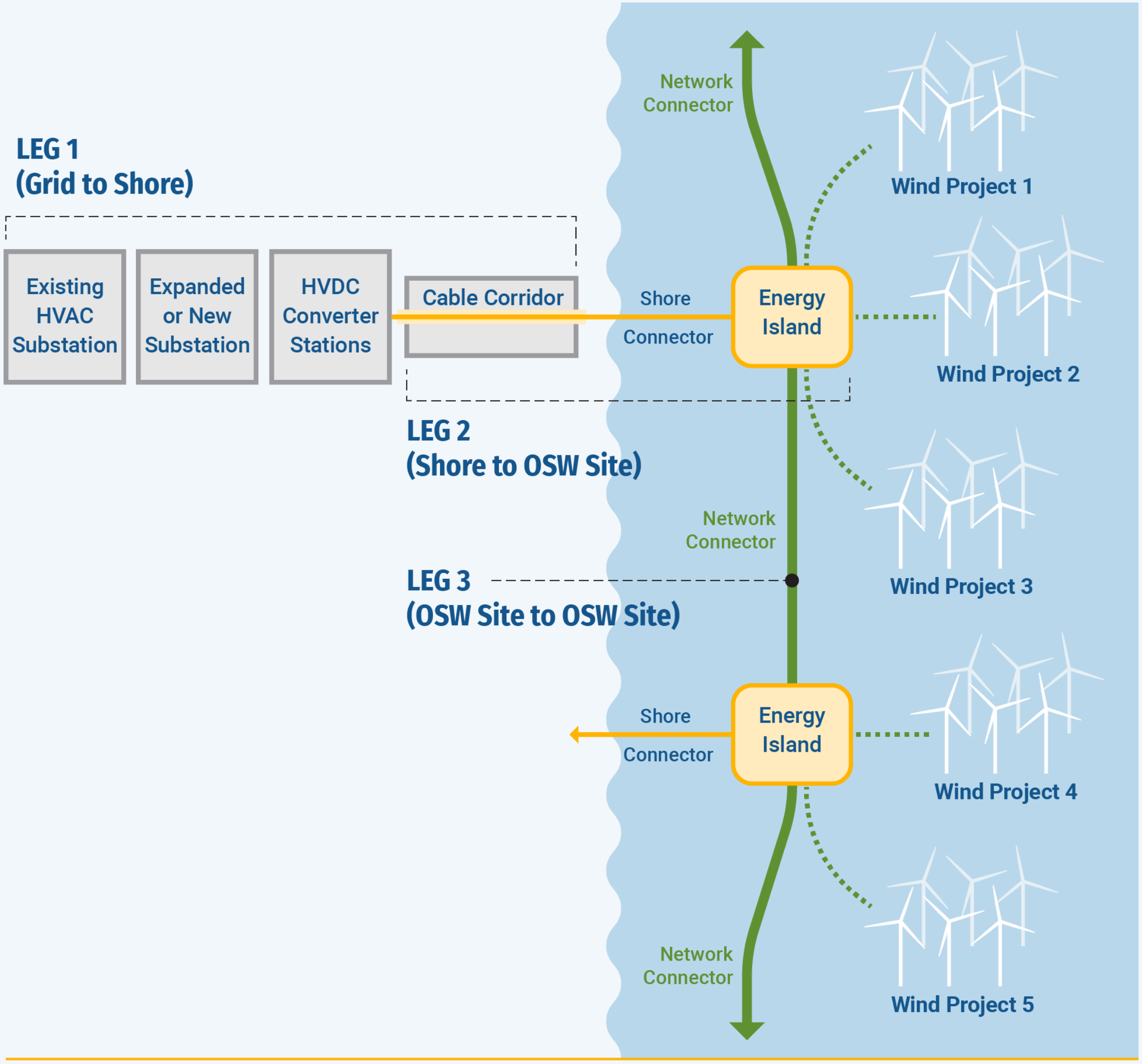


Figure 18. Atlantic Transmission Backbone: Legs 1, Leg 2, & Leg 3

The Atlantic Transmission Backbone would reduce energy costs to consumers. In the U.S., states typically require each new offshore wind project to fund and build its own interconnection line to the onshore grid. Each cable landing is expensive to site, permit, and construct – especially in the face of environmental impact concerns and local resistance. With the Atlantic Transmission Backbone, each new offshore wind project would just have to connect to the nearest energy island rather than to the onshore grid, translating into lower costs for consumers who don't have to pay for that infrastructure. Additionally, the Atlantic Transmission Backbone would reduce energy costs by efficiently delivering power from lower-priced regions to higher-priced regions.

The National Renewable Energy Laboratory estimates that the economic benefits of building out an Atlantic transmission backbone – updated grid capacity, avoided production and generation costs, and avoided redundant infrastructure buildout – outweigh the cost 2.7:1, and would provide nearly $400M in benefits annually by 2050.[133]

The Atlantic Transmission Backbone would also shift the burden of transmission development from offshore wind developers to specialized third-party transmission developers. In particular, it would substantially simplify grid connections, which comprise 15-30 percent of offshore wind construction costs.[134] **By reducing costs for developers, the Atlantic Transmission Backbone would make offshore wind projects more attractive to investors – a boon to the development of the industry.**

Southern New England is already taking the first steps toward an Atlantic Transmission Backbone. In August 2024, a coalition of states including Massachusetts, Connecticut, and Rhode Island won a $389 million grant through the U.S. Department of Energy's (DOE) Grid Innovation Program (GIP) to fund the coalition's Power Up New England Project.[135] By adding and upgrading offshore wind points of interconnection in Southeast Massachusetts and Southeast Connecticut, the Power Up New England project will advance Leg 1 of the Atlantic Transmission Backbone. Furthermore, Southern New England states are participating in a request for federal support to establish a Northeast States Collaborative on Interregional Transmission.[136]

However, none of the states have yet committed state resources to unlock offshore wind capacity. In contrast, New Jersey has proactively planned upgrades to onshore point-of-interconnection under the State Agreement Approach ("SAA"). In 2022, New Jersey's Board of Public Utilities selected the Larrabee Tri-Collector Solution offshore wind transmission project and related onshore grid upgrades, projected to yield over $900 million in cost savings to carry up to 3,500 MW.[137] New Jersey was in the process of a second SAA planned transmission solicitation to handle an additional 3,500 MW when the Federal Energy Regulatory Commission Order No. 1920 was issued.[138]

New York State has also moved forward with planned transmission projects that would benefit multiple offshore wind projects. In June 2023, the New York Independent Systems Operator ("NYISO") selected Propel Energy to build a transmission upgrade to carry 3,000 megawatts

[133] Brinkman et al. Page xv, Table ES-3.
[134] IRENA Secretariat, "Renewable Energy Technologies: Cost Analysis Series."
[135] Governor Maura Healey, Lt. Governor Kim Driscoll, and Federal Funds & Infrastructure Office, "Massachusetts, New England States Selected to Receive $389 Million in Federal Funding for Transformational Transmission and Energy Storage Infrastructure | Mass.Gov."
[136] MA Executive Office of Energy and Environmental Affairs et al., "New England States Seek Federal Funding for Significant Investments in Transmission and Energy Storage Infrastructure."
[137] NJ BPU, "New Jersey Board of Public Utilities Selects Offshore Wind Transmission Project Proposed by Mid-Atlantic Offshore Development and Jersey Central Power & Light Company in First in Nation State Agreement Approach Solicitation."
[138] NJ BPU, "IN THE MATTER OF THE SECOND STATE AGREEMENT APPROACH FOR OFFSHORE WIND TRANSMISSION."

(MW) of offshore wind energy from Long Island to the NYISO grid.[139] A few months later, New York Public Services Commission ("PSC") approved $1.4 billion in funding for the project.[140] New York is advancing a second high capacity planned transmission project that would deliver at least 4,770 MW of offshore wind energy to New York City when competed, with a solicitation that has received four bids.[141]

4.5: Strong labor and equity standards will ensure offshore wind investments create high-quality, family-supporting union jobs that boost local economies.

Southern New England's governments, businesses, and labor organizations have an historic opportunity to partner to custom-build a new, high-road clean energy industry that is good for the climate and good for working people. State and federal governments have a unique role to play in facilitating partnerships with supportive policies so that the industry can be an engine for equitable workforce development.

Offshore wind has the potential to create high-quality union jobs that help tackle inequality in a region that faces major income and racial inequality. Of the three states, Rhode Island had the highest poverty rate as of 2017,[142] and the poverty rate for Black and Latinx Rhode Islanders together is more than four times higher than for white Rhode Islanders.[143] Connecticut ranks third in the nation in income inequality, while Massachusetts ranks sixth.[144,145] In 2022, 14.3 percent of Black Connecticut residents and 18.7 percent of Latinx residents were living in poverty, compared to only 6.6 percent of white Connecticut residents.[146] In Massachusetts, 8 percent of white state residents live in poverty compared to 15 percent of Black, 23 percent of Latinx, 11 percent of Asian, and 19 percent of American Indian/Alaska Native residents.[147] Strong labor and equity standards, vital for a climate and jobs strategy for offshore wind, have the potential to support good paying union jobs and redress historic inequalities in Southern New England.

Labor standards are also critical to building the offshore wind industry at the scale and speed that climate science demands. Unions play a crucial role in accelerating the development of large-scale projects, like offshore wind farms, by ensuring a highly-skilled, well-trained, and reliable workforce that can execute complex projects effectively and efficiently. Utilizing union labor can achieve cost savings, greater productivity, improved quality, and higher levels of safety

[139] NYISO, "NYISO Board Selects Transmission Project to Deliver Offshore Wind Energy."
[140] Ciampoli, "New York PSC Approves $1.4 Billion in Financing for NYPA Transmission Project | American Public Power Association."
[141] Gabrielle, "NYISO Reveals Bids in NYC Offshore Transmission Solicitation."
[142] Deloitte, "2019 Wage Distribution, Rhode Island State Profile."
[143] Kaiser Family Foundation, "State Health Facts: Poverty Rate by Race/Ethnicity."
[144]Economic Policy Institute, "The unequal states of America: Income inequality in Connecticut."
[145] Economic Policy Institute, "The unequal states of America: Income inequality in Massachusetts."
[146] Kaiser Family Foundation, "State Health Facts: Poverty Rate by Race/Ethnicity."
[147] Kaiser Family Foundation, "State Health Facts: Poverty Rate by Race/Ethnicity."

for workers, ensuring that the massive number of clean energy projects planned across the country can be built at the scale and speed science demands.[148,149]

In March 2024, the AFL-CIO and labor organizations across the region – the Massachusetts AFL-CIO, the Massachusetts Building Trades Unions, the Connecticut AFL-CIO, the Connecticut State Building and Construction Trades Council, the Rhode Island AFL-CIO, and the Rhode Island Building and Construction Trades Council – publicly outlined a suite of principles to maximize high-quality job creation and equity across the offshore wind industry in Southern New England ahead of the bid deadline for developers in the region's first joint offshore wind procurement.

These principles would ensure investments in offshore wind support an inclusive, skilled, and unionized offshore wind workforce in the region:

Labor Standards

- Commit to strong labor standards for offshore wind construction, operations and maintenance, maritime, ports, and local supply chain infrastructure by entering into Project Labor Agreements (PLAs) and card check neutrality agreements or Community Benefits Agreements (CBAs).
- Adhere to prevailing wage standards with fringe benefit rates for construction.
- Ensure a free and fair process for workers interested in forming a union for permanent jobs.

Transparency and Accountability

- Follow all licensing standards for offshore construction. These measures aim to uphold the highest standards of safety, environmental sustainability, and operational efficiency in the development and maintenance of offshore wind projects.
- Commit to PLAs in the construction of any new ports or major renovation/upgrade projects in existing ports.

State Investment in a Domestic Unionized Supply Chain

- Scale up state and federal investments into the supply chain and domestic manufacturing with strong labor standards for offshore wind components and prioritize local sourcing and local hiring where feasible.
- Ensure that developers utilize domestically produced components and materials where possible, potentially utilizing the model New York has proffered for steel components.
- Invest in local port infrastructure to support offshore wind projects, supply chain, staging, and assembly, and employing local workers.

[148] Michael McFadden, Sai Santosh, & Ronit Shetty. "Quantifying the Value of Union Labor in Construction Projects." Independent Project Analysis. October 2022.
[149] Frank Manzo IV, Michael Jekot, & Robert Bruno. "The Impact of Unions on Construction Worksite Health and Safety: Evidence from OSHA Inspections." *Illinois Economic Policy Institute*. November 30, 2021.

Workforce Development

- Allocate resources to union-affiliated workforce development programs and support existing labor- management programs in this field or develop programs with labor that focus on skills required for the offshore wind industry.
- Have a Joint Labor Management registered apprenticeship program for all construction trades with apprenticeship programs that will be employed on the project at the time of bid.
- Ensure strong labor and equity standards to create lifelong union career opportunities for workers, especially women and people of color, through union pre-apprenticeship programs.

Conclusion: Southern New England's Clean Energy Future Starts Offshore

Facing the greatest increase in temperatures in the continental U.S. and increasingly frequent and severe storms, floods, and freezes, Southern New England stands at a critical juncture. With each year, the challenge of mitigating climate change grows. As this report has shown, Southern New England's world-class offshore wind represents the greatest opportunity to address climate change while bringing economic benefits to communities across the region.

Offshore wind has had an uneven start in Southern New England. On the one hand, the region has hosted pioneering offshore wind power and infrastructure projects. On the other, three developers withdrew their offshore wind contracts in 2023 due to high interest rates and a constrained global supply chain. Additionally, Massachusetts, Rhode Island, and Connecticut's 2024 joint procurement failed to award even half of the 6,000 MW they issued. While costs are currently high, the DOE and NREL project that, with the development of the industry, prices can be halved within a decade, bringing lower utility bills to the region.

But to realize those low prices, projects must proceed and the industry must scale up. Fortunately, the passage of the Inflation Reduction Act (IRA) has opened up unprecedented support for making those investments. By building on the IRA's incentives for clean energy generation, manufacturing, and infrastructure, Southern New England can create a comprehensive, regional approach to offshore wind development that reduces costs and drives economic growth.

This report calls on leaders in Rhode Island, Massachusetts, and Connecticut to adopt a climate and jobs strategy to develop the offshore wind industry and build 30 GW by 2040 and 60 GW by 2050. Achieving this goal will require doubling down on working together to develop a high road offshore wind industry. The three states can build on existing regional coordination efforts, such as the joint procurement process and the Power Up New England project, and make new joint investments in ports, manufacturing, vessels, and transmission. Including Project Labor Agreements for construction and card check neutrality agreements or Community Benefits Agreements for permanent jobs like operations and maintenance work and manufacturing jobs will ensure the creation of high quality jobs, spreading the economic benefits of the new industry to communities across the region.

The federal government also has a major role to play in implementing such an ambitious approach. By performing a review of the U.S. Bureau of Ocean Energy Management's leasing policy, the federal government can identify processes to support a faster pace of offshore wind development. Federal investment in the offshore wind supply chain and transmission grid will also be critical for supporting the states.

By implementing a climate and jobs strategy, Southern New England can establish itself as a national leader in offshore wind and set an example of how to build a high-road clean energy industry by placing union workers at the forefront.

To confront the pressing challenges of climate change and realize the immense economic potential of offshore wind, Southern New England can harness the prevailing winds from the Atlantic Ocean. The climate and jobs strategy provides a clear path forward, ensuring that the offshore wind industry not only powers the future but also drives equitable economic growth and job creation. By adopting a climate and jobs strategy, the region can secure a better future, transforming the North Atlantic winds into the winds of prosperity.

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Appendices and Supplemental Information

Appendix A – Southern New England's Supply Chain Policies and Investments, Additional Tables and Figures

Table 8. Comparison of evaluation criteria in MA, RI, and CT's most recent OSW RFPs

Massachusetts (08/23 RFP)	Connecticut (02/24 RFP)	Rhode Island (10/23 RFP)
Quantitative (70 points)	**Quantitative (75 points)**	**Price (70%)**
(1) Direct Contract Costs & Benefits (2) Other Costs & Benefits to Retail Consumers	(1) Direct contract benefits (2) Indirect economic benefits	(1) Direct contract costs & benefits (2) Indirect costs & benefits
Qualitative (30 points)*	**Qualitative (25 points)**	**Non-Price (30%)**
(1) Economic Benefits to the Commonwealth (2) Low Income Ratepayers in the Commonwealth (3) Diversity, Equity, and Inclusion Plan (4) Environmental and Socioeconomic Impacts from Siting (5) Experience and Track Record of the Bidder (6) Siting, Permitting, Project Schedule, and Financing Plan (7) Firm Delivery & Energy Storage Benefits (8) Reliability Benefits (9) Additional Long-Term Contracts with Third Parties (10) Benefits, Costs, and Contract Risk	(1) Consistency with the policy goals outlined in the Connecticut Comprehensive Energy Strategy and the IRP (2) Meaningful public participation and environmental justice practices (3) Plans for the use of skilled labor and impact on Connecticut's economic development (4) Plans and practices to avoid, minimize, and mitigate current known and future discovered impacts to wildlife, natural resources, ecosystems and traditional or existing water-dependent uses, including, but not limited to, commercial fishing	(1) Site status (2) Permits & approvals (3) Environmental characterization and mitigation (4) Interconnection and transmission (5) Critical path schedule (6) Economic benefits to the state of Rhode Island

** In MA, qualitative criteria are further divided into Economic Development and Project Impact Criteria (15 points) and Bidder Experience and Project Viability Criteria (15 points)*

Table 9. Planned and operational offshore wind port locations

*Port Name**	State	Status	Site Name	Supported Activities
Port of New Bedford	MA	Operational	New Bedford Marine Commerce Terminal	Marshaling
	MA	Operational	Pope's Island	O&M
	MA	In development	Foss New Bedford Marine Terminal	Flexible Laydown
Salem	MA	In development	Salem Offshore Wind Terminal	Marshaling
Somerset	MA	In development	Brayton Point	Manufacturing
Martha's Vineyard	MA	In development	Tisbury Marine Terminal	O&M
Port of Providence	RI	Operational	Provport Offshore Wind Construction Hub	Flexible Laydown, Manufacturing
East Providence	RI	In development	South Quay Marine Terminal	Marshaling
Port of Davisville	RI	Operational	Quonset Point	Flexible Laydown
Port of New London	CT	Operational	New London State Pier	Marshaling
Bridgeport	CT	In development	Barnum Landing	O&M

Table 10. Public investments in Southern New England's offshore wind ports

Description	State	Port(s)	Supported Activities	Amount (M)	Funding source	Year Announ ced
New Bedford Terminal construction	MA	Port of New Bedford	Marshaling	$113	State	2015
Federal Economic Development Grant for New Bedford port	MA	Port of New Bedford	Multiple uses	$16	Federal	2020
MASSCEC grants	MA	Salem, Port of New Bedford	Marshaling	$120	State	2022

MASSCEC grants	MA	Somerset	Manufacturing	$25	State	2022
MASSCEC grants	MA	Port of New Bedford	O&M	$20	State	2022
MASSCEC grants	MA	Port of New Bedford	Multiple uses	$15	State	2022
BIL funding for Salem port	MA	Salem	Marshaling	$33	Federal	2022
Bridgeport Port Authority offshore wind O&M project	CT	Bridgeport	O&M	$10.50	Federal	2022
FY2023 RI Offshore Wind Port Upgrades	RI	Port of Davisville	Flexible laydown	$60	State	2022
FY2023 RI Offshore Wind Port Upgrades	RI	East Providence	Marshaling	$35	State	2022
Rebuild Rhode Island Tax Credit	RI	East Providence	Marshaling	$15	State	2022
BIL Funding for New Bedford port	MA	Port of New Bedford	Multiple uses	$24	Federal	2023
Redevelopment of State Pier Terminal	CT	Port of New London	Marshaling	$210	State	2024

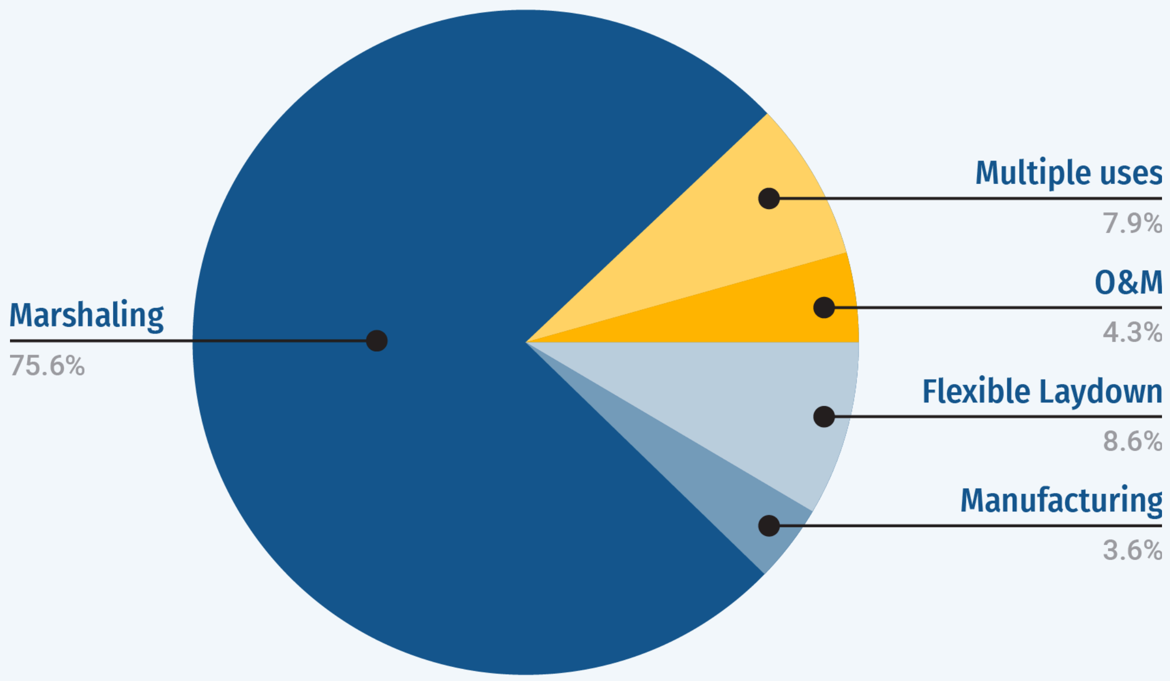

Figure 23. Wind port investments by activities supported

Appendix B – Offshore Wind Job Creation, Additional Figures

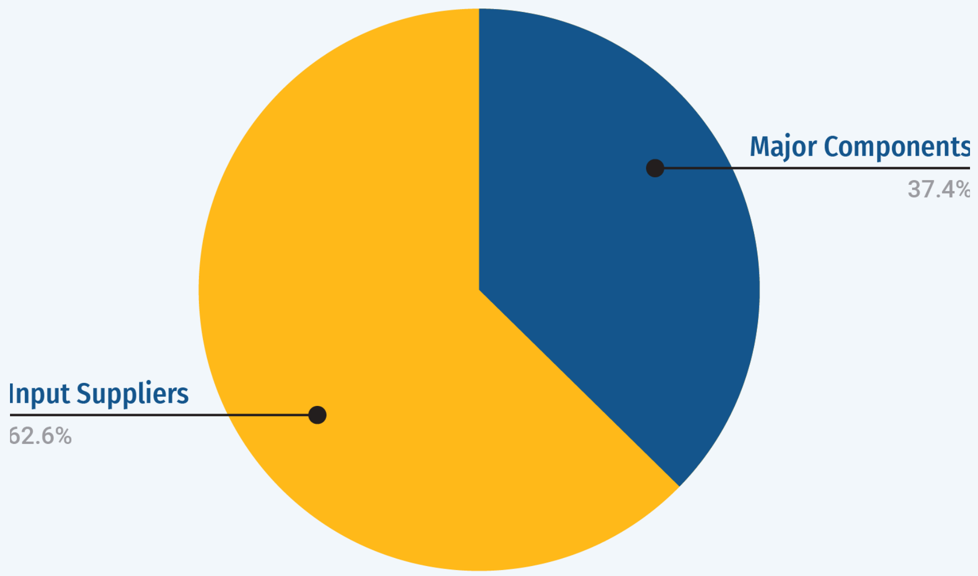

Figure 24: Offshore wind manufacturing job creation breakdown, by facility type

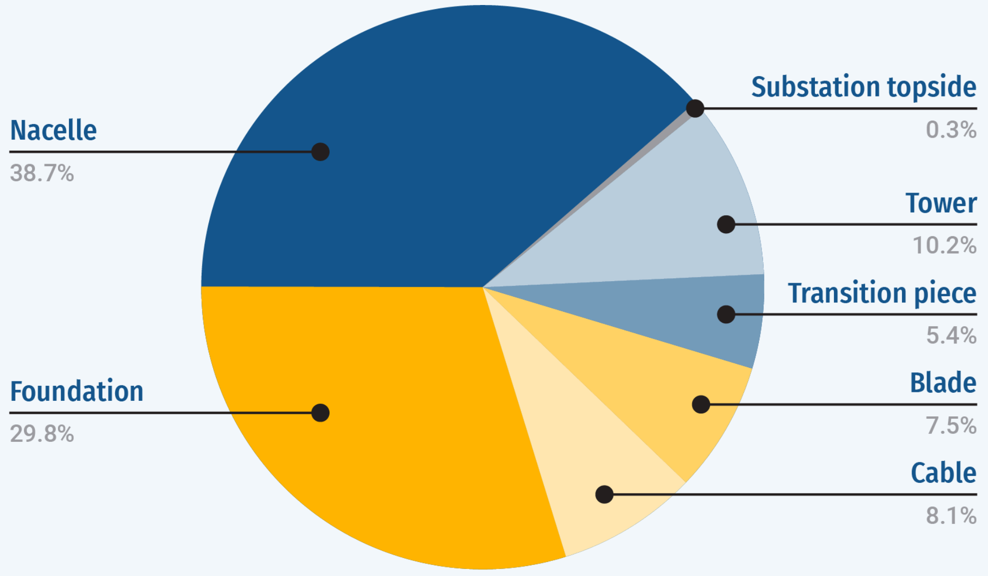

Figure 25: Offshore wind manufacturing job creation breakdown, by component type

Appendix C – Methodology

Onshore Wind and Solar Buildout and Land Requirements

To estimate the maximum potential onshore wind capacity for Massachusetts, Rhode Island, and Connecticut, "potential wind" dataset was downloaded from the WINDExchange U.S. Installed and Potential Wind Power Capacity and Generation webpage.[150] The onshore wind potential for each state was calculated by summing the capacity across classes.

The potential onshore wind capacity was calculated to be 192 MW (RI); 4,749 MW (MA), and 1,679 MW (CT). Together, these states could build approximately 6,620 MW, or 6.6 GW, of onshore wind capacity. In comparison, Texas has an onshore wind potential of approximately 1,348 GW, about 204 times greater than the combined potential of Massachusetts, Rhode Island, and Connecticut.

Capacity factors for MA, RI, and CT onshore wind was calculated using the following formula:

$$`Capacity\ Factor` = \frac{Annual\ energy\ production\ (W/year)}{System\ rated\ capacity\ (W) \times 24\ (hours\ /\ day) \times 365\ (days/year)}$$

2030, 2040, 2050 Electricity Demand and Offshore Wind Capacity Goals

As reported by the Energy Information Administration,[151] CT, MA, and RI's electricity demand in 2022 was 27,767 GWh; 50,983 GWh; and 7,576 GWh respectively. Current estimates of annual growth from ISO-NE (1.8% annually from 2024-2033)[152] are extended through 2040 to estimate the total electricity demand for each state by 2030 and 2040: 99,570 GWh (2030 MA-RI-CT Electricity Demand) and 119,016 GWh (2040 MA-RI-CT Electricity Demand). 9 GW of offshore wind with 47% capacity factor would generate 37,055 GWh, just over 37% of 2030 MA-RI-CT Electricity Demand.

Assuming that Southern New England's offshore wind farms have a capacity factor equal to 47%, consistent with North Atlantic capacity factors in Table 3, Southern New England would need to build approximately 30 GW of Offshore Wind by 2040 to generate 119,016 GWh (2040 MA-RI-CT Electricity Demand).

Assuming a 47% Capacity Factor, 60 GW could produce offshore wind energy approximately equal to 100% of MA-CT-RI 2050 Electricity Demand and an additional 100,000 MWh for export.

[150] WINDExchange, "U.S. Installed and Potential Wind Power Capacity and Generation."
[151] EIA, "US Electricity Profile 2022."
[152] Walton, "ISO-NE Anticipates 17% Rise in Annual Energy Use by 2033, Led by EVs and Heating."

Appendix D – Glossary

Cable corridors: Cable corridors are designated pathways for cables connecting offshore to onshore infrastructure.

Crew Transfer Vessels (CTVs) and Service Operation Vessels (SOVs): Transfers personnel and light equipment during construction and operations. Deployment of CTVs vs. SOVs depends on distance how far the offshore wind project is from the shore.

Energy islands: Offshore energy island facilities can collect power from multiple offshore wind sites to reduce redundant cabling.

Flexible laydown ports: These ports allow developers to store and stage smaller offshore wind components. Upgrading existing ports to flexible laydown operations is generally less intensive than other offshore wind port upgrades.

Heavy Lift Vessels (HLVs): Necessary for installing next-generation foundations. HLVs are already used in the oil-and-gas industry, but new builds and retrofits will be needed to meet demand from national offshore wind targets.

High-Voltage Alternating Current (HVAC) substations: Transmission substations are junctions in the electrical network that perform a variety of essential functions. For example, substations convert electricity into different voltages so that it can be safely and cost-efficiently transmitted to neighborhood-level distribution networks.

High-Voltage Direct Current (HVDC) converter stations: Offshore transmission infrastructure often employs High Voltage Direct Current (HVDC) technology for efficient long-distance transmission. Before being dispatched to the main grid, electricity arriving from offshore wind farms must be converted from DC to AC.

Manufacturing ports: In order to host offshore wind manufacturing facilities, manufacturing ports must have navigation channels that are wide and deep enough to provide offshore wind components reliable access to waterways and heavy-lift wharves for ships to dock, load, and unload. Manufacturing ports typically need large areas to store input materials and finished components.

Marshaling ports: At marshaling ports, offshore wind components are gathered, partially assembled, and then loaded onto ships for installation at sea. These ports require expansive storage areas and wharves designed to support unusually high weight capacities.

Network connectors: Power flow between energy islands will increase network resiliency and cost-efficiency.

Operations and maintenance (O&M) ports: O&M ports will be the base of operations for servicing existing offshore wind farms. They require warehouses for spare components and must accommodate Service Operation Vessels (SOVs) and Crew Transfer Vessels (CTVs) used to transport crewmembers and spare parts back and forth to offshore wind sites.

Offshore Support Vessels: Specialty vessels for a variety of functions, such as environmental surveys, cable laying, anchor handling, platform servicing.

Specialized Feeder Barges: These vessels can transport components from ports to foreign-flagged WTIVs at offshore project locations, but cannot install turbines or foundations. Compared to WTIVs, feeder barges are less expensive to build and there are more shipyards that can build them.

Shore connectors: Cables from energy islands to the shore are needed to bring offshore wind power to the main grid.

Wind Turbine Installation Vessels (WTIVs): Highly specialized vessels for constructing offshore wind turbines at sea. Currently, there are only 6-7 in the world that can install next-generation wind turbines. There are a limited number of shipyards that can construct WTIVs.

Afterword & Acknowledgements

– Mike Fishman, President and Executive Director, Climate Jobs National Resource Center

This report represents the culmination of the work of the Climate Jobs National Resource Center in collaboration with leaders of Climate Jobs Rhode Island, Climate Jobs Massachusetts, and the Connecticut Roundtable on Climate and Jobs.

The CJNRC is committed to the development of an offshore wind industry that delivers all the benefits of a climate and jobs strategy. The climate and jobs strategy emphasizes investments in clean energy capacity, a robust domestic supply chain, and a deep commitment to placing union workers at the center of our clean energy buildout. By pairing OSW installations with local job creation measures and labor standards that support union participation, policymakers, developers, and suppliers can attract and retain the skilled workers needed for the long term success of the offshore wind industry. Labor organizations are central to this approach, ensuring that we distribute economic benefits from new clean energy investments widely and equitably, helping to build and sustain public support for climate investments.

I want to thank Lee Smith, National Policy Director of CJNRC for leading the team that worked on the report and serving as editor of the report. He was assisted by an excellent research team, Jay Wu, Abraham Lyon, and Taylor Maness. I also want to thank other senior staff at CJNRC, including Dave Hancock, Matt Ryan, and Iain Gold. The report benefited from valuable input from Sushma Raghavan, Anandi van Diepen-Hedayat, and Juan Guevara from CJNRC's offshore wind campaign team. The legal team of CJNRC, led by Deedee Fitzpatrick with support by Kate Poole and David Gomez, reviewed the text to ensure its accuracy. Avalon Hoek Spaans, Ben Harper, and Garphil Julien from the Cornell ILR Climate Jobs Institute gave us feedback on the report. Meg Studer designed its graphics.

Special thanks to Eric Hines, Professor of the Practice, Civil and Environmental Engineering at Tufts University and Patrick Crowley, Secretary-Treasurer of the Rhode Island AFL-CIO for their invaluable input and their contributions writing the report's Introduction and Foreword.