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# Offshore Wind Industry in Massachusetts

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## Table of Contents

## Abstract

Massachusetts like many states all across the country are struggling with the effects of climate change. And like many states all across the country, Massachusetts is also finding innovative methods of reducing their carbon footprint. One of the methods that Massachusetts will be utilizing is the offshore wind industry. On March 26, 2021, Governor Charlie Baker signed Senate Bill 9 - An Act Creating a Next Generation Roadmap for Massachusetts Climate Policy (Office of Governor Charlie Baker and Lt. Governor Karyn Polito, et al., 2021). This bill fully cements Massachusetts commitment of achieving a net-zero emissions by 2050 (Office of Governor Charlie Baker and Lt. Governor Karyn Polito, et al., 2021). And on August 11, 2022, Governor Baker signed HB 5060 - An Act driving clean energy and offshore wind. Some of key provisions of this bill include is to reshape the way that the state connects to offshore wind power and accelerate the states' commitment of reaching net-zero emissions by 2050 (Young, 2022). Both of these bills signify that Massachusetts is serious about tackling climate change, and harnessing the potential of the offshore wind industry as a springboard to a more sustainable future.

In November of 2021, history was made off the coast of Massachusetts. The first major commercial offshore wind farm was officially approved by the federal government and by the Massachusetts Department of Public Utilities. This project is called Vineyard Wind I. This offshore wind farm will have the ability to power roughly 400,000 homes (Frangoul, 2021). One of the key hopes of this project is that it will help Massachusetts reach its climate plan of having a net-zero emissions by 2050. This industry on paper has the potential of changing the trajectory of how the state of Massachusetts acquires energy. If this project and industry go according to plan, it will demonstrate that the offshore wind industry can play a key role in fighting climate

change and benefit local communities by generating thousands of jobs. For some, the benefits outweigh the risks.

Even with all these new investments in an industry that could potentially help Massachusetts reach its climate goals, many questions still linger. Massachusetts is a heavyweight in the fishing industry. Last year it was reported that it was valued at around $670 million, the second highest in the country (State of Massachusetts Division of Fisheries, 2021). The fishing industry is very much concerned that they will lose substantial amounts of revenue due to the locations of where if the offshore wind farms will be placed. In addition, there an ever growing concern that these offshore wind farms could potentially damage wildlife in the surrounding areas.

This project will hope to analyze the benefits and the risks of utilizing the offshore wind warms for energy consumption. Another main goal of this project is to figure out if local industries such as the fishing industry and local wildlife are at risk of being harmed at the expense of offshore wind farms or if there is a possibility of coexisting. Furthermore, this project will also dive deeply into a past attempt of placing offshore wind farms off the coast of Massachusetts and why it has failed and if this project is doomed to have the same fate. Finally, I will give my final thoughts and recommendations of whether offshore wind farms' benefits outweigh the risks.

## Introduction

When Governor Baker signed both Senate Bill 9 and HB 5060 it demonstrated not only to Bay Staters but also the country that Massachusetts will be taking climate change seriously and that the offshore wind industry has serious potential of reducing our carbon footprint. On March of 2021, the Biden administration officially approved the nation's first commercial large scale in farm (Davenport & Friedman, 2021). The name of this offshore wind farm will be called Vineyard Wind I. This offshore wind farm will have up to 82 wind turbines and they could generate up to 800 megawatts of electricity, enough to power 400,000 homes (Davenport & Friedman, 2021). This wind farm will vastly dwarf the two existing wind farms off the coast of Rhode Island and Virginia, both of their wind farms together only generate about 42 megawatts of electricity (Davenport & Friedman, 2021). Both the Biden and administration and The State of Massachusetts strongly believe that offshore wind has the potential of reducing our carbon foot print and reaching both the federal governments' and Massachusetts' climate change goals.

With a brand new industry set to commence their operations it also bring a fresh set of problems as well. One of the greatest opponents of the offshore wind industry is the fishing industry. One of the reasons why the fishing strongly opposes offshore wind farms off the coast of Massachusetts is because it will severely damage their revenues. Since local fisherman will be barred from entering waters leased by wind farm developers, this would make fishing trips longer and more difficult (Mindcock, 2022). In addition, many fisheries believe that these turbines will be very difficult to navigate around and which in turn limit the amount of seafood they could catch (Davenport & Friedman, 2021). Part of the reason why local fisheries are gaining so much attention is due to their financial contributions they have generated for the Commonwealth of Massachusetts. For 20 years in a row, the City of New Bedford has the

highest valued sea port in the country valued around $451 million (State of Massachusetts, 2021). Since the fisheries contribute so much financially to Massachusetts' economy, the offshore wind industry has no choice but to listen to their concerns.

The fisheries is not the only concern that the offshore wind farm has to worry about. The offshore wind industry also has to worry about its potential harm in can do to the local marine life. Recently, there has been an unprecedented amount of dead whales that have washed up along the east coast. Many environmental groups strongly believe that it is no coincidence that so many dead whales are appearing all along the east coast beaches right around the same time that so many offshore wind farms are beginning to be built.

## Literature Review

This literature review will explore and analyze some of the offshore wind projects in Massachusetts that are in various stages of development. Furthermore, this literature review will also analyze some of the state's initiatives that helped catapult the offshore wind industry. The main goal is to explore the positives and negatives of utilizing offshore wind as an alternative source of energy consumption. Some positive effects that this literature review will be analyzing will be on the economic and environmental impacts it will have on Massachusetts. On the other hand, the negative effects that this literature review will explore and analyze will be negative effects on the local fisheries and the potential harm offshore wind drilling can have on whales. This literature review will attempt to see both sides of the spectrum, the positive side and also the negative side.

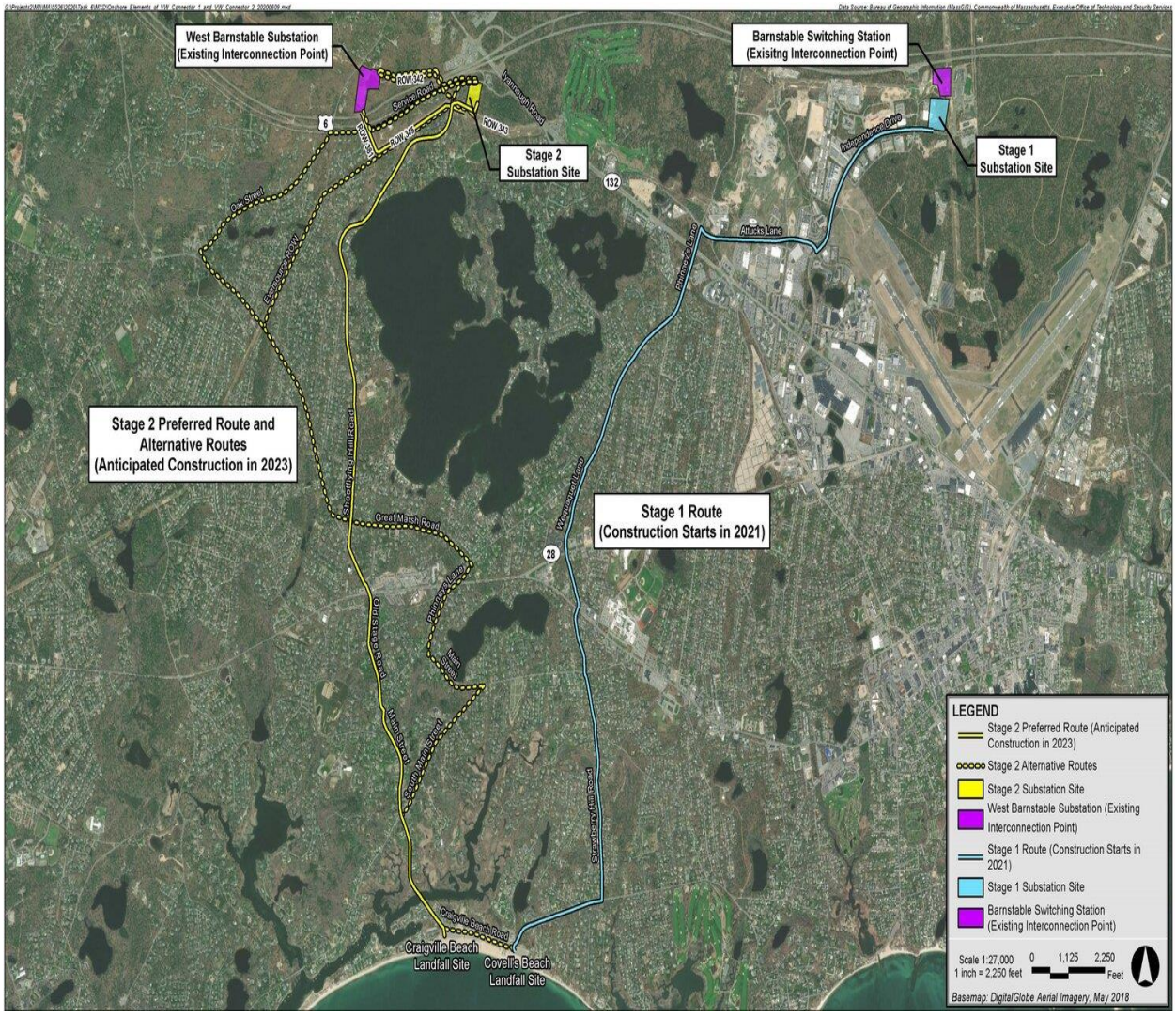
### Project Number 1: Vineyard Wind I

Vineyard Wind I became the largest commercial offshore wind farm when it was approved by the federal government and by the Massachusetts Department of Public Utilities. This project will be located 15 miles off the coast of Nantucket and 35 miles off the coast of mainland Massachusetts (Vineyard Wind, n.d.). This windfarm consists 62 wind turbines spaced out one nautical mile apart (Vineyard Wind, n.d.). Each turbine will generate of about 13 megawatts annually with a combined total of 800 megawatts annually apart (Vineyard Wind, n.d.). This windfarm will have the capacity of powering roughly 400,000 homes.

The method that in which Massachusetts communities will receive Vineyard Wind's energy will be through transmission cables. Vineyard Wind I will construct two transmission cables that will run through Barnstable, Massachusetts. Specifically, both transmission cables

will stretch over 35 miles and buried 6 feet below the seabed from the offshore wind farms to Barnstable's shores in Covell's Beach (Vineyard Wind, n.d.). Both transmission cables will pass through Covell's Beach but after that both cables will have different routes. The first cable called Stage 1 will pass through Barnstable's Covell's Beach and connect to Massachusetts grid through a substation adjacent to an existing substation in Independence Park in Hyannis (Vineyard Wind, n.d.). While the second cable called Stage 2 will also pass through Covell's Beach but and reach a substation that is located in Shootflying Hill Road and interconnect to a grid located in West Barnstable (Vineyard Wind, n.d.). Stage 1 commenced construction in 2021 while Stage 2 will have an anticipated construction in 2023. Below you will find both the routes of Stage 1 and Stage 2.

**Figure 1**




Note. Vineyard Wind in Barnstable: Stage 1 & 2 Map [Map], by Vineyard Wind, n.d., (https://www.vineyardwind.com/onshore-cable-route).

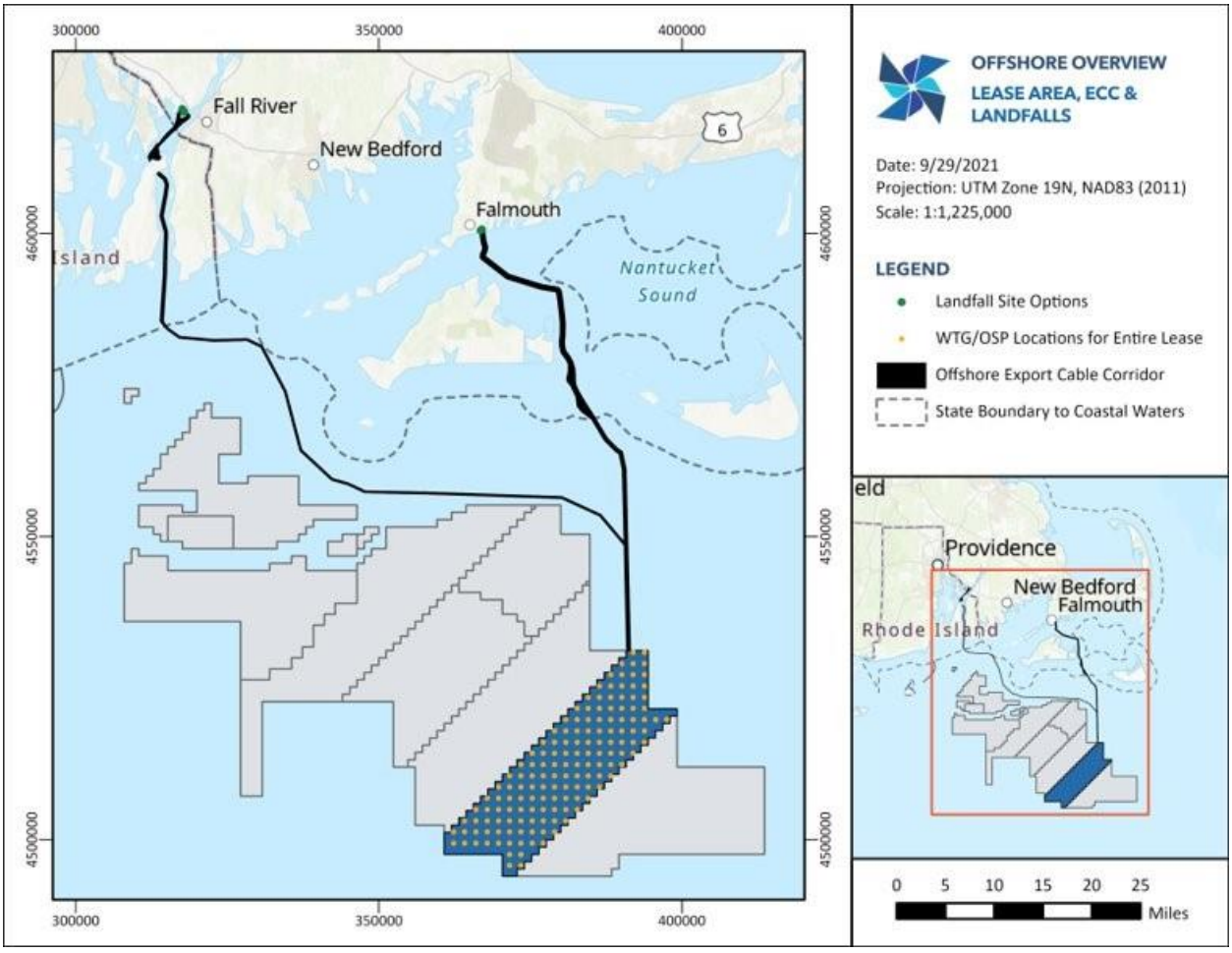
The initial costs of Vineyard Wind I will be $2.3 billion and will rise up to $3 billion (Groom, 2021). In addition, this project will be financed through nine banks (Martin, 2021). The bank nine banks that will be financing this project will be Bank of America, J.P. Morgan, BBVA, NatWest, Santander, Crédit Agricole, Natixis, BNP Paribas and MUFG Bank (Vineyard Wind, 2021). This project will be a joint venture between Avangrid Renewables, a subsidiary of

AVANGRID, Inc. and Copenhagen Infrastructure Partners (CIP) (Vineyard Wind, 2021). The 62 turbines will be supplied by General Electric (Groom, 2021).

**Project Number 2: SouthCoast Wind (Formerly known as Mayflower Wind)**

The second offshore wind farm that is being planned and developed is SouthCoast Wind, formerly known as May Flower Wind. This project will be one of the largest offshore wind farms in terms of energy production. SouthCoast Wind will have the capacity of producing about 2,400 megawatts (MW), this the equivalent of powering about one million homes (SouthCoast Wind, n.d.). Furthermore, this windfarm will occupy over 123,388 acres or 199 square miles of lease area (Southcoast Wind, n.d.). This windfarm will be located 30 miles south of Martha's Vineyard and 20 miles south Nantucket. Also, the estimated amount of wind turbines that this windfarm will require in order to generate 2,400 MW yearly will be around 149 wind turbines. Below you will find a map of the location of where SouthCoast's offshore wind farm will be located.

**Figure 2**



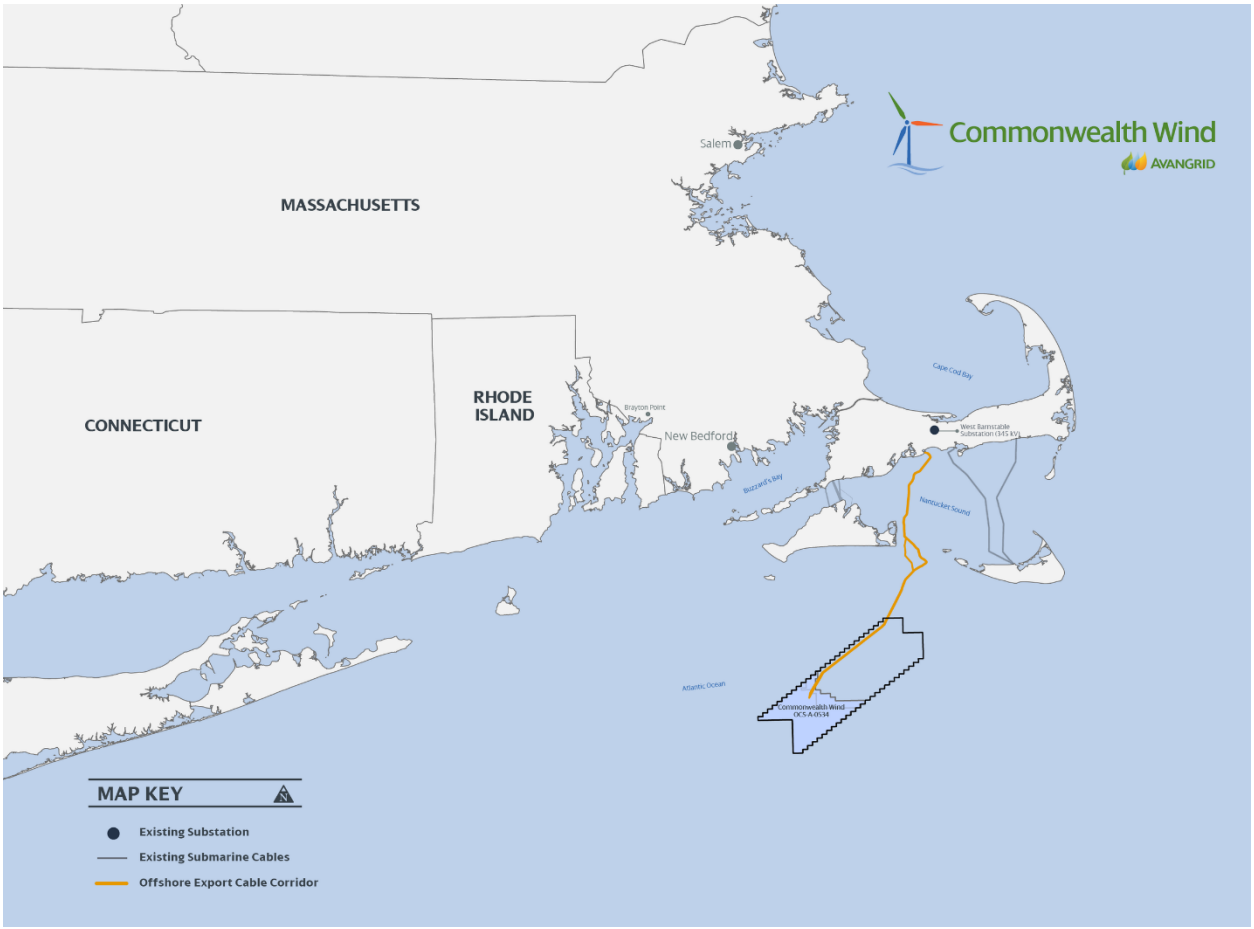

Note. Lease area [Map], by SouthCoast Wind, n.d., (https://southcoastwind.com/southcoast-wind-1/).

Due to the immense size of this project SouthCoast Wind will be divided into two phases, the first phase will be called SouthCoast Wind 1 (SouthCoast Wind, n.d.). While second phase has not been named it has been assumed it will be called SouthCoast Wind 2. SouthCoast Wind 1 will generate the first 1,200 MW while the other half of this project will deliver the other 1,200. SouthCoast Wind 1 is estimated to be completed by the end of the 2020 while the second phase still does not have a definite completion year.

**Commonwealth Wind**

The last offshore windfarm in my research is Commonwealth Wind. Out of all of the offshore windfarms mentioned in the paper the only one that does not have a completion date is this one. Commonwealth Wind, an offshore windfarm being developed by Avangrid will have the capacity of generating 1232MW of energy per year (Commonwealth Wind, n.d.). This is the equivalent of powering roughly 700,000 homes in Massachusetts per year (Commonwealth Wind, n.d.). This offshore windfarm will be located 22 miles south of Marth's Vineyard and south of the Park City offshore wind project. The map below provided by Avangrid demonstrates the exact location of Commonwealth Wind.

**Figure 3**




Note. Lease area [Map], by Commonwealth Wind, n.d., (https://www.commonwealthwind.com/barnstable).

Due to Avangrid's involvement in both Vineyard Wind I and Commonwealth Wind there is an agreement to establish a single corridor of approximately 1500 feet width to lay the electric cables from all the projects in Avangrid's leased area (Commonwealth Wind, n.d.). The map above shows the cable corridor that Commonwealth Wind and also Vineyard Wind I will utilize.

Due to this project still being in the early development stages information for this project are still quite limited.

## Components of wind turbines and connecting to the grid

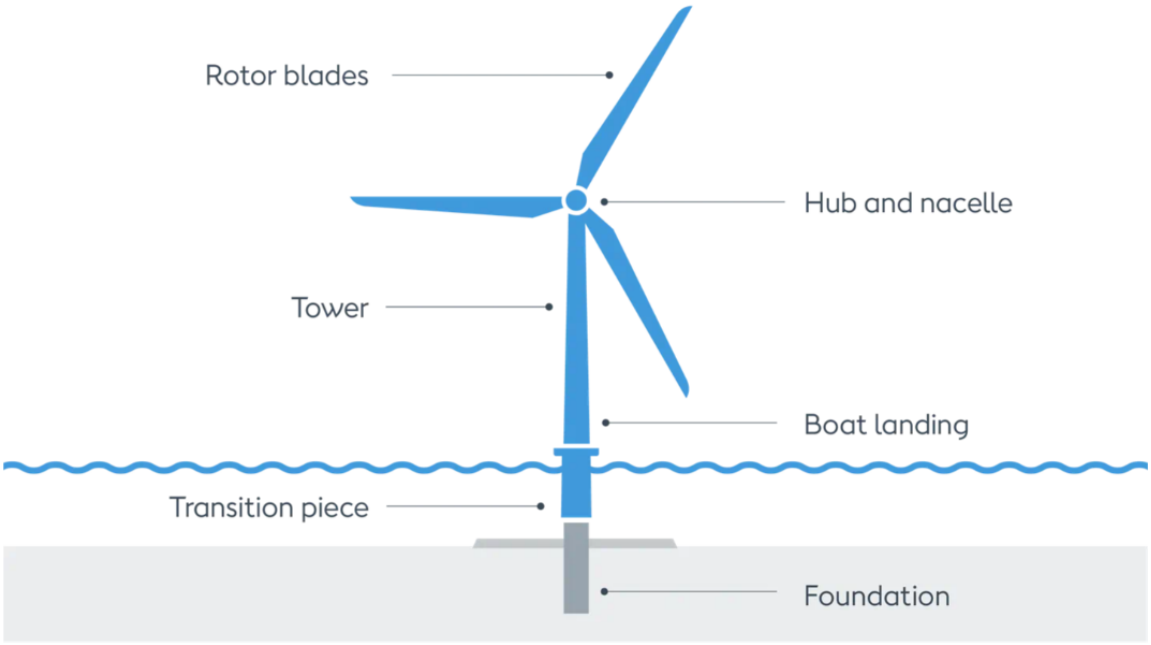
To understand how Massachusetts received energy from offshore wind farms first you must understand how offshore wind turbines generate and dispense energy. The concept of offshore windfarms is both a simple and also a complex process. According to the U.S. Department of Energy Wind Energy Technologies Office "…instead of using electricity to make wind—like a fan—wind turbines use wind to make electricity. Wind turns the propeller-like blades of a turbine around a rotor, which spins a generator, which creates electricity" (U.S. Department of Energy Wind Energy Technologies Office, n.d.). Harnessing the power of wind to make wind turbines spin to make electricity on paper sounds very simple which indeed it is, but the complexities begin once you dive deeper into the internal mechanisms of turbines and the connections utilized to connect to the onshore grid. The figures below will further enlighten energy production and transfer.

### Components of the wind turbines

The first part and perhaps the most important is the wind turbine itself. The three main sections of a wind turbine are the tower, nacelle (the box containing the generator), and the rotors

(the section containing the blades). Figure 4 located below provided by the company Orsted details perfectly in its simplest forms the sections of an offshore wind turbine.

**Figure 4**



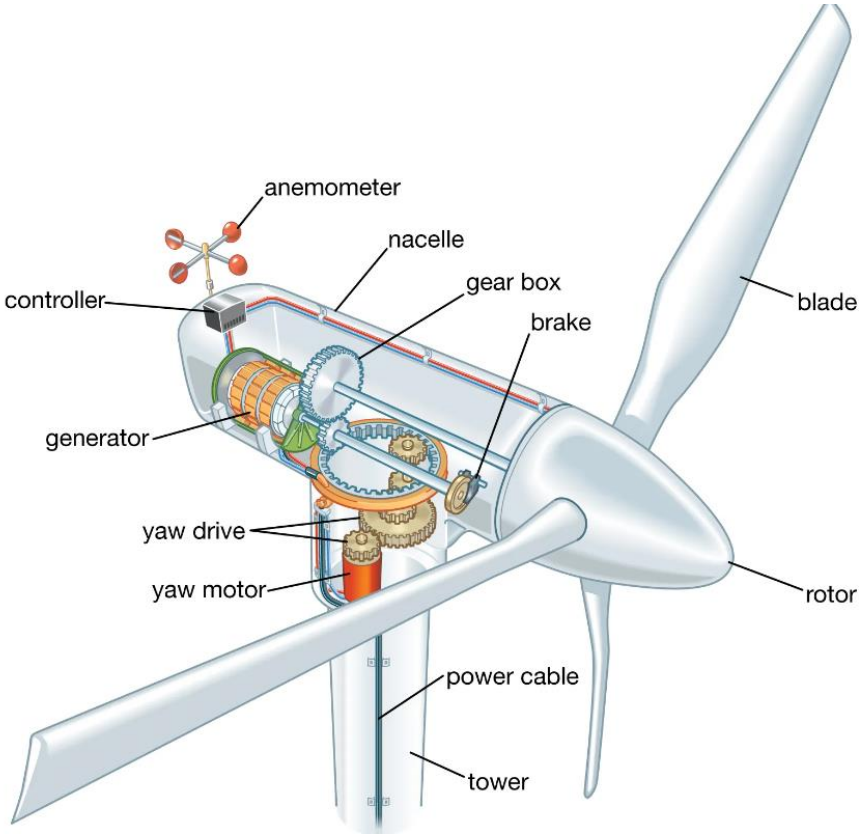

Note. Offshore wind turbine [Diagram], Orsted, n.d. (https://us.orsted.com/renewable-energy-solutions/offshore-wind/what-is-offshore-wind-power/how-do-offshore-wind-turbines-work).

The first section of the turbine that I will be discussing is the tower (see Figure 4 for reference). The tower supports the entire wind turbine. Since there is more wind speed with height, the taller the tower the more opportunities there is to capture wind to generate electricity (U.S. Department of Energy Wind Energy Technologies Office, n.d.). Also, the higher elevation the less turbulent are the winds (U.S. Department of Energy Wind Energy Technologies Office, n.d.). Wind turbines on average are getting bigger in the United Sates as the years go by. In 2016, the average size of an offshore wind turbine was about 330 feet, by 2035 offshore wind turbines are projected to be 500 feet tall, or as tall as the Washington Monument (U.S. Department of Energy Wind Energy Technologies Office, 2022).The reason why turbines are

becoming much taller is to capture more energy since wind speeds increase as the altitude increases (U.S. Department of Energy Wind Energy Technologies Office, 2022).

The next section I will be discussing will be the nacelle. The nacelle is a cover that houses all of the internal components of the wind turbines. The nacelle is located on top of the tower and depending the size of the turbine it can reach the size of a house and for a 1.5MW geared turbine a nacelle can weigh up to 4.5 tons (U.S. Department of Energy Wind Energy Technologies Office, n.d.). Figure 5 located below courtesy of the *Encyclopedia Britannica* demonstrates perfectly where the nacelle is located in the turbine.

**Figure 5**




Note. Offshore wind turbine [Diagram], by Encyclopedia Britannica, 2023, (https://www.britannica.com/technology/wind-turbine).

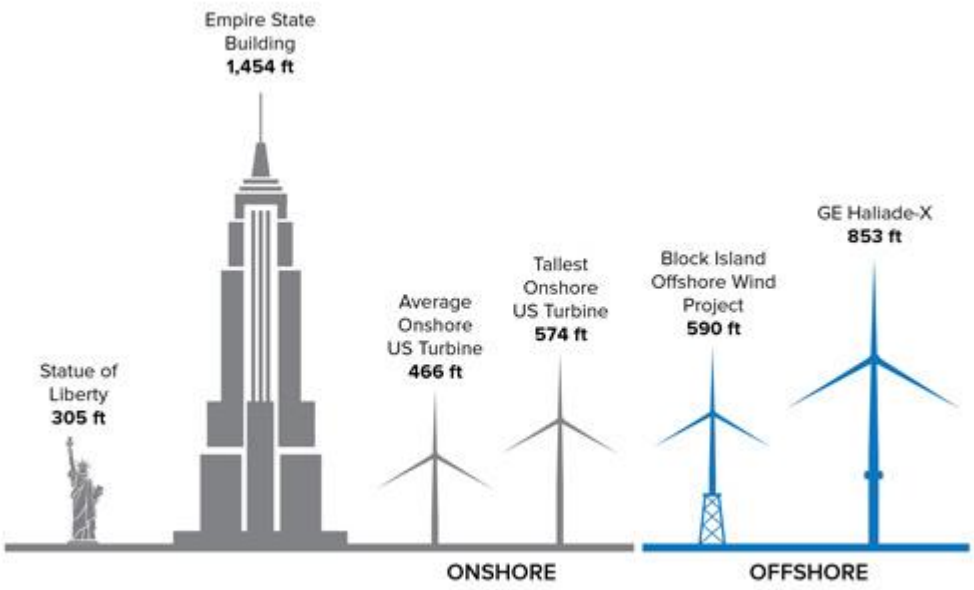
The nacelle is not important in itself. What makes the nacelle so important is what it houses inside. The nacelle houses crucial components that are essential to the turbine and to energy production. Some notable components that are house inside the nacelle are the gearbox, generator, controller and brakes (U.S. Department of Energy Wind Energy Technologies Office, n.d.). It is the first two components that are especially critical to electricity production. The gearbox is where the drivetrain converts the low-speed, high-torque rotation of the turbine's rotor (blades and hub assembly) into electrical energy (U.S. Department of Energy Wind Energy Technologies Office, n.d.). The U.S. Department of Energy Wind Energy Technologies Office describe perfectly the importance of the generator when they write the following:

> The generator is driven by the high-speed shaft. Copper windings turn through a magnetic field in the generator to produce electricity. Some generators are driven by gearboxes … and others are direct-drives where the rotor attaches directly to the generator. (U.S. Department of Energy Wind Energy Technologies Office, n.d.)

This demonstrates us that the gearbox and the generator play an integral role generating electricity. Even though they are not seen visually like the tower or the blades, there contributions should not be estimated.

Finally, the last major component and arguably perhaps the most important is the blades. Figures 4 and 5 located above demonstrate the location of the blades. In general, offshore wind turbines tend to much larger that their onshore wind counterparts. Figure 6 located below demonstrates the size comparisons between onshore wind turbines, offshore wind turbines and well known American monuments.

**Figure 6**




Note. Offshore wind turbines height comparison [Diagram], by New York State, n.d. (https://www.nyserda.ny.gov/All-Programs/Offshore-Wind/About-Offshore-Wind/Offshore-Wind-101).

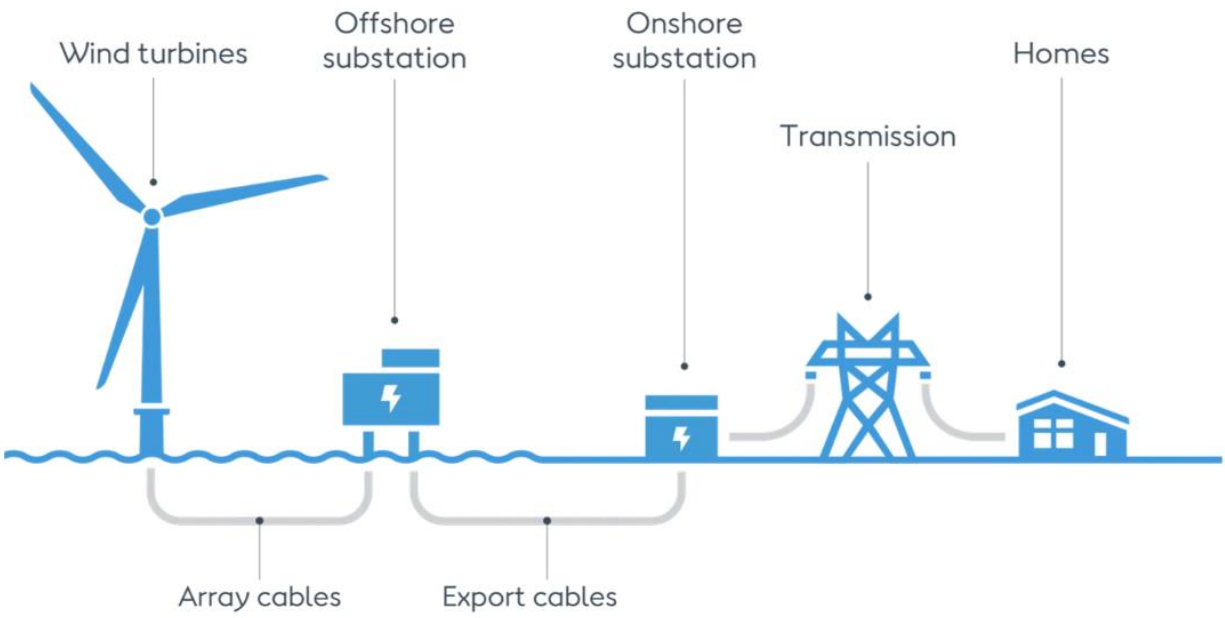
Just for reference, the GE-Haliade-X offshore wind turbine located in the far right in the figure above, each blade is estimated to be 351 feet long or roughly the size of a football field (U.S. Department of Energy Wind Energy Technologies Office, n.d.). Part of the reason why offshore wind turbines and their respective blades are much larger that their onshore counterparts is due to a variety of factors. One of the major factors is wind speed. According to the U.S. Department of Energy Office of Energy Efficiency & Renewable Energy offshore wind turbines require a minimum of windspeeds between 6-9 miles per hour the (U.S. Department of Energy Office of Energy Efficiency & Renewable Energy, 2017). Onshore wind compared to offshore wind tends to be much weaker but most importantly there is a greater consistency of wind speeds in offshore wind versus onshore wind. According to National Grid “higher wind speeds and consistency in direction means offshore installations require fewer turbines to produce the same

amount of energy as onshore wind farms" (National Grid, n.d.). This is part of the reason why offshore wind turbines tend to be much larger than onshore wind turbines, the larger the blades the less wind and more energy they can produce.

**Connecting to the grid**

Finally, the last major step is understanding how energy generated offshore reaches onshore. Figure 7 below courtesy of the energy company Orsted demonstrates perfectly with all its simplicity how offshore energy reaches onshore and connects to grid.

**Figure 7**




Note. Offshore wind diagram [Diagram], by Orsted, n.d., (https://us.orsted.com/renewable-energy-solutions/offshore-wind/what-is-offshore-wind-power/how-do-offshore-wind-turbines-work).

Essentially, offshore wind turbines capture the wind and generate electricity. The electricity then travels from under water high voltage transmission cables to an offshore substation. The electricity captured in the offshore substation is then via transmission cables to an onshore substation. The electricity captured on the onshore substation, that voltage is then adjusted so it

can be easily exported to local transmissions. From local transmissions that electricity is finally supplied to all the homes and businesses in the area.

Knowing how offshore windfarms generate and dispense energy may sound like a boring and bland topic but this could not be further from the truth. As a matter of fact, by knowing how offshore windfarms generate and dispense energy we will gain a greater understanding of the simplicities and complexities that come with this industry. In addition, by knowing this topic you will also gain a greater appreciation of how such simple concept with the help of Mother Nature can generate energy in capacities never thought before. Finally, by knowing how electricity travels offshore to our local grids it will help you gain a much greater appreciation of how offshore wind turbines create and transport electricity.

## Why Massachusetts?

The state of Massachusetts has many things going in its favor in order to develop offshore wind farms off their coast. One reason is due to the favorable climate and geographical conditions. According to a 2016 study conducted by the National Renewable Energy Laboratory (NREL) the shores off the coast of Massachusetts were deemed to be the most favorable for installing offshore wind farms. The NREL determined that the “best resource, based on quality and quantity, was found to be in northeast states such as Maine, Massachusetts, Rhode Island, New York, and New Jersey. Massachusetts has the highest technical offshore resource potential” (National Renewable Energy Laboratory, 2016). What makes Massachusetts such an ideal location for offshore wind farms is due to the consistent wind speeds, shallow continental shelf, shallow waters and expansive shoreline ( (McCarron, 2023). Due to these factors Andrew Doba,

Communications Director for Vineyard Wind has called Massachusetts the “Saudi Arabia of wind” (Yablonski & Byrne, 2023).

It is not just the climate and geographical conditions that make Massachusetts such an ideal location for offshore windfarms but also favorable policies in the state. As mentioned earlier, Massachusetts took the opportunity of passing two pieces of legislation that would benefit greatly the development offshore windfarms. The two pieces of legislation are Senate Bill 9 - An Act Creating a Next Generation Roadmap for Massachusetts Climate Policy and HB 5060 - An Act driving clean energy and offshore wind. Both of these pieces of legislation would prove to be extremely influential in the development of offshore wind farms.

Out of both pieces of legislation, Senate Bill 9 - An Act Creating a Next Generation Roadmap was the first one to be passed and laid the ground work for offshore wind development. What makes Senate Bill 9 such an influential piece of legislation for offshore wind is that it “codifies the target of net zero greenhouse gas emissions by 2050” (Metropolitan Area of Council, n.d.). In addition, this bill has provisions in which it mandates how Massachusetts receive energy. In this bill, Massachusetts requires that “utilities secure an additional 2,400 megawatts of wind power, raising the state’s total procurement level to 5,600 megawatts” (Wasser, 2021). In addition, through this bill “…utilities like National Grid, Eversource and Unitil will have to purchase ever-increasing amounts of renewable energy. Starting in 2025, they’ll need to increase their renewable energy portfolio by at least 3% every year” (Wasser, 2021). Finally, this bill gives a new brand new set of priorities for the Department Utilities (DPU). Previously, the main goals for the DPU have been safety, reliability and affordability when it came to utilities (Wasser, 2021). Now, DPU has added “security, equity and reducing greenhouse gas emissions to the list” (Wasser, 2021). By adding these new initiatives to the

DPU's repertoire, it greatly expands the role that DPU has when it comes to fighting climate change. Senate Bill 9 has played a crucial role laying the foundation not only with fighting climate change but also finding alternative options for energy.

H. 5060 - An Act driving clean energy and offshore wind builds on the bill mentioned previously. One of its more signature section of this bill is to assist the expansion of offshore wind farms. In this bill there a variety of provisions that assist the offshore wind industry. One method is by eliminating the price caps on electricity for offshore wind farms. Prior to the passage of this bill, new offshore wind farms were required to produce electricity below a certain cost (WBUR News & Wire Services, 2021). By eliminating the price caps, critics of the price caps argue that "…by prioritizing power prices, Massachusetts was sacrificing important economic development opportunities and possibly even disincentivizing wind developers from bidding on project solicitations" (Wasser, 2022). Another method in which this helps the offshore wind industry is by providing tax incentives. Under this Bill, the state of Massachusetts is able to provide up to $35 million per year in tax incentives to offshore wind companies (Stacy, 2022). These tax incentives will be authorized through the Massachusetts Clean Energy Center (MassCEC) and the Massachusetts Department of Revenue (Stacy, 2022). The selection process has also changed. Previously, utilities like Eversource and National Grid would play a role in selecting the winning bids but now that responsibility will now fall under the Department of Energy Resources (Wasser, 2022).

This Bill also greatly expands the role of MassCEC. In addition to the $35 million tax incentives it will give to a select offshore wind companies it will also perform other duties. Another role that MassCEC will be conducting is handling the Massachusetts Offshore Wind Industry Investment Trust Fund. Through the Massachusetts Offshore Wind Industry Investment

Trust Fund, MassCEC will "…promote the manufacture of domestic supply chain components of the offshore wind industry; stimulate increased financing for permanent manufacturing facilities; advance clean energy research, technology, and innovation; and prepare individuals for offshore wind careers by supporting workforce training" (Nahigian, et al., 2022). Under this Bill MassCEC will play a crucial role in the offshore wind industry.

It's not just state laws that will also benefit offshore wind companies in Massachusetts but also federal law as well. The recently passed Inflation Reduction Act (IRA) also provides incentives for offshore wind farms. One of the more notable provisions that through the Inflation Reduction Act it "…provides a 30% tax credit for offshore wind projects that begin construction before January 1, 2026" (Congressional Research Service, 2022). In addition the IRA also "…appropriates $100 million for convening stakeholders and conducting analysis related to interregional transmission development and development of transmission for offshore wind energy (Congressional Research Service, 2022). At the federal level, there is also an array of avenues where the offshore wind industry can find assistance.

Through a combination of geographical, economical, and political factors, the offshore wind industry in Massachusetts will have an opportunity to thrive.

## Benefits of the offshore wind industry

The offshore wind industry as many have predicted would bring many benefits to Massachusetts. In this section I will go in depth about the benefits that the offshore wind farms mentioned above will bring. I will break down the benefits into two sections. The first one will be the environmental benefits, the second section will be the economic benefits and the local

benefits. The reason why I have decided to merge both the economic and local benefits due to the large amount of ovrlap that will exist between both topics.

**Environmental Benefits**

Vineyard Wind i, SouthCoast Wind, and Commonwealth Wind will all bring large amounts of benefits to the state of Massachusetts. Vineyard Wind I for example "…will eliminate 1.68 million metric tons of carbon dioxide emissions annually - the equivalent of taking 325,000 cars off the road" (Vineyard Wind, n.d.). One the other hand, SouthCoast Wind is expected to generate about "2,400 megawatts (MW) of low-cost clean energy, or enough to power over one million homes" (SouthCoast Wind, n.d.). While Commonwealth Wind will have the capacity to "…deliver a groundbreaking 1,232MW of clean and affordable energy and cut greenhouse gas emissions by over 2.35 million tons per year, the equivalent of taking more than 460,000 cars off the road" (Commonwealth Wind, n.d.). All of these offshore windfarms will play a crucial role in meeting Massachusetts' climate goals.

**Economic and Local benefits**

Vineyard Wind I will be the first offshore windfarm will be diving into the benefits they will offer to the state of Massachusetts. Recently, Vineyard Wind I submitted their first annual report to the Massachusetts Department of Energy and Resources called "Vineyard Wind I Impact on Jobs and Economic Output", this report was prepared by the University of Dartmouth and Springline Research Group. Both of these organizations were responsible of the preliminary analysis of the job and economic growth that Vineyard Wind I may bring to the state in 2017 (Young, 2023). This report revealed some significant information. In the report, Vineyard Wind I far exceeded the economic and job output that was projected in the 2017 preliminary analysis.

During every phase of the Vineyard Wind I project there were gains according to the report. During the development phase which lasted between 2017-2021 Vineyard Wind I gained 278 full-time equivalent (FTE) job years, this was a 152 FTE jobs years increase over the 126 FTE job years that UMASS Dartmouth predicted in 2017 (Vineyard Wind I, 2022). During the construction phase of the project which began in September of 2021, from September to December of 2021 Vineyard Wind I 151 union and non-union were employed (Vineyard Wind I, 2022). From 2022 and onwards Vineyard Wind I has employed a total of 199 workers, 105 of these workers were union members (Vineyard Wind I, 2022).

In addition, the vast majority of these were jobs were done by Massachusetts workers and to a certain extent residents who lived near the offshore wind farms. According to the report "…80.3% of the workers employed during the September through December 2021 period are Massachusetts residents, and 79.3% employed to date in 2022 are Massachusetts residents" (Vineyard Wind I, 2022). Currently, as of September of 2022 Vineyard Wind I employs a total of 122 full-time workers, 66 directly by Vineyard Wind I and 56 by contractors (Vineyard Wind I, 2022). Out of the directly employed workers, 75.6% were from Massachusetts while the 65.2% of the contractors where from Massachusetts (Vineyard Wind I, 2022). Out of all of Vineyard Wind I's Massachusetts employees both directly and contracted, 38% were residents from Southeastern, Massachusetts. This demonstrates the direct employment benefits that Massachusetts workers have received due to the offshore win industry.

It's not just the amount of jobs created through Vineyard Wind I's development but also economics affect it has had both directly and indirectly. During the development phase, "…economic activity generated 666 jobs, $59.3 million in labor income, $79.1 million in value added to the Massachusetts economy, and $166.6 million in new economic output" (Vineyard

Wind I, 2022). While during the construction phase which is still ongoing, it has "…generated 190 jobs, $15.4 million in labor income, $20.3 million in value added, and $37.8 million in economic output" (Vineyard Wind I, 2022). Currently, most of the construction work is being done onshore in Barnstable. Once the offshore wind construction phase begins, Massachusetts will begin seeing the impacts around the second quarter of 2023 (Vineyard Wind I, 2022). There is a very strong possibility that economic benefits to be much greater once the offshore work picks up.

Vineyard Wind I will also invest in communities in other ways than just jobs and clean energy. Vineyard Wind I signed a Good Neighbor Agreement in August of 2020 (Town and County of Nantucket, n.d.) with Nantucket. The Good Neighbor Agreement is an agreement between Vineyard Wind I and the Town and County of Nantucket that lists a set of commitments that Vineyard Wind I will complete. The Town and County of Nantucket describe perfectly this agreement when they write following:

> Vineyard Wind's top executives committed to remove the first row of turbines, employ an Aircraft Lighting Detection System (ALDS) for the top of turbines to reduce nighttime lighting impacts, use a non-reflective paint color to minimize turbine visibility, and create a $16 million Nantucket Offshore Wind Community Fund, which will be administered by the Community Foundation for Nantucket. (Town and County of Nantucket, n.d.).

The Nantucket Offshore Wind Community Fund will provide significant investments to the Nantucket Community. According to the Town and County of Nantucket, the Nantucket Offshore Wind Community Fund will "…support local initiatives to combat the effects of climate change, enhance coastal resiliency, and protect, restore, and preserve Nantucket's

cultural and historic resources" (Town and County of Nantucket, n.d.). The Town and County of Nantucket have already received the first $4 million from Vineyard Wind I and as their projects begin to unfold, Vineyard Wind I will continue to provide additional funding to the Nantucket Offshore Wind Community Fund for the next 8-10 years (Town and County of Nantucket, n.d.).

The next offshore windfarm I will be diving into the benefits will be SouthCoast Wind (formerly Mayflower Wind). According to SouthCoast Wind, this offshore wind farm project is projected to bring in 20, 000 jobs to Southern New England and 14,000 jobs to the South Coast region of Massachusetts throughout the life of the project (SouthCoast Wind, n.d.). Furthermore, out of these projected jobs, SouthCoast Wind has committed to sourcing 75% operations and maintenance jobs from the local workforce (SouthCoast Wind, n.d.). From a local resident's ratepayer perspective, SouthCoast wind is projected to generate over $2 billion in savings throughout the life of the project and bring in a total of $2.5 billion in economic benefit to Massachusetts (SouthCoast Wind, n.d.). Due to SouthCoast Wind still in the permitting phase, this information is most likely subject to change.

Finally, the last offshore windfarm, I will be diving into the benefits will be Commonwealth Wind. According to Commonwealth Wind, their offshore wind project is estimated to create around 11,000 full-time equivalent (FTE) jobs (Commonwealth Wind, n.d.). Due to this project is in the early phases of development. There is not that many new information at the moment.

It's not just the direct community investments from the offshore wind companies that will benefit Massachusetts communities but also investments at the state level. On December of 2022, the Baker-Polito Administration announced a $180 million in offshore wind infrastructure (Cristantiello, 2022). This money will be the though the Massachusetts Offshore Wind Industry

Ports Investment Challenge and will be administered by the MassCEC (Niforos, 2022). Funded in December of 2021, when Governor Charlie Baker signed *An Act Relative to Immediate COVID-19 Recovery Needs* the Massachusetts Offshore Wind Industry Ports Investment Challenge is a competitive funding opportunity that is administered by the MassCEC. According to the MassCEC, the purpose of the Massachusetts Offshore Wind Industry Ports Investment Challenge is to allocate state resources that will be "…utilized to drive private and other public investments in the redevelopment of and improvements to Massachusetts port facilities to bring inactive and under-utilized sites into productive use for the offshore wind industry" (Massachusetts Clean Energy Center, 2022).

What makes the Massachusetts Offshore Wind Industry Ports Investment Challenge notable is that it allocated state resources to not just one project but to multiple projects. Some notable projects that this program has allocated resources include $75 million investment to the City of Salem and Crowley Maritime to transform a once coal-fired power plant into a wind terminal where components of the wind turbine will be assembled (Cristantiello, 2022). Another notable investment a $25 million investment to Prysmian Projects North America "…for the redevelopment of part of the Brayton Point Marine Commerce Center in Somerset to construct a manufacturing facility and terminal for marine high voltage cables" (MassCEC, 2022). The other notable investment will be a $15 million investment to the New Bedford Port Authority for the improvement of its North Terminal 1 port facility for the increased vessel traffic that will occur due to the offshore wind industry (MassCEC, 2022). The Massachusetts Offshore Wind Industry Ports Investment Challenge demonstrates the wide array investments that the state of Massachusetts is willing to do in order support a successful implementation of the offshore wind industry.

## Negative effects of the offshore wind industry

### Fishing Industry

The offshore wind industry will not only bring benefits to Massachusetts but also some potential negatives. One of the potential negative benefits that the offshore wind industry would bring would be the potential loss of income for the local Massachusetts fisheries. The fisheries industry is a financial juggernaut in Massachusetts. It is estimated that the fisheries industry sustains both indirectly and directly roughly 87,000 jobs (Perry and Heyman, 2020). According to a report published by the Port of New Bedford, New Bedford's fishing industry supported roughly 6,200 jobs directly and roughly 39,000 jobs indirectly (Port of New Bedford, 2019). Furthermore the fishing industry "supported $1.8 billion of total personal wage and salary income" (Port of New Bedford, 2019). In terms of the amount of jobs it supports, the fishing industry truly is a heavyweight.

It is not just the amount of jobs the fishing industry supports but also the large value this industry has financially. Massachusetts is consistently ranked as one of the top seafood producing states in the country based on vessel landings. Vessel landings are the "revenue from, fish that are caught, brought to shore, processed, and sold for profit" (National Oceanic and Atmospheric Administration, n.d). The port New Bedford's for the 21$^{st}$ year in a row ranked at the highest valued fishing port in the country (Vanasse, 2022). While Massachusetts as a state as a whole was been ranked high as well. In the year 2019, Massachusetts ranked second highest in terms of total value in the fishing industry with a value of around $679.3 million, only Alaska had a larger value in the fishing industry (Commonwealth of Massachusetts Division of Marine Fisheries, 2021). Even more astounding is that in the year 2021 Massachusetts reached an all-time high in seafood value (Commonwealth of Massachusetts Division of Marine Fisheries,

2022). In the year 2021, Massachusetts seafood value reached an all-time high of $800 million, much higher than their 2020 value which was $558 million (Commonwealth of Massachusetts Division of Marine Fisheries, 2021). As you can see, the fisheries industry is not just important for supporting jobs but also has the potential of generating millions of dollars in revenue for the state of Massachusetts.

It was a no brainer that the fisheries industry would not support the offshore wind industry since there is money to me made. When the Bureau of Ocean Energy Management (BOEM) produced a report indicating that the the effects of offshore windfarms in commercial fisheries was categorized as “major” the fishing industry has opposed heavily opposed offshore wind farms (Carpenter, 2019). The main reason why the local fishing industry opposes the offshore wind industry is because they strongly believe it will significantly reduce their revenue. Even though BOEM characterized the effects of offshore windfarms as “major” to the revenues of the fishing industry they also mentioned that Vineyard Wind’s leased area would be reduce their revenues by $14 million (Wolman, 2022). To appease the fisheries, Vineyard Wind 1 and five other offshore wind lease holders agreed to a turbine layout to address the fishing and transit concerns, this layout decision could cut energy production by 30 percent (Wolman, 2022). The amount of revenue loss that the fisheries could lose due to offshore winds farms is very much open for debate and perhaps will not be settled until the distant future.

Many experts believe that the fishing industry’s animosity towards offshore windfarms has been misguided, that it should be guided towards another major issue, and that is climate change. Climate change has significantly damaged the fishing industries revenues. From 1996 to 2017, climate change has reduced jobs in New England’s coastal towns by 16 percent (Kaufman, 2019). As waters become warmer, many species of fish, scallops, crabs, and lobsters their

populations begin to decline, which in turn make fisheries travel much farther to capture them. Climate change perhaps has and will do far more damage in revenue losses to the fisheries than what offshore windfarms will do.

**Right Whales**

Another major concern of offshore wind development is the negative effects it will have on the whale population. Since December, there have been around a dozen whales that have washed on beaches across the Atlantic coast (Wanna, et al., 2023). One particular concern is the endangered North Atlantic right whale. There is an estimated to be around 350 North Atlantic whales in existence, out of those 350 there only 95 mature females (Parry, 2023). Out of the dozens of whales that have washed up 16 have been humpback whales and one has been a North Atlantic right whale (Parry, 2023). Many environmental advocates strongly believe that this no coincidence, that offshore wind development is responsible for the deaths of these washed up whales.

On the other hand, many experts believe that the blame on offshore wind on the deaths of the washed up whales has been misguided. Part of the reason why many believe is because the cause of deaths of these whales has not been identified and it can take months to obtain results (Cohen, 2023). In addition, sighting dead whales washed up across the Atlantic beaches is not an uncommon occurrence. Since 2016, ten or more humpback whales have been washed up shore and in 2017 there was a record high of 34 (Parry, 2023). Currently, the common threats that many whales are vessel strikes, entanglements, and pollution (Cohen, 2023). Furthermore, offshore vessels currently constitute only about 2 percent of marine traffic in the Atlantic Ocean (Wanna, et al. , 2023). Also, the current work that offshore wind vessels are doing along the Atlantic coast are surveying for more potential developments (Cohen, 2023). The lack vessel

traffic and work they are doing in the Atlantic waters is a strong case in demonstrating that offshore wind is no responsible for the recently washed up whales.

## Conclusion

Offshore wind farms to a certain extent can be one of the solutions in tackling climate change. Offshore wind farms will bring a tremendous amount of benefits to the state of Massachusetts. From the amount of jobs it will bring, investment to coastal communities, the lack of dependency in fossil fuels, and lowering Massachusetts carbon footprint. Currently in America, large scale offshore windfarms are still in their infancy and in a laboratory phase. Nevertheless, it is truly an amazing time if you are in favor of offshore wind development since governments, the public, and policies are favoring them.

But at the same time, no matter how many positives offshore wind farms bring it also crucial to identify the negatives as well. The potential revenue loss of a major economic heavyweight like the fisheries and harm it can have on whale populations are important topics to keep an eye on. It necessary to see these offshore wind projects from both sides of the spectrum, if they fail to it will give the perception that they shoving this industry in the throats of Baystaters.

## Project Overview

### Introduction

In November of 2021, history was made off the coast of Massachusetts. The first major commercial offshore wind farm was officially approved by the federal government and by the Massachusetts Department of Public Utilities. This project is called Vineyard Wind I. This offshore wind farm will have the ability to power roughly 400,000 homes (Frangoul, 2021). One of the key hopes of this project is that it will help Massachusetts reach its climate plan of having a net-zero emissions by 2050. This industry on paper has the potential of changing the trajectory of how the state of Massachusetts acquires energy. If this project and industry go according to plan, it will demonstrate that the offshore wind industry can play a key role in fighting climate change and benefit local communities by generating thousands of jobs. For some, the benefits outweigh the risks.

Though not everyone is entirely thrilled by this new industry. The Massachusetts fishing industry has been very vocal that these offshore wind projects will negatively affect their economies. The Massachusetts fishing industry is major heavyweight in the state's economy. Last year it was reported that it was valued at around $670 million, the second highest in the country (State of Massachusetts Division of Fisheries, 2021). A slew of lawsuits have been filed to impede the offshore industry from breaking ground.

This project will dive into the positives and negatives that the offshore wind industry may have in Massachusetts. In addition, this project will also analyze the affect this industry will have on the Massachusetts fisheries.

**Major Stakeholders**

Key stakeholders in this project include MPA Senior Leadership graduate student Luis Santos.

Community stakeholders are the following:

- Local fisheries
- Massachusetts Division of Fisheries
- Massachusetts Department of Public Utilities
- Coastal cities
- Coastal residents

**Project Goal and Scope**

**Project Goal**

The goal of this project it to analyze and determine to the positives and negatives of building an offshore wind farm off the coast of Massachusetts. In addition, I will also analyze the affects that the offshore wind industry will have on the Massachusetts fishing industry and if both industries can coexist.

## Project Scope

### In Scope:

- The plans and reports that the offshore wind farms such as Vineyard Wind I, Mayflower Wind, and Commonwealth Wind will publish.
- The reports of coastal cities such as New Bedford indicating the benefits and risks the offshore wind industry will have in their community.

### Out of Scope:

- Other New England based offshore wind farms and their benefits and risks.
- Joint statewide offshore wind farms and their benefits and risks.

## Assumptions

- As an individual that is not too familiar in with the fishing industry I run the risk of painting a broad brush on the entire industry. I often forget that there is different kinds of fishing industries within the fisheries such as scallop fishing and oyster farming. If I don't pay close attention to differences between the fisheries I run the risk of marginalizing some.
- As a self-advocate for renewable industries this could potentially lead to biases. This could potentially lead to problems down the road if I don't pay close attention since I could be only searching for documents and data that supports the offshore wind

industry. Going forward it would be best to take a neutral approach and selecting and dissecting articles and data and demonstrate the positives and negatives of offshore wind farms.

- I will complete this project on time.

**4. Constraints**

- Many of the offshore winds farms will not be completes until 2023.
- Limited information on a finely tuned subject.
- Project will only be limited to the state of Massachusetts.
- Too many assessments based on projections.

## 5 Risks

- A negative risk of this project will be that I don't take into consideration the differences between the fisheries. This could cause me to paint a broad-brush in the fishing industry and skew data and articles like mentioned above.
- A positive risk would be would be to complete opposite of the note above and that this that research will take into consideration the fishing industry and create a pathway of establishing a plan of coexistence between both industries.

## 6 Stakeholder Sign-off

(For capstone thesis/case study students only capstone advisor signature is required)

This project charter has been signed off by the client, capstone advisor and project team members.

| | | |
|---|---|---|
| _____ | _____ | _____ |
| Name | Title | Date |
| _____ | _____ | _____ |
| Name | Title | Date |

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