OFFSHORE WIND STUDY

Massachusetts Department of Energy Resources

With Support from Levitan & Associates

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Contents

Figures

Tables

Acronyms

ACP	Alternative Compliance Payment
BOEM	Bureau of Ocean Energy Management
CEC	Clean Energy Certificate
CES	Clean Energy Standard
CO_2	carbon dioxide
CPS	Clean Peak Standard
DOER	Department of Energy Resources
DPU	Department of Public Utilities
EDCs	Electric Distribution Companies
FCM	Forward Capacity Market
GWSA	Global Warming Solutions Act
ISO-NE	Independent Service Operator New England
ITC	Investment Tax Credit
MW	megawatts
MWh	megawatt-hour
ORECs	Offshore Wind Renewable Energy Certificates
PPA	power purchase agreement
REC	Renewable Energy Certificate
RFP	Request for Proposals
RPS	Renewable Portfolio Standard
U.S.	United States

Introduction

Massachusetts is a national leader in the advancement of offshore wind. The *Energy Diversity Act*, Chapter 188 of the Acts of 2016 ("Energy Diversity Act"), signed by Governor Baker in August 2016, directed the Massachusetts Electric Distribution Companies (EDCs) to jointly and competitively solicit proposals for 1,600 megawatts (MW) of offshore wind energy generation through multiple solicitations conducted with the Department of Energy Resources (DOER) and to subsequently enter into cost-effective long-term contracts for such. This led the EDCs and DOER to solicit for and ultimately select 800 megawatts (MW) of offshore wind from Vineyard Wind at $65/megawatt-hour (MWh) (2017$) in May 2018, kickstarting major development of the industry in New England. The EDCs and DOER are currently in the process of soliciting and procuring the remaining 800 MW of offshore wind authorized by the Energy Diversity Act.

In 2018, Massachusetts passed *An Act to Advance Clean Energy*, Chapter 227 of the Acts of 2018, which required DOER, by July 31, 2019, to 1) investigate the necessity, benefits and costs of requiring the EDCs to conduct solicitations and procurements for up to 1,600 MW of additional offshore wind and 2) evaluate the previous solicitation and procurement process and make recommendations for any improvements.[1] This additional offshore wind, subject of the study, is beyond the initial 1,600 MW authorized by the *Energy Diversity Act*.

Offshore wind is a renewable resource that offers numerous benefits. An additional 1,600 MW procurement of offshore wind energy will result in over 6,000,000 MWh of annual clean energy when fully online. Offshore wind energy generation has a greater capacity factor, approaching 50 percent on an annual basis, than many other renewable energy generators such as solar, especially during winter months. This is due to the high-quality wind resources off New England's coast and advancements in turbine technology. As seen in Figure 1, the first solicitation of offshore wind was cost competitive with other clean energy policies.

[1] As part of this Study, DOER reviewed the process of the first 83C solicitation but did not complete a review of second 83C solicitation for the remaining 800 MW as the solicitation is currently ongoing and will not be complete until end of 2019.

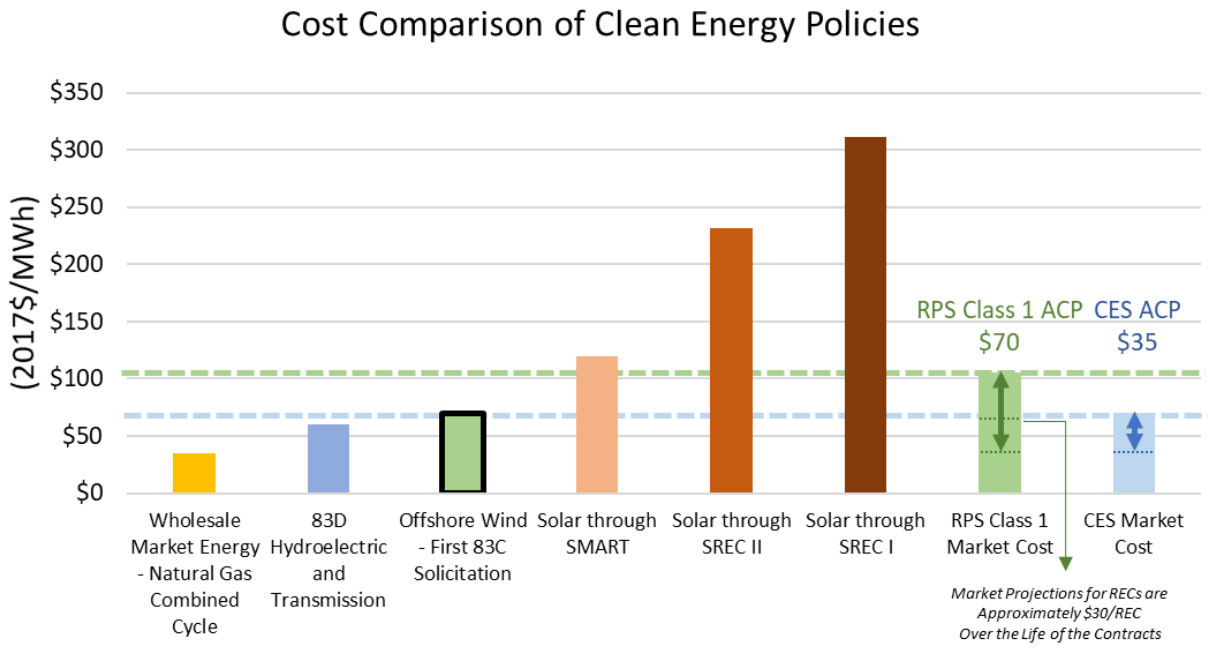

Figure 1: Cost Comparison of Clean Energy Policies[2]

Overview

Over the last decade, state and federal governments have worked extensively to identify wind energy lease areas for offshore wind development that minimize environmental impacts. To date, the Bureau of Ocean Energy Management (BOEM) has delineated 15 lease areas from Massachusetts to North Carolina. Many developers have secured development rights to the lease areas through an auction process undertaken by BOEM. The first leases were auctioned in 2013 off the coast of Massachusetts and went for $3.8 million. In the second auction for the lease areas off Massachusetts held in 2015, the price for leases went for less than $300,000. Since then, the offshore wind energy industry in the US has developed rapidly and competition for the lease areas has exceeded anticipations. In comparison, at the most recent auction held in 2018 for leases off the coast of Massachusetts, the cost to secure a lease culminated at $135 million. In addition to the 15 lease areas already identified by BOEM, the federal government has identified additional call areas off the coasts of New York and South Carolina for potential future offshore wind development. Figure 2 depicts the current holders.

[2] All costs are approximate. The cost of energy will vary based on multiple factors including location.

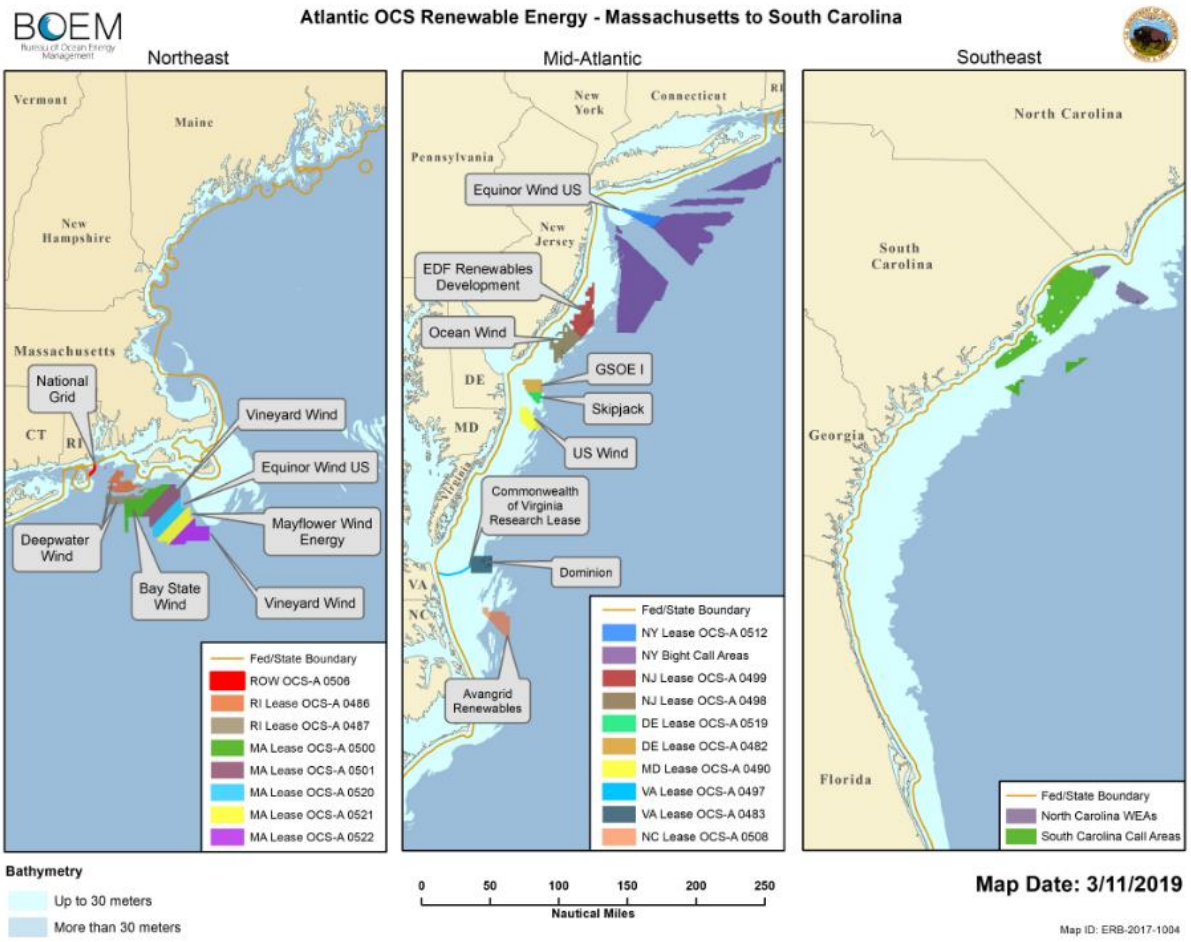

Figure 2: Location of Offshore Wind Lease Areas

Following the Commonwealth's lead, several other states along the Atlantic Seaboard have been aggressively pursuing long-term contracts for offshore wind in order to advance their clean energy goals and to secure investment in local economic development. In 2017, Maryland Public Service Commission announced in an Order that it had selected two projects, the 248 MW US Wind project and 120 MW Skipjack project, for awarding Offshore Wind Renewable Energy Certificates (ORECs) to support the development of offshore wind. In 2018 in collaboration with Massachusetts, Rhode Island procured 400 MW from the Revolution Wind project. Connecticut followed soon thereafter with an additional procurement of 200 MW from the Revolution Wind project in its "Best in Class Request for Proposal (RFP)", and a subsequent 104 MW also from the Revolution Wind project through its Zero Carbon Resources RFP. Both New York and New Jersey have followed with separate procurements for approximately 800 MW or more, and 1,100 MW, respectively. As states are successfully completing offshore wind procurements, additional policies to expand their offshore wind goals are being considered in Maryland, Connecticut, and Virginia. In New Hampshire, steps have been taken to establish an intergovernmental offshore renewable energy task force to deliberate on the identification of wind energy areas off its coast.

Analysis

DOER utilized a combination of both extensive stakeholder outreach and quantitative energy sector modeling, to analyze the cost-effectiveness of an additional 1,600 MW of offshore wind, the optimal timing of any future procurements, and other impacts on the environment and economy from the growth of offshore wind in Massachusetts. DOER solicited input from the public and key stakeholders, including environmental groups, developers, industry groups, EDCs, fisheries, and academia, through the issuance of written stakeholder questions and meetings with DOER staff.

For the quantitative analysis, three project scenarios were modeled as representative examples of future offshore wind development, incorporating different nameplate capacity of additional offshore wind beyond the 83C target and different in-service dates to investigate the impact on the energy system and the Renewable Portfolio Standard (RPS) and Clean Energy Standard (CES) markets. These results were used to determine the cost and benefits of an additional 1,600 MW of offshore wind, optimal timing of any future procurements, and the impact on emissions and compliance with Massachusetts's Global Warming Solutions Act (GWSA).

Scenario	Additional Offshore Wind	In-Service Dates
Reference Case	1,600 MW from First 83C, 0 MW of Additional	N/A
Scenario 1	800 MW	2025
Scenario 2	1,600 MW	800 MW in 2025 and 800 MW in 2027
Scenario 3	1,600 MW	800 MW in 2028 and 800 MW in 2030

Table 1: Modeling Scenarios

This analysis assumes that cost-effective procurements occur when the projected benefits of buying clean energy through the contract are greater than the projected benefits of buying the same amount of clean energy in the wholesale energy markets and the renewable energy certificate (RECs) and clean energy certificate (CEC) markets. Any contracts executed through 83C may include two products from the offshore wind project: 1) wholesale energy and 2) RECs that can be used for compliance with the RPS and CES.[3] The EDCs will use the contracted products either for their own customers or sell the products into the market, receiving payment that offsets ratepayer costs. These are the direct benefits of the contract (see Table 2). The contracts also provide indirect benefits from reductions in wholesale energy and RPS and CES market costs as well as the avoided cost of complying with the GWSA emissions targets. These indirect benefits occur when ratepayers pay less for energy if the new offshore wind

[3] Section 83C allows for contracts that are either for energy and RECs or RECs alone. This analysis assumed offshore wind contracts for both energy and RECs. Contracts were assumed to be 20 years

development reduces the market cost of all energy, also called market suppression, or when ratepayers avoid having to pay even more in the future to secure emission reductions in the electric sector.[4]

Cost of Offshore Wind Contracts *(What the EDCs are Buying through the Contract)*	Benefits from Offshore Wind Contracts *(Savings Impacting Ratepayers)*
• **Contract price for Energy**	• Sale of Energy into Wholesale Market (Direct Benefit) • Reduction in Wholesale Market Costs
• **Contract price for Renewable Energy Certificates (RECs)**	• Use of RECs for RPS and CES Compliance (Direct Benefit) • Reduction in Cost in the REC and CEC Markets • Avoided Cost of GWSA Compliance

Table 2: Summary of Costs and Benefits for Future Clean Energy Procurements

Findings - Necessity, Benefits and Costs

1. ***Based on current market projections an additional procurement for 1,600 MW of offshore wind has a likelihood of cost-effectiveness that justifies additional solicitations.***

Using market projections for both the cost and the benefits of the contracts, all three scenarios were cost-effective showing a net benefit to ratepayers (see Table 3). An additional procurement for 1,600 MW of offshore wind is projected to save ratepayers $670 million to $1.27 billion over the 20-year life of the contract versus purchasing the same amount of clean energy in the markets (energy plus RECs/CESs).

The first 83C solicitation resulted in cost-effective clean energy at $65/MWh (2017$). If future benefits are as projected in this study, the levelized cost would need to be less than approximately $71-75/MWh, or within about 10%, for a future 1,600 MW contract for the contracts to be quantifiably cost-effective.

[4] This analysis utilized a value of $16.51 as the avoiding cost of Global Warming Solutions Act compliance, consistent with the first 83C solicitation. This value represents an avoiding cost of future emission reductions that may have to be paid by ratepayers through other electric sector policies.

Scenario	Additional Offshore Wind	In-Service Dates	Total Net Benefit (2019$)	Levelized Net Benefit ($/MWh) (2019$)
Reference Case	1,600 MW of First 83C, 0 MW of Additional	N/A	--	--
Scenario 1	800 MW	2025	$1.10 billion	$16
Scenario 2	1,600 MW	800 MW in 2025 and 800 MW in 2027	$670 million	$2
Scenario 3	1,600 MW	800 MW in 2028 and 800 MW in 2030	$1.27 billion	$13

Table 3: Quantitative Net Benefit Analysis

Benefits are described above as "net" meaning inclusive of the costs (benefits minus costs equals net benefit), and as both total benefits, the amount of benefit anticipated from the project, and as levelized, the total benefits divided by the number of MWh of generation. The results are presented as the value today, in 2019 dollars.[5] Scenario 3 shows the highest total projected benefits, providing an anticipated $1.27 billion of net benefit while Scenario 1 shows the highest levelized projected benefit at $16 of benefit per MWh purchased. Projected levelized benefits begin to decrease as the larger offshore wind procurements are modeled but Scenarios 2 and 3 with 1,600 MW of offshore wind are still cost-effective, providing greater benefit than their anticipated costs. The impact of project size and timing on the levelized benefits is described in more detail in the findings below

2. ***Offshore wind can provide significant contributions towards achieving GWSA targets and is particularly valuable in winter months.***

As seen in Figure 3, each scenario results in reductions to carbon dioxide (CO_2) emissions across New England relative to the reference case through an increase of clean energy generation. Scenarios 2 and 3 with 1,600 MW of offshore result in approximately double the amount of CO_2 emissions reductions compared to procuring only an additional 800 MW. The power system modeling showed that natural gas was the predominant fuel being displaced and other less clean fuels, such as oil, were also being displaced at times. During severe winter storm events, offshore wind energy has particular benefit of lowering energy prices and reducing greenhouse gas emissions by minimizing reliance on oil and coal fired generation units because of its higher winter capacity factor than other renewable resources.[6]

[5] The included analysis utilized an inflation rate of 2 percent and a discount rate (the electric distribution companies' weighted cost of capital) at 6.99 percent, consistent with the first 83C solicitation.

[6] ISO-NE, High-Level Assessment of Potential Impacts of Offshore Wind Additions to the New England Power System During the 2017-2018 Cold Spell; December 17, 2018; https://www.iso-ne.com/static-assets/documents/2018/12/2018_iso-ne_offshore_wind_assessment_mass_cec_production_estimates_12_17_2018_public.pdf

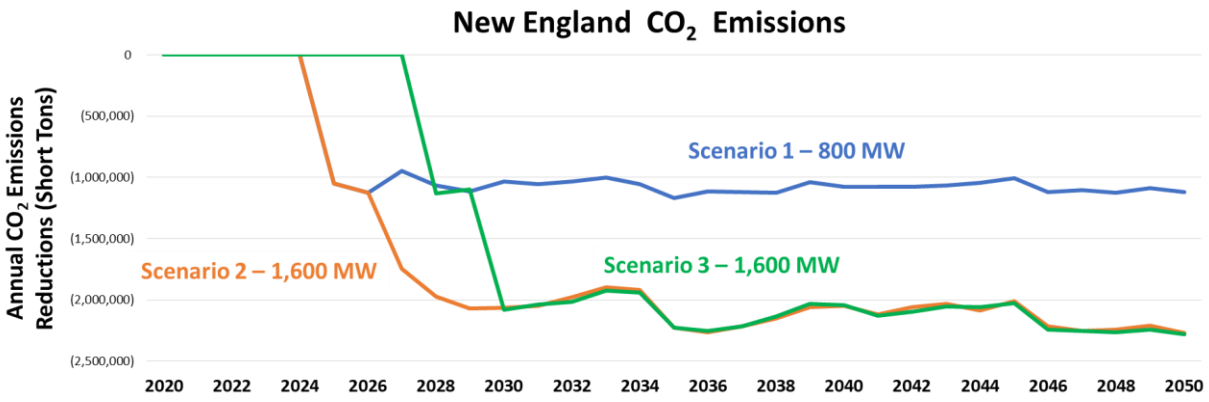

Figure 3: New England Emission Reductions

3. ***However, the benefits of procuring an additional 1,600 MW of offshore wind is highly dependent on regional REC market projections, which have significant market uncertainty.***

The cost-effectiveness of any future contract is highly dependent on future changes to the regional REC market. The value or benefit of RECs varies based on market supply and demand principles. The demand for RECs depends on both Massachusetts' and other New England states' RPS and CES obligations. These obligations are set as a percentage of total electric load, meaning as load increases so does the need and market demand for RECs. Absent a flood of new RPS eligible resources, an increase in demand increases the market price and therefore value of any REC. The market value will continue to increase with demand until it is capped by the states' alternative compliance payment (ACP) value where the RPS obligations can be met with a cash payment in lieu of a certificate.

Using the forecasts for this study, the REC benefits for Scenario 2 are projected to be approximately $34/MWh. Figure 4 shows how various changes in the projections of the REC market can impact REC benefits of the additional offshore wind contracts. If electric load is higher than forecasted in this study because of greater electrification of transportation and heating increasing the RPS and CES compliance obligations, the benefits of procuring offshore wind increase, as seen in Figure 4 in purple. If there are more RECs in the regional market than forecasted in this study due to other states adding more clean energy, then the benefits of procuring offshore wind decreases, as seen in Figure 4 in green. Therefore, given the high amount of uncertainty with RPS market projections, any additional solicitations for offshore wind will need to be evaluated at the time of procurement to determine whether they are cost-effective based on market conditions at that time.

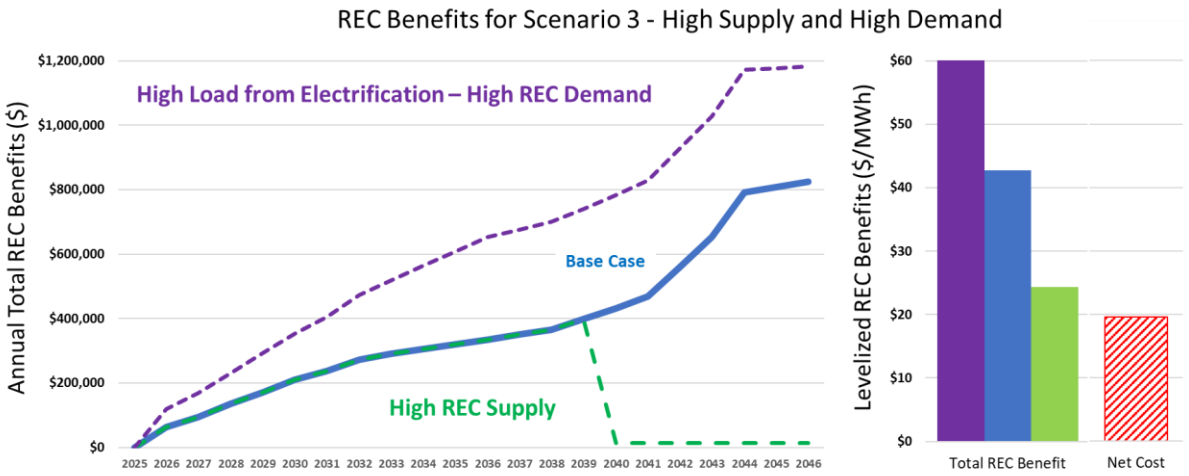

Figure 4: Total and Levelized REC Benefits - Scenario 3

In recent years, the market value of RECs has declined because load has been decreasing from Massachusetts' highly successful energy efficiency programs. There has also been a dramatic growth in the supply of RECs from renewable clean energy resources being built and developed throughout Massachusetts and from other states' clean energy policies. However, future policies to electrify the heating and transportation sectors would increase load and therefore increase the regional demand for RECs.

4. ***There are greater benefits to offshore wind contracts in later years as RPS and CES obligations continue to increase.***

Because the RPS and CES obligations are designed to increase each year, projections indicate that there is more value to the REC supply produced from the additional offshore wind contracts in the later years, as seen in Figure 4. In later years, the additional offshore wind is projected to be needed for the larger RPS and CES compliance obligation, offsetting higher market costs when supply is less than demand. In contrast, in early years, the number of RECs from offshore wind is projected to exceed the market demand. As a result, excess RECs would be sold at a low price into an oversupplied REC market, which would reduce the direct market benefit of the RECs. Further, if the RECs are sold and not retained for Massachusetts, the emissions reductions associated with the excess contracted offshore wind would not count towards GWSA compliance.

Scenario 3 where the offshore wind comes online in 2028 and 2030 is more cost-effective than Scenario 2 where offshore wind comes online in 2025 and 2028 because more of the additional offshore wind RECs are projected to be used to offset higher RPS and CES compliance costs as described above. Additionally, Scenario 1 with only 800 MW has lower total benefits due to its smaller size but higher levelized benefits because the project more closely aligns with the size of the RPS and CES obligations, thereby reducing the amount of "surplus" RECs that must be sold into the market at a depressed price. This analysis shows that the size and timing of any future offshore wind projects will impact the benefits to Massachusetts ratepayers.

5. Benefits for ratepayers are greatest if EDCs retain any excess additional offshore wind RECs that would otherwise be sold at a loss in the regional RPS market.

If there are more RECs than needed for Massachusetts compliance, any RECs in excess of Massachusetts suppliers' need are sold into a regional oversupply. If the RECs are not retained, Massachusetts loses the emissions reductions associated with that energy and the contracted offshore wind does not count towards GWSA compliance. In order to counter this effect, Section 83C allows for DOER to notify the EDCs to retain purchased RECs to facilitate reaching GWSA targets.[7] Figure 5 below shows the anticipated retention of RECs in the Base Case for Scenario 2. First, the EDCs would use the clean energy attributes they have on existing contracts, including the offshore wind projects procured through the first 83C solicitations, to meet their RPS and CES compliance obligations (Existing Contracted Clean Energy in grey). If there is still demand in the Massachusetts RPS, suppliers would then utilize any of the additional offshore wind attributes from Scenario 2 (Additional OSW in green). If there is still demand after all the contracted clean energy was utilized, suppliers would utilize the regional market RECs that are not on contract (Regional Market RECs in yellow). Excess RECs must be sold unless DOER notifies the EDCs to return the RECs (Excess Additional OSW in light green). It is projected that in early years (as shown in Figure 5 for years 2025-2031) with the additional 1,600 MW of offshore wind, the EDCs will contract for more RECs than needed for Massachusetts RPS and CES obligations. Instead of selling these excess RECs above the Massachusetts RPS obligation, DOER's analysis shows that there are more benefits for ratepayers if the EDCs retain these RECs when market prices are very low and use the RECs toward GWSA emissions reduction targets (see Table 4). Although there would still be a small direct benefit from selling the REC into the oversupplied market, assumed to be $2 in this analysis, there would be a greater indirect benefit of retaining the REC for GWSA compliance and avoiding a future ratepayer cost to obtain additional clean energy to meet emission reduction targets.

[7] "[P]rovided that the department of energy resources has not notified the distribution company that the renewable energy certificates should be retained to facilitate reaching emission reduction targets pursuant to chapter 298 of the acts of 2008 or chapter 21N of the General Laws, [the EDCs] shall sell the purchased renewable energy certificates to minimize the costs to ratepayers under the contract," Acts of 2016, Chapter 188.

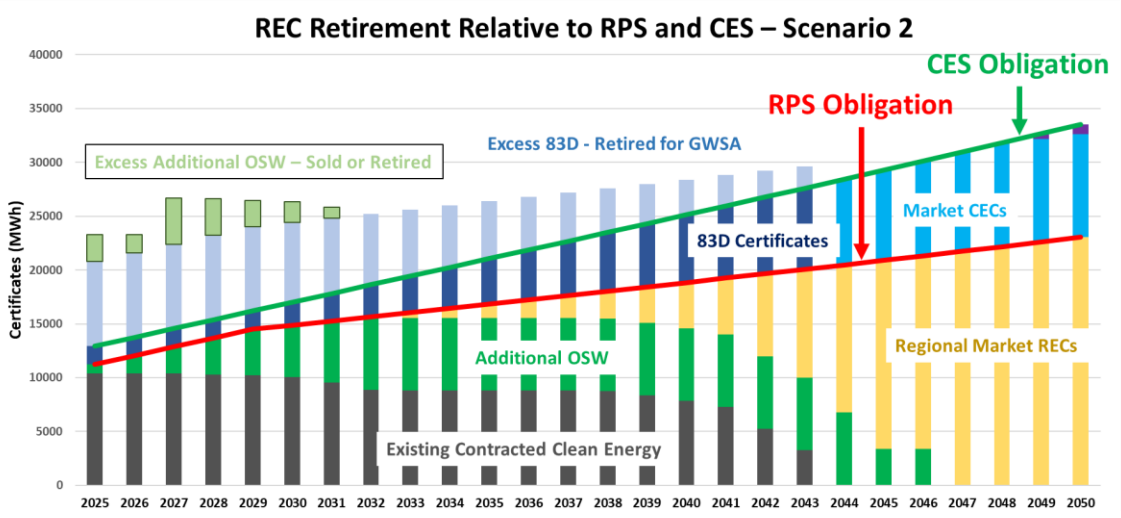

Figure 5: REC Retirement Relative to RPS and CES

Quantitative Net Benefits Analysis	Levelized Net Benefit or (Cost) ($/MWh)	
	Sell Excess RECs	Retire Excess RECs for GWSA
Scenario 1	$16	$18
Scenario 2	$2	$4
Scenario 3	$13	$14

Table 4: Benefit of Retiring Excess RECs

6. ***There are benefits to continuing to enable the pairing of energy storage with offshore wind although analysis also shows the benefit of standalone storage on the grid that could enable grid flexibility for a number of resources including multiple offshore wind facilities.***

Offshore wind is an intermittent resource, generating electricity when the wind blows and not in response to electric demand. To support a growing amount of intermittent renewable energy generation, energy storage will need to be developed to charge during low cost periods when there is excess offshore wind and discharge during high cost peak times. Pairing energy storage with offshore wind will allow the Commonwealth to meet peak demand times with clean energy instead of high cost and high emissions fuel oil. These benefits will also be incentivized as part of the Clean Peak Standard (CPS) regulations that are currently under development by DOER.

Energy storage can currently be procured through 83C as an allowable paired resource. Although proposals with energy storage were submitted in the first 83C solicitation, the selected project did not include paired storage. Because the contracted price from the selected project is now the price cap for future solicitations, it may be difficult to select energy storage in future solicitations. Although energy storage may provide greater benefits such as reducing costs and emissions during peak times and increasing grid flexibility, the additional cost of a paired energy storage project may be challenging under the current price cap.

Analysis showed that the greatest benefits came from energy storage systems that were connected directly to the grid instead of behind the meter of the additional offshore wind. Behind the meter, the energy storage system can charge with excess offshore wind and discharge during times of high demand. Connected to the grid in front of the meter, the energy storage system could operate similarly but also provide other services to the system when not being utilized by the offshore wind. This would maximize the benefits of the energy storage without increasing cost.

7. ***While the expiration of the federal Investment Tax Credit (ITC) at the end of 2019 is expected to have a short-term impact on the cost of offshore wind, the cost of offshore wind development is currently expected to decline over time with improvements to technologies and supply chain.***

The cost of offshore wind has declined significantly in the last several years largely due to the increase size of the turbines which yield greater energy production while minimizing infrastructure costs. In the United Kingdom, this has led to a price decline of over 50 percent between its auctions held in 2015 (£120/MWh) versus 2017 (£57.50). Along with technology improvements, growth of the U.S. domestic offshore wind supply chain is anticipated to reduce costs by lowering shipping costs and minimizing risk of disruption to construction schedules. Current projections anticipate that the levelized cost of energy will decline by approximately 3 percent per year between 2020-2030.[8] While the expiration of the federal ITC may have a short-term effect on the price of offshore wind, the long-term trend of declining costs is anticipated to continue due to these additional factors.

8. ***At this time, procurements that provide long-term contracts are necessary for offshore wind projects to be financed and constructed.***

Currently the Independent Service Operator New England's (ISO-NE) wholesale market is unable to provide enough revenue and certainty to secure financing to construct offshore wind projects. ISO-NE's Forward Capacity Market (FCM) provides a fixed revenue stream that is estimated to cover roughly just ten to fifteen percent of the fixed costs to build and operate an offshore wind project.[9] In contrast, ISO-NE's FCM provides a fixed revenue stream that is estimated to cover roughly two-thirds of the capital cost of a new gas-fired plant for its first seven years of operation.[10] Other revenue sources from energy and REC markets are volatile making it challenging to finance offshore wind. Given the inability for offshore wind developers to receive sufficient revenue certainty from the wholesale market, offshore wind projects will not be able to be financed and constructed solely from the wholesale market at this time.

[8] Annual Technology Baseline Data, National Renewable Energy Laboratory, 2018
[9] RENEW, written stakeholder comment, March 2019.
[10] Id.

9. ***However, there are risks with having a significant portion of electricity demand under long-term contracts.***

The EDCs collectively have executed a total of 62 long-term contracts, ending at various times, for a total financial commitment of over $22 billion. Annually, 1,600 MW of offshore wind represents 6,000,000 MWh of energy or 15 percent of EDC demand. With an additional 1,600 MW of offshore wind, over half (approximately 60 percent) of the EDCs electricity load will be supplied through long-term contracts instead of the wholesale competitive markets. This high amount of energy tied up in long-term contracts may impact wholesale markets and may shift risk to ratepayers as energy markets change. Flexibility to capture declines in cost and other benefits from changes in technologies could be lost over time.

Successful procurements "rely on the strong balance sheets and credit profiles" of the EDCs to secure the most competitive bids and lowest prices.[11] The EDCs have stated that the "cumulative impact of these long-term obligations could ultimately negatively affect the financial profiles of the Distribution Companies."[12] The Massachusetts Department of Public Utilities' (DPU) order for the Vineyard Wind contract acknowledged the size of the EDCs' contracting obligation and the possibility of these contracts could "negatively impact the Companies' credit ratings and result in increased costs that would ultimately be passed on to ratepayers".[13]

Also, as more clean energy enters the competitive wholesale market through fixed long- term contracts, some stakeholders stated that there is a risk that financial institutions will lose confidence in the market, leading to increase energy prices for ratepayer. These additional risks to ratepayers due to the size and number of these contracts cannot be quantified at this time and may change as market rules and regulations shift over time.

Findings – Solicitation Process

1. ***Predictable, staggered offshore wind procurements targeting 800 MW has the potential to capture additional economic benefits of a growing offshore wind industry in the Northeast.***

Northeast states including New York, New Jersey, and Connecticut are pursuing aggressive offshore wind targets, showing a large opportunity for the growth of a northeast offshore wind industry. A staggered predictable procurement schedule would provide increased market visibility which would lead to greater predictability in the market for supply chain providers, lowering risk of investment in Massachusetts. Staggering solicitations enables multiple points for developers to enter the market while protecting ratepayers and the Commonwealth from being over reliant on one project.

As a region, an organized pipeline of offshore wind solicitations in the U.S. may increase investments in domestic supply chain services. This contributes to lower offshore wind costs by minimizing shipping costs and disruption in construction schedules. Staggering solicitations is important as it enables

[11]Section 83 Distribution Companies Joint Testimony, DPU 18-76 through 18-78, page 41.
[12] Id. at 42.
[13] DPU Order, DPU 18-76 through 18-78, page 69.

multiple points for developers to enter the market while protecting ratepayers and the Commonwealth from being over reliant on one project. A procurement schedule would clearly indicate to neighboring states when Massachusetts would be undertaking solicitations, fostering an opportunity for improved coordination of procurements.

Additionally, efforts are underway to consider the extension of the federal ITC for offshore wind projects. The federal ITC has an impact on project financing and could impact the procurement schedule.

2. ***Ideally, solicitations should be at least 24-30 months apart to adequately capture lessons learned from prior solicitations, provide sufficient time for stakeholder feedback, create robust competition and to better align with the growth in the RPS and CES markets.***

Utilizing a staggered procurement schedule with 800 MW solicitations will allow for projects to be evaluated as energy and RPS markets change, while capturing economies of scale and anticipated declines in cost. Effective and successful solicitations required significant time from an experienced and diverse team. Contracts entered into by the EDCs are multi-billion-dollar contracts that have long-term cost implications on ratepayers and require adequate time to develop a fair process to fully evaluate the proposals. Additionally, stakeholder feedback has assisted the RFP process and adequate engagement requires time to complete to incorporate lessons learned. Figure 6 summarizes the necessary steps and milestones required to undertake a solicitation in Massachusetts. The process takes approximately 24-30 months to complete process. Therefore, solicitations should occur no sooner than 24 months following the issuance of the RFP.

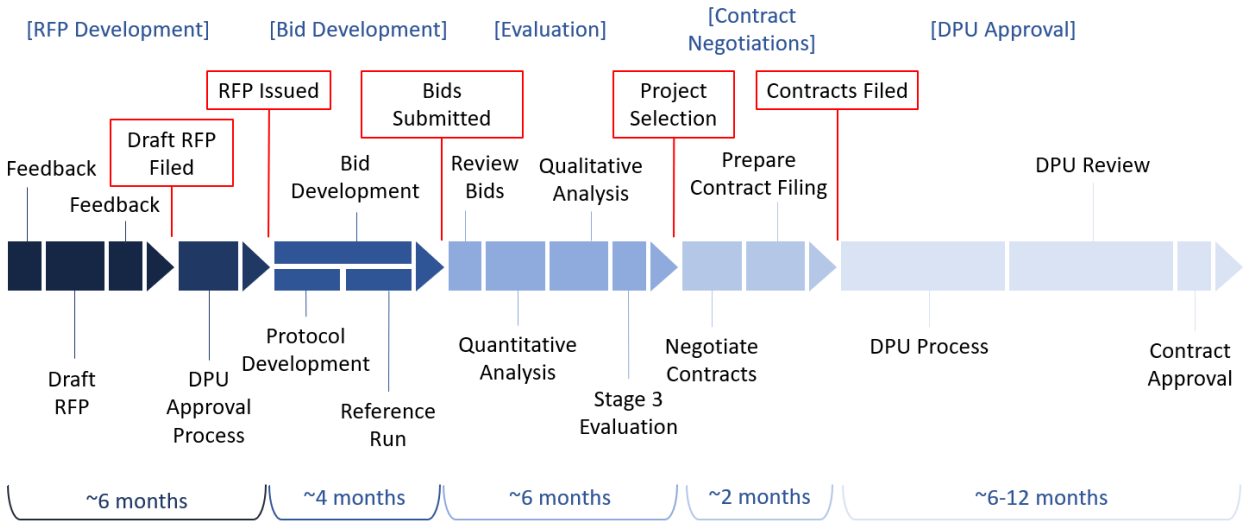

Figure 6: Procurement Process Timeline

Allowing for time between solicitations also provides benefits in the RPS and CES markets which increase annually. Too much procured clean energy in a short period of time will saturate the REC

market with an oversupply of certificates, greatly reducing their value and therefore the overall benefit and cost-effectiveness of the project.

3. ***In order to evaluate benefits of independent transmission and maximize transmission competition, potential transmission solutions would need to be identified and evaluated prior to the solicitations for 1,600 MW of additional offshore wind.***

With the passage of the Clean Energy Act of 2018, DOER is now able to require distribution companies to jointly and competitively solicit and procure proposals for offshore wind energy transmission. Independent transmission has the potential benefit of minimizing impact on fisheries, optimizing the transmission grid, and reducing costs. These potential benefits must be weighed against potential cost to construct the network and potential risks of stranded costs if the system is not operational when required by generation assets.

In order for a transmission solution to be open to wider competition and for the benefits to be evaluated effectively, a transmission only solicitation would need to be separate from the energy generation and would need to be completed before the offshore wind generation is solicited.

For example, following a one-time transmission only solicitation, a preferred option for independent transmission could be contingently selected. In the subsequent solicitations for offshore wind generation, bidders would be required to pair their generation with both a generator lead line construction and the preferred independent transmission solution from the previous one-time solicitation for independent transmission. This would allow evaluation of two options for each offshore wind generation bid: one with a generator-lead line and one with the independent transmission option. Then the most beneficial option to ratepayers could be selected.

4. ***The offshore wind industry is rapidly evolving, and other states are undertaking efforts outside of the procurements to secure economic development.***

The landscape on offshore wind sector has changed dramatically since 2016. Offshore wind developers are not as reliant on Massachusetts procurements in order to build projects because multiple other states are issuing solicitations for offshore wind energy. The solicitation processes in other states are also evaluating economic development as a component of their procurement, creating increased competition for Massachusetts to secure the economic development opportunities. Outside of procurements, other states are creating offshore wind tax credit programs and making investments in port infrastructure to increase economic development within their state. Notably, New Jersey with its $100 million offshore wind tax credit program, New York with its $200 million support for port infrastructure, and Connecticut with its $35.5 million investment its port facility in New London, are taking additional steps outside of energy procurements to position themselves for greater economic activity. The assumption that economic development will be secured solely through procurements no longer holds true. The Commonwealth should also recognize that economic development funded through procurements is ultimately reflected in the price for offshore wind, which increases costs for electric ratepayers. In order for Massachusetts to maintain its leading position, the state should

continue to create economic development programs outside of the procurements in addition to continuing to evaluate it as a criterion within the procurements processes.

5. ***As part of the solicitation process, the EDCs make up the Selection Team. Although some stakeholders have raised concerns about the Selection Team because of EDC-affiliated companies, the Independent Evaluator participates in and monitors the solicitation to ensure a fair and objective process, especially regarding any affiliate relationships.***

The EDCs are the contracting parties who have undertaken the procurements in Massachusetts. The EDCs have affiliate companies that are unregulated owners of generation and transmission assets, and in some cases have been a part of a developer's team who has submitted proposals to the procurements being undertaken by the EDCs. Due to the potential for a conflict of interest, a stringent code of standards has been put in place and statute requires an independent evaluator has been hired to "ensure an open, fair and transparent solicitation and bid process that is not unduly influenced by an affiliate company".[14] In each procurement, the independent evaluator has concluded that the process was properly and fairly conducted and the bid selection decision was objective and in accordance with RFP criteria.

Under the established process, the selection team is comprised of the EDCs and if the EDCs cannot unanimously agree on the same bid, the final binding decision would be made by DOER, after consulting with the independent evaluator. In the recent 83C and 83D solicitations, the EDCs could not reach unanimous agreement and the selection was made by DOER. Other states that are undertaking similar procurements have different procedures as established through their own laws and regulations. For example, in Connecticut, the EDCs are a part of the evaluation team, but the selection of the projects is made by the Commissioner of the Department of Energy and Environmental Protection, in consultation with others.

Recommendations

1. ***The EDCs should proceed with additional offshore wind solicitations for up to 1,600 MW of offshore wind and only enter into contracts if found to be cost-effective.***

Based on the information that DOER has before it at this time, an analysis on costs and benefits of an additional procurement justify moving forward with up to 1,600 MW of additional offshore wind solicitations. Given uncertainty around regional REC market projections, the cost effectiveness of all proposals should continue to be evaluated at the time of the solicitation. To protect ratepayers, any future solicitations should maintain a price cap similar to the price of the first 83C contract.

Under current market conditions, in order to capture the greatest impact to the Massachusetts Greenhouse Gas Inventory for GWSA compliance while reducing ratepayer costs, incremental offshore wind RECs should first be used to offset existing regulatory compliance costs associated with the RPS

[14] Section 83C(f)

and CES. Once so met, if there are additional offshore wind RECs that exceed the Massachusetts RPS and CES obligations, these certificates should be retained in Massachusetts for GWSA compliance instead of being sold.[15] This ensures Massachusetts ratepayers receive an additional benefit of the greenhouse gas emissions reduction from the offshore wind projects.

2. ***Using the solicitation process framework for offshore wind generation provided in Section 83C, the additional procurements should be conducted for up to 800 MW in 2022, 2024 and, if necessary, to meet the procurement target, 2026. DOER should conduct a technical conference to assess whether and/or how a solicitation for independent transmission should occur and if necessary, issue a separate contingent solicitation for independent transmission in 2020 prior to additional solicitations for offshore wind.***

The proposed schedule strikes a balance between capturing cost effectiveness offered by later procurements with a steady pipeline of solicitations to spur and maintain economic development opportunities. A defined schedule provides market visibility for supply chain development, increasing opportunities for economic development and benefits for the Commonwealth. Visibility on the schedule will also increase opportunity to coordinate with other states and other solicitations.

Beginning the additional offshore wind solicitations will increase the likelihood of cost-effective proposals and successful solicitations. This timing aligns future development with the growing demand for clean energy in RPS and CES markets. Additionally, this schedule will leverage the anticipated cost declines of the technology. However, if changes are made to federal ITC, the schedule should be adjusted as appropriate.

[15] Under Acts of 2018, Chapter 227, DOER may notify the EDCs to retain any renewable energy certificates to facilitate reaching emission reduction targets.

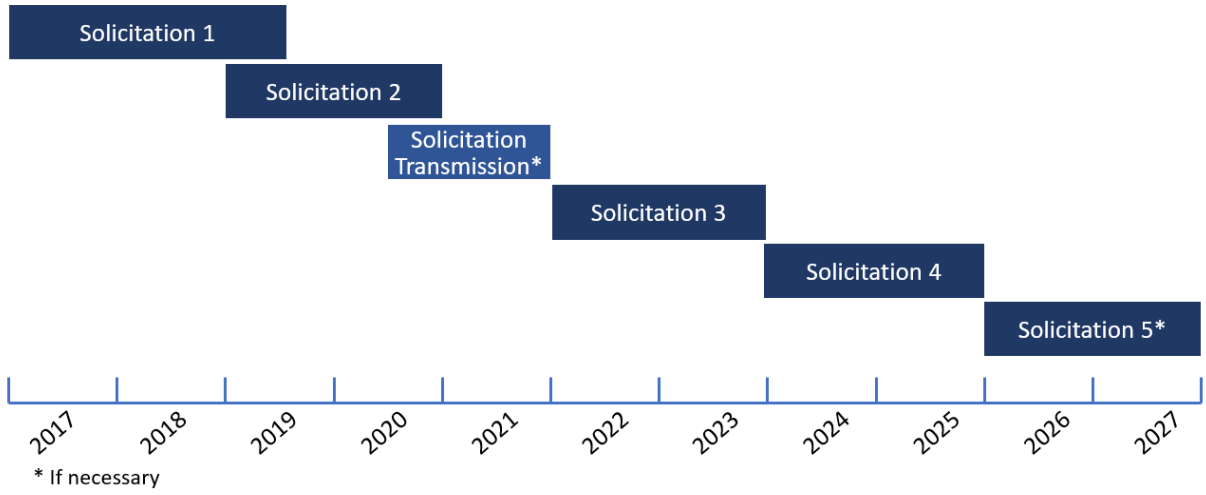

Figure 7: Procurement Schedule

The only feasible way to evaluate the benefits and cost effectiveness of independent transmission is to undertake a separate one-time transmission only process prior to undertaking a solicitation for generation. DOER should hold a technical conference with stakeholders to evaluate whether a solicitation for independent transmission should occur and how the solicitation should be undertaken. The transmission solicitation could occur in 2020, prior to the solicitation for the additional offshore wind generation, which would follow the solicitation process and framework provided in Section 83C. If the solicitation results in the identification of a preferred transmission solution, the additional offshore wind solicitation may include a requirement for generation developers to propose projects that utilize the identified transmission.

3. ***DOER should consider the benefits of an energy storage solicitation along with continuing to allow paired storage in the additional offshore wind solicitation.***

Analysis showed that there are benefits to energy storage, especially with grid-connected systems, by providing grid flexibility as intermittent renewable generation increases. Securing energy storage paired with offshore wind generation as currently allowed through the offshore wind solicitations may be challenging because the price cap was set in the first 83C solicitation by a project without paired energy storage. Although the addition of energy storage may increase the overall benefits of the project, it would likely also increase the cost to the contract. Completing an energy storage solicitation separately and in addition to the offshore wind solicitation may identify cost-effective creative energy storage solutions that maximize energy storage benefits. A separate energy storage solicitation may also help meet any obligations created by the Clean Peak Standard more cost-effectively.

4. The Commonwealth should continue to evaluate ways to cost-effectively finance clean energy, reduce risk to ratepayers and improve the procurement process.

There are multiple areas that DOER should continue to study as the Commonwealth moves forward with additional offshore wind solicitations.

- First, further assessment would be useful in determining the effect long-term contracts have on the EDCs balance sheets and wholesale markets. Since 2008, the Massachusetts EDCs have assembled a portfolio of cost-effective clean and renewable energy power purchase agreements (PPAs) under the Green Communities Act and subsequent amendments with over half (approximately 60 percent) of the EDCs' electricity load anticipated to be supplied through long-term contracts instead of the wholesale competitive markets. The need, costs, and risks to Massachusetts ratepayers for long-term contracts should be continuously evaluated in the context of our changing energy landscape.

- Second, while offshore wind provides unique energy and environmental attributes, the Commonwealth's energy and environmental goals and the competitiveness of the wind industry would benefit from comparative evaluation of all renewable and clean energy resources through the competitive solicitation process. Offshore wind has intrinsic resource attributes that make it particularly compelling, including coincident production with expensive winter peak periods, relative close proximity to electric load, and onshore economic development opportunities. However, there continues to be rapid innovation in all renewable and clean energy resources and as evidenced by the sharp decline in pricing in offshore wind just two years from the enactment of the Energy Diversity Act of 2016, expectations of future pricing of other resources may also change quickly. As a result, DOER recommends that the statute be revised to authorize the Commissioner of DOER, after review, to expand eligible resources under competitive solicitations to include other RPS and CES resources. This would allow the Commonwealth to compare all clean and renewable resources and advance the clean or renewable project that best meets the environmental, economic, and energy goals of the GWSA while eliminating the need for a statutory price cap for offshore wind projects. This change would proactively address the chance of not identifying a cost-effective project through future solicitations if pricing were to fall for other renewable and clean resources while increasing for offshore wind.

- Additionally, although the Independent Evaluator stated the first 83C solicitation was "properly and fairly conducted,"[16] some stakeholders have suggested that DOER, after participating as a member of the Evaluation Team and in consultation with the Independent Evaluator, should select this winning proposal following written recommendation from each of the EDCs. DOER recommends continuing to utilize the

[16] Independent Evaluator Report, DPU D.P.U. 18-76/18-77/18-78

Independent Evaluator and assess the selection process and whether there are opportunities for improvement in order to minimize any identified risk from affiliated projects.

5. ***While procurements should continue to encourage developers to maximize economic development opportunities, the Commonwealth should evaluate whether there is value in doing economic development for the offshore wind industry outside of the procurements.***

There is a limit to the amount of economic development that can be financed through the contracts if the pricing of any additional offshore wind procurements continues at or declines below current levels to help achieve cost-effectiveness. Also, as more economic development is included in procurements, there is a risk that it could increase the cost of electricity contracts, which could have detrimental impact on economic development for other energy-intensive industries. Therefore, Massachusetts procurements should continue to encourage developers to maximize economic development opportunities and we should continue to include it as evaluation criterion. However, consideration should be given to the balance of having economic development costs in the procurement contracts which impacts electricity rates versus other economic development mechanisms outside these contracts. It is worthwhile to continue to look at economic development outside of the procurements to enable an "industry cluster" to develop in the Commonwealth.

Appendix A: State Offshore Wind Economic Development

State	Procurement	Economic Investment
Massachusetts	• Authority to procure 1,600 MW of cost-effective offshore wind by 2027 • Authority for DOER to require an additional 1,600 MW to be solicited by 2035	• +$100m state investment in port infrastructure in New Bedford • Secured $15m from developer for offshore wind accelerator fund. • Secured $15m in resiliency and affordability funds • Secured $16m in host community agreement
Connecticut	• Authority to procure 3% of load from offshore wind • Authority to procure zero carbon resources which include offshore wind • Pending legislation proposes to establish 2,000 MW offshore wind goal"	• $35.5m state investment its port facility in New London • Secured $35m from developers for port improvements and other in-state construction commitments • $22.5m in previously committed from developer for State Pier infrastructure improvements
New Jersey	• Authority for 3,500 MW of offshore wind by 2030	• $100m Offshore Wind Tax Credit Program
New York	• Authority for 2,400 MW of offshore wind by 2030 • State goal for 9,000 MW of offshore wind by 2035	• $200m state investment in port infrastructure
Rhode Island	• No set target for offshore wind • Procuring offshore wind under two statutes for renewable energy	• Secured $40m from developers for port improvements
Maryland	• 2.5% carve-out for offshore wind in the RPS • Legislation passed to double the RPS, requiring 1,200 MW of additional offshore wind to meet 2.5% carve-out	• Secured $39.6m for port improvements and $76m in steel fabrication plant from developers

Appendix B: Stakeholder Engagement List

DOER would like to thank the many stakeholders that provided feedback in the offshore wind study process either through coordinated meetings with DOER staff and consultants or through written comments. The feedback received was instrumental in the identification of areas for investigation and guidance on recommendations. DOER will continue to work with stakeholders on offshore wind matter as local development continues.

For written stakeholder comments, please refer to https://www.mass.gov/service-details/offshore-wind-study

Stakeholder Engagement List	
Acadia Center	New Bedford Port Authority
Anbaric	New Bedford Seafood Consulting
Associated Industries of Massachusetts	New England Power Generation Association
Atlantic Wind Connection	Northeastern University
Bristol Community College	Old Bedford Village Community Development
Calpine	Orsted
CLF	POWER-US
Commercial Fisherman (various)	Renew Northeast
Environment Massachusetts Research and Policy Center	Responsible Offshore Development Alliance
Environmental League of Massachusetts	Richard Kerver
Environmental Organization Consortium	Seakeeper
Equinor	Self-Reliance Corporation
Eversource	Siemens Gamesa
Fisheries Survival Fund	Sierra Club
HQ US	Southeastern Massachusetts Consortium
ISO-NE	The Energy Consortium
K2 Management	Tufts University
Martha's Vineyard Fishermen's Preservation Trust	University of Massachusetts- Amherst
Mass Audubon	University of Massachusetts - Dartmouth
Massachusetts Lobstermen's Association	University of Massachusetts - Lowell
Mayflower Wind	Union of Concerned Scientists
National Grid	Unitil
National Wildlife Federation	Vineyard Wind
Nature Conservancy	Woods Hole Oceanographic Institution
New Bedford Economic Development Council	