

Offshore Wind Working Group Report to the Governor



June 29, 2018

**Prepared by the DNREC Division of Coastal, Climate, and Energy
and Synapse Energy Economics**

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Glossary

BOEM	Bureau of Ocean Energy Management
capex	capital expenditure
CO ₂	carbon dioxide
COD	commercial operation date
CZA	(Delaware) Coastal Zone Act
DEC	Delaware Electrical Cooperative
DEMEC	Delaware Municipal Electric Corporation
DE WEA	Delaware Wind Energy Area; designated by BOEM
DOE	(U.S.) Department of Energy
DPL	Delmarva Power & Light
HVAC	high-voltage alternating current
HVDC	high-voltage direct current
IO&M	installation, operations, and maintenance
IRR	internal rate of return
kW	kilowatt; 1,000 watts
kWh	kilowatt hour
LBNL	Lawrence Berkeley National Laboratory
LCOE	levelized cost of energy; the average cost of energy over time in current dollars
MD WEA	Maryland Wind Energy Area; designated by BOEM
MW	megawatt; 1,000 kilowatts
MWh	megawatt hour; 1,000 kilowatt hours
Nm	nautical miles
NO _x	nitrogen oxides
NREL	National Renewable Energy Laboratory
O&M	operation and maintenance
OCS	Outer Continental Shelf
OEM	original equipment manufacturer, e.g. turbine manufacturer
OREC	offshore wind renewable energy credit; one MWh of output of an offshore wind project as defined in Maryland law
OSW	offshore wind
PJM	PJM Interconnection, LLC; the regional grid operator serving Delaware and the Mid-Atlantic region
PPA	power purchase agreement
REC	renewable energy credit
REPSA	Renewable Energy Portfolio Standards Act; 26 <i>Del.C.</i> Chapter 1. Subchapter III-A ; Delaware's renewable energy law
RPS	renewable portfolio standards
SREC	solar renewable energy credit
SO ₂	sulphur dioxide
WEA	wind energy area; an area of federal waters designated by the Bureau of Ocean Energy Management (BOEM) for offshore wind development

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1. Executive Summary

On August 28, 2017, Governor Carney signed Executive Order 13 (Appendix A) creating the Offshore Wind Working Group “to study how Delaware can participate in developing offshore wind, identify ways to leverage the related economic opportunities, and make specific recommendations for engaging in the development of offshore wind for Delaware.” More specifically, EO 13 charged the Working Group with the following tasks:

5. The Working Group shall convene no later than September 30, 2017 and shall consider at least the following matters:
 - a. Review of the pertinent laws and regulations governing the development of offshore wind, and recommendations of changes to laws and regulations;
 - b. Review of the environmental benefits of developing offshore wind for Delaware;
 - c. Review of the economic opportunities presented by the offshore wind industry;
 - d. Consideration of the benefits and costs of developing offshore wind, including environmental and health benefits, energy market impacts, economic opportunities and rate impacts; and
 - e. Identification of the barriers and opportunities involved in developing offshore wind to benefit Delaware.

6. No later than December 15, 2017, the Working Group shall submit a report to the Governor that includes at least the following:
 - a. Report on the relevant laws, regulations, benefits, costs, barriers and opportunities for developing offshore wind to serve Delaware;
 - b. Recommendations for shorter- and longer-term strategies for procuring offshore wind power to serve Delaware;
 - c. Recommendations for plans to develop job opportunities for Delaware in the offshore wind industry; and
 - d. A draft of any necessary implementing legislation including possible amendments to Delaware’s Renewable Energy Portfolio Standards Act.

The Working Group was established after Maryland’s Public Service Commission approved two offshore wind projects in 2017. US Wind won approval to build 248 MW off of Ocean City. Deepwater Wind won approval to build 120 MW off of Rehoboth Beach. These projects are being built to serve Maryland’s electric customers and spur economic development in Maryland. Maryland’s electric customers will pay for the projects, and Maryland’s Public Service Commission included specifications for economic development in approving the projects. They are being built in federal offshore wind energy areas established by the Bureau of Ocean Energy Management, which is part of the U.S. Department of the Interior.

The first offshore wind project in the US, the 30 MW Block Island project was built in 2016. The two Maryland projects will total 368 MW. Massachusetts, Rhode Island, Connecticut, New York and New Jersey are also preparing or implementing plans to solicit proposals to build offshore wind. The Working

Group was presented analysis from several experts that offshore wind prices are likely to fall significantly as development ramps up and the industry supply chain develops.

The Working Group met eight times, and considered material submitted by a variety of sources, all of which is found on DNREC's offshore wind webpage, found at www.de.gov/offshorewind. The recommendations are found in a memorandum to the Governor, dated December 15, 2017 (Appendix B), and a further set of draft recommendations, dated May 15, 2018 and revised on June 22, 2018 (Appendix C).

First, the Working Group recommended no immediate procurement of offshore wind from a project already approved by another state. This specifically applies to the Maryland projects. One of the developers (Deepwater Wind) had expressed an interest in adding capacity to the project to serve Delaware. The Working Group did not recommend such a procurement.

Second, the Working Group said that several options deserve further consideration, including:

- ▶ A large scale purchase
- ▶ Incremental commitments to future projects
- ▶ Waiting until more developers propose projects in the Mid-Atlantic region
- ▶ Evaluating other renewable resources in lieu of offshore wind

The Working Group posed a series of questions for further review and analysis in order to consider these options. These questions cover project cost, rate impacts, cost allocation, environmental impacts, and economic costs and potential benefits.

Those questions were further developed in the draft recommendations developed by the Working Group on April 23, which are organized around three key questions:

1. What factors need to be considered before Delaware can respond when a company proposes to develop offshore wind to serve Delaware?
2. What factors need to be considered in a decision as to whether the State would solicit or purchase energy, capacity or renewable energy credits (RECs) from an offshore wind project?
3. What would Delaware need to do to position itself to become the location for part of the supply chain for offshore wind projects in the Mid-Atlantic?

These three questions are broken down into more detailed questions for further analysis.

This report is presented in two parts. Sections 1 through 9 were prepared by DNREC staff and Synapse Energy Economics to summarize the information and analysis presented to and discussed by the Working Group. Section 10 presents the Recommendations developed by the Working Group as captured in the Memorandum to the Governor of December 15, 2017 and the Recommendations dated May 15, 2018 and revised on June 22, 2018.

2. Offshore Wind Working Group

Members

Chair: Bruce Burcat, *Executive Director, Mid-Atlantic Renewable Energy Coalition*
Senator David McBride
Senator Harris McDowell
Representative Ronald Gray
Representative Trey Paradee
Jeff Bullock, *Secretary of State*
Shawn Garvin, *Secretary, Department of Natural Resources and Environmental Control*
Robert Howatt, *Executive Director, Public Service Commission Staff*
Raj Barua, *Executive Director, Public Service Commission Staff*
(Mr. Howatt retired and was replaced by Mr. Barua.)
Drew Slater, *Public Advocate*
Albert Shields, *Policy Director, Office of the Governor*
Mario Giovannini, *Director of Energy Acquisition, Delmarva Power & Light*
Patrick McCullar, *President and CEO, Delaware Municipal Electric Corporation*
Mark Nielson, *Vice President, Staff Services, Delaware Electric Cooperative*
Dr. Jeremy Firestone, *Director, Center for Carbon-Free Power Integration, University of Delaware*
Brenna Goggin, *Director of Advocacy, Delaware Nature Society*
Jeffery Gordon, *President, American Birding Association*
Guy Marcozzi, *President and CEO, Duffield Associates*
Collin O'Mara, *President and CEO, National Wildlife Federation*
James Maravelias, *President, Delaware State AFL-CIO*

Staff

Thomas Noyes
Jessica Quinn
Kathleen Harris
DNREC Division of Climate, Coastal, and Energy

Consultants

Max Chang
Spencer Fields
Synapse Energy Economics

Public Comments

Members of the public were afforded the opportunity to comment at each of the Working Group meetings, Public comment workshops were held in Lewes, Odessa, New Castle and Bethany Beach, drawing about 180 total participants. Transcripts of each of the public comment workshops were prepared. Additionally, more than 50 written comments have been received.

A webpage was established (www.de.gov/offshorewind) to compile and make public the agendas, minutes, reports, analysis, reference materials, transcripts and public comments relating to the Working Group's deliberations.

3. Delaware and Offshore Wind

In 2006, the General Assembly passed the Electric Utility Retail Customer Supply Act EURCSA (House Bill 6) which included a provision for soliciting proposals to build generation in Delaware. Three proposals were submitted: a new coal-fired plant, a new natural gas-fired plant, and an offshore wind project submitted by Bluewater Wind. After the four state agencies tasked with approving one of the projects could not agree on approval of the offshore wind proposal, the General Assembly took up the matter. A resolution urging the agencies to approve a PPA with Bluewater Wind passed the House. After further negotiations, Senate Bill 328 approving a 200 MW offshore wind farm passed the Senate and House in June of 2008. Following the bill's passage and the subsequent approval by the Delaware Public Service Commission (PSC), Bluewater Wind was expected to be the first offshore wind project in the United States.

Bluewater Wind was acquired by Babcock & Brown, an Australian firm, which sold the company to NRG. NRG followed through with studies and development work for two years before cancelling the project in December of 2011. The statutory provisions to encourage offshore wind development that were adopted in 2008 have since expired.

4. Wind Power Cost Trends

Offshore wind generation has been part of the European electric grid for over 25 years, since the first offshore wind turbine was installed in Denmark in 1991. A report from Wind Europe states that as of December 31, 2016, Europe had a total of 12,631 MW from 3,589 grid-connected wind turbines in ten countries. In 2016 alone, an additional 1,558 MW of capacity was added to the grid. While offshore wind may have an upfront cost that is more expensive than traditional energy technologies, the costs of energy and installation decrease as additional offshore wind turbines are installed in part due to economies of scale the subsequent projects experience. A report by Bloomberg New Energy Finance states that:

Onshore wind levelized costs will fall 47% by 2040, thanks to cheaper, more efficient turbines and advanced OPEX regimes. In the same period, offshore wind costs will slide a whopping 71%, helped by experience, competition, and economies of scale.¹

During one of the Offshore Wind Working Group meetings, the members were presented with information about offshore wind in Europe and the United States by Dr. Stephanie McClellan, the Director of the Special Initiative on Offshore Wind at the University of Delaware. This presentation focused on the economics of offshore wind in Europe and how these costs may be reflected in the United States. The Bloomberg New Energy Finance report from April 2017 compares the levelized costs

¹ Bloomberg New Energy Finance Offshore Wind Workshop: Market Update, April 2017.

of other sources of energy to an offshore wind project financed in the first half of 2017 with an expected commissioning date two years later.

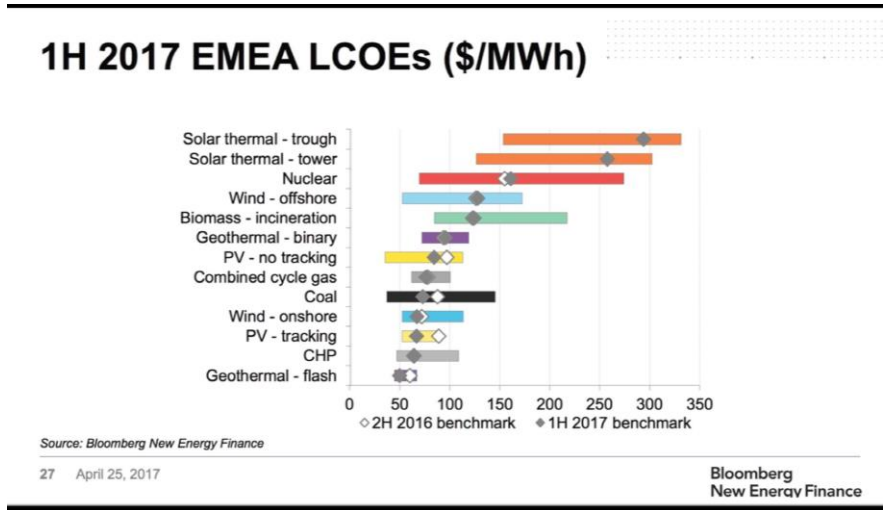


Figure 1: Levelized Cost of Electricity.²

It should be noted that there have been a number of unsubsidized offshore wind power bids accepted in Europe in 2017 and 2018, depending on location.

Onshore wind energy costs in the U.S. have decreased as more projects are built. If the same trends are assumed for offshore wind, than the energy costs should decrease as more offshore wind capacity is built.

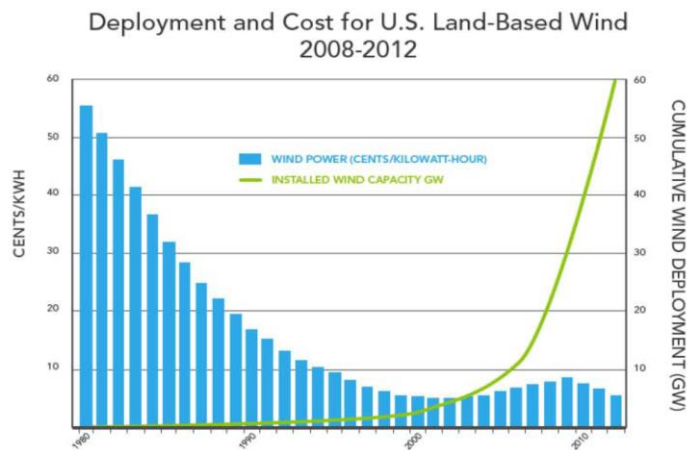


Figure 2: Deployment and Cost Trends for U.S. Land-Based Wind.³

² Ibid.

³ US Offshore Wind Energy: Future Cost Analyses and Update. Stephanie McClellan. Available at <http://www.dnrec.delaware.gov/energy/Documents/Offshore%20Wind%20Working%20Group/Briefing%20Materials/McClellan%20DE%20OWWG%20presentation%20SIOW.pdf>.

Dr. McClellan also presented information on offshore wind in the United States. In 2015, Rhode Island installed five offshore wind turbines off of Block Island, becoming the first offshore wind farm in the United States. Like the projects in Europe, the costs associated with offshore wind are also projected to decrease as the industry matures. In March 2016, the University of Delaware published the “Massachusetts Offshore Wind Future Cost Study” which projected costs for offshore wind projects of different sizes.

Project	Anticipated Financial close (year)	Project size (MW)	OSW Market Visibility in New England (MW)	LCOE (¢/kWh)
MA project proposed	2014 ^a	468	400	24¢ ^b
RI project under construction	2015	30	30	30¢ ^c
Tranche A (this study)	2020	400	2,000	16.2¢
Tranche B (this study)	2023	800	2,000	12.8 ¢
Tranche C (this study)	2027	800	2,000	10.8¢

Table 1: Projected Costs for Offshore Wind in Massachusetts.⁴

5. Offshore Wind in Maryland

In May 2017, the Maryland Public Service Commission (MD PSC) awarded offshore wind renewable energy credits (ORECs) under statute⁵ to two offshore wind projects to be built off the coast of the Delmarva Peninsula.⁶ The two projects will provide a total of 368 megawatts (MW) of capacity. The two companies to submit bids for OREC prices were Skipjack Offshore Energy, LLC, and US Wind, Inc. Skipjack is a subsidiary of Deepwater Wind Holdings, LLC.

The Maryland projects are being built to serve Maryland’s electric customers and spur economic development in Maryland. Maryland’s electric customers will pay for the projects, and Maryland’s Public Service Commission included specifications for economic development in approving the projects. They are being built in federal offshore wind energy areas established by the Bureau of Ocean Energy Management, which is part of the U.S. Department of the Interior.

⁴ Massachusetts Offshore Wind Future Cost Study. Available at <http://www.dnrec.delaware.gov/energy/Documents/Offshore%20Wind%20Working%20Group/Briefing%20Materials/MA-Offshore-Wind-Future-Cost-Study-rev-4-April-16.pdf>.

⁵ Title 20, Subtitle 61, Code of Maryland Regulations (COMAR). Available at <http://mdrules.elaws.us/comar/20.61.06>.

⁶ Maryland Public Service Commission. Order 88192. Docket No. 9431. Issued May 11, 2017. Available at <http://www.psc.state.md.us/wp-content/uploads/Order-No.-88192-Case-No.-9431-Offshore-Wind.pdf>.

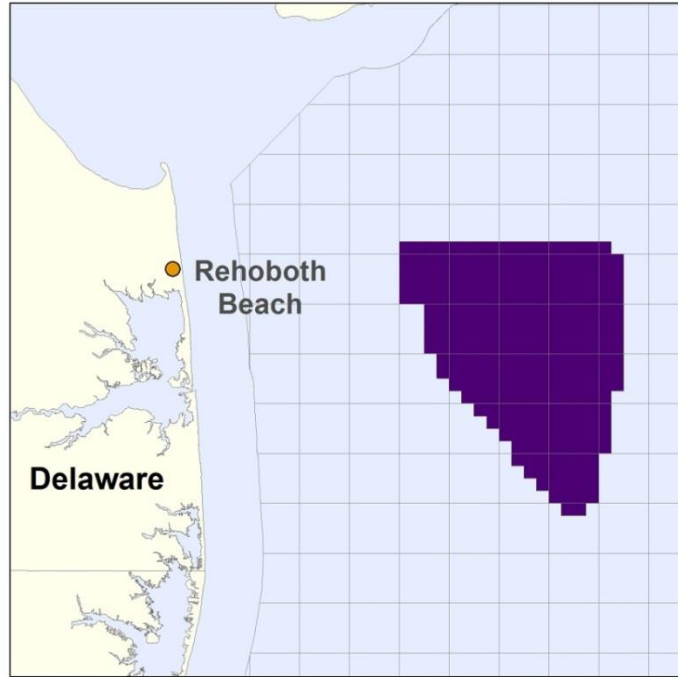


Figure 3: BOEM Delaware Wind Energy Area⁷

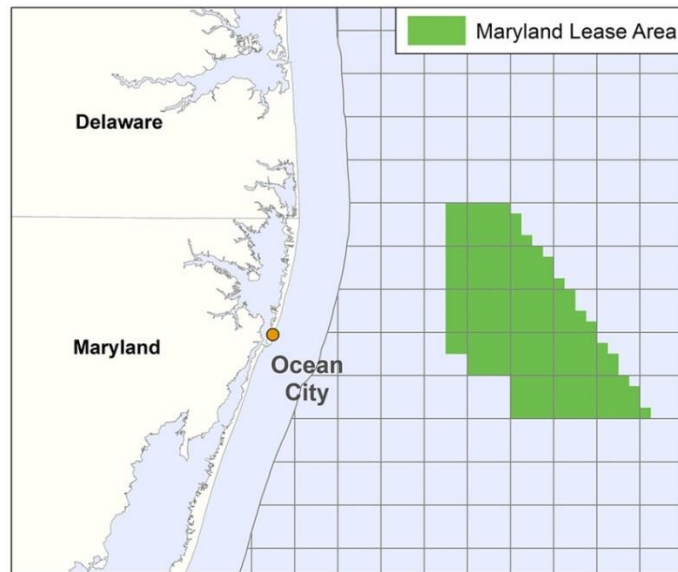


Figure 4: BOEM Maryland Wind Energy Area.⁸

⁷ Source: BOEM. <https://www.boem.gov/Delaware/>.

⁸ Source: BOEM. <https://www.boem.gov/Maryland/>.

US Wind proposed to develop a 248 MW project in the Maryland Wind Energy Area (MD WEA)), with an estimated completion date of January 2020. Importantly, the capacity that US Wind proposed to develop for the OREC credits is only a part of a larger plan to develop the Maryland WEA. Ultimately, US Wind plans to develop as much as an additional 500 MW in the WEA. Skipjack, on the other hand, proposed a 120 MW project in the Delaware Wind Energy Area, with a delivery date of November 2022, located off the coast of Delaware with delivery into Maryland. The project would only utilize the southern portion of the Delaware WEA, leaving the remainder open for future development of wind projects.

The total project costs are relatively consistent between the two proposals. The US Wind project, which is twice as large as the Skipjack project, forecasts costs to be slightly less than double those of the Skipjack proposal. The projected cost savings come from harnessing economies of scale and building smaller, less expensive turbines. US Wind proposed a total project cost of \$1.375 billion (in 2016 dollars), or \$5,544 per kilowatt of capacity installed. Skipjack’s proposed total project cost is \$720 million (in 2016 dollars), or \$6,000 per kilowatt.

Component	US Wind	Skipjack
Project size (MW)	248	120
Number of turbines	62	15
Turbine capacity (MW)	4 (or 6)	8
Commercial operation date	Jan. 2020	Nov. 2022
Project cost (\$M 2016\$)	\$1,375	\$720
Project cost (\$/kW 2016\$)	\$5,544	\$6,000
Approved OREC price (\$/MWh 2012\$)	\$131.93	\$131.93
Net OREC cost (\$/MWh 2012\$)	\$77.22	\$70.18
Projected capacity factor	42.10%	43.30%
Distance from Maryland shoreline (miles)	17	20-24

Table 2: Summary of Maryland’s Offshore Wind Projects.⁹

In Maryland, the statute requires/allows for the Commission to select offshore wind resources to receive the offshore wind renewable energy credits (ORECs). The ORECs include: energy, capacity, ancillary services, and environmental attributes.¹⁰ The OREC price threshold is set at \$190 per megawatt hour (2012\$). Further, the cumulative impact of the ORECs of projects receiving the award cannot be greater than \$1.50 per month for residential rates, or 1.5 percent of annual non-residential bills.

⁹ Chang, M. 2017. “Direct testimony on the applications of US Wind and Skipjack Wind for the development of offshore wind projects pursuant to the Maryland Offshore Wind Energy Act of 2013.” Maryland Public Service Commission Docket No. 9431. On behalf of Maryland Office of People’s Counsel. February 15, 2017. Levitan and Associates Updated Tables, March 27, 2017 ML 214210.

¹⁰ Maryland Public utilities Act §7–704.1. Available at <http://mgaleg.maryland.gov/webmga/frmStatutesText.aspx?pid=&tab=subject5&stab=&ys=2017RS&article=gpu§ion=7-704.1&ext=html&session=2017RS>.

However, there is no need for projects' OREC bids to be "at cost"; rather, they can come up with the price independent of cost of service calculations.

As proposed, the project OREC prices would have been \$177.64 per megawatt-hour for US Wind (in 2012 dollars) and \$134.36 per megawatt-hour for Skipjack (in 2012 dollars). During the course of the hearings in front of the Maryland Public Service Commission, however, the two companies proposed lower prices for their OREC bids, with the PSC ultimately awarding each company a leveled price of \$131.93 per megawatt-hour (2012 dollars).

One of the questions posed to the Working Group was whether Delaware would want to contract for additional wind power from one or both of these companies. Deepwater told the Working Group that it would have additional capacity space in its Maryland project to sell to Delaware customers. US Wind would not have additional capacity in its project. Both companies would also be interested in selling capacity from any future projects to Delaware.

6. Renewable Energy in Delaware

The Renewable Energy Portfolio Standards Act (REPSA) was first established by Senate Bill 74 in 2005, and has been amended several times. REPSA requires that Delaware's utilities procure an increasing amount of the electricity they sell from renewable resources each year until 25 percent is generated from renewable resources (3.5 percent for solar) by 2025. DPL's RPS compliance is regulated by the PSC. The Delaware Electric Cooperative (DEC) and the Delaware Municipal Electric Corporation (DEMEC), which are not subject to PSC regulation, instead develop and implement "comparable plans" under REPSA. It is projected that DPL's residential customers will see RPS costs as a percentage of their bills start to decrease in 2021.

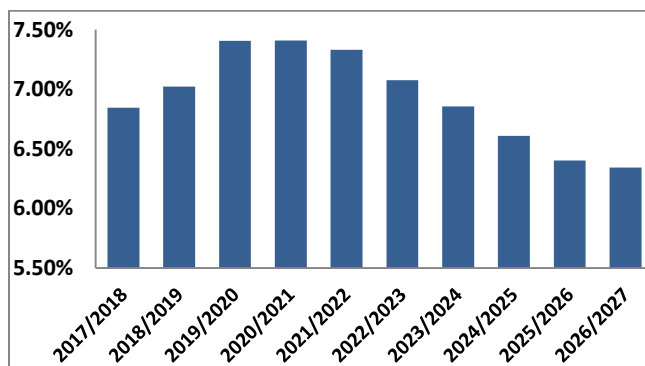


Figure 5: Projected RPS Costs, DPL Residential Customers, % of Total Bills¹¹

¹¹ DPL Integrated Resource Plan (IRP) 2016, Section 8, p. 11. Available at <http://www.dnrec.delaware.gov/energy/Documents/Offshore%20Wind%20Working%20Group/Briefing%20Materials/Delmarva%20Power%202016%20Integrated%20Resource%20Plan.pdf>.

QFCP offsets (Bloom Energy), the fuel cell project that DPL uses to offset a portion of its RPS compliance represents more than half of RPS costs. Delmarva Power projected its future RPS costs in its 2016 Integrated Resource Plan:

Projection of the Total Cost to Comply with the RPS Requirement

Planning Year	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27
Projected RECs by Source										
Solar Supply	99,838	116,172	132,450	148,772	165,139	181,379	197,485	213,735	229,574	228,846
Wind Contracts	450,755	450,755	562,883	562,883	562,883	562,883	675,011	675,011	619,896	542,735
QFCP Offsets	453,000	453,000	453,000	453,000	453,000	453,000	453,000	453,000	453,000	453,000
Spot-REC	63,313	162,243	129,168	175,513	222,713	269,366	203,330	250,683	350,827	423,449
Total RECs	1,066,906	1,182,170	1,277,501	1,340,167	1,403,735	1,466,628	1,528,825	1,592,429	1,653,297	1,648,030
REC Costs (k\$)										
Solar Supply	\$7,351	\$7,717	\$8,099	\$8,489	\$8,927	\$9,218	\$9,253	\$9,122	\$9,097	\$8,905
Wind Contract RECs	\$13,853	\$13,287	\$14,743	\$12,463	\$12,065	\$11,748	\$14,584	\$14,246	\$13,167	\$11,562
Wind Contract Net Energy Cost	\$3,296	\$3,035	\$2,468	\$1,234	-\$1,046	-\$1,444	-\$1,761	-\$1,616	-\$1,954	-\$1,711
QFCP Offsets	\$32,488	\$31,656	\$33,462	\$32,780	\$31,919	\$32,036	\$31,911	\$32,082	\$32,745	\$34,592
Spot-REC	\$712	\$2,173	\$2,069	\$3,227	\$4,499	\$5,473	\$3,701	\$3,943	\$4,556	\$4,383
Total RPS Compliance Costs (k\$)	\$57,700	\$57,868	\$60,841	\$58,192	\$56,363	\$57,031	\$57,688	\$57,777	\$57,611	\$57,731

Figure 6: DPL’s Projected RPS Costs by Category¹²

The potential impact that an offshore wind project would have on these projected RPS costs are discussed in Section 8 of this report.

7. Environmental Benefits and Costs

Environmental Benefits

The Working Group considered some of the benefits of offshore wind. Staff presented several different results based on different methods for calculating the avoided emissions from an offshore wind project.

These decreases in air emissions depend on location and the effects of renewable energy on the dispatch of other generating unit. It was noted that the Levitan Report to the MD PSC projected lower avoided emissions for offshore wind compared to land based wind. This result was based on the assumption that a wind project located close to a cluster of coal plants would displace more coal emissions than a project off of the Delmarva Peninsula (which only has one coal plant).

Calculating the emissions reductions from specific generating units is challenging. Sophisticated models are used to project the dispatch of different generating units in the PJM region in different circumstances. For this reason, this report refers to all of the studies presented to the Working Group without attempting to give one greater weight than another.

¹² Ibid. p. 10.

The Working Group reviewed different methods for projecting avoided emissions from offshore wind and other renewable resources. Staff presented this table summarizing avoided emissions based on a 200 MW wind farm.

Avoided emissions from a 200 MW wind farm	Units	CO2	SO2	NOx
Annual				
PJM average	Tons	373,667	497	283
Buonocore, et al.	Tons	455,000	1,495	618
Lifetime (20 years)				
PJM average	Tons	7,473,331	9,944	5,650
Howatt (Levitan)	Tons	9,900,000	118	13,686

Table 3: Avoided Emissions from Offshore Wind¹³

The PJM average figures assume that offshore wind would displace the PJM region’s average emissions per MWh. This is a more conservative figure than the PJM marginal rate, which is higher due to more fossil fuel generating units being dispatched when demand increases. The Levitan figures refer to the Levitan analysis presented to the Maryland PSC.¹⁴ The Buonocore figures are from a peer reviewed research paper that projects the avoided emissions from an offshore wind project off the coast of Maryland.¹⁵ Using the PJM average emissions per MWh, CO₂ reductions of offshore wind were compared to emissions from coal plants and automobiles.

Coal Plants	Value
Coal plant size (MW)	100
Average coal capacity factor	60%
Annual generation (MWh)	525,600
Average coal emission rate (lbs/MWh)	2,000
Average annual emissions (metric tons)	476,817
Offshore wind capacity required to offset emissions from a 100 MW coal unit	280

Table 4: Comparison of Avoided Emissions.¹⁶

¹³ DNREC Staff presentation. November 26, 2017. Available at <http://www.dnrec.delaware.gov/energy/Documents/Offshore%20Wind%20Working%20Group/Briefing%20Materials/dnrec-staff-presentation-owwg-20171129.pdf>.

¹⁴ Levittan & Associates. Available at http://www.dnrec.delaware.gov/energy/Documents/Offshore%20Wind%20Working%20Group/Briefing%20Materials/LevitanAssociates_UpdatedTables_27Mar17.pdf

¹⁵ Buonocore, et al. Available at <http://www.dnrec.delaware.gov/energy/Documents/Offshore%20Wind%20Working%20Group/Briefing%20Materials/BuonocoreLuckowEtAl-HealthAndClimateBenefitsOfOSW-2016.pdf>

¹⁶ Sources: <https://www.pjm.com/~media/library/reports-notice/special-reports/20170317-2016-emissions-report.ashx>; <https://www.epa.gov/greenvehicles/greenhouse-gas-emissions-typical-passenger-vehicle>.

Cars	Value
Average fuel economy (MPG)	22
Annual average vehicle miles travelled (VMT)	11,400
Gasoline consumed per year (gallons)	528
CO2 per gallon burned (lbs)	20
CO2 per car per year (metric tons)	5
Number of cars emissions avoided per 1 MW of offshore wind	364
How many cars' worth of emissions does an 8 MW wind turbine avoid?	2,911
How many cars' worth of emissions does a 50 MW wind farm avoid? (6 8MW turbines)	17,466
How many cars' worth of emissions does a 200 MW wind turbine avoid? (25 8 MW turbines)	72,777

Table 5: Comparison of Avoided Emissions.¹⁷

The Levitan Report, prepared for the Maryland PSC, concluded that onshore wind would be more effective than offshore wind in reducing CO₂ emissions.

For either project, we found that CO₂ emissions (one of the principal greenhouse gasses) would decrease in Maryland as in-state power plants (mostly gas-fired) operate less frequently. Due to market response reductions in planned onshore wind resources in western and central PJM, CO₂ emissions (from coal-fired plants) would increase in those regions. Reduced CO₂ from power plants in Maryland would help limit global warming and help Maryland achieve its carbon and greenhouse gas reduction goals. NO_x (a precursor to ground-level ozone, a component of smog, and a contributor to acid rain) and SO₂ (a contributor to acid rain and a cause of respiratory problems) emissions would decrease for both Projects as well. The change in power plant emissions for US Wind is about twice the change for Skipjack, reflecting the size difference between the Projects. (ES-40)¹⁸

In Order 88192, the MD PSC opined on the conclusion made in the Levitan analysis regarding increased CO₂ emissions in its modeling analysis. The MD PSC noted that the Levitan analysis was premised on current RPS standards in MD, which would not take into account possible changes in RPS requirements in the future. Specifically, the MD PSC noted that Maryland, “has acted to accelerate and increase the

¹⁷ Sources: <https://www.pjm.com/~media/library/reports-notice/special-reports/20170317-2016-emissions-report.ashx>; <https://www.epa.gov/greenvehicles/greenhouse-gas-emissions-typical-passenger-vehicle>

¹⁸ Levitan. Available at http://www.dnrec.delaware.gov/energy/Documents/Offshore%20Wind%20Working%20Group/Briefing%20Materials/LevitanAssociates_UpdatedTables_27Mar17.pdf.

RPS obligation since the completion of the Levitan analysis.”¹⁹ The MD PSC further concluded that “any degree of continued state, federal, or market-driven demand for new renewables in or adjacent to the PJM region will discount the realization of the market response contemplated by the Levitan analysis and increase the emission reductions realized by the proposed OSW projects in-State and throughout the PJM region.”²⁰

While all studies confirm the value of renewable resources in reducing air emissions, the variation in the results in the studies suggest the need for closer analysis. These variations do not bring the overall benefits of renewable energy into question.

Environmental Costs or Risks

Offshore wind will involve heavy industrial construction and operations in a sensitive environment, with potential impacts on birds and sea life. Conservationists and fishermen, among others, have expressed concerns and shared research on the possible impacts and ways to prevent or ameliorate such impacts. The Working Group was provided with two studies on offshore wind: “The large scale impact of offshore windfarm structures on pelagic primary production in the southern North Sea”²¹ by Slavik, et al., and “Distribution and Abundance of Wildlife along the Eastern Seaboard 2012-2014”²² by the Biodiversity Research Institute.

8. Offshore Wind Costs

Cost Trends in the U.S.

The Working Group looked at projected cost trends in the U.S. offshore wind industry. Studies were presented to the Working Group that showed costs falling in Europe, and projected to fall in the U.S. as the industry develops.

¹⁹ MD PSC. Order 88192. Case 9431. May 11, 2017. Page 66. Available at <http://www.dnrec.delaware.gov/energy/Documents/Offshore%20Wind%20Working%20Group/MD%20PSC%2088192.pdf>.

²⁰ Ibid.

²¹ <https://arxiv.org/pdf/1709.02386.pdf>

²² <http://roa.midatlanticocean.org/project/williams-et-al-2015-mid-atlantic-wildlife-studies-distribution-and-abundance-of-wildlife-along-the-eastern-seaboard-2012-2014/>

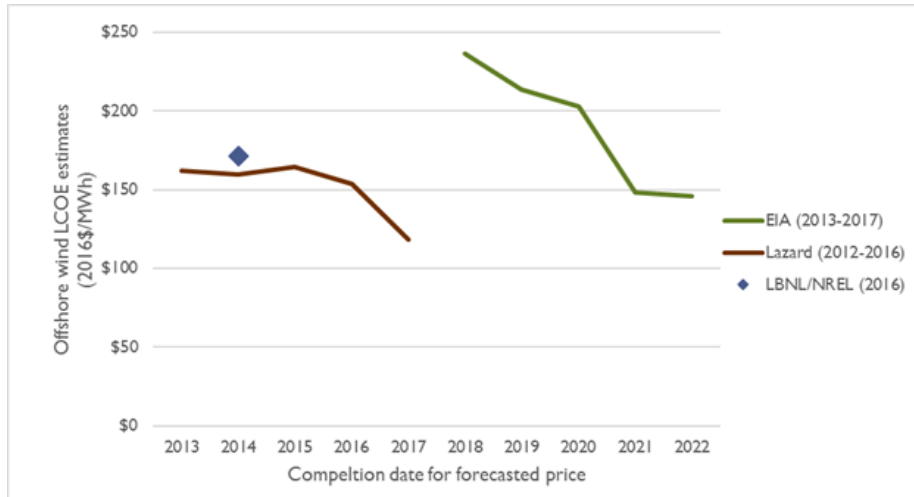


Figure 7: Projected Levelized Cost of Energy for Offshore Wind.²³

The key drivers of cost reduction in the U.S. will be larger, more efficient wind turbines and scale. As more projects are committed and built, the industry will make the investments to drive costs lower. As an example, the first U.S. project, Block Island, was installed with a European liftboat which was brought to the site at great expense.

Commitments from other states are driving industry interest (and investment) in offshore wind. Maryland has approved 368 MW. Massachusetts is committed to 1.6 GW. NY is committed to 2.4 GW. New Jersey is committed to 1.1 GW, and is considering increasing that commitment to 3.5 GW. These commitments are the key driver to reducing costs. As noted, 1,490 MW of offshore wind is being negotiated for approval by Massachusetts, Rhode Island, Connecticut, and New York.

Ratepayer Impacts

The Working Group devoted a great deal of attention to studying what an offshore wind project would cost Delaware customers. Since there is no specific proposal on the table, staff projected what one of the Maryland projects would look like for Delaware customers, starting with DPL.

At the urging of some Working Group members, staff distinguished between levelized costs (the average cost of a project discounted to current dollars and the cost in the first year and some subsequent years, based on published data from Maryland. Levelized costs, while providing a useful benchmark for comparing different sources of power, can obscure the actual cost of a project in any given year.

Staff calculated the projected overall cost to DPL, DEMEC and DEC, and the monthly cost to a customer using 1,000 kWh/month²⁴ of a small project of only 30 MW, 4-5 turbines, based on Maryland pricing.

²³ US Offshore Wind Energy: Future Cost Analyses and Update. Stephanie McClellan. Available at <http://www.dnrec.delaware.gov/energy/Documents/Offshore%20Wind%20Working%20Group/Briefing%20Materials/McClellan%20DE%20OWWG%20presentation%20SIOW.pdf>.

Project Size: 30 MW		Year 1	Year 6	Year 16	Year 20
Gross OREC price	\$/MWh	\$145.26	\$144.19	\$138.96	\$135.41
Net OREC Price	\$/MWh	\$85.28	\$80.48	\$75.01	\$67.01
Overall Gross Monthly Rate Impact	\$/MWh	\$1.68	\$1.67	\$1.61	\$1.57
Overall Net Monthly Rate Impact	\$/MWh	\$0.99	\$0.93	\$0.87	\$0.78
Overall Gross Monthly Rate Impact	\$	\$1.68	\$1.67	\$1.61	\$1.57
Overall Net Monthly Rate Impact	\$	\$0.99	\$0.93	\$0.87	\$0.78
Cost to DPL	\$MM	\$6.40	\$6.04	\$5.63	\$5.03
Cost to DEMEC	\$MM	\$1.96	\$1.85	\$1.72	\$1.54
Cost to DEC	\$MM	\$1.35	\$1.27	\$1.19	\$1.06

Table 6: Cost of a Hypothetical 30 MW Offshore Wind Project.²⁵

The gross OREC is the cost of the wind project before energy and capacity sales to the grid. The net OREC is the projected cost after energy and capacity sales. The table shows that the cost in early years would be higher than in later years. A larger project of 100 MW would have a proportionately larger impact.

Bob Howatt of the PSC Staff provided analysis on the possible cost of larger offshore wind project to an average annual residential customer at the meeting of December 15, 2017:

Customer and small business costs for 12,000 KWh

50-200 MW - Based on all Delaware sales

- Between \$10.44 & \$41.74 per year– best case
- Between \$15.03 & \$60.32 per year -worst case

50-200 MW - Based on Delmarva Power sales

- Between \$14.53 & \$58.13 per year– best case
- Between \$20.93 & \$83.99 per year -worst case

Table 7: Projected Costs of Offshore Wind for Delaware²⁶

Mr. Howatt concluded by noting that offshore wind costs are coupled with efforts by other east coast states to identify economic development objectives.

²⁴ 1,000 kWh is simply illustrative. The US EIA reports that the average residential usage for Delaware is 947 kWh/month. To adjust to reflect this difference, the reader can reduce the monthly cost figures by 5.3 percent.

²⁵ http://webapp.psc.state.md.us/newIntranet/casenum/submit_new.cfm?DirPath=C:\Casenum\9400-9499\9431\Item_93\&CaseN=9431\Item_93.

²⁶ Presentation by Bob Howatt. Available at <http://www.dnrec.delaware.gov/energy/Documents/Offshore%20Wind%20Working%20Group/Briefing%20Materials/Howatt%20re%20OFFSHORE%20WIND%20POWER%20Nov%202014%202017.pdf>.

9. Economic Development Opportunities

One of the key questions discussed by the Working Group was whether such requirements set by Maryland (or other states for future procurements) precluded Delaware’s participation in developing supply chain opportunities. More specifically, the question is whether economic development requirements will preclude consideration of Delaware’s locational advantages.

In 2013, Navigant Consulting published a report for the U.S. Department of Energy to identify opportunities for the United States to foster an offshore wind industry. The report identified the following supply chain components applicable to the offshore wind industry.²⁷

- ▶ Wind Turbine Assembly
- ▶ Gearboxes and Generators
- ▶ Power Converters and Transformers
- ▶ Bearings
- ▶ Castings and Forgings
- ▶ Pitch and Yaw Systems
- ▶ Blades
- ▶ Blade Materials: Resin and Glass/Carbon Fiber
- ▶ Towers
- ▶ Foundations/ Substructures
- ▶ Substations
- ▶ Array Cable
- ▶ Export Cable

Some of the component industries are currently not in place in the United States, which would represent opportunities for Delaware. The recent approval of the proposed US Wind and Skipjack offshore wind applications brings these, and other, opportunities for Delaware to the fore.

In its Order 88192, the Maryland Public Service Commission (MD PSC) references the need to foster the offshore wind supply chain associated with the two offshore wind development projects. In discussing the need for an offshore wind supply chain, the MD PSC wrote:

Indeed, through this Order the State is positioned to become a national leader in the burgeoning offshore wind industry by securing tangible commitments to develop a robust supply chain in Maryland utilizing small businesses and minority business enterprises, while also revitalizing and re-purposing existing port infrastructure to bring much-needed job opportunities to areas of the State especially impacted by previous economic downturns. Further, the “all-in” approach to offshore wind that we undertake today signals to our neighbors and the world that Maryland is ready to serve as a regional hub and a substantial base for additional offshore wind development up and down the East Coast, thus, yielding sustained job growth for many years to come.²⁸

²⁷ Navigant. *U.S Wind Offshore Wind Manufacturing and Supply Chain Development*. Feb. 22, 2013. Available at https://www1.eere.energy.gov/wind/pdfs/us_offshore_wind_supply_chain_and_manufacturing_development.pdf.

²⁸ MD PSC Order 88192. Page 1. Available at <http://www.dnrec.delaware.gov/energy/Documents/Offshore%20Wind%20Working%20Group/MD%20PSC%2088192.pdf>.

The MD Commission required the two companies to invest in a steel fabrication plant, invest in upgrades to the Sparrows Point shipyard in Baltimore, and spend at least 19 percent of capital expenditures on direct in-state expenditures. In addition, the Maryland Commission required that the Sparrows Point facility would be the marshaling point for the two projects, and that the port at Ocean City would serve as the operations and maintenance port.²⁹

The Maryland Commission noted the economic benefits quantified by its consultant would result in 1,298 job-years (a job-year is one full time job for one year) for the construction phase and 2,282 job-years for the operating phase of the US Wind project. For the Deepwater project, these figures would be 913 job-years for the construction phase and 484 job-years for the operating phase.³⁰

While the commitments required by the Maryland PSC would seem to lock down most significant economic development opportunities, the Working Group discussed how Delaware might benefit from economic development opportunities from the Maryland projects and from future projects. Maryland's approach of requiring specific locations for specific tasks was described by industry experts as economically inefficient. A more efficient method—one that could favor Delaware as a port location for instance—would be to allow the industry's developers and suppliers to choose locations based on value.

Both Siemens-Gamesa and Ørsted have stated that their decision-making and investments regarding supply-chain services are and will be based on efficient location and that they prefer to view the east coast as one large market rather than individual state markets. Until there is sufficient demand for numbers of turbines or blades, large investments in manufacturing will not occur. But there are hundreds of smaller, component parts, such as those listed above, that can be procured in the U.S. rather than shipped from Europe. They state that the supply chain can be divided into different categories: staging; onshore installations (e.g. manufacturing); and consultancies. Location-based opportunities include operations and maintenance, construction activities (including cranes, labor, temporary construction installations), knowledge-based services (such as ocean engineering and other marine-based consultancies), and staging harbors (satellite harbors are needed if the main harbor is more than 100 nautical miles away from the wind farm). Eventual investments in factories will go where the most projects are located; long-term sustainability of operations will be the main determining factors.³¹ Additional opportunities include land-based construction activities related to bringing the transmission on-shore and linking up with the grid.

Consider the requirement that the Sparrows Point site be used for turbine staging and deployment. Travel time from Sparrows Point to the wind energy areas is estimated to be 24 hours. Passage through the C&D Canal is not practical. Delaware could provide an important role as a secondary staging area for crews or equipment based on proximity to the Maryland and Delaware Wind Energy Areas.

²⁹ Ibid. Page 63.

³⁰ Ibid. Page 62.

³¹ Joergen Scheel, VP Offshore North America, Siemens Gamesa and Annegrethe Jeppesen, Head of US Procurement, Ørsted. 2018 Governors' Advisors' Energy Policy Institute Pre-Institute Workshop: State Offshore Wind Opportunities. Washington DC. June 11, 2018.

Another logistical challenge facing liftboats or jack up vessels is presented by the Jones Act, which requires that vessels traveling between U.S. ports be built in the United States. No such boats exist today. Deepwater Wind brought a liftboat over from Europe at great expense for its Block Island project. The U.S. offshore wind industry will need shipbuilders to build such boats.

Professor Willett Kempton described the supply chain opportunities and presented his research (funded by the US Department of Energy) into industrializing the offshore wind supply chain. He said that the industry is still developing supply chain techniques and still looking for efficient staging locations. New Bedford, MA is the only port that has been adapted for serving the offshore wind industry to date. It is much too far away to serve mid-Atlantic wind projects. Sparrow's Point has its inefficiencies. He looked at other possible locations in light of industry requirements and concluded that only a few sites could serve the industry in a cost effective manner, and identified four other locations: New York, Paulsboro, Delaware City (near the refinery) and Norfolk.

Dr. Kempton described the current process for assembly and installation of offshore wind. The components are brought to a deployment port, or laydown area, staged for installation. Installation ships are "jack up vessels" or lift boats that can put down "spuds" or legs to become stable are used assemble the components at the site.

Dr. Kempton described a project he is leading, funded by the U.S. Department of Energy, to "industrialize" the supply chain to make it more efficient. In this process, wind turbines would be assembled on land, and lifted by specialized boat to be installed onsite. This process, which could create significant savings in capital expenditures, would only be feasible at a few locations along the east coast. Delaware City is one possible location. The closest "competitive" ports—Sparrows Point and Paulsboro—are not able to provide that kind of deployment, and are much further from the mid-Atlantic. Ultimately, as prices continue to drop, ports, which are the lynch-pin of the supply chain, will be selected by industry, not based on the demands of states, but on the ability to deploy wind turbines in a cost-effective manner.

10. Recommendations

The Working Group's recommendations are found in the Memorandum to the Governor, dated December 15, 2017 (Appendix 2), and a further set of draft recommendations, dated May 15, 2018, (Appendix 3).

At the Working Group meeting on December 11, 2017, the members adopted two resolutions. These resolutions were communicated in the Memorandum to the Governor dated December 15, 2017.

First, the Working Group voted to rule out one option: Delaware should not move on the immediate procurement of offshore wind energy from a project already approved by another state.

The Working Group adopted a second resolution with two parts:

1. These options deserve further consideration:

- ▶ Consider a large-scale purchase (i.e. a purchase of over 100 megawatts of power).
- ▶ Consider incremental commitments to future projects, instead of large-scale purchases (i.e. a purchase of over 100 megawatts of power), until the market drives costs lower.
- ▶ Consider waiting until more developers propose projects in the mid-Atlantic region, such as the proposed projects in New Jersey, New York, and Massachusetts, and scale purchases to be consistent with Delaware's Renewable Portfolio Standard (RPS).
- ▶ Explore the procurement of other renewable resources in lieu of offshore wind.

2. In order to address these options the following questions must be answered:

- ▶ Is there a need for more capacity in the PJM region?
- ▶ How much would an offshore wind project cost in total dollars?
- ▶ What subsidies are required for an offshore wind project to become viable?
- ▶ What would that cost be to all classes of ratepayers?
- ▶ How should an offshore wind subsidy be paid for?
 - Should Delaware create an Offshore Wind Renewable Energy Credit (OREC) carve-out similar to that created for Solar Renewable Energy Credits (SRECs)?
 - Should Delaware create a special utility tax?
 - Should Delaware increase the existing renewable energy fund charge?
 - Should Delaware use Regional Greenhouse Gas Initiative (RGGI) funding?
 - Should Delaware have the Public Service Commission require Delmarva Power to contract for offshore wind?
- ▶ What are the benefits and costs of developing supply chain opportunities?
- ▶ Is Delaware able to take advantage of the benefits of offshore wind without directly investing in an offshore wind project?
 - ▶ Should Delaware use lower cost resources such as land-based wind, solar, and energy efficiency instead of offshore wind?
 - ▶ How do the customer benefits of distributed solar affect the relative benefits and costs compared to offshore wind?
 - ▶ What are the differences in avoided emissions impacts between land-based wind west of Delaware and offshore wind?
 - ▶ What are the expected impacts on tourism?
 - ▶ What are the potential environmental impacts of offshore wind?
 - ▶ What would be the environmental impact of a tanker hitting an offshore wind installation?
 - ▶ What are the advantages and disadvantages of waiting to act on offshore wind?
 - ▶ What is the impact of an offshore wind carve-out on the RPS?
 - ▶ How will an increase in utility rates impact economic development and jobs throughout the state?
 - ▶ What is the relative elasticity (economic impact) of higher electric rates?

These further questions were compiled by DNREC staff and circulated to Working Group members before inclusion in the memorandum.

At its meeting of April 23, 2018, the Working Group identified factors and parameters that Delaware should consider in either responding to or soliciting proposals for offshore wind. This discussion is memorialized in the Draft Recommendations dated May 15, 2018 and amended June 22, 2018, attached as Appendix 3.

Some of the factors and parameters are preliminary and could be addressed in the near-term; others cannot be addressed unless a specific project proposal is presented. In addition, the Working Group has identified things that Delaware would need to do or examine in order to position itself to become the locations for part of the supply chain for offshore wind projects in the Mid-Atlantic.

The preliminary items that are recommended to be addressed are:

- ▶ Identification of the State’s jurisdiction for developing or proceeding with an offshore wind project.
 - Identification of any legal authority Delaware has to require utilities to purchase electricity or renewable energy credits (RECs) from any specific electricity generating project.
 - Determination of whether the state has the legal authority to purchase energy directly and for what purposes.
 - Identification of where approval authority lies (by statute) for an offshore wind development project.
- ▶ Examination of the different processes that Delmarva Power, Delaware Electric Cooperative and the municipal electric providers have that would impact purchasing electricity from an offshore wind project.
- ▶ Examination of the environmental impacts, in general, of offshore wind in relation to other renewable and non-renewable sources of energy.
- ▶ Examination of the likelihood that an offshore wind project would displace, or to what extent it might displace, a fossil fuel generating facility that would have a direct impact on the air quality of Delaware.
- ▶ Examination of the health impacts of displacing fossil fuel generated electricity with cleaner energy resources, such as offshore wind.
- ▶ Examination of ratepayer willingness to pay more for offshore wind electricity. If willingness to pay exists, how much more would Delawareans be willing to pay?
- ▶ Examination of the potential impact of various levels of increased electric rates on economic development, including impact on the potential for new and existing businesses; the impact on Delaware rate payers discretionary income; etc..
- ▶ Examination of rate structures that could be employed to address the regressive nature of electricity on lower income households so as to minimize the price burden on those households.
- ▶ Examination of the costs and benefits that Delaware could obtain through partnerships with other projects located regionally, in or delivered to PJM states.

This further analysis was organized under the three questions:

1. What factors need to be considered before Delaware can respond when a company proposes to develop offshore wind to serve Delaware?
2. What factors need to be considered in a decision as to whether the State would solicit or purchase energy, capacity or renewable energy credits (RECs) from an offshore wind project?
3. What would Delaware need to do to position itself to become the location for part of the supply chain for offshore wind projects in the Mid-Atlantic?

What factors need to be considered before Delaware can respond when a company proposes to develop offshore wind off Delaware's coast?

General Information

- ▶ Location and landfall of the proposed project.
- ▶ Size of the proposed project (number of turbines, energy production, area).
- ▶ Total cost of the proposed project, including:
 - Cost of energy/capacity
 - Cost of RECs and term
- ▶ Is the proposal to purchase energy and capacity or RECs?
- ▶ Does Delaware need, or will it benefit from, the additional generating capacity proposed?
- ▶ Do Delaware's utilities need the proposal to meet their RPS requirements?
- ▶ Can Delaware meet its 2030 RGGI commitments in a cost-effective and feasible manner without procuring any offshore wind power, and if so, how would it do so; and if not, how much offshore wind power would need to be procured?
- ▶ Identification of what new facilities, including transmission upgrades, would be needed to support the project.

Environmental Impacts

- ▶ Identification of the positive and negative environmental impacts from the proposed project, including net impacts on air emissions and impacts on marine and avian populations.

Economic Impacts

- ▶ Proposal for who will pay for the project and a consideration of alternatives to ratepayer funding.
- ▶ Cost comparison between the proposed project and development of alternative renewable energy resources.
- ▶ Identification of short-term (construction) and long-term (operation & maintenance) job impacts.
 - Labor/workforce development plan: Will Delaware labor be used?
- ▶ Evaluate the difference in labor and economic development benefits obtained from a project in Delaware compared to a project located elsewhere.

- ▶ Evaluate the labor and economic development benefits compared to the potential job losses due to higher electricity prices.
- ▶ Evaluate costs in light of projected declining costs of future offshore wind projects.
- ▶ Identification of any impacts on marine traffic.
- ▶ Tourism impacts
 - Analysis of impact from people interested in seeing turbines compared to the impact on people choosing alternate destinations due to visible turbines.

Ratepayer impacts

- ▶ Determination of which rate classes will be impacted by the project and how.
 - Monthly bill impacts (both dollar amount and percentage of total bill)
 - Exemptions for any ratepayers
 - Impacts on industrial ratepayers
 - Mitigations for low-income ratepayers
- ▶ Determination of the mechanism for paying for the project.
- ▶ Analysis of the impacts of current projects that impose costs on ratepayers (including Bloom Energy and the RPS), including the time horizon and level of those costs.

What factors need to be considered in a decision as to whether the State would solicit or purchase energy, capacity or RECs from an offshore wind project?

General Information

- ▶ Determination of the price trigger to buy offshore wind electricity.
- ▶ Size of the proposed purchase.
- ▶ Determination of the need for additional energy and capacity.
- ▶ Determination of the need for additional RECs.
- ▶ Projected capacity benefits from the proposed purchase or solicitation, to Delaware and/or to the PJM region.
- ▶ Have other renewables been considered given their price, capacity, and availability? If buying from a project, location of the project.
- ▶ Is the proposal to purchase energy, capacity and/or RECs?
- ▶ Does the State benefit from offshore wind in other states even if not a participant or purchaser?
- ▶ Identification of what new facilities, if any, would be needed to be constructed in Delaware to support the project.
- ▶ Can Delaware meet its 2030 RGGI commitments in a cost-effective and feasible manner without procuring any offshore wind power, and if so, how would it do so; and if not, how much offshore wind power would need to be procured?
- ▶ Will there be any costs or impact on Delaware even if it does not purchase power (e.g. will the transmission line make land in Delaware)?

Environmental Impacts

- ▶ Identification of the positive and negative environmental impacts from the proposed purchase or solicitation.
- ▶ Could there be positive environmental impacts without the State purchasing offshore wind?

Economic Impacts

- ▶ Total cost of the proposed purchase.
- ▶ Analysis of the projected economic costs and benefits to Delaware of joining other states on a project compared to developing a Delaware-sited project.
- ▶ Proposal for who will pay for the purchase and a consideration of alternatives to ratepayer funding, if applicable.
- ▶ Cost comparison between the proposed purchase and purchase of alternative renewable energy resources.
- ▶ Identification of short-term (construction) and long-term (operation & maintenance) Delaware job impacts, if applicable.

Ratepayer impacts

- ▶ Determination of which rate classes will be impacted by the project and how.
 - Monthly bill impacts (both dollar amount and percentage of total bill)
 - Exemptions for any ratepayers
 - Impacts on industrial ratepayers
 - Mitigations for low-income ratepayers
- ▶ Analysis of the impacts of current projects that impose costs on ratepayers (including Bloom Energy and the RPS), including the time horizon and level of those costs.

What would Delaware need to do to position itself to become the location for part of the supply chain for offshore wind projects in the Mid-Atlantic?

For the supply chain question, the Working Group focused on identifying areas of opportunities for Delaware and some action items for follow-up that could be considered by the Delaware Prosperity Partnership.

Evaluating Supply Chain Opportunities

- ▶ Identify Delaware's strengths and the resources and how they can be used:
 - In the supply chain
 - To reap benefits from regional offshore wind projects (e.g. linemen, river boat pilots)
- ▶ Identify what other states have committed to or required to be located in their state to evaluate where there are supply chain opportunities that the state can benefit from.
- ▶ Determine what pieces of the supply chain Delaware should seek to play an important role in identify potential locations for various types of supply chain activities (manufacturing, vessel sites, etc.).

Manufacturing Components and Related Items

- ▶ Energy Storage technology development, manufacturing, and deployment.
 - Pursuing a role in energy storage technology development would reap benefits for Delaware in all renewable energy sources, not just offshore wind.
 - Evaluate sites as potential locations for energy storage deployment for projects in and out of Delaware.
- ▶ Coatings and materials.
- ▶ Identify regulatory incentives such as priority permitting or pre-permitted industrial parks.
- ▶ Identify financial incentives such as tax credits, grants and loans.
 - Who would provide the incentive?
 - Amount of potential incentives.

Becoming a Service Center for Regional Offshore Wind Farms

- ▶ Develop or identify opportunities for Delaware linemen to work on transmission line projects and servicing wind turbines for other states.
- ▶ Develop a center for wind turbine-related workforce development.
 - Specialized skills and/or certifications

Research Opportunities for Delaware Colleges and Universities

- ▶ Identify current related research at Delaware academic institutions, for example:
 - Delaware's academic institutions can lead the nation in completing and having the expertise needed to conduct benthic environment, geotechnical, or marine and bird impact research/studies that will be needed by other states as they complete offshore wind projects.
 - UD research presented to the Working Group by Dr. Willett Kempton showed there may be potential for UD to develop innovative construction and deployment technologies to offer to the supply chain.
 - Similarly, Delaware Technical and Community College (DTCC) and Delaware State University (DSU) have a significant role in advancing innovative technologies and workforce development.
- ▶ Identify other areas within Delaware academic institutions that could strongly position Delaware to participate in the supply chain such as developing a center for professional skills development focused on engineers, lawyers, environmental scientists and members of the financial community.

Appendix A: Executive Order 13

TO: HEADS OF ALL STATE DEPARTMENT AND AGENCIES

RE: CREATING A WORKING GROUP TO CONSIDER THE OPPORTUNITY TO BUILD OFFSHORE WIND TO SERVE DELAWARE

WHEREAS, offshore wind power is a renewable and clean source of energy that can contribute to Delaware's efforts to reduce air pollution and greenhouse gas emissions; and

WHEREAS, Delaware could benefit from the job opportunities created by developing offshore wind to serve the people of Delaware; and

WHEREAS, Delaware has an interest in participating in the development of new sources of clean energy; and

WHEREAS, the Maryland Public Service Commission recently approved offshore wind proposals by Deepwater Wind and US Wind to deliver a total of 368 megawatts to Maryland customers; and

WHEREAS, these two projects, which are located off the Delaware coastline, will not make use of all of the potential wind resource available in our offshore waters; and

WHEREAS, the Maryland projects could offer new opportunities to develop offshore wind at a scale and on a timetable that could create value at a reasonable balance of costs and benefits for Delaware; and

WHEREAS, Delaware should investigate the opportunities to develop offshore wind in a way that maximizes the long term economic and environmental benefits while minimizing the impact on ratepayers.

NOW, THEREFORE, I, JOHN C. CARNEY, by virtue of the authority vested in me as Governor of the State of Delaware, do hereby DECLARE and ORDER the following:

1. The Offshore Wind Working Group ("Working Group") is hereby established to study how Delaware can participate in developing offshore wind, identify ways to leverage the related economic opportunities, and make specific recommendations for engaging in the development of offshore wind for Delaware.

2. The Working Group shall consist of not less than 17 members to include but not be limited to the following:

- a. two representatives appointed by the Pro Tempore of the Senate;
- b. two representatives appointed by the Speaker of the House;
- c. the Secretary of State; d. the Secretary of DNREC;
- e. the Executive Director of the Public Service Commission;
- f. the Public Advocate;
- g. the Governor's Policy Director;
- h. the following members shall be appointed by and serve at the pleasure of the Governor;
- i. a Chair;
- ii. no less than three members from the energy sector, which may include representatives from a regulated electric utility, municipal electric utility and rural electric cooperative and;

iii. no less than five members which may include representatives from the higher education, non-profit, business, and labor union communities, or such members who have expertise in the subject matter.

3. Members serving by virtue of position may appoint a designee to serve in their stead and at their pleasure.

4. The Governor may increase the size of the Working Group and appoint additional members at his pleasure.

5. The Working Group shall convene no later than September 30, 2017 and shall consider at least the following matters:

- a. Review of the pertinent laws and regulations governing the development of offshore wind, and recommendations of changes to laws and regulations;
- b. Review of the environmental benefits of developing offshore wind for Delaware;
- c. Review of the economic opportunities presented by the offshore wind industry;
- d. Consideration of the benefits and costs of developing offshore wind, including environmental and health benefits, energy market impacts, economic opportunities and rate impacts; and
- e. Identification of the barriers and opportunities involved in developing offshore wind to benefit Delaware.

6. No later than December 15, 2017, the Working Group shall submit a report to the Governor that includes at least the following:

- a. Report on the relevant laws, regulations, benefits, costs, barriers and opportunities for developing offshore wind to serve Delaware;
- b. Recommendations for shorter- and longer-term strategies for procuring offshore wind power to serve Delaware;
- c. Recommendations for plans to develop job opportunities for Delaware in the offshore wind industry; and
- d. A draft of any necessary implementing legislation including possible amendments to Delaware's Renewable Energy Portfolio Standards Act.

7. The Division of Energy & Climate of the Department of Natural Resources and Environmental Control will be the lead agency in staffing the Working Group.

8. The Working Group shall dissolve on June 30, 2018 unless reconstituted by further executive order.

9. The Working Group will be subject to the Open Meeting Laws and all meetings will be open to the public.

APPROVED this 28th date of August 2017.

John C. Carney
Governor

ATTEST:
Secretary of State

Appendix B: Memorandum to the Governor, December 15, 2017

Memorandum

To: The Honorable John Carney, Governor
From: Bruce Burcat
Chair, Offshore Wind Working Group
Date: December 15, 2017
Re: Progress Report from the Offshore Wind Working Group

As Chair of the Working Group, I am pleased to present this memorandum on our progress to date. Since October, the Working Group has met six times and hosted two public comment workshops. Throughout this process, the Working Group has had informative and productive conversations regarding the questions outlined in Executive Order 13. While a great deal of work has been completed, we recognize that additional work still needs to be done. Therefore, the Offshore Wind Working Group respectfully submits this memorandum on our deliberations so far.

At our meeting on December 11, we adopted two resolutions. First, the Working Group voted to rule out one option: Delaware should not move on the immediate procurement of offshore wind energy from a project already approved by another state.

The Working Group adopted a second resolution with two parts:

1. These options deserve further consideration:
 - ▶ Consider a large-scale purchase (i.e. a purchase of over 100 megawatts of power).
 - ▶ Consider incremental commitments to future projects, instead of large-scale purchases (i.e. a purchase of over 100 megawatts of power), until the market drives costs lower.
 - ▶ Consider waiting until more developers propose projects in the mid-Atlantic region, such as the proposed projects in New Jersey, New York, and Massachusetts, and scale purchases to be consistent with Delaware's Renewable Portfolio Standard (RPS).
 - ▶ Explore the procurement of other renewable resources in lieu of offshore wind.

2. In order to address these options the following questions must be answered:
 - ▶ Is there a need for more capacity in the PJM region?
 - ▶ How much would an offshore wind project cost in total dollars?
 - ▶ What subsidies are required for an offshore wind project to become viable?
 - ▶ What would that cost be to all classes of ratepayers?
 - ▶ How should an offshore wind subsidy be paid for?
 - Should Delaware create an Offshore Wind Renewable Energy Credit (OREC) carve-out similar to that created for Solar Renewable Energy Credits (SRECs)?
 - Should Delaware create a special utility tax?
 - Should Delaware increase the existing renewable energy fund charge?
 - Should Delaware use Regional Greenhouse Gas Initiative (RGGI) funding?
 - Should Delaware have the Public Service Commission require Delmarva Power to contract for offshore wind?
 - ▶ What are the benefits and costs of developing supply chain opportunities?

- ▶ Is Delaware able to take advantage of the benefits of offshore wind without directly investing in an offshore wind project?
- ▶ Should Delaware use lower cost resources such as land-based wind, solar, and energy efficiency instead of offshore wind?
- ▶ How do the customer benefits of distributed solar affect the relative benefits and costs compared to offshore wind?
- ▶ What are the differences in avoided emissions impacts between land-based wind west of Delaware and offshore wind?
- ▶ What are the expected impacts on tourism?
- ▶ What are the potential environmental impacts of offshore wind?
- ▶ What would be the environmental impact of a tanker hitting an offshore wind installation?
- ▶ What are the advantages and disadvantages of waiting to act on offshore wind?
- ▶ What is the impact of an offshore wind carve-out on the RPS?
- ▶ How will an increase in utility rates impact economic development and jobs throughout the state?
- ▶ What is the relative elasticity (economic impact) of higher electric rates?

It should be emphasized that this list of questions is not exhaustive, and there are other questions not specified in the resolution that have been raised by Working Group members and the public that we plan to address.

The Working Group is constituted until June 30, 2018, and we are committed to using this time to further analyze and address these questions in anticipation of submitting a final report. The Working Group plans to continue to meet in 2018. We are also committed to providing ongoing opportunities for public comment including hosting more public comment sessions before issuing a final report. Meeting agenda, minutes, reference material, analysis, and public comments are posted online at www.de.gov/offshorewind.

On behalf of all the members of the Working Group, thank you for the opportunity to participate in this important effort.

Appendix C: Recommendations, June 22, 2018

Offshore Wind Working Group Recommendations June 22, 2018

The Offshore Wind Working Group has identified factors and parameters that Delaware should consider in either responding to or soliciting proposals for offshore wind. Some of the factors and parameters are preliminary in nature could be addressed in the near-term; others cannot be addressed unless a specific project proposal is presented. In addition, the Working Group has identified things that Delaware would need to do or examine in order to position itself to become the locations for part of the supply chain for offshore wind projects in the Mid-Atlantic.

The preliminary items that are recommended to be addressed are:

- Identification of the State’s jurisdiction for developing or proceeding with an offshore wind project.
 - Identification of any legal authority Delaware has to require utilities to purchase electricity or renewable energy credits (RECs) from any specific electricity generating project.
 - Determination of whether the state has the legal authority to purchase energy directly and for what purposes.
 - Identification of where approval authority lies (by statute) for an offshore wind development project.
- Examination of the different processes that Delmarva Power, Delaware Electric Cooperative and the municipal electric providers have that would impact purchasing electricity from an offshore wind project.
- Examination of the environmental impacts, in general, of offshore wind in relation to other renewable and non-renewable sources of energy.
- Examination of the likelihood that an offshore wind project would displace, or to what extent it might displace, a fossil fuel generating facility that would have a direct impact on the air quality of Delaware.
- Examination of the health impacts of displacing fossil fuel generated electricity with cleaner energy resources, such as offshore wind.
- Examination of ratepayer willingness to pay more for offshore wind electricity. If willingness to pay exists, how much more would Delawareans be willing to pay?
- Examination of the potential impact of various levels of increased electric rates on economic development, including impact on the potential for new and existing businesses; the impact on Delaware rate payers discretionary income; etc.).
- Examination of rate structures that could be employed to address the regressive nature of electricity on lower income households so as to minimize the price burden on those households.
- Examination of the costs and benefits that Delaware could obtain through partnerships with other projects located regionally, in or delivered to PJM states.

This remainder of this document is organized under the three questions:

1. What factors need to be considered before Delaware can respond when a company proposes to develop offshore wind to serve Delaware?
2. What factors need to be considered in a decision as to whether the State would solicit or purchase energy, capacity or renewable energy credits (RECs) from an offshore wind project?
3. What would Delaware need to do to position itself to become the location for part of the supply chain for offshore wind projects in the Mid-Atlantic?

What factors need to be considered before Delaware can respond when a company proposes to develop offshore wind off Delaware’s coast?

General Information

- Location and landfall of the proposed project.
- Size of the proposed project (number of turbines, energy production, area).
- Total cost of the proposed project, including:
 - Cost of energy/capacity
 - Cost of RECs and term
- Is the proposal to purchase energy and capacity or RECs?
- Does Delaware need, or will it benefit from, the additional generating capacity proposed?
- Do Delaware’s utilities need the proposal to meet their RPS requirements?
- Can Delaware meet its 2030 RGGI commitments in a cost-effective and feasible manner without procuring any offshore wind power, and if so, how would it do so; and if not, how much offshore wind power would need to be procured?
- Identification of what new facilities, including transmission upgrades, would be needed to support the project.

Environmental Impacts

- Identification of the positive and negative environmental impacts from the proposed project, including net impacts on air emissions and impacts on marine and avian populations.

Economic Impacts

- Proposal for who will pay for the project and a consideration of alternatives to ratepayer funding.
- Cost comparison between the proposed project and development of alternative renewable energy resources.
- Identification of short-term (construction) and long-term (operation & maintenance) job impacts.
 - Labor/workforce development plan: Will Delaware labor be used?
- Evaluate the difference in labor and economic development benefits obtained from a project in Delaware compared to a project located elsewhere.
- Evaluate the labor and economic development benefits compared to the potential job losses due to higher electricity prices.
- Evaluate costs in light of projected declining costs of future offshore wind projects.
- Identification of any impacts on marine traffic.
- Tourism impacts
 - Analysis of impact from people interested in seeing turbines compared to the impact on people choosing alternate destinations due to visible turbines.

Ratepayer impacts

- Determination of which rate classes will be impacted by the project and how.
 - Monthly bill impacts (both dollar amount and percentage of total bill)
 - Exemptions for any ratepayers
 - Impacts on industrial ratepayers
 - Mitigations for low-income ratepayers
- Determination of the mechanism for paying for the project.
- Analysis of the impacts of current projects that impose costs on ratepayers (including Bloom Energy and the RPS), including the time horizon and level of those costs.

What factors need to be considered in a decision as to whether the State would solicit or purchase energy, capacity or RECs from an offshore wind project?

General Information

- Determination of the price trigger to buy offshore wind electricity.
- Size of the proposed purchase.
- Determination of the need for additional energy and capacity.
- Determination of the need for additional RECs.
- Projected capacity benefits from the proposed purchase or solicitation, to Delaware and/or to the PJM region.
- Have other renewables been considered given their price, capacity, and availability? If buying from a project, location of the project.
- Is the proposal to purchase energy, capacity and/or RECs?
- Does the State benefit from offshore wind in other states even if not a participant or purchaser?
- Identification of what new facilities, if any, would be needed to be constructed in Delaware to support the project.
- Can Delaware meet its 2030 RGGI commitments in a cost-effective and feasible manner without procuring any offshore wind power, and if so, how would it do so; and if not, how much offshore wind power would need to be procured?
- Will there be any costs or impact on Delaware even if it does not purchase power (e.g. will the transmission line make land in Delaware?).

Environmental Impacts

- Identification of the positive and negative environmental impacts from the proposed purchase or solicitation.
- Could there be positive environmental impacts without the State purchasing offshore wind?

Economic Impacts

- Total cost of the proposed purchase.
- Analysis of the projected economic costs and benefits to Delaware of joining other states on a project compared to developing a Delaware-sited project.
- Proposal for who will pay for the purchase and a consideration of alternatives to ratepayer funding, if applicable.
- Cost comparison between the proposed purchase and purchase of alternative renewable energy resources.

- Identification of short-term (construction) and long-term (operation & maintenance) Delaware job impacts, if applicable.

Ratepayer impacts

- Determination of which rate classes will be impacted by the project and how.
 - Monthly bill impacts (both dollar amount and percentage of total bill)
 - Exemptions for any ratepayers
 - Impacts on industrial ratepayers
 - Mitigations for low-income ratepayers
- Analysis of the impacts of current projects that impose costs on ratepayers (including Bloom Energy and the RPS), including the time horizon and level of those costs.

What would Delaware need to do to position itself to become the location for part of the supply chain for offshore wind projects in the Mid-Atlantic?

For the supply chain question, the Working Group focused on identifying areas of opportunities for Delaware and some action items for follow-up that would most likely be done by the Delaware Prosperity Partnership.

Evaluating Supply Chain Opportunities

- Identify Delaware's strengths and the resources and how they can be used:
 - In the supply chain
 - To reap benefits from regional offshore wind projects (e.g. linemen, river boat pilots)
- Identify what other states have committed to or required to be located in their state to evaluate where there are supply chain opportunities that the state can benefit from.
- Determine what pieces of the supply chain Delaware should seek to play an important role in identify potential locations for various types of supply chain activities (manufacturing, vessel sites, etc.).

Manufacturing Components and Related Items

- Energy Storage technology development, manufacturing, and deployment.
 - Pursuing a role in energy storage technology development would reap benefits for Delaware in all renewable energy sources, not just offshore wind.
 - Evaluate sites as potential locations for energy storage deployment for projects in and out of Delaware.
- Coatings and materials.
- Identify regulatory incentives such as priority permitting or pre-permitted industrial parks.
- Identify financial incentives such as tax credits, grants and loans.
 - Who would provide the incentive?
 - Amount of potential incentives.

Becoming a Service Center for Regional Offshore Wind Farms

- Develop or identify opportunities for Delaware linemen to work on transmission line projects and servicing wind turbines for other states.
- Develop a center for wind turbine-related workforce development.
 - Specialized skills and/or certifications

Research Opportunities for Delaware Colleges and Universities

- Identify current related research at Delaware academic institutions, for example:
 - Delaware’s academic institutions can lead the nation in completing and having the expertise needed to conduct benthic environment, geotechnical, or marine and bird impact research/studies that will be needed by other states as they complete offshore wind projects.
 - UD research presented to the Working Group by Dr. Willett Kempton showed there may be potential for UD to develop innovative construction and deployment technologies to offer to the supply chain.
 - Similarly, Delaware Technical and Community College (DTCC) and Delaware State University (DSU) have a significant role in advancing innovative technologies and workforce development.
- Identify other areas within Delaware academic institutions that could strongly position Delaware to participate in the supply chain such as developing a center for professional skills development focused on engineers, lawyers, environmental scientists and members of the financial community.