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March 24, 2017

David J. Collins
Executive Secretary
Public Service Commission
Of Maryland
6 St. Paul Street, 16th Floor
Baltimore, Maryland 21202

Re: Case No. 9431

Dear Mr. Collins:

Enclosed for filing, please find an original and seventeen (17) copies of the Direct Testimony of Maximilian Chang on behalf of the Office of People's Counsel in the above-referenced proceeding. A copy has been provided to all parties of record. This is identical to the testimony that was filed by the Office of People's Counsel on February 15, 2017 (ML# 212755), except that all designations of confidential information have been removed.

Should you have any questions, please do not hesitate to contact me.

Respectfully submitted,

/electronic signature/
William F. Fields
Senior Assistant People's Counsel

WFF:eom
cc: All Parties of Record (PSC Service List Case No. 9431)

BEFORE THE
PUBLIC SERVICE COMMISSION
OF MARYLAND

IN THE MATTER OF THE APPLICATIONS OF US WIND, INC. AND SKIPJACK OFFSHORE ENERGY, LLC FOR A PROPOSED OFFSHORE WIND PROJECT(S) PURSUANT TO THE MARYLAND OFFSHORE WIND ENERGY ACT OF 2013	* * * * *	CASE NO. 9431

~~Confidential~~ Direct Testimony of Maximilian Chang

On Behalf of
Maryland Office of People's Counsel

~~ ATTORNEYS' EYES ONLY **~~**

February 15, 2017

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I. INTRODUCTION AND PURPOSE OF TESTIMONY

Q Please state your name, business address, and position.

A My name is Maximilian Chang. I am a Principal Associate with Synapse Energy Economics, an energy consulting company located at 485 Massachusetts Avenue, Cambridge, Massachusetts.

Q Please summarize your work experience and educational background.

A My experience is summarized in my resume, which is attached as **Attachment MPC 1**. I am an environmental engineer and energy economics analyst who has analyzed energy industry issues for more than seven years. In my current position at Synapse Energy Economics, I focus on economic and technical analysis of many aspects of the electric power industry, including: (1) utility reliability performance and distribution investments, (2) nuclear power, (3) wholesale and retail electricity markets, and (4) energy efficiency and demand response alternatives. I have been an author and project coordinator for the 2011 and 2013 biennial New England Avoided Energy Supply Component reports used by energy efficiency program administrators in the six New England states to evaluate energy efficiency programs.

Q Please describe Synapse Energy Economics.

A Synapse Energy Economics is a research and consulting firm specializing in energy and environmental issues, including electric generation, transmission and distribution system reliability, ratemaking and rate design, electric industry restructuring and market power, electricity market prices, stranded costs, efficiency, renewable energy, environmental quality, and nuclear power.

Synapse's clients include state consumer advocates, public utilities commission staff, attorneys general, environmental organizations, federal government agencies, and utilities.

Q On whose behalf are you testifying in this case?

A I am testifying on behalf of the Maryland Office of People's Counsel ("OPC").

Q Have you submitted testimony in other recent regulatory proceedings?

A Yes. I have previously testified before the District of Columbia Public Service Commission, the Kansas Corporation Commission, the Massachusetts Department of Public Utilities, and the Maine Public Utilities Commission. I have also filed testimony before the Delaware Public Utilities Commission, Hawaii Public Utilities Commission, New Jersey Board of Public Utilities, and the United States District Court District of Maine.

Q Have you testified in front of the Maryland Public Service Commission previously?

A Yes, I have testified before the Maryland Public Service Commission ("MDPSC" or "Commission") in Case No. 9406 regarding Baltimore Gas and Electric's base rate case, in Case No. 9418 regarding Pepco's base rate case, and in Case No. 9424 regarding Delmarva Power and Light's base rate case.

Q What is the purpose of your direct testimony?

A My direct testimony summarizes conclusions and recommendations to the Commission regarding its evaluation of the offshore wind applications submitted by U.S. Wind, Inc. ("US Wind") and Skipjack Offshore Energy, LLC ("Wind (Skipjack") (collectively referred to as the "Applicants"). I recognize that the Commission must consider many factors as required by the statute; however, I have been asked by the Office of People's Counsel to address the projected ratepayer impacts of the two applications.

Q What data did you rely upon to prepare your testimony and exhibits?

A I relied primarily on the work products produced by the Commission's consultant, Levitan and Associates, Inc. ("Levitan"). Specifically, I relied up the Levitan confidential report, *Evaluation and Comparison of US Wind and Skipjack Proposed Offshore Wind Project Applications,* dated December 11, 2016 ("Levitan Report") and confidential supporting work papers provided by Levitan. I also relied upon the confidential application documents and confidential responses to various data requests provided by both US Wind and Skipjack.

Q Do you have any attachments to your testimony?

A Yes. I am attaching cited reports referenced in my testimony. I do not attach the confidential Levitan report or testimonies filed by the Applicants that are already part of the record in this case.

Q Was your testimony prepared by you or under your direct supervision?

A Yes.

II. CONCLUSIONS AND FINDINGS

Q Please summarize your conclusions and findings regarding the Levitan and Associates report and the offshore wind applications from US Wind and Skipjack.

A My conclusions and findings are summarized below:

- ~~**<Begin Confidential>**~~ Levitan found that both the US Wind and Skipjack applications meet the minimum legislative thresholds ~~**<End Confidential>**~~ described in the Code of Maryland Regulations ("COMAR") 20.61.06 and Md. Code Ann. Pub. Utils. ("PUA") § 7-704.1.

- The Levitan Report found that the US Wind project proposal would result in a net residential rate impact of ~~**<Begin Confidential>**~~ $1.49/month or 99 percent ~~**<End Confidential>**~~ of the allowable residential rate impact cap of $1.50/month. The Levitan Report found that the Skipjack project proposal would result in a net residential rate impact from ~~**<Begin Confidential>**~~ $0.45 or 30 percent ~~**<End Confidential>**~~ of the allowable residential rate impact cap of $1.50/month.

- The Levitan Report found that the net economic benefits of the US Wind project proposal are approximately ~~**<Begin Confidential>**~~ twice ~~**<End Confidential>**~~ the net economic benefits of the Skipjack project proposal.

- ~~**<Begin Confidential>**~~ The ratepayer impact of the US Wind project proposal allows for very minimal uncertainty in Levitan's forecasts of market dynamic values in order to remain under the mandated legislative

rate impact caps. Small changes, within the realm of reasonable uncertainty, to the forecasted assumptions used in the US Wind rate impact analysis, such as actual and forecasted energy prices, capacity prices, Renewable Energy Credit ("REC") prices, and/or energy production, may result in an exceedance of the residential and/or non-residential rate impact thresholds established under Maryland law. Similar changes to the forecasted assumptions used in the Skipjack proposal, however, would result in rate impacts below the rate impact caps.

- The Commission should accept the Skipjack application based on the rate impact calculations used in the Levitan Report. These calculations show that small fluctuations to the underlying assumptions used in the Levitan Report are unlikely to push the rate impact of Skipjack's project proposal above the residential rate impacts thresholds established by the Maryland legislation. The Skipjack proposal will also afford Maryland ratepayers the opportunity to consider additional offshore wind projects. These projects may take advantage of downward cost trends observed and anticipated in the future. ~~**<End Confidential>**~~

III. SUMMARY OF THE MARYLAND OFFSHORE WIND APPLICATION REVIEW PROCESS

Q Please describe your understanding of Maryland's legislative requirement for the review of off-shore wind applications.

A In 2013, the Maryland General Assembly enacted House Bill 226 ("HB 226"), the "Maryland Offshore Wind Energy Act of 2013," which amended PUA § 7-704.1(e). The revisions to state law created an "off-shore wind renewable energy credit" ("OREC") mechanism to promote the development of Maryland offshore wind projects. In order to mitigate ratepayer impacts, HB 226 establishes an OREC price and net-ratepayer impact threshold for an off-shore wind project. The OREC price threshold is set at $190 per megawatt-hour in 2012 dollars. The residential rate impact is set at $1.50 per month in 2012 dollars and the non-residential rate impact is set at 1.5 percent per month. Additionally, HB 226 directed the

Commission to develop common standards of review for assessing off-shore wind applications based on a certain consistent set of data.

Q Please describe your understanding of the standards of review for the Commission to accept and review an offshore wind application under COMAR 20.61.06.

A After the passage of HB 226, the Commission drafted regulations that added a new section to Title 20, Subtitle 61 of COMAR, which governs the Renewable Energy Portfolio Standard program. The new section, COMAR 20.61.06, contains two sub-sections that describe the Commission's standard of review for offshore wind project proposals.

The first, COMAR 20.61.06.02, covers Application Requirements and establishes the administrative minimum threshold that must be met by any offshore wind project proposal. Primarily, this section of COMAR addresses the filing requirements for applications and details what data must be included in an application such as a flow chart of the applicant's organizational structure, a forecast of net annual energy production from the new offshore wind resource, financing mechanisms, and a plan for permitting and construction of the project.

The second, COMAR 20.61.06.03, covers the Evaluation Criteria that the Commission must use to judge, rank, and ultimately choose applications. First, the Commission must review the minimum threshold criteria to determine if the proposed OREC bid associated with an application is within the range established by HB 226, and if the net ratepayer impact exceeds the established limits. The Commission must also perform a qualitative review of each project and assess the likelihood of success of developing the project. This component of the review process addresses issues associated with development risks and the qualifications of the applicant team. Finally, the Commission is tasked with a quantitative review of each application and must consider the proposal's rate impact, the economic impacts, and the environmental and health impacts. For this portion of the review, the Commission must perform or commission an independent quantitative impact analysis beyond that provided by the applicant.

IV. SUMMARY OF THE OFFSHORE WIND APPLICATIONS

Q Please describe your understanding of the two offshore wind applications.

A ~~**<Begin Confidential>**~~ The Applicants submitted proposals for the Commission to consider. US Wind, a subsidiary of Renexia and Toto Holding SpA, submitted a proposal to develop a 248 MW project in a Bureau of Ocean Energy Management ("BOEM") tract, located approximately 12 nautical miles[1] off the coast of Fenwick Island, Delaware and 15 nautical miles off the coast of Ocean City, Maryland.[2,3] US Wind anticipates a project completion date of 2020 and estimates that its project will generate approximately 913,845 MWh of electricity annually. Skipjack, a subsidiary of Deepwater Wind Holdings, LLC, whose majority owner is D.E. Shaw, submitted a proposal to develop a 120 MW project in a BOEM tract located approximately 15 nautical miles off the coast of Delaware.[4] Skipjack anticipates a project completion date of 2023[5] and estimates that its proposal will annually generate approximately 455,482 MWh of electricity. Both projects would interconnect with Maryland and the rest of PJM on the Delmarva Peninsula. Levitan estimates that the net ratepayer costs of the two projects will be $2,081 million for US Wind's proposal and $625.4 million for Skipjack's proposal[6] in 2016 dollars. The following table summarizes the two applications:

[1] One nautical mile is 1.15 statute miles.
[2] Levitan and Associates, Inc. *Evaluation and Comparison of US Wind and Skipjack Proposed Offshore Wind Project Applications*. December 11, 2016. (Confidential Version). Page 31.
[3] ~~**<BEGIN CONFIDENTIAL>**~~ Levitan noted that its measurements indicate that the distances of the project would be 10.2 nautical miles to Fenwick Island and 13.5 nautical miles to Ocean City. ~~**<END CONFIDENTIAL>**~~
[4] Levitan. (2016) Page 98.
[5] Levitan. (2016) Page 102.
[6] Levitan. (2016) Page ES-41. The net ratepayer costs are the gross OREC price net energy, capacity, and REC credits; and energy, capacity, and REC price effects.

Table 1 - Summary of Proposed Offshore Wind Projects Per Levitan Report

Component	US Wind	Skipjack
Project Size (MW)	248	120
Number of turbines	62	15
Turbine Capacity (MW)	4	8
Commercial Operation Date	Jan-20	Nov-22
Project Cost ($M 2016$)	$1,375	$720
Projected Annual Generation (MWh)	913,845	455,482
Projected Capacity Factor	42.10%	43.30%

~~**<End Confidential>**~~

Q What will the resulting price for generated energy be based on each proposal?

A Both Applicants provide a gross OREC price. The gross OREC prices submitted by the Applicants represent US Wind's and Skipjack's estimates for the lifetime costs of each project. Each applicant's gross OREC prices also embeds assumptions regarding profit margins, the investment tax credit ("ITC"), and/or tax equity financing that are difficult to disentangle without the benefit of the underlying workbooks and financial models used by the Applicants to derive their proposed OREC price. ~~**<Begin Confidential>**~~ Without the ITC, the gross OREC price for the Skipjack proposal would increase as observed in the Levitan Report.[7] US Wind's proposal assumes it can utilize the 30 percent ITC.[8] ~~**<End Confidential>**~~ Since the gross OREC price is what Maryland ratepayers will pay for the project to be built, this represents a rough approximation of the levelized cost of electricity for the two projects. The table below shows the levelized cost of energy based on values from the Levitan Report.

[7] Levitan (2016) Page 127.
[8] Levitan (2016) Page 58.

Table 2 - Levelized Cost of Energy Estimate Based on Levitan Report Values (2012$) ~~<Begin Confidential>~~

Component	US Wind	Skipjack
Gross ORECs ($M PV)	$2,865,792	$1,056,624
Discounted Generation (MWh)	16,132,922	7,864,312
Levelized Cost of Energy (MWh)	$177.64	$134.36

Based on the above table, these values indicate that the cost of energy is approximately $0.177/kWh for the US Wind proposal and $0.134/kWh for the Skipjack proposal. ~~<End Confidential>~~

Q What would the premium for energy be for the two offshore wind proposals when compared to other renewable energy sources?

A Generally, the net OREC price presented each application represents what the premium of each offshore wind project would be relative to other Maryland renewable energy resources. The table below, taken from data in the Levitan Report, provides a summary of the net OREC prices for each project.

Table 3 - Levelized Net OREC Price Reported in Levitan Report (2012$) ~~<Begin Confidential>~~

Components (2012$/kWh Levelized)	US Wind	Skipjack
Gross OREC Price	$0.178	$0.134
Avoided Energy Credits	-$0.043	-$0.044
Avoided Capcity Credits	-$0.004	-$0.005
Avoided REC Credits	-$0.012	-$0.012
Net OREC Price	$0.118	$0.073

~~<End Confidential>~~

Based on this table, the renewable energy premium associated with each proposed project is ~~<Begin Confidential>~~ $0.118/kWh for US Wind's proposal and $0.073/kWh for Skipjack's proposal. ~~<End Confidential>~~

V. THE COMMISSION SHOULD ACCEPT THE CONCLUSIONS OF THE LEVITAN REPORT

Q Please summarize your recommendations regarding the use of the Levitan Report.

A In compliance with Commission Order No. 88004, Levitan provided copies of their work papers to OPC on February 4, 2017. I have had a limited opportunity to review in detail every specific assumption made in these workpapers. I note that the Applicants appear to generally accept the conclusions reached in the Levitan Report.

Q Please indicate if the Applicants had the opportunity to review the Levitan Report.

A Yes, the Applicants filed supplemental testimony commenting on their respective review of the Levitan Report. It is my understanding that neither applicant had the opportunity to review the supporting workbooks used by Levitan before February 4, 2017, so the Applicants' reviews were probably limited to the conclusions and descriptions found in the Levitan Report.

Q Do the Applicants generally agree with the findings in the Levitan Report?

A ~~**<Begin Confidential>**~~ Yes. US Wind concludes that the Levitan Report addresses the substantive issues in this case with the exceptions of a few clarifications.[9] Skipjack also generally agrees with the conclusions reached in the Levitan Report, but disagreed with some of Levitan's analyses regarding incentives, conditions, and ratepayer impacts.[10]

Q Please describe the areas where US Wind took exception to the Levitan Report.

A In its supplemental testimony, US Wind noted disagreement with the following areas of the Levitan Report:

- transmission line characterization;

[9] Supplemental Direct Testimony of Paul Rich. January 4, 2017. 1:19-23.
[10] Direct Testimony of Jeffrey Grybowski. January 4, 2017. 16:20-22.

- location of interconnection point;
- outreach to small businesses;
- cost discrepancy to Skipjack's proposal due to the size of Skipjack's proposed project; and
- qualitative differences between the two projects.

Q Does the US Wind supplemental testimony take issue with any specific Levitan values?

A No, it does not appear that US Wind critiques any of the values calculated by Levitan in US Wind's supplemental testimony. ~~**<End Confidential>**~~

Q Please describe the areas where Skipjack took exception to the Levitan Report in its direct testimony dated January 4, 2017.

A Skipjack noted disagreements with the following areas of the Levitan Report:

- investment tax credit;
- provisions to pursue development;
- cost to ratepayers;
- commercial operation date;
- market impacts

Q Does Skipjack's direct testimony take issue with any specific Levitan values?

A No, it does not appear that Skipjack critiques any of the values calculated by Levitan in its direct testimony.

Q At this time, do you believe that any of the calculations and assumptions in the Levitan Report need to be adjusted?

No, at this time I do not have any adjustments to make to the values presented in the Levitan Report. ~~**<Begin Confidential>**~~ Notably, Levitan indicates in its report that several assumptions used by the Applicants differed, which make the final

values presented in the applications impossible to compare said-by-side.[11] Instead, Levitan recommends that the Commission adopt the values used by Levitan for each project to allow for side-by-side comparisons. ~~**<End Confidential>**~~

VI. FINDINGS FROM THE LEVITAN REPORT

Q Please summarize the findings from the Levitan Report that are relevant to your testimony.

A The Commission hired Levitan to perform the qualitative and quantitative review of the Skipjack and US Wind applications. ~~**<Begin Confidential>**~~ In its report, Levitan finds that both projects meet the minimum thresholds under COMAR 20.61.06.02 and PUA § 7-704.1(e). Specifically, the project approval requirements and related observations are summarized in the Levitan Report and reproduced below.

Table 4 –Summary of Project Approval Requirements Per Levitan Report[12]

Approval Requirement	US Wind	Skipjack
Demonstrates Net Economic, Environmental, and Health Benefits?	Yes; about double Skipjack benefits	Yes; about one-half US Wind benefits
Meets Net Residential Rate Impact Cap?	Yes; $1.49/month	Yes; $0.45/month
Meets Net Non-Residential Rate Impact Cap?	Yes; 1.47%	Yes; 0.44%
OREC Price below Price Cap?	Yes; $177.64/MWh	Yes; $134.26/MWh

~~**<End Confidential>**~~

Q Please describe how Levitan calculated its estimate for the net ratepayer costs associated with each of the two applications?

A On page ES-41 of the Levitan Report, Levitan summarizes its calculations of the net ratepayer impacts of the two proposals. Levitan defines the net ratepayer impact as "the levelized equivalent of the proposed OREC Price annual payments, less the

[11] Levitan. (2016) Page ES-26.

[12] The Levitan Report provides a sensitivity analysis of the Skipjack OREC price based on assumptions of the ITC. We have presented the base value in this analysis.

levelized equivalent of forecasted energy and capacity market and REC credits, plus any reductions in wholesale energy and capacity prices, all expressed in 2012 dollars per year."[13]

Q Please describe how Levitan adjusted the Applicants' calculations in the Levitan Report to make each of the two applications comparable.

A Levitan made a number of adjustments to each applicant's calculations in order to arrive at an independent assessment of each application. Specifically, Levitan noted:

> Our quantitative analyses included independent forecasts of net ratepayer impacts, in-state economic impacts, and emission and health benefits, consistent with COMAR 20.61.06.03 B(2). Our independent forecasts were designed to provide the MDPSC with a consistent and impartial basis of comparison for the two proposed offshore wind projects. The MDPSC will use our findings in general to evaluate the two applications and issue an order pursuant to COMAR 20.61.06.03 C, D, and E.[14]

~~**<Begin Confidential>**~~ As noted above, the Levitan analysis shows that both proposed projects meet the minimum requirements under the law.[15] ~~**<End Confidential>**~~

Q Did the Levitan Report quantify the residential and non-residential rate impacts of the two applications relative to the legislative rate impact caps?

A Yes. As noted in Table 4 above, Levitan summarizes the residential and non-residential rate impacts for the two applications. However, the values for the two proposals differ based on Levitan's calculations of the residential and non-residential rate impacts and how close the calculations are to the rate impact caps. The differences are shown below:

[13] Levitan and Associates. (2016) Page ES-35.
[14] Levitan and Associates. (2016). Page ES-3
[15] Levitan and Associates. (2016) Page ES-42.

Table 5 - US Wind and Skipjack Relative Cap Calculations Per Levitan Report ~~<Begin Confidential>~~

	US Wind	Percent of Cap	Skipjack	Percent of Cap
Residential Rate Impact Cap ($1.50)	$1.49	99%	$0.45	30%
Non-residential Rate Impact Cap (1.5%)	1.47%	98%	0.44%	29%
Gross OREC cost (2012$)	$177.64	93%	$134.26	71

As shown in the table above, the US Wind proposal is just below the cap for three of the primary metrics that the Commission must consider when evaluating a potential proposal. For the residential rate impact metric, US Wind is at 99% of the maximum residential rate impact cap of $1.50/month. On non-residential rate impact, US Wind is at 98% of the non-residential rate impact cap of 1.50 percent of non-residential customers' total annual electric bills. Finally, the gross OREC cost of US Wind's proposal is at 93% of the $190/MWh cap. The smaller Skipjack proposal is correspondingly further away from the caps. On residential rate impacts, Skipjack is at 30% of the residential rate impact cap of $1.50/month. On non-residential rate impacts, Skipjack is at 29% of the residential rate impact cap of 1.50%. Finally, the gross OREC cost of Skipjack's proposal is at 93% of the $190/MWh cap. **~~<End Confidential>~~**

VII. ADDITIONAL COMMENTS ON THE APPLICATIONS

Q Please summarize the developmental challenges faced by the two Applicants.

A The US Offshore Wind industry is nascent. In late 2016, Skipjack's parent organization, Deepwater Wind Holdings, LLC ("Deepwater Wind"), completed the first deployment of offshore wind turbines off the coast of Block Island, Rhode Island totaling 30 MW. No other wind projects have been completed off the coast of the US. In January 2017, Deepwater Wind received approval to develop a 120

MW project off the coast of Long Island, NY.[16] Given the inexperience of the US off-shore wind industry, both the US Wind proposal and the Skipjack proposal have a certain amount of development risk. The Skipjack project will have the advantage of being able to leverage the experience obtained by Deepwater Wind through both the Block Island and Long Island projects. As noted in the Levitan Report, US Wind's offshore experience is, however, limited to only experienced contractors.[17] To date, Renexia has developed and sold a 22.8 MW onshore wind project in Italy.[18] However, neither Renexia nor its parent, Toto Holdings SpA, have developed offshore wind projects in Europe.

Q Are there development penalties in either application?

A ~~**<Begin Confidential>**~~ No. The Levitan Report notes that neither applicant has incorporated penalties for failure to meet development deadlines.[19] ~~**<End Confidential>**~~

Q Please describe how the OREC prices are determined.

A The OREC prices are described as follows in the Levitan Report:

> Pursuant to the Regulations, an applicant is permitted to submit either a 1-part or 2-part OREC price. In a 2-part OREC price, the first component is a firm set of prices and the second component is subject to a true-up (to occur at a later date) based upon any change between the MDPSC's estimated cost of transmission upgrades and PJM's actual upgrade costs as specified in an executed Interconnection Service Agreement. The total OREC price after any true-up would remain subject to the price and net rate caps in the Regulations.[20]

[16] https://www.rtoinsider.com/deepwater-wind-offshore-wind-farm-37236
[17] Levitan and Associates. (2016). Page 29.
[18] http://www.renexia.it/en/progetti/ponte_albanito.html
[19] Levitan and Associates. (2016) Page ES-41
[20] Levitan and Associates. (2016) Footnote 8, Page ES-5

Q Do you have concerns about the OREC prices submitted by both applicants?

A I have concerns about the OREC prices submitted by both Applicants. Despite requests, neither applicant provided details as to how it derived its OREC prices. OREC prices for both Applicants are fixed in the workbooks they provided in response to data requests. Therefore, there is no way to determine the detailed components of the proposed OREC prices. Levitan does not challenge the reasonableness of the OREC prices in its report, notwithstanding the statutory cap of $190/MWh levelized in 2012$. As a result, the profit margin of each applicant is unknown. ~~**<Begin Confidential>**~~ Levitan did note that the initial US Wind application exceeded the $190/MWh price cap, but that US Wind then submitted a revised OREC price bid that was within the OREC price cap.[21] Even though, Levitan ultimately concludes that each proposal is below the legislative price cap, there remains a question about whether the two applications are truly competitive since there were only two submitted proposals and one proposal needed to be re-submitted in order to remain below the OREC price cap. The fact that there are two applicants does, at the very least, allow for a comparative assessment of reasonableness based on a side-by-side comparison of the OREC price used by each applicant. ~~**<End Confidential>**~~

VIII. UNCERTAINTY IN FORECAST OF US WIND'S INPUT ASSUMPTIONS

Q Please summarize your concerns regarding the sensitivity of the US Wind proposal.

A The Levitan Report determined that the US Wind proposal is at ~~**<Begin Confidential>**~~ $1.49/month for the residential rate cap and 1.47 percent of the non-residential rate cap. As I have noted earlier, these are at 99 and 98 percent of the legislative caps. At such levels, I am concerned that small changes in market dynamics may result in the US Wind proposal exceeding one or both of the legislative rate impact caps. Any forecast of market dynamics is subject to uncertainty that could move in either direction. I am concerned that the US Wind

[21] Levitan and Associates. (2016) Page ES-3

proposal is predicated on the accuracy of the forecasts of energy prices, energy sales, REC prices, capacity prices, and energy production being consistent with the forecasts presented in the Levitan Report in order to remain below the statutory rate impact caps. On the other hand, the Skipjack rate impacts are small enough to withstand more volatile market dynamics and remain below the rate impact caps. ~~**<End Confidential>**~~

Q Please describe the rate impact caps that the Commission must consider when it reviews US Wind's and Skipjack's applications.

A Under Maryland law, Maryland the residential and non-residential rate impact cannot exceed $1.50 and 1.5 percent as stated below:

- (ii) the projected net rate impact for an average residential customer, based on annual consumption of 12,000 kilowatt–hours, combined with the projected net rate impact of other qualified offshore wind projects, does not exceed $1.50 per month in 2012 dollars, over the duration of the proposed OREC pricing schedule;

- (iii) the projected net rate impact for all nonresidential customers considered as a blended average, combined with the projected net rate impact of other qualified offshore wind projects, does not exceed 1.5% of nonresidential customers' total annual electric bills, over the duration of the proposed OREC pricing schedule.[22]

As written, the law indicates that rate impacts for both the residential and non-residential customers would be "combined with the projected net rate impacts of other qualified offshore wind projects." ~~**<Begin Confidential>**~~ Since the US Wind proposal is at 99 percent and 98 percent of the residential and non-residential rate impacts, accepting the US Wind project would prevent the possibility of any other future offshore wind projects. ~~**<End Confidential>**~~

[22] PUA § 7-704.1 (ii) and (iii).

Q Is there uncertainty associated with forecasts of market dynamics incorporated in the rate impact calculations?

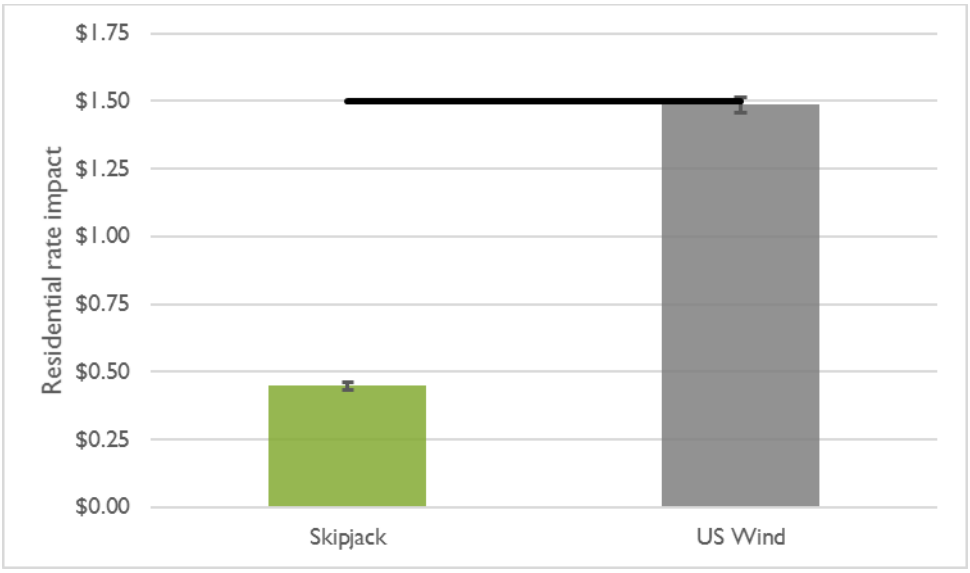
A Yes. The calculation of the residential and non-residential rate impact is composed of forecasts of: (1) Maryland energy sales that could affect the amount of OREC revenue collected from Maryland ratepayers;[23] (2) avoided energy credits based on projections of PJM energy prices: (3) avoided capacity credits based on the projections of BRA capacity prices: (4) avoided REC prices based on future REC price projections; (5) energy market price effects; (6) capacity market price effects; and (7) REC market price effects. As with any forecast of market dynamics, there is uncertainty in the forecast of the input components in the Levitan Report. That said, there are components that have a more profound effect than others. These components are the Maryland energy sales, avoided energy credits, avoided REC credits, and avoided capacity credits.

Q Have you projected how sensitive the values in each application are to changes in market dynamic forecasts?

A Yes. To illustrate the impact of forecast uncertainty in Levitan's rate impact calculations, I have adjusted the values of avoided energy credits and avoided capacity credits in levelized residential and non-residential rate impact values for both the US Wind and Skipjack proposals. For illustrative purposes, I have adjusted the annual avoided energy credits and avoided capacity credits by five percent in both an upward and downward direction. The following figures show the changes in rate impacts with these adjustments.

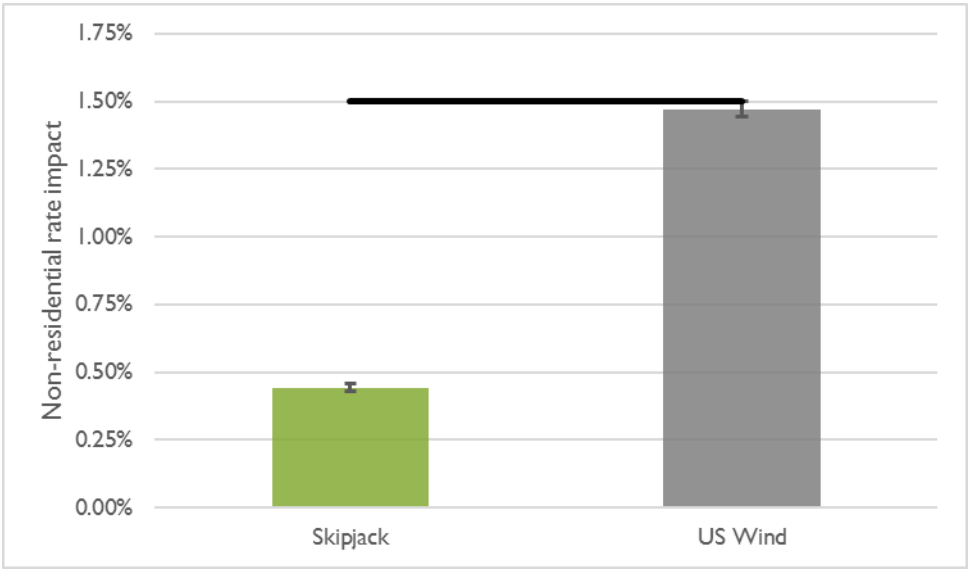
[23] While the OREC price will not change for MD ratepayers, there is some risk to the developer that should MD energy sales fall there would be a corresponding decrease. Both applicants bear this risk.

Figure 1 - Residential Rate Impact Uncertainty from a Five Percent Change Avoided Energy and Capacity Credits ~~<Begin Confidential>~~



~~<End Confidential>~~

Figure 2 - Non-Residential Rate Impact Uncertainty from a Five Percent Change Avoided Energy and Capacity Credits ~~<Begin Confidential>~~



The two figures show that a five percent change in the forecast of avoided energy and capacity credits results in an increase in the rate impacts that would cause the US Wind proposal to exceed the rate impact caps. On the other hand, a similar

change to the values in Skipjack's proposal will not result in an exceedance of the rate impact caps. ~~**<End Confidential>**~~

IX. SKIPJACK'S APPLICATION PROVIDES THE COMMISSION WITH MORE FLEXIBILITY

Q Earlier you summarized sensitivities that would affect the residential and non-residential rate impact caps of the US Wind's project proposal. Do these sensitivities also impact the Skipjack project proposal?

A Yes, the same changes in market dynamics that would impact the US Wind proposal would also apply to the Skipjack proposal. However, there are important distinctions between the resulting impacts on these two proposals. When I applied the same sensitivity analysis to the Skipjack proposal, ~~**<Begin Confidential>**~~ the results did not exceed either the residential or non-residential rate caps. I believe, therefore, that the Skipjack proposal would allow the residential and non-residential rates to remain below the statutorily prescribed maximums even if the value of certain assumptions increased or decreased. ~~**<End Confidential>**~~

Q Are there projections of future offshore wind cost trends?

A Yes, recent studies examine offshore wind cost trends utilizing both data and expert opinions. In 2015, the National Renewable Energy Laboratory ("NREL") published a report that examines the state of the market for offshore wind technologies.[24] This study investigated available costs and projected costs to analyze the state of the global offshore wind market. In 2016, authors from the Lawrence Berkeley National Laboratory conducted a survey of offshore wind experts to forecast cost trends in the industry.[25] Both approaches provide useful data for the Commission to consider.

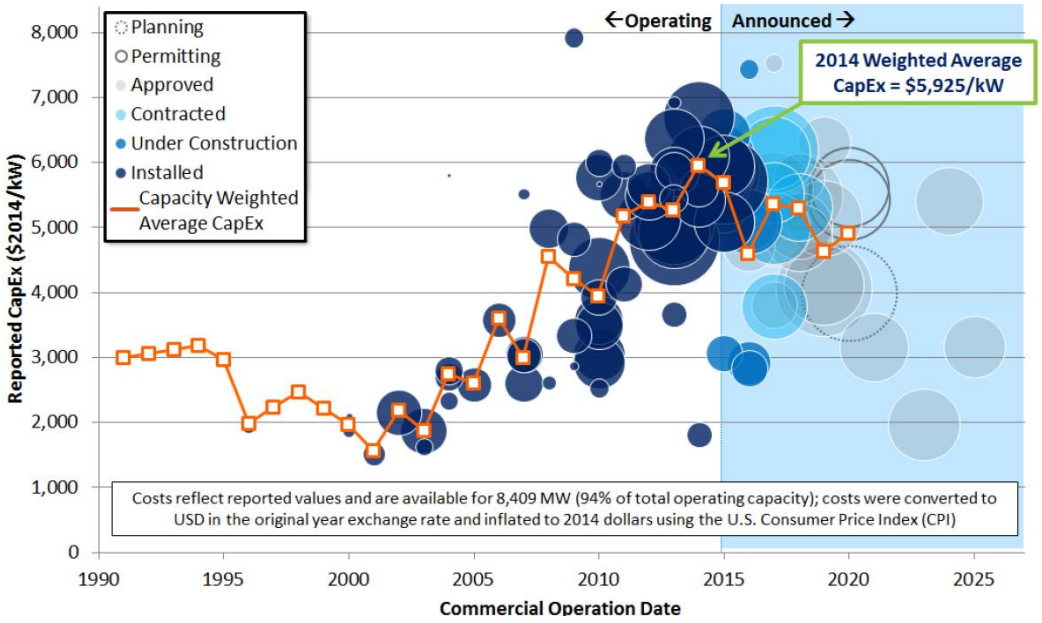
[24] Smith, A. et al. 2014-2015 Offshore Wind Technologies Market Report. NREL/TP-5000-64283. September 2015. Attached hereto at **Attachment MPC-2**.
[25] Wiser, R. et al. *Expert Elicitation Survey on Future Wind Energy Costs*. Nature Energy. Article 16135 September 2016. Attached hereto as **Attachment MPC-3**.

Q Please summarize the findings from the 2015 NREL report regarding trends in capital expenditures for the offshore wind industry.

A The 2015 NREL report concludes that capital expenditures are the largest contributor to the life cycle costs of offshore wind projects.[26] In their examination, the authors combined reported capital expenditures for operational projects and announced projects at various stages. The authors recognize that the reported capital expenditures for individual projects have limitations regarding transparency and comparability. That said, the capacity weighted capital expenditure average trend line provides insight into the direction of cost trends in the industry as shown in

A Figure 3 below.

Figure 3 - Offshore Wind Capital Expenditure Trends from 2015 NREL Report[27]



The capacity weighted capital expenditure trend shows a peak in 2014 that is now trending downward globally in both contracted and approved offshore wind

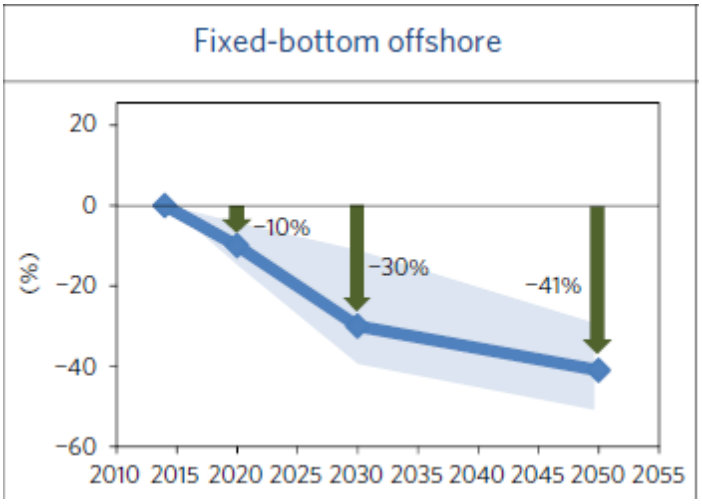
[26] NREL (2015) P.68.
[27] NREL (2015) Figure 20. P.69.

projects. This trend is corroborated by the opinions within the offshore wind industry.

Q Please summarize the findings from the survey of offshore wind experts.

A A group of researchers solicited the opinions of 163 wind experts across the globe about future cost trends in the wind industry including fixed bottom and floating offshore wind platforms.[28] The following figure shows the median elicited expectation trend in the levelized cost of energy projections for fixed bottom offshore wind projects relative to a 2014 baseline value.

Figure 4 - Elicited Trends in Levelized Cost of Energy for Offshore Wind Projects from 2016 Research Paper.



Similar to the data presented in the 2015 NREL report, the 2016 paper suggests that there is a widespread expectation that medium- and long-term trends in the cost of offshore wind projects will continue to decline.

The two figures suggest that future offshore wind proposals might benefit from the downward cost trend. ~~**<Begin Confidential>**~~ Should the Commission approve the US Wind proposal, it would be unable to consider future offshore wind projects given the current residential and non-residential rate impact caps. ~~**<End Confidential>**~~

[28] Wiser, R (2016).

X. FINDINGS AND RECOMMENDATIONS

Q What are your findings and recommendations for the Commission?

A I recommend and conclude the following:

- ~~**<Begin Confidential>**~~ Levitan found that both the US Wind and Skipjack applications meet the minimum legislative thresholds ~~**<End Confidential>**~~ described in the Code of Maryland Regulations ("COMAR") 20.61.06 and Md. Code Ann. Pub. Utils. ("PUA") § 7-704.1.

- The Levitan Report found that the US Wind project proposal would result in a net residential rate impact of ~~**<Begin Confidential>**~~ $1.49/month or 99 percent ~~**<End Confidential>**~~ of the allowable residential rate impact cap of $1.50/month. The Levitan Report found that the Skipjack project proposal would result in a net residential rate impact from ~~**<Begin Confidential>**~~ $0.45 or 30 percent ~~**<End Confidential>**~~ of the allowable residential rate impact cap of $1.50/month.

- The Levitan Report found that the net economic benefits of the US Wind project proposal are approximately ~~**<Begin Confidential>**~~ twice ~~**<End Confidential>**~~ the net economic benefits of the Skipjack project proposal.

- ~~**<Begin Confidential>**~~ The ratepayer impact of the US Wind project proposal allows for very minimal uncertainty in Levitan's forecasts of market dynamic values in order to remain under the mandated legislative rate impact caps. Small changes, within the realm of reasonable uncertainty, to the forecasted assumptions used in the US Wind rate impact analysis, such as actual and forecasted energy prices, capacity prices, REC prices, and/or energy production, may result in an exceedance of the residential and/or non-residential rate impact thresholds established under Maryland law. Similar changes to

the forecasted assumptions used in the Skipjack proposal, however, would result in rate impacts below the rate impact caps.

- The Commission should accept the Skipjack application based on the rate impact calculations used in the Levitan Report. These calculations show that small fluctuations to the underlying assumptions used in the Levitan Report are unlikely to push the rate impact of Skipjack's project proposal above the residential rate impacts thresholds established by the Maryland legislation. The Skipjack proposal will also afford Maryland ratepayers the opportunity to consider additional offshore wind projects. These projects may take advantage of downward cost trends observed and anticipated in the future. ~~**<End Confidential>**~~

Q Does this conclude your testimony?

A It does. However, I reserve the right to update my testimony based upon additional responses from the Applicants and Levitan.