Rev 2: Updates shown in red on slides 7 and 23-26

# Offshore Wind Capital Costs and ITC for ORTP Calculation: A Proposed Amendment

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NEPOOL Markets Committee

October 6-8, 2020

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The comments expressed herein represent the views of RENEW and not necessarily those of any particular member of RENEW.

# Presentation Outline

- Background: How We Got Here
- Summary of RENEW's Concerns and Proposed Amendment
- Stepping Back to Look at ORTP Intent
- Intuition about Offshore Wind Costs
- ITC Assumption
- Capital Cost Assumption
  - Top Down Benchmarking
  - Bottom Up Benchmarking
- Impact on the ORTP Value
- Cost Estimate Precision vs. ORTP
- Updated RENEW Proposal
- Tariff Redlines

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# Background: How We Got Here

- ISO has proposed to use $5,876/kW (2019$) for the overnight capital cost of Offshore Wind, which RENEW believes is far outside the range of reasonableness

| | ISO | RENEW | Links |
|---|---|---|---|
| MC June 10 | Proposed $5,500-6,000/kW range | Met with ISO, shared public reports showing lower costs | June 10 CEA Materials |
| MC July 14-15 | Refined estimate to $5,876/kW (2019$) | Engaged Daymark Energy Advisors to analyze the cost that could be supported by revenues from recent, local OSW PPAs.<br><br>Daymark presented findings to MC: Installed cost of $2,300-3,700/kW (2019$) could be supported by PPAs. Weighted avg cost = $2,900/kW.<br><br>RENEW presented more public data supporting lower cost range. | July 14-15 CEA Materials<br><br>RENEW Presentation |

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# Background: How We Got Here (cont'd)

| | ISO | RENEW | Links |
|---|---|---|---|
| MC August 11-13 | Released Discounted Cash Flow (DCF) model showing overnight capital cost of $5,876/kW, 0% ITC.<br><br>Preliminary ORTP = $58.88-59.05/kW-mo | Released Daymark model used to calculate capital costs that could be supported by PPA rates.<br><br>Presented memo to MC with more public data and line item feedback on several elements of the capital cost assumption supporting lower capital cost.<br><br>Shared information with MC and sent detailed follow up to ISO on 18% ITC being assumed for 2025 COD OSW projects. | August 11-13 CEA Materials<br><br>RENEW Memo<br><br>RENEW PPA Model |
| MC September 8-10 | No change to $5,876/kW cost assumption.<br><br>Updated DCF model with 18% ITC to illustrate impact, stated intention to use 0% ITC in final model | Presented even more public data supporting lower cost range.<br><br>Presented proposed amendment changing overnight capital cost to $2,900/kW (2019$)<br><br>Indicated intention to offer amendment to assume 18% ITC | September 8-10 CEA Materials<br><br>RENEW Presentation |

Updated

# Summary of RENEW's Concerns and Proposed Amendment

- ISO proposes to use $5,876/kW (2019$) for the overnight capital cost of Offshore Wind and assumes 0% Investment Tax Credit (ITC), resulting in an ORTP of $52.459 - $52.667/kW-mo
- RENEW believes this cost is double current commercial expectations based on:
  - Daymark's analysis of costs that could be supported by recently executed local offshore wind PPAs
  - Publicly available data from a wide range of sources
- RENEW believes an 18% ITC should be assumed based on:
  - Review of ITC (in lieu of PTC) eligibility rules
  - Public reports of actual projects with 2025 COD expecting to use ITC
- ISO has not presented any benchmarking that supports any element of its cost assumption, either top-down or bottom-up
- RENEW is proposing an amendment to use a lower overnight cost assumption ($3,000/kW, 2019$) and 18% ITC for OSW in FCA 16

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# Stepping Back
# What the Tariff Requires in This Exercise

- This is what the Tariff says about the development of the capital cost and tax assumptions to be used in the ORTP model:

> **III.A.21.1.2. Calculation of Offer Review Trigger Prices.**
>
> (b) For New Generating Capacity Resources, the methodology used to recalculate the Offer Review Trigger Price pursuant to subsection (a) above is as follows. **Capital costs**, expected non-capacity revenues and operating costs, assumptions regarding depreciation, **taxes** and discount rate **are input into a capital budgeting model** which is used to calculate the break-even contribution required from the Forward Capacity Market to yield a discounted cash flow with a net present value of zero for the project. The Offer Review Trigger Price is set equal to the year-one capacity price output from the model. The model looks at 20 years of real-dollar cash flows discounted at a rate (Weighted Average Cost of Capital) consistent with that expected of a project whose output is under contract (i.e., a contract negotiated at arm's length between two unrelated parties).

- Neither the Tariff nor ISO's original filing to create the MOPR in 2012 (ER12-953) discuss how the capital cost assumption is to be developed.

# Stepping Back
# Intent of the ORTP Calculation

- ISO's Dec 2013 filing updating ORTPs for FCA 9 (ER14-616) described the intent of the ORTP calculation as follows:

  "ORTPs are set at the low end of the competitive range of expected offers so as to strike a reasonable balance by **only subjecting resources to IMM review which plainly appear commercially implausible absent out-of-market revenues**."

  "It is important that the ORTPs be set **at a level consistent with expected prevailing market conditions for the pertinent Capacity Commitment Periods** so as to ensure the effective implementation of buyer-side mitigation."

- In FERC's February 2013 Order accepting ISO's proposal, they affirm that the proposal complies because of this intention:

  "In the case of New England, use of trigger prices at the low end of the spectrum strikes a reasonable balance by not subjecting clearly competitive offers to IMM evaluation, but **only addressing those offers that plainly appear commercially implausible absent out-of-market revenues**. Because we find the assumptions behind ISO-NE's trigger prices, and the trigger prices themselves, well within the range of reasonableness, we find them in compliance with prior Commission directives."

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# Stepping Back
# Intent of the RENEW Amendment

- What RENEW is proposing:
  - RENEW proposes to substitute capital cost and tax (ITC) assumptions that are *consistent with expected prevailing market conditions* for FCA 16
- What RENEW is not proposing:
  - RENEW is not suggesting that any out-of-market revenues be considered or used in any way in the ORTP calculation.

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# Stepping Back
# Expected vs. Actual Costs

- The IMM stressed the importance of setting the ORTP "**at a level consistent with expected prevailing market conditions**"
- Only offers "**which plainly appear commercially implausible absent out-of-market revenues**" are meant to be subject to IMM review.
- If the current "expected prevailing market condition" is that it will cost $3,000/kW to build an OSW project in New England with a 2025 COD, it doesn't matter whether developers ultimately experience cost overruns.
- The purpose of the ORTP analysis is to prevent offers that would be uneconomic absent out-of-market revenues. It is not to protect developers (or the market) from bad commercial decisions.
- RENEW's proposed assumption is based on results from the analysis of three projects being developed by market competitors and is aligned with recent publicly reported offshore wind cost data.
- We believe this is sufficient evidence that RENEW's assumption, rather than the ISO's, represents the "expected prevailing market condition" and it is not necessary (or appropriate) to look only at actual costs for projects that have already been built given the rapid pace of change in OSW.

# Stepping Back
# Original ORTP Capital Cost Development

- The original capital cost assumptions developed for the first round of ORTPs for FCA 8 were developed by Shaw Consultants International in 2012.
- Shaw's final report, included with ISO's 2012 MOPR filing, describes the source of their wind cost estimates:
  - Onshore wind
    - "Based on current project cost information for an actual wind project reviewed by Shaw Consultants."
  - Offshore wind
    - "Based on a survey of published cost data" (cites 4 news articles published by *Block Island Times, Offshore Wind Biz, The Providence Journal, Wind Power*)
- The report presented only total EPC costs
  - Their Offshore Wind overnight capital cost assumption was $4,905/kW (2011$) (equivalent to $5,747/kW in 2019$).
- It is understandable that somewhat more rigor might be desirable, even if not required.

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# Stepping Back
# "Bottom Up" Approach Introduced in FCA 9

- The IMM introduced the "bottom up" approach to estimating costs in the FCA 9 ORTP recalculation. They describe the rationale in their testimony (ER14-616):

  > "The ORTPs for generation resources are based on detailed "bottom up" cost analyses by resource and technology type. **A "bottom up" cost analysis is conducted by defining the individual components of a project (i.e., equipment costs, labor costs, engineering costs, interconnection fees, etc.), estimating each of the project's component costs and, finally, summing the individual component costs to develop a total project cost.** The "bottom up" approach allows for greater transparency of the assumptions, as well as permitting cross-comparison between different resource and technology types. In contrast, performing a "top-down" analysis by, for instance, relying exclusively on high-level publicly available reports to construct ORTPs, would not provide the IMM with sufficient confidence to effectively implement buyer-side mitigation."

- Later in their testimony they add:

  > **"All cost components were cross-compared against other publicly available datasets for reasonableness."**

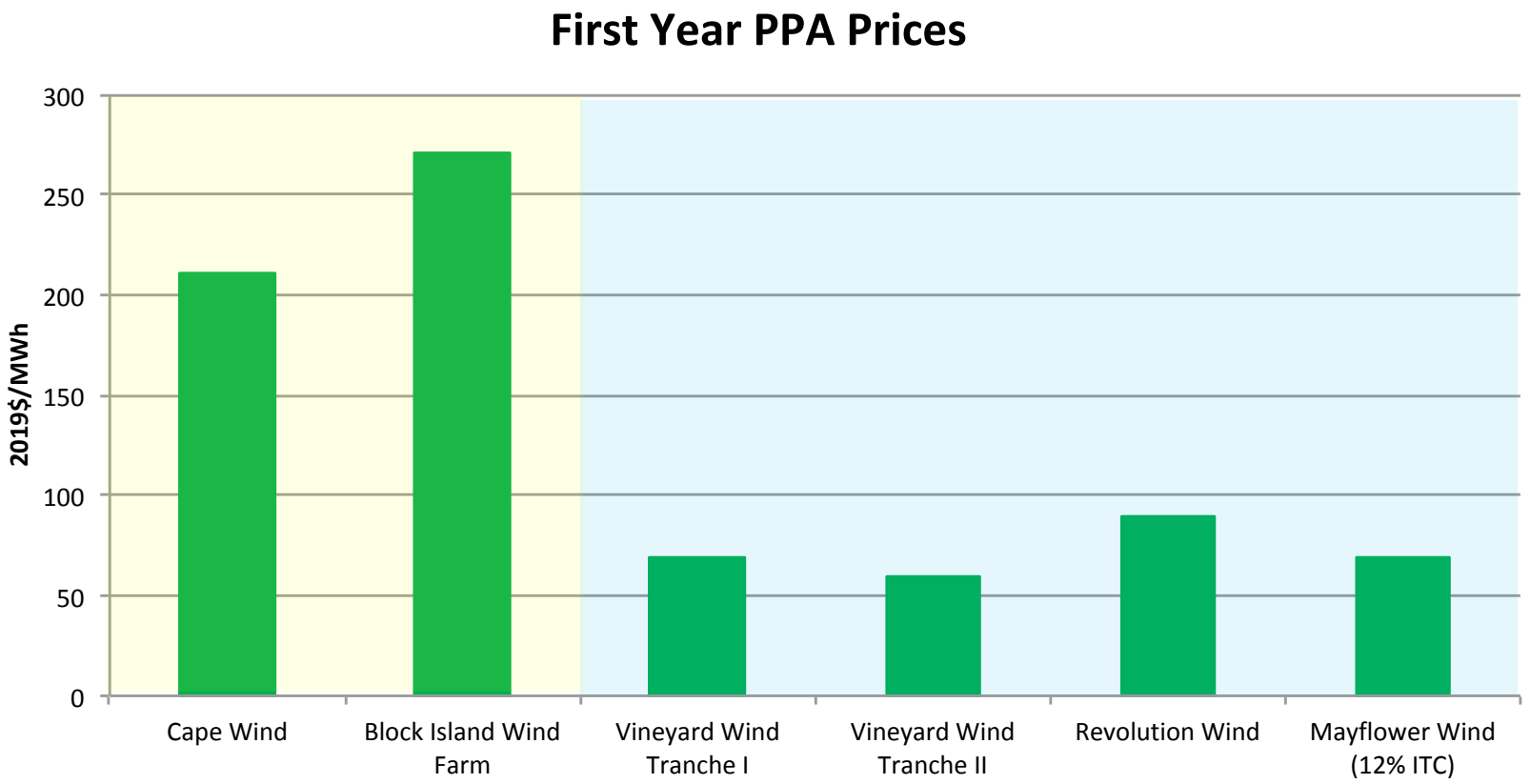
# Stepping Back
# Current Approach Strays from Intent

- The development of ISO's currently proposed OSW capital cost assumption strays from the described intent.
  - It does not reflect "expected prevailing market conditions"
  - ISO has so far rejected all attempts we have made to perform "a cross-compar[ison] against other publicly available datasets for reasonableness" and has shared none of their own.

- RENEW's proposed capital cost and tax assumptions conform to the stated intent.
  - Reflects "expected prevailing market conditions"
  - The Daymark analysis provides full "transparency of the assumptions"
  - Reflects an extensive "cross-compar[ison] against other publicly available datasets for reasonableness."

# Some Intuition About OSW Costs
# Local PPA Prices Over Time

- There has been a 70% reduction in local OSW contract prices over the past decade driven by both capital and operating cost reductions




| | Year of PPA | 2010 | 2009 | 2019 | 2019 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|
| Contract Products Included | Energy | x | x | x | x | x | x |
| | RECs | x | x | x | x | x | x |
| | Capacity | x | x | | | | |

# Some Intuition About OSW Costs Highlight: Cape Wind

- Project history
  - Cape Wind entered the interconnection queue in 2001
  - Was supposed to be the western hemisphere's first offshore wind project
  - In 2010 signed a PPA for 50% of output with NGrid at $207/MWh in first year
    - Starting price was later reduced to $187/MWh
  - In 2012 signed PPA for 25% of output with NStar starting at $187/MWh
  - Cleared as New in FCA 7 in February 2013
    - IMM reviewed Cape Wind's cost projections to determine whether its offer was Out-of-Market (per III.13.1.1.2.6 at the time)
- Project Description
  - Project planned to install 130 wind turbines rated 3.6 MW each
  - Total size = 468 MW
  - Expected cost = $2.6 billion
  - **Expected cost per kW = $5,556/kW**

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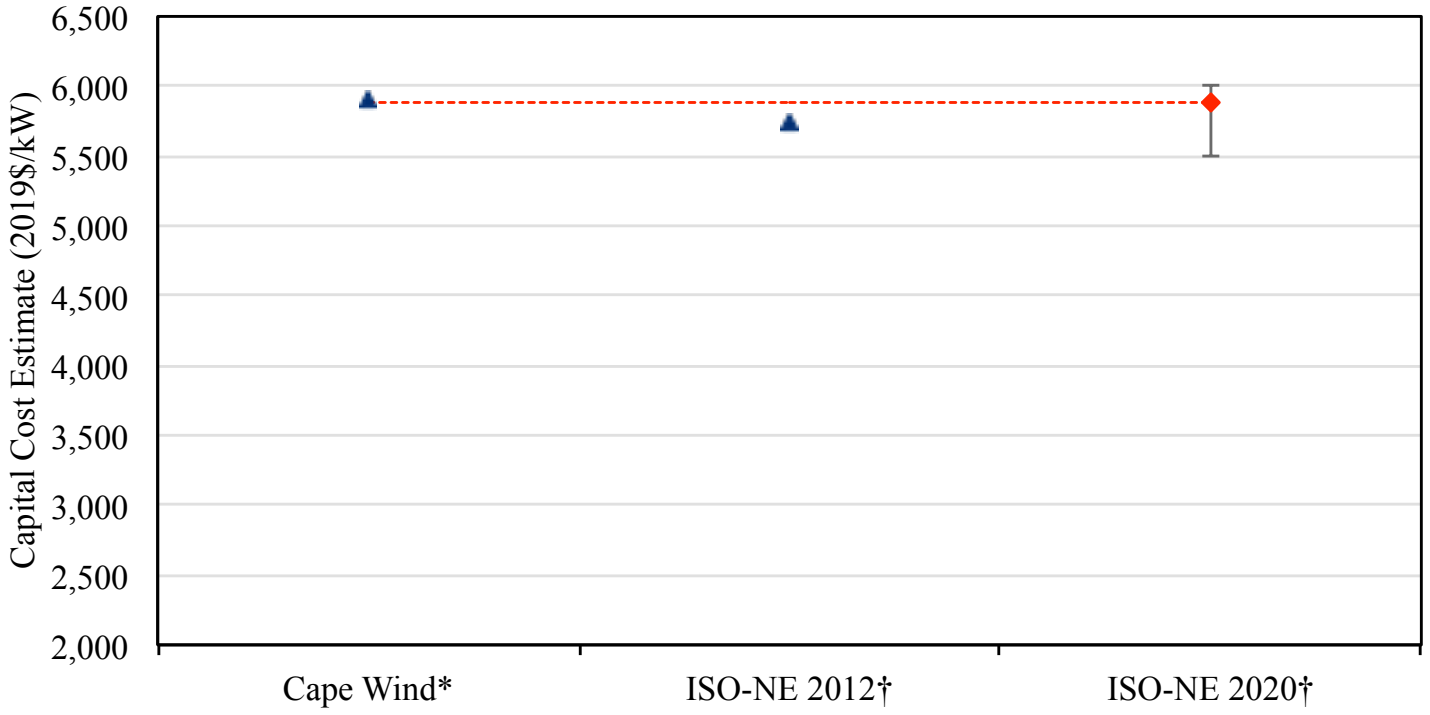
# Some Intuition About OSW Costs Highlight: Cape Wind

- Despite the 70% reduction in OSW contract prices, ISO's proposed capital cost assumption appears strikingly similar to the expected cost of Cape Wind and the assumption used by ISO in the 2012 ORTP calculation




*Installed Capital Costs
†Overnight Capital Costs

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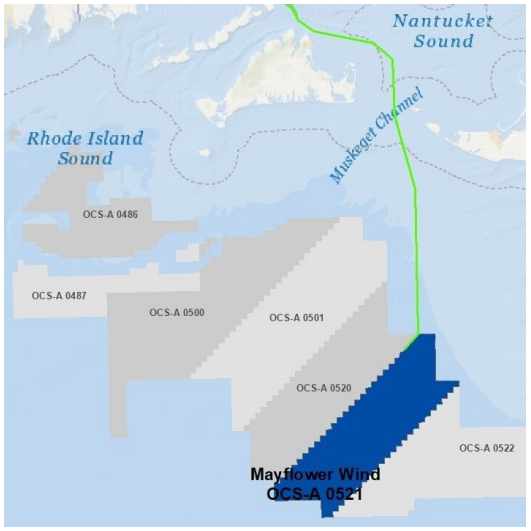
# Some Intuition About OSW Costs Highlight: Mayflower Wind

- Project history
  - Mayflower Wind won rights to lease area capable of up to 1,600 MW in December 2018, entered interconnection queue that month
  - Joint venture of Shell and EDP Renewables
  - In early 2020 signed a PPA for 100% of output from 804 MW project with 2025 COD, resulting from MA 83CII RFP
    - $77.76/MWh fixed price for 20 years (no escalation) for energy and RECs
      - Assumes project qualifies for 12% Investment Tax Credit (ITC)
    - PPA requires project to maximize ITC
      - Fixed price reduced to $75.26/MWh if project qualifies for 18% ITC
  - Has not qualified in FCM yet - Not public whether or not IMM has reviewed project's costs in qualification process
- Project Description
  - Turbine selection TBD
  - Total contracted size = 804 MW
  - Expected cost = not public
  - Implied cost from DEA analysis = $2,300-$2,600/kW



# ITC Assumption

- In December 2019 the production tax credit (PTC) was extended
  - Qualifying wind projects can claim an investment tax credit (ITC) in lieu of the PTC
  - ITC values before and after the December 2019 change are shown in table
- Wind projects are qualified to claim the ITC if they meet two requirements
  1. Start of construction, as shown in table
  2. Continuity
- Start of Construction can be demonstrated by
  - actual physical construction, or
  - incurring 5% of total eligible costs
- ISO assumes the ORTP project starts physical construction in 2021
  - Could meet 18% ITC eligibility requirement by incurring 5% of costs by Dec 31, 2020
  - Common practice

| Start of Construction Before | ITC (Prior law) | ITC (Dec 2019 law) |
|---|---|---|
| Jan 1, 2017 | 30% | 30% |
| Jan 1, 2018 | 24% | 24% |
| Jan 1, 2019 | 18% | 18% |
| Jan 1, 2020 | 12% | 12% |
| Jan 1, 2021 | 0% | 18% |

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# ITC Assumption

- Continuity can be demonstrated by
  - Achieving COD within 4 years of the year in which “construction” began (safe harbor, no continuity documentation required)
  - Providing documentation of the facts and circumstances that show continuity through COD
- Demonstrating continuity could be hard for a project that ”began construction” in 2016 or 2017 intending to rely on the 4-year safe harbor and has not documented continuity (or has not made continuous efforts)
- Demonstrating continuity for a project that a) has not yet begun construction and b) knows it will require 5 years to reach COD, would be expected as standard practice
  - This is the case for the ORTP project
- Mayflower Wind is a perfect case in point
  - Signed PPA in Feb 2020 that assumes project qualifies for at least 12% ITC, required to make efforts to qualify for 18% ITC (tax law changed in middle of PPA negotiation)
  - Contracted COD is 2025

# Why RENEW Believes ISO's Capital Cost Assumption is High – Top Down Benchmarking

RENEW has primarily looked to two top-down methodologies for benchmarking the capital cost assumption.

1. PPA Analysis Underpinning RENEW's Recommendation
   - RENEW Engaged Daymark Energy Advisors to analyze the cost that could be supported by revenues from recent, local OSW PPAs.
   - Daymark presented findings to MC in July, posted model for MC in August: Installed cost of $2,300 to $3,700/kW (2019$) could be supported by PPAs. Weighted avg cost = $2,900/kW.
   - **Updating this analysis utilizing ISO's FCA 16 assumptions results in a weighted average cost of $3,000/kW that could be supported by the PPAs.**
   - There is uncertainty in the analysis, but RENEW utilized what we believe to be reasonably conservative assumptions and sensitivities in a fully transparent analysis and has received no feedback regarding any inappropriate assumptions

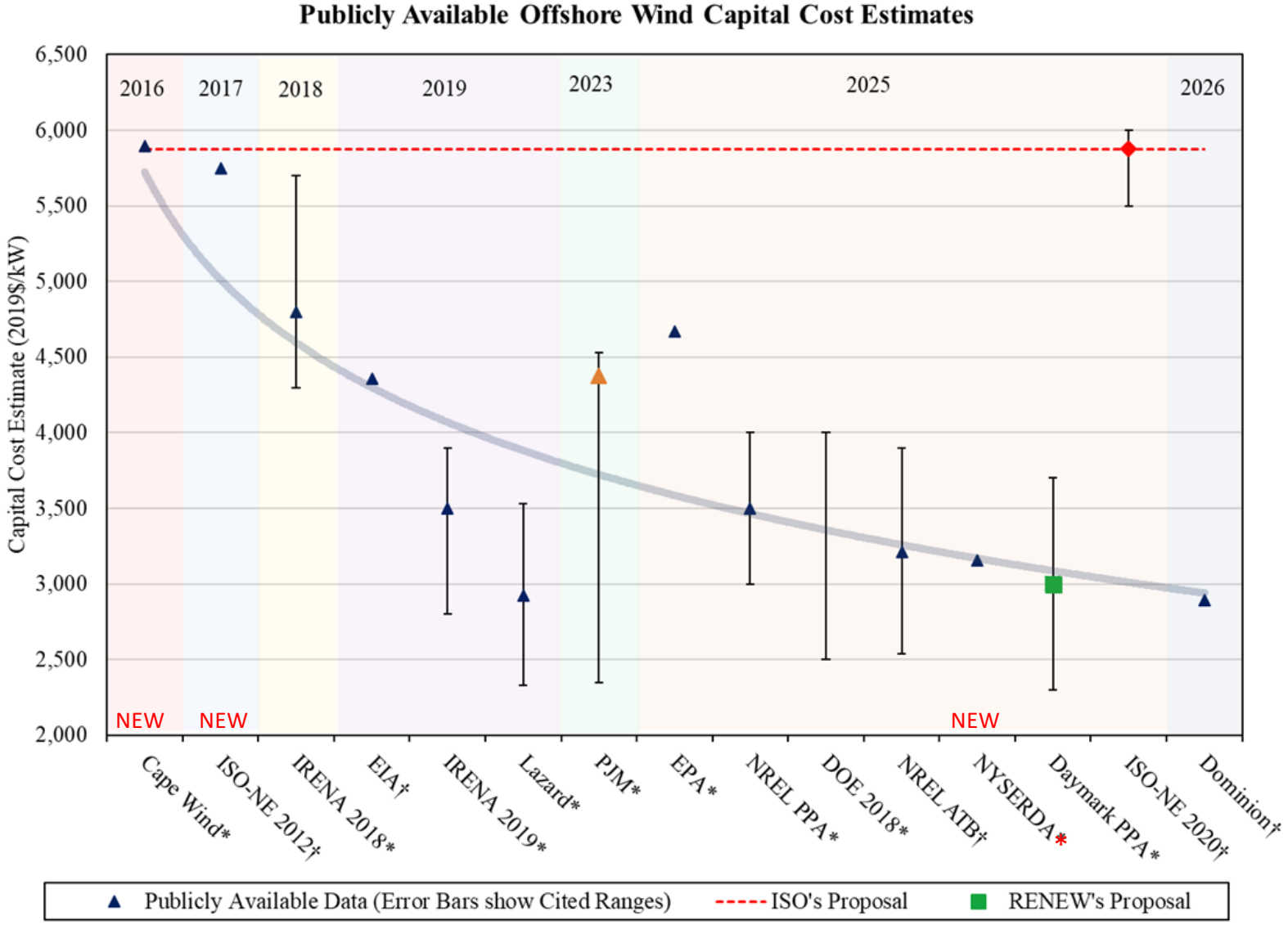
2. Literature Review
   - RENEW has looked at a wide range of sources to gauge industry expectations for capital costs both globally and in the United States over time (Cape Wind, NREL, Lazard, DOE, IRENA, EPA, EIA, Dominion, NYSERDA, and PJM)
   - This provides extensive benchmarking for the reasonable range of where the final value should land

# A Note on Cost Terminology

- Some of the cost numbers we provide are ”Installed capital costs” while others are “Overnight capital costs”, all are labelled as such
- Overnight capital cost is the cost of a construction project if no interest was incurred during construction, as if the project was built "overnight"
- Installed capital cost includes interest incurred during construction
- Overnight costs are lower than installed costs
- The difference between these metrics is small enough that large cost trends can still be observed when looking at both types of costs

Updated
(EPA shifted up)

# A Review of the Publicly Available Data Regarding Offshore Wind Capital Costs




*Installed Capital Costs
†Overnight Capital Costs
‡Shaded bands indicate the year of expected/actual COD NEW

*Notes on the values in this figure are included on the next four slides*

Updated

# Notes on the Publicly Available Data Regarding Offshore Wind Capital Costs

| | Source | Year Published | Representative Value (2019$/kW) | Range (2019$/kW) | Link |
|---|---|---|---|---|---|
| 1. | Cape Wind | ~2012 | ~$5,896 | N/A | www.nytimes.com/2017/12/19/us/offshore-cape-wind-farm.html |
| 2. | ISO-NE 2012: FCA 8 ORTP Calculation | 2012 | $5,747 | N/A | https://www.iso-ne.com/static-assets/documents/regulatory/ferc/filings/2012/dec/er12_953_001_12_3_12_fcm_redesign_compl.pdf |
| 3. | IRENA: Renewable Power Generation Costs in 2018 | 2019 | $4,800 | $4,300-5,700 | www.irena.org/-/media/Files/IRENA/Agency/Publication/2019/May/IRENA_Renewable-Power-Generations-Costs-in-2018.pdf |
| 4. | EIA: AEO2020 Cost of New Generating Technologies | 2019 | $4,356 | N/A | www.eia.gov/outlooks/aeo/assumptions/pdf/table_8.2.pdf |
| 5. | IRENA: Renewable Power Generation Costs in 2019 | 2019 | $3,500 | $2,800 – 3,900 | www.irena.org/publications/2020/Jun/Renewable-Power-Costs-in-2019 |
| 6. | Lazard: 2019 Levelized Cost of Energy | 2019 | $2,925 | $2,330 – 3,530 | www.lazard.com/media/451086/lazards-levelized-cost-of-energy-version-130-vf.pdf |
| 7. | PJM: Recalculation of the Default MOPR Floor Offer Prices | 2020 | $4,375 | $2,350 – 6,323 | www.pjm.com/-/media/committees-groups/committees/mic/2020/20200228-mopr/20200228-item-03a-pjm-preliminary-cone-values.ashx |
| 8. | EPA: IPM Platform 2018 Reference Case | 2018 | $4,673 | N/A | www.epa.gov/airmarkets/documentation-ipm-platform-v6-november-2018-reference-case-all-chapters |
| 9. | NREL Vineyard Wind PPA Analysis | 2019 | $3,500 | $3,000-4,000 | www.nrel.gov/docs/fy19osti/72981.pdf |
| 10. | DOE: 2018 Offshore Wind Technologies Market Report | 2018 | N/A | $2,500 – 4,000 | www.energy.gov/sites/prod/files/2019/09/f66/2018%20Offshore%20Wind%20Technologies%20Market%20Report.pdf |

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Updated

# Notes on the Publicly Available Data Regarding Offshore Wind Capital Costs

| | Source | Year Published | Representative Value (2019$/kW) | Range (2019$/kW) | Link |
|---|---|---|---|---|---|
| 11. | NREL: 2020 Annual Technology Baseline | 2020 | $3,213 | $2,541 – 3,900 | atb.nrel.gov/electricity/2020/data.php |
| 12. | NYSERDA/NY DPS: White Paper on Clean Energy Standard Procurements to Implement New York's Climate Leadership and Community Protection Act | 2020 | $3,155 | N/A | https://www.nyserda.ny.gov/About/Newsroom/2020-Announcements/2020-06-18-New-York-Advances-Framework-to-Implement-the-States-Climate-Law-and-Decarbonize-its-Power-Sector |
| 13. | Daymark PPA Analysis for RENEW | 2020 | $3,000 | $2,300 – 3,700 | www.iso-ne.com/static-assets/documents/2020/07/a5_b_ii_renew_northeast_offshore_wind_capital_costs_and_rec_price_assumptions_for_ortp_calculation_rev1.pdf |
| 14. | ISO-NE: Overnight Capital Cost | 2020 | $5,876 | $5,500 – 6,000 | www.iso-ne.com/static-assets/documents/2020/07/a5_b_i_cea_mm_presentation_cone_ortp.pptx |
| 15. | Dominion IRP | 2020 | $2,894 | N/A | scc.virginia.gov/docketsearch/DOCS/4m__01!.PDF |

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Updated

# Notes on the Publicly Available Data Regarding Offshore Wind Capital Costs

1. **Cape Wind**: The expectation that the project would cost $2.6 billion was widely reported. It was not reported what dollar year this was in so we assumed it was in 2016$ based on the project clearing in FCA 7.
2. **ISO-NE 2012**: FCA 8 ORTP Calculation. ISO-NE December 2, 2012 filing in Docket ER12-953, Benchmark Price Model Inputs Final Report by Shaw Consultants International, Section 2.1.3 show an overnight capital cost of $4,905/kW (2011$). Interest during construction is excluded from overnight cost.
3. **IRENA**, Renewable Power Generation Costs in 2018: Of the European projects commissioned in 2018 that were 400 MW or larger (the largest one being around 550 MW) the capital cost range was $4,300 - $5,700/kW with a simple average of $4,800 (2018$). This comes from Figure 3.3 of the report.
4. **U.S. Energy Information Administration**, Cost and Performance Characteristics of New Generating Technologies, Annual Energy Outlook 2020: Table 1 shows the base overnight cost of $4,356/kW (2019$) for a 400 MW project that is not among the first four OSW units. Table 2 shows the regional adjustment of 1.0 for OSW in ISO-NE.
5. **IRENA**, Renewable Power Generation Costs in 2019: Of the European projects commissioned in 2019 that were 400 MW or larger (the largest one being about 600 MW) the capital cost range was $2800 - $3900/kW with a simple average of $3,500 (2019$). This comes from Table 4-4 of the report.
6. **Lazard's** Levelized Cost of Energy Analysis – Version 13.0, November 2019: Slide 2, note 2 gives a capital cost range of $2,330 - $3,530/kW. Slide 10 note 1 gives an estimated midpoint capital cost of $2,925/kW. Slide 17 shows the project size is 210 – 385 MW and includes a CapEx range of $2,350 - $3,550/kW due to rounding to the nearest $50/kW).
7. **PJM** presentation to the Market Implementation Committee, February 28, 2020, "Preliminary Default MOPR Floor Offer Prices for New Generation Capacity Resources", slide 4 gives an assumed capital cost of $4,375/kW for a 400 MW project. Slide 14 lists the capital costs in each of the sources reviewed by PJM, ranging from $2,350 - $6,323/kW. PJM selected the second highest cost among the sources reviewed that represented a fixed-bottom turbine rather than a floating turbine (of the values reviewed by PJM, those above $4,529/kW were for turbines on floating platforms and have therefor been excluded from the range shown in this presentation).
8. **EPA**, IPM Platform 2018 Reference Case: As part of the EPA's Power Sector Modeling Platform v6 for 2018, the developed capital cost assumption for offshore wind with a vintage of 2025 was $4,122/kW (2016$) for a 600 MW project as seen in Table 4-16. EPA suggests a locational adder for ISO-NE (EPA at 4-26) resulting in a value of $4,390/kW (2016$).

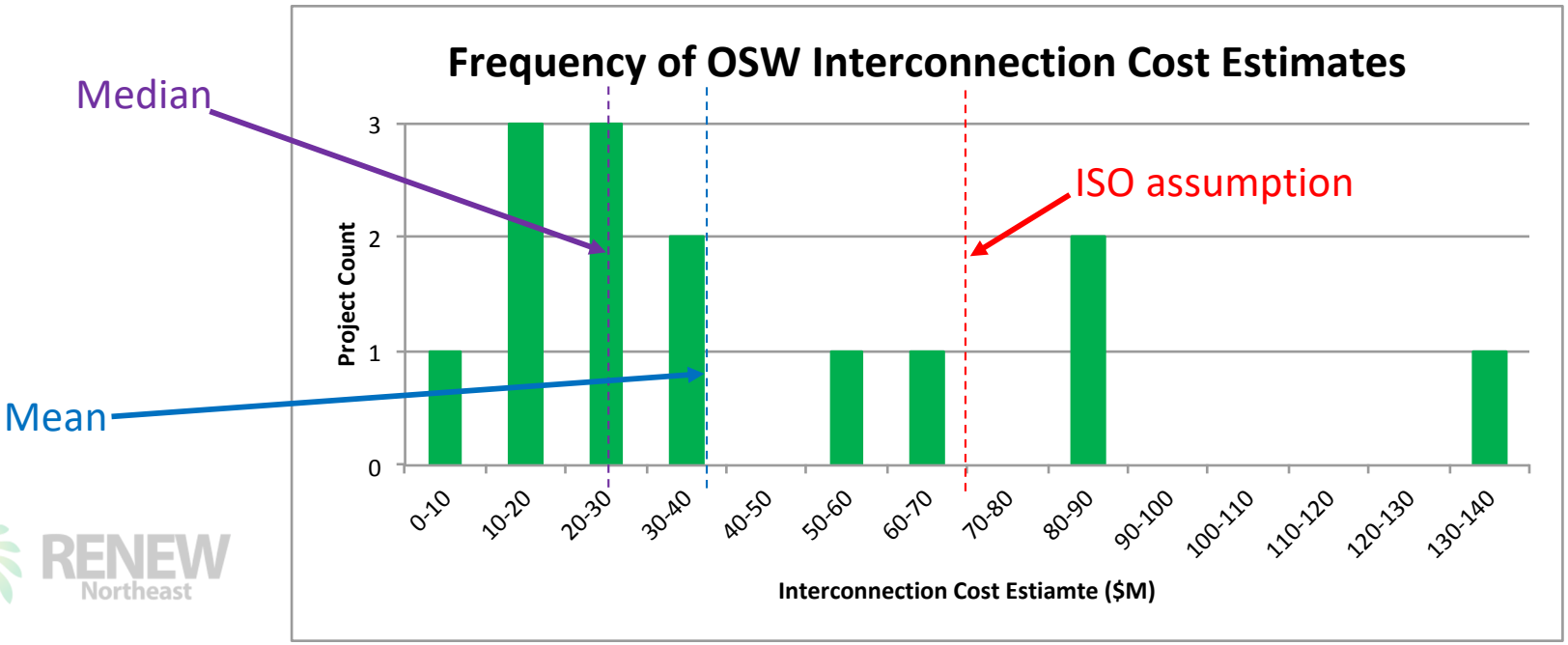
# Notes on the Publicly Available Data Regarding Offshore Wind Capital Costs

9. **NREL PPA,** The Vineyard Wind Power Purchase Agreement: Insights for Estimating Costs of U.S. Offshore Wind Projects: After the PPA price between the Massachusetts electric distribution companies and Vineyard Wind was published, NREL endeavored to calculate an implied LCOE for the project. As part of this calculation they estimated capital costs for the 800 MW project to be $3,500/kW citing Bloomberg New Energy Finance and studied this number with a sensitivity of ±$500/kW.
10. **DOE**, 2018 Offshore Wind Market Technologies Report: Citing reported project data, DOE suggested that they expect to see the gradual decline of CapEx costs to a range of $2,500-4,000/kW between the years 2020-2030.
11. **NREL, 2020 ATB**: National Renewable Energy Laboratory's 2020 Annual Technology Baseline (ATB): Offshore Wind Classes 1-7 are for fixed-bottom turbines with a capital cost range of $2,491 to $3,824/kW (2018$) for the sum of the overnight capital cost (which excludes grid connection costs) and the grid connection cost for a 600 MW project with a 2025 COD. Class 6 is closest to the hypothetical ORTP project, with a moderate/expected cost of $3,150/kW. Only Class 7 has a higher expected cost of $3,152/kW.
12. **NYSERDA/NY DPS:** White Paper on Clean Energy Standard Procurements to Implement New York's Climate Leadership and Community Protection Act: "Base case" cost assumption for 800 MW project in NY Bight with AC interconnection and 2025 COD based on Renewables Consulting Group's proprietary model and benchmarked against actual bids received by NYSERDA in its 2018 OSW solicitation. Total cost assumption = $3,218/kW (2020$). This number represents a total installed cost, not an overnight cost.
13. **Daymark PPA Analysis for RENEW**: Daymark Implied Offshore Wind CapEx Calculation. Summary presented to the NEPOOL Markets Committee at its July 14-15, 2020 meeting (agenda item 5.b.ii), spreadsheet with calculation details posted with the materials for the August 11-13, 2020 Markets Committee meeting (agenda item 4.a.iv).
14. **ISO-NE: Overnight Capital Cost:** 800 MW project with AC interconnection to Brayton Point and 2025 COD
15. **Dominion IRP**: The 2020 Integrated Resource Plan of Virginia Electric and Power Company, Case No. PUR-2020-00035, May 1, 2020, Appendix 5N lists an overnight installed cost of $2,952/kW (2020$) for three projects, each 852 MW, to reach COD in 2026 and 2027 (per Appendix 3B).

***Note**: All costs have been adjusted to 2019$ using a 2% annual inflation index.*

# Why RENEW Believes ISO's Capital Cost Assumption is High – Bottom Up Benchmarking

- One representative line item with significant, publicly available data for benchmarking: Interconnection Cost
  - ISO assumes $70 million interconnection cost
- $70M does not align with typical cost estimates in the 14 OSW interconnection studies completed by ISO-NE through 9/29/2020
  - The median interconnection cost is $26 million (mean = $38M)
- $70M appears roughly double "expected prevailing market conditions"
  - Interconnection cost is a rounding error in the overall capex figure ($70M out of $4.7B)
  - Simply supports RENEW's contention that ISO's overall costs are roughly double "expected prevailing market conditions"

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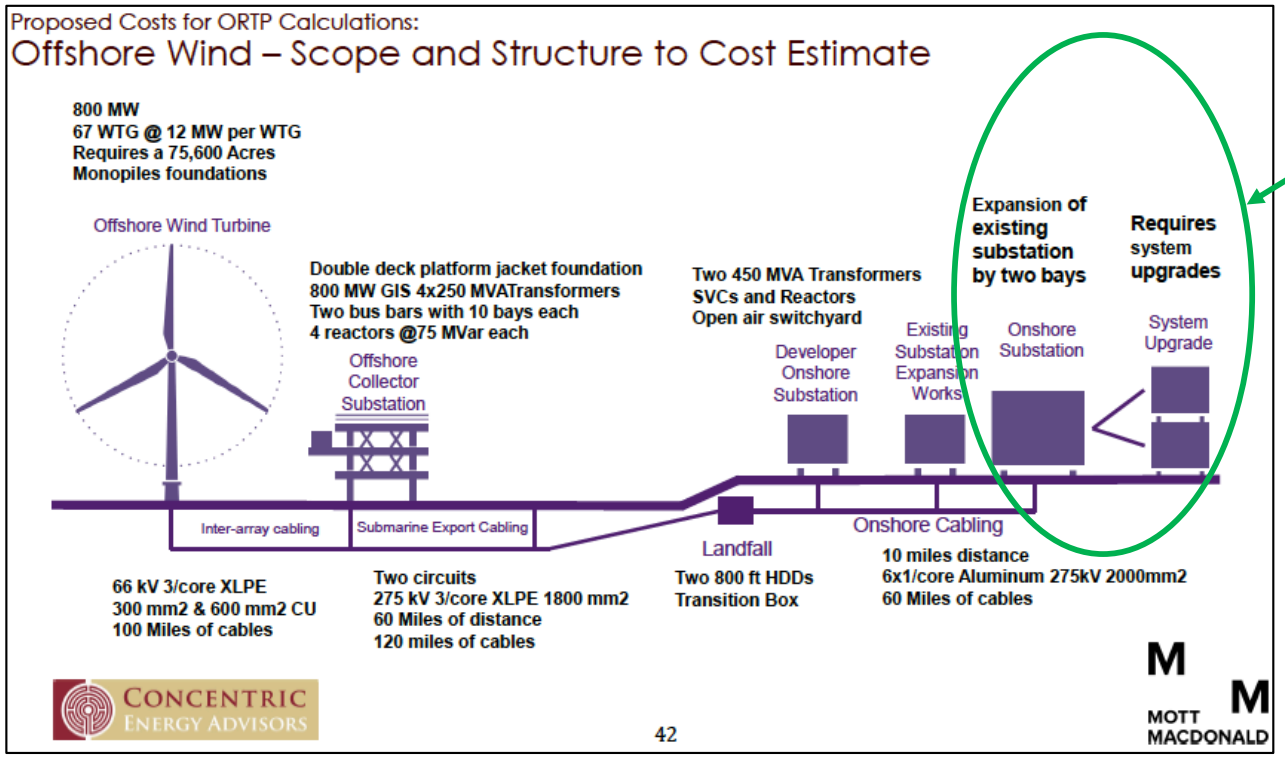
# Interconnection Cost Benchmarking Data

- The 14 OSW interconnection study results as of 9/29/2020 are summarized here
  - Study type is noted as Feasibility Study (FS) or System Impact Study (SIS)
  - Both FS and SIS reports provide non-binding good-faith cost estimates
  - SIS results are bolded
- QP618 is essentially identical to ORTP project
  - FS cost estimate was $24.1M, SIS estimate was $15.1M
  - FS and SIS both report cost estimate accuracy as -50%/+200%

| Queue Position | Study Type | Report Date | POI | Project Gross MW | Project Net MW at POI | Interconnection Cost ($M) | Interconnection ($/kW) |
|---|---|---|---|---|---|---|---|
| **618** | **SIS** | **7/18** | **Brayton Point** | **840** | **800** | **$15.1** | **$17.98** |
| **624** | **SIS & MMD** | **7/19 & 7/20** | **Barnstable** | **840** | **800** | **$7.7** | **$9.17** |
| **632** | **SIS** | **1/20** | **Bourne** | **900** | **880** | **$18.0** | **$20.00** |
| 669 | FS | 1/19 | Brayton Point | 288 | 288 | $3.9 | $13.44 |
| 700 | FS | 1/19 | W. Barnstable | 832 | 795 | $43.7 | $52.55 |
| **781** | **SIS** | **5/20** | **Davisville** | **790** | **704** | **$105.0** | **$132.98** |
| 782 | FS | 6/19 | Kent County | 352 | 352 | $8.3 | $23.58 |
| 791 | FS | 1/20 | Montville | 876 | 805 | $76.4 | $87.21 |
| 792 | FS | 3/20 | Montville | 876 | 805 | $25.8 | $29.45 |
| 806 | FS | 4/19 | West Barnstable | 874 | 827 | $23.3 | $26.66 |
| 829 | FS | 12/18 | New Bourne | 1,028 | 1,000 | $35.3 | $34.34 |
| 830 | FS | 2/20 | West Barnstable | 881 | 860 | $27.0 | $30.64 |
| 893 | FS | 9/20 | Millstone | 1,240 | 1,200 | $74.5 | $60.08 |
| 909 | FS | 5/20 | Bell Rock | 880 | 814 | $71.3 | $81.02 |

# Why RENEW Believes ISO's Capital Cost Assumption is High – Bottom Up Benchmarking

- ISO has rejected the use of this interconnection study data as a basis for the interconnection cost estimate
- We do not know what the $70M assumption is based on if not interconnection data
- The below slide from ISO's Aug MC presentation is the only information provided to explain the $70M assumption.




Only detail provided

# Why RENEW Believes ISO's Capital Cost Assumption is High – Bottom Up Benchmarking

- NYSERDA and NY Department of Public Service released a whitepaper in June 2020 assessing cost to meet NY's Offshore Wind Standard
  - "Base case" Capex assumption for 800 MW OSW in NY Bight with AC interconnection and 2025 COD (nearly identical to ISO-NE ORTP project)
  - OSW base case costs based on Renewables Consulting Group's proprietary model
  - Benchmarked against actual bids received by NYSERDA in its 2018 OSW solicitation
  - Total installed cost assumption = $3,155*/kW (2019$)
    - Very close to RENEW's recommended overnight cost assumption (105%)

NY Bight

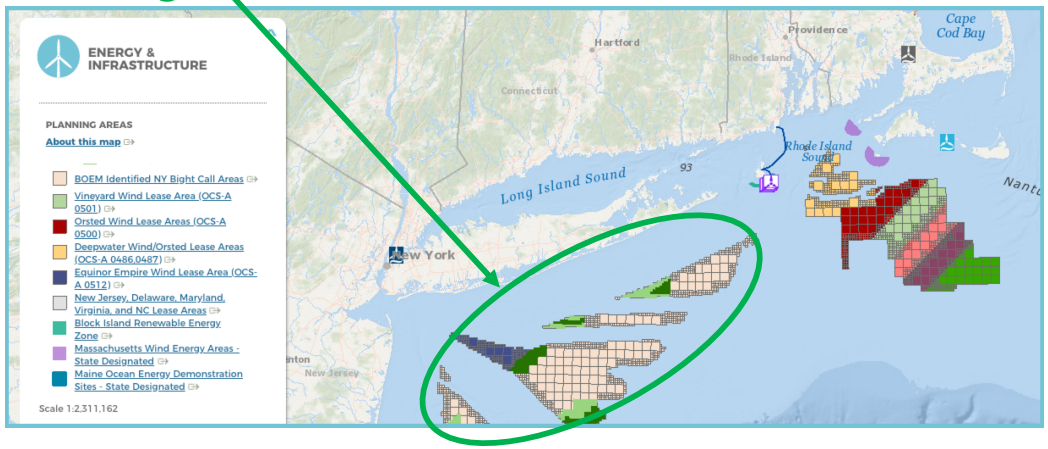
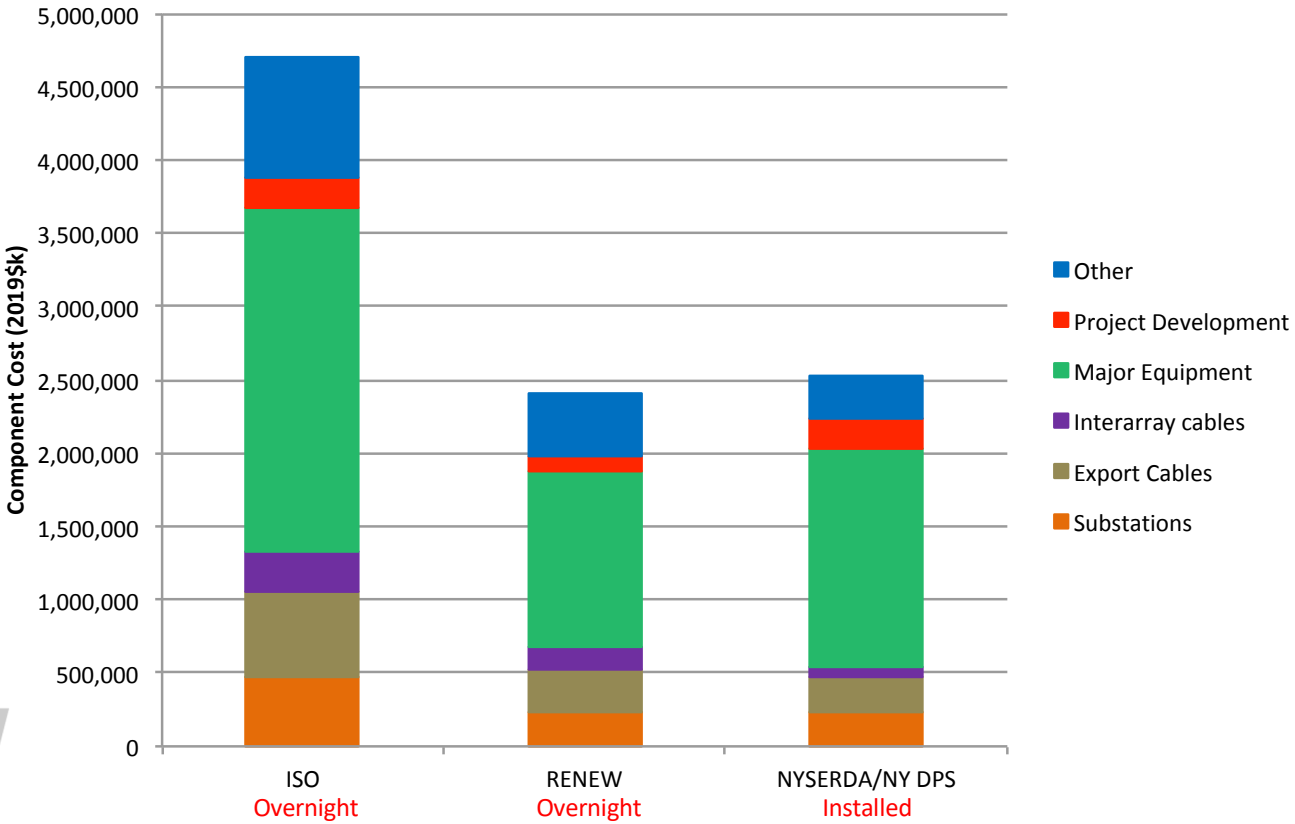



Image: www.northeastoceandata.org/updated-map-of-offshore-energy-planning-areas/

| NYSERDA/NY DPS Base Case Estimate | 2019$/kW |
|---|---|
| Project Development | 264 |
| Turbine Supply | 1,174 |
| Foundation Supply | 415 |
| Installation of Turbines and Foundations | 256 |
| Supply and Installation of Array Cables | 106 |
| Supply and Installation of Substations | 301 |
| Supply and Installation of Export Cables | 280 |
| Other | 361 |
| **Total** | **3,155** |

# Why RENEW Believes ISO's Capital Cost Assumption is High – Bottom Up Benchmarking

- RENEW broke down its total cost assumption of $3,000/kW into the component line items in ISO's DCF model as shown below
  - ISO's ratios between categories were maintained with interconnection fixed at $35.5M
- ISO and RENEW overnight cost components benchmarked against NYSERDA/DPS installed cost, shows good level of agreement between RENEW and NYSERDA/DPS
  - Components grouped here by color are detailed on the next slide

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# Why RENEW Believes ISO's Capital Cost Assumption is High – Bottom Up Benchmarking

RENEW maintained ISO's proposed ratios between categories, fixing interconnection at $35.5M and

| | ISO's Estimate 2019$k Overnight | RENEW's Proposed Adjustment 2019$k Overnight |
|---|---|---|
| EPC Costs | | |
| Offshore Substation Platform | 465,000 | 234,610 |
| Install Submarine Export Cabling | 583,000 | 294,146 |
| Construct Landfall Transition Box | 134,000 | 67,608 |
| Interarray Cabling | 288,000 | 145,307 |
| Major Equipment | 2,333,000 | 1,200,000 |
| Project Contingency | 380,300 | 194,167 |
| **Total EPC** | **4,183,300** | **2,135,839** |
| Non-EPC Costs | | |
| Owner's Development Costs (Services) | 217,000 | 110,792 |
| Owner's Contingency | 21,700 | 11,079 |
| Electrical Interconnection | 70,000 | 35,500 |
| Financing Fees (4% of costs financed w/debt) | 167,332 | 85,434 |
| Working Capital (1% of EPC) | 41,833 | 21,358 |
| **Total Non-EPC** | **517,865** | **264,163** |
| **Total Cost (2019$)** | **4,701,165** | **2,400,002** |
| **Total Cost (2019$/kW)** | **5,876** | **3,000** |

| NYSERDA/NY DPS Base Case Estimate 2019$k Installed Cost | |
|---|---|
| Supply and Installation of Substations | 240,784 |
| Supply and Installation of Export Cables | 224,314 |
| Supply and Installation of Array Cables | 84,706 |
| Turbine Supply | 938,824 |
| Foundation Supply | 331,765 |
| Installation of Turbines and Foundations | 204,706 |
| Project Development | 210,980 |
| Other | 288,627 |
| **Total** | **2,523,922** |
| **Total (2019$/kW)** | **3,155** |

# ORTP Impact of Capex and ITC Changes

| | FRM Sunset & ISO ESI | FRM Sunset & NEPOOL ESI | FRM & No ESI |
|---|---|---|---|
| ISO's ORTP (2019$/kW-mo) | $52.46 | $52.51 | $52.67 |
| ORTP changing only overnight cost to $3,000/kW (2019$/kW-mo) | $7.69 | $7.74 | $7.90 |
| ORTP changing only ITC to 18% (2019$/kW-mo) | $32.52 | $32.57 | $32.73 |
| ORTP changing overnight cost and ITC (2019$/kW-mo) | ($2.49) | ($2.44) | ($2.28) |

RENEW Northeast

# Cost Estimate Precision vs. ORTP

- RENEW believes that $3,000/kW is a reasonable, middle-of-the-range estimate of expected costs for local OSW projects fitting the description of the ORTP project
- RENEW recognizes that there may be some feelings of uncertainty given lack of familiarity and experience with large OSW projects here
- A capital cost of up to $3,200/kW would still result in an OSW ORTP of $0, so there is some leeway in the precision of the assumption without impacting the final ORTP.

# RENEW's Proposed Amendment

- Using RENEW's cost and ITC assumptions in ISO's DCF model results in a calculated ORTP of $(2.28) - $(2.49)/kW-mo, resulting in an actual ORTP of $0.00/kW-mo

- RENEW believes these values accurately capture commercial expectations for offshore wind capital costs and set appropriate expectations for offshore wind's participation in the FCM

| | FRM Sunset & ISO ESI | FRM Sunset & NEPOOL ESI | FRM & No ESI |
|---|---|---|---|
| ISO's ORTP (2019$/kW-mo) | $52.46 | $52.51 | $52.67 |
| RENEW's Proposed ORTP (2019$/kW-mo) | $0.00 | $0.00 | $0.00 |

RENEW Northeast

*DCF = Discounted Cash Flow

# RENEW's Proposed Amendment: Sample Redline

## NEPOOL ESI and FRM Sunset

### III.A.21.1.1. Offer Review Trigger Prices for the Forward Capacity Auction.

For resources other than New Import Capacity Resources, the Offer Review Trigger Prices for the ~~twelfth Forward Capacity Auction (for the~~ Capacity Commitment Period beginning on June 1, 2025~~2021)~~ shall be as follows:

| Generating Capacity Resources | |
|---|---|
| **Technology Type** | **Offer Review Trigger Price ($/kW-month)** |
| Simple Cycle ~~c~~Combustion ~~t~~Turbine | $6.354~~6.503~~ |
| ~~c~~Combined ~~c~~Cycle ~~g~~Gas ~~t~~Turbine | $9.108~~7.856~~ |
| ~~o~~On-~~s~~Shore ~~w~~Wind | $0.000~~11.025~~ |
| Offshore Wind | $0.000 |
| Energy Storage Device – Lithium Ion Battery | $5.778 |
| Photovoltaic Solar | $11.014 |

ISO's proposed changes are marked in blue.
RENEW's proposed changes are marked in red.

# Questions?

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