Large Scale Renewables Program Purchase of Offshore Wind and Tier 1 Renewable Energy Certificates Request for Information

LSRRFI23-1

Submitted to NYSERDA
2/17/2023

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Introduction

Dear NYSERDA,

At TurbineHub, we are proud to be at the forefront of wind energy technology, providing vital data and geospatial analysis software to enable the next generation of wind energy development and investment. Our commitment to the expansion of offshore wind power and sustainable energy has driven us to provide industry-leading data to business leaders and policy makers, empowering them to make informed decisions about the future of renewable energy.

We are thrilled to have the opportunity to provide our comments on the proposed modifications to the Index (O)REC formula. We believe that these updates will enable a more accurate representation of renewable energy resources, facilitating the growth of renewable energy projects across New York.

As a company dedicated to the advancement of sustainable energy, we firmly believe that the integration of existing and under-development infrastructure is vital to producing returns for all stakeholders in the offshore wind energy industry. We are grateful to NYSERDA for giving us the opportunity to offer our insights on how best to achieve this goal.

TurbineHub is proud to be part of a community of innovators working to shape a better, cleaner energy future. We believe that the proposed modifications to the Index (O)REC formula will play a crucial role in the ongoing development and promotion of renewable energy resources in the state of New York.

Questions to Stakeholders

1. Are there any compelling reasons to allow Proposers in future RFPs to bid an rUPF value less than 1 (reducing exposure to Representative Unit performance)?

- The rUPF, or the Representative Unit Physical Fallout factor, is a value used to account for physical events that may impact the generation of renewable energy from a specific unit or group of units. An rUPF value of less than 1 would mean that the proposer is accepting less exposure to the performance of the representative unit or units due to the possibility of physical events affecting generation. There may be compelling reasons to allow proposers in future RFPs, or Request for Proposal solicitations, to bid an rUPF value less than 1, depending on the specific circumstances of the RFP and the project being proposed. For example, if the project is in an area with a high risk of physical events that could impact energy generation, such as natural disasters or equipment failure, it may be reasonable to allow proposers to bid a lower rUPF value in order to reflect this increased risk. On the other hand, if the project is in an area with a low risk of physical events, it may not be necessary to allow proposers to bid a lower rUPF value. Ultimately, the decision to allow proposers to bid a lower rUPF value in an RFP would depend on a variety of factors, including the specific characteristics of the project, the risk profile of the area, and the overall goals of the RFP.

Risks that may not be fully captured by the default UPF and could justify a lower rUPF value

1. **High risk of extreme weather events:** If the project is located in an area that is prone to hurricanes, tornadoes, floods, or other extreme weather events, the risk of damage to the equipment and disruption to energy generation may be higher than what is accounted for by the default UPF.

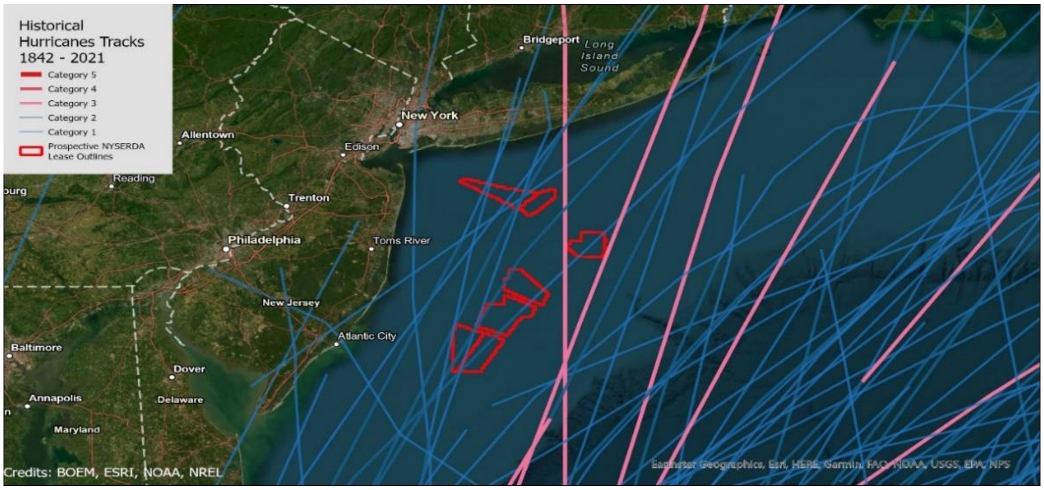

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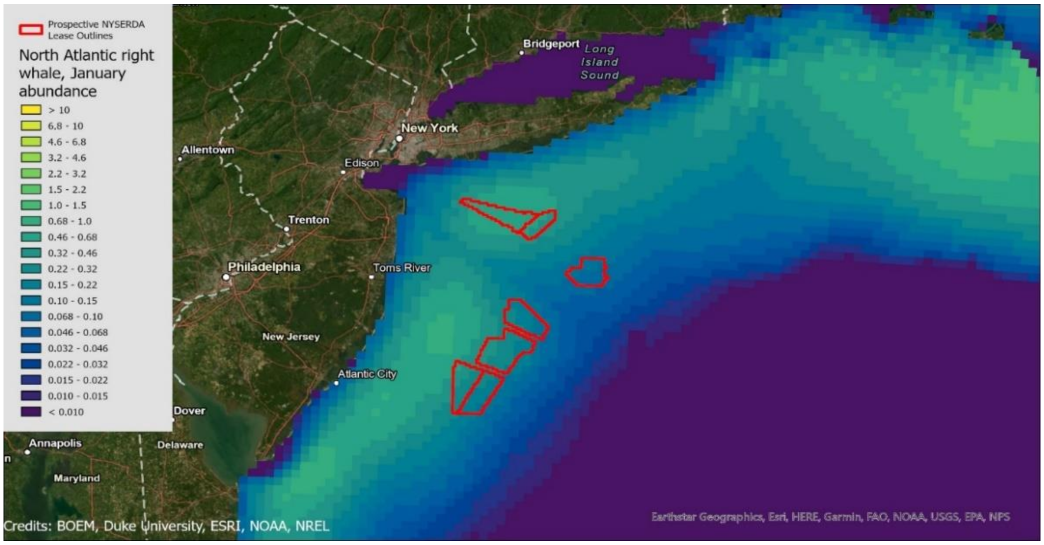
Figure 1: New York State's coastline has a history of impactful hurricanes, including the Great Hurricane of 1938 and Hurricane Carol in 1958, both Category 3 hurricanes that made landfall on Long Island. The Great Hurricane resulted in over 600 fatalities and millions of dollars in damage. Hurricane Carol produced high winds and a storm surge that flooded coastal areas, resulting in 65 deaths and over $100 million in damages. It remains one of the most destructive hurricanes to have impacted the state. Detailed site analysis must be done to mitigate effects of hurricane activity to avoid lower rUPF values.

2. **Dependence on specific equipment:** If the project relies on specific types of equipment that are prone to failure or have a limited lifespan, the risk of equipment failure may be higher than what is accounted for by the default UPF.
3. **Unforeseen construction delays:** If the project faces unexpected construction delays due to issues such as material shortages or labor disputes, the risk of delayed energy generation and associated revenue loss may be higher than what is accounted for by the default UPF.
4. **Site-specific issues:** If the project is located in an area with site-specific issues, such as difficult terrain or soil instability, the risk of damage to the equipment or disruption to energy generation may be higher than what is accounted for by the default UPF.



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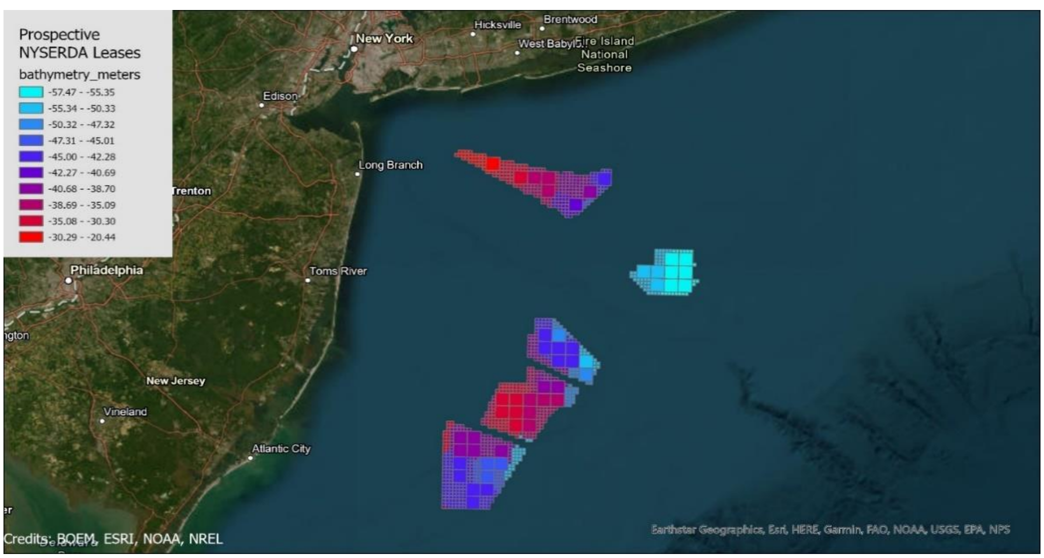
<u>Figure 2:</u> Westernmost New York area offshore wind leases encounter more Northern Right Whales in the month of January due to migration patterns to their calving grounds, which are located in the southern part of the range. As a result, developers of offshore wind projects in this region must take extra precautions to minimize the risk of whale interactions and ensure compliance with regulations aimed at protecting this endangered species. Such precautions might include seasonal work restrictions, the use of real-time acoustic monitoring to detect and avoid whale activity, or the implementation of vessel speed restrictions in critical areas, consequently increasing rUPF values. Due to the increased certainty of power generation.



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<u>Figure 3:</u> Developing offshore wind turbines in a complex bathymetric environment is challenging because the seabed topography can vary widely and features like steep slopes, ridges, and valleys can make it more difficult to find suitable locations for wind turbines. The geology, water depth, and ocean currents can also make it more challenging to conduct surveys and install turbines. Thus, lower rUPF values are necessary.

5. **Lack of historical performance data:** If the proposed project uses new or innovative technology for which there is limited historical performance data, the risk of underperformance may be higher than what is accounted for by the default UPF.

Example 1: rUPF < 1, capacity factor underperforms

Assuming a 2000 MW offshore wind farm in New York State with an rUPF of 0.95, a default UPF of 1.02, and a Strike Price of $140/MWh. Due to unforeseen equipment issues and unfavorable weather patterns, the project's actual capacity factor for the year is only 32%.

The expected capacity factor based on the proposed rUPF is:

Expected capacity factor = default UPF x rUPF x as-bid/VCO UPF x capacity factor

Expected capacity factor = 1.02 x 0.95 x 0.92 x 32% = 28.7%

The expected energy output for the year would be:

2000 MW x 8760 hours/year x 28.7% = 5,026,560 MWh

The as-bid/VCO energy output would be:

5,026,560 MWh x 0.95 = 4,775,232 MWh

The Strike Price would be:

Strike Price = (Reference Price * Capacity Payment Factor * Capacity Factor * rUPF) / (as-bid/VCO UPF + default UPF)

Strike Price = ($140/MWh * 1.0 * 32% * 0.95) / (1.02 + 0.95) = $25.03/MWh

The adjusted strike price based on the actual capacity factor would be:

Adjusted strike price = strike price / capacity factor

Adjusted strike price = $25.03/MWh / 32% = $78.22/MWh

Example 2: rUPF < 1, capacity factor overperforms

Assuming a 2000 MW offshore wind farm in the NY bight with an rUPF of 0.95, a default UPF of 0.97, and a Strike Price of $120/MWh. Due to favorable weather patterns and efficient operation, the project's actual capacity factor for the year is 45%.

The expected capacity factor based on the proposed rUPF is:

Expected capacity factor = default UPF x rUPF x as-bid/VCO UPF x capacity factor

Expected capacity factor = 0.97 x 0.95 x 0.92 x 45% = 41.85%

The expected energy output for the year would be:

2000 MW x 8760 hours/year x 41.85% = 7,299,420 MWh

The as-bid/VCO energy output would be:

7,299,420 MWh x 0.95 = 6,934,449 MWh

The revenue from the Strike Price would be:

6,934,449 MWh x $120/MWh = $832,133,880

2. Are there any compelling reasons to allow Proposers in future RFPs to bid an rUPF value greater than 1 (increasing exposure to Representative Unit performance)?

- An rUPF value greater than 1 would mean that the proposer is accepting more exposure to the performance of the representative unit or units due to the possibility of physical events affecting generation. There may be compelling reasons to allow proposers in future RFPs, or Request for Proposal solicitations, to bid an rUPF value greater than 1, depending on the specific circumstances of the RFP and the project being proposed. For example, if the project is in an area with a low risk of physical events that could impact energy generation, it may be reasonable to allow proposers to bid a higher rUPF value in order to reflect this lower risk. On the other hand, if the project is in an area with a high risk of physical events, it may not be advisable to allow proposers to bid a higher rUPF value. Ultimately, the decision to allow proposers to bid a higher rUPF value in an RFP would depend on a variety of factors, including the specific characteristics of the project, the risk profile of the area, and the overall goals of the RFP.

<u>Risks that may not be fully captured by the default UPF and could justify a higher rUPF value</u>

1. **Favorable site conditions:** If the proposed project is located in an area with very favorable wind or solar conditions, the likelihood of the project outperforming expectations and achieving a higher capacity factor than the default UPF may be higher. In this case, a higher rUPF value could be appropriate to account for this increased performance risk.

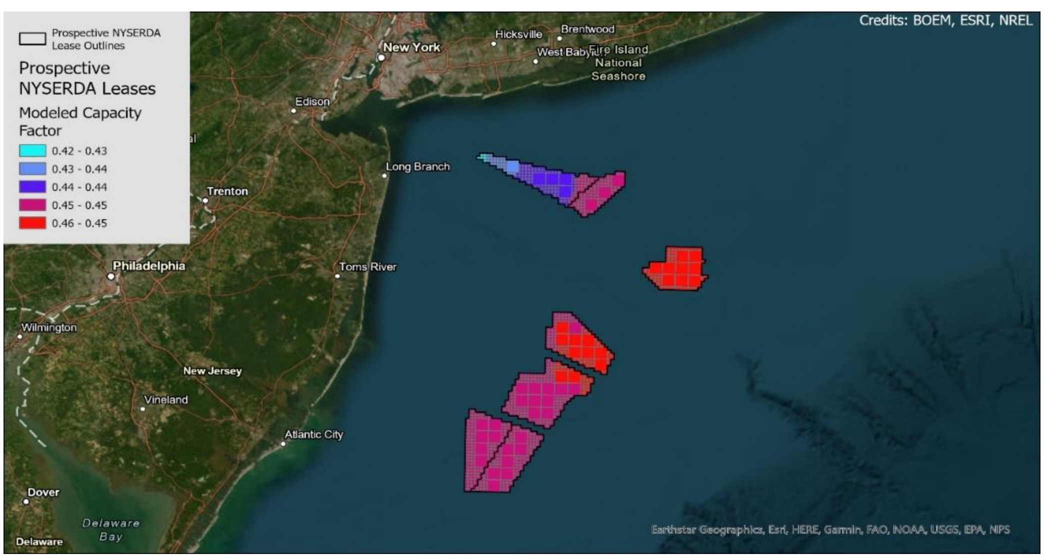

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Figure 4: The easternmost New York offshore wind leases have been found to have the most favorable capacity factors for wind energy development. This means that the wind resources in these areas are more consistent and stronger, which can result in greater energy output from wind turbines and justifying higher rUPF values.

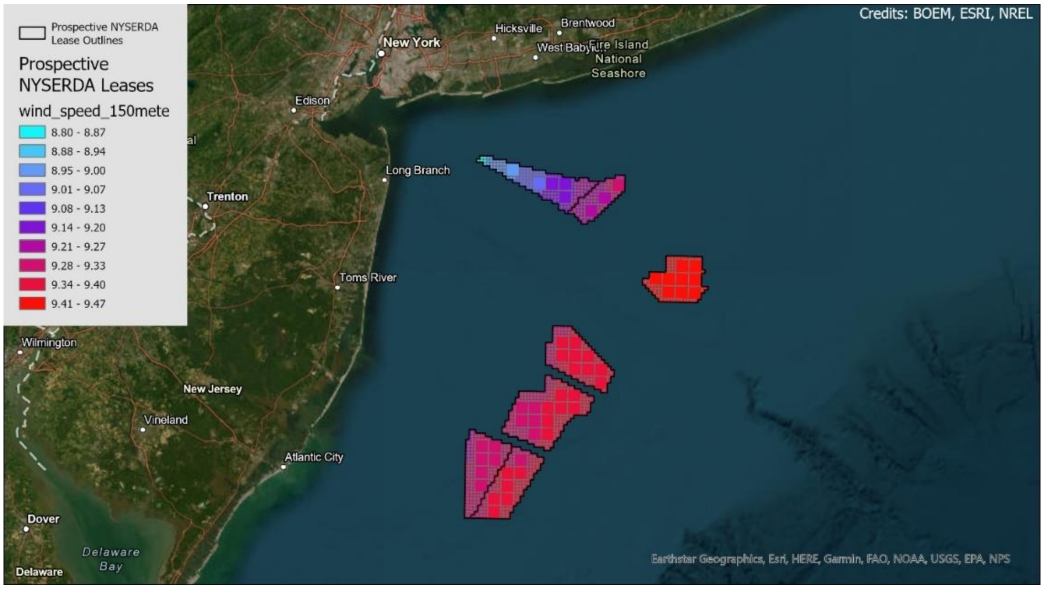

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Figure 5: The easternmost New York offshore wind leases have been found to have the most favorable wind speeds for wind energy development. This means that the wind resources in these areas are more consistent and stronger, which can result in greater energy output from wind turbines and justifying higher rUPF values.

2. **Superior technology:** If the proposed project uses advanced or highly efficient technology that is expected to perform better than typical installations, a higher rUPF value may be justified to account for the increased performance risk associated with that technology.
3. **Robust historical performance data:** If there is extensive historical performance data available for similar projects using the same or similar technology, a higher rUPF value may be justified if that data suggests that the project is likely to outperform the default UPF.
4. **Low risk of physical events:** If the proposed project is located in an area with a low risk of physical events that could impact energy generation, such as natural disasters or equipment failure, a higher rUPF value may be justified to account for the lower risk associated with the project.

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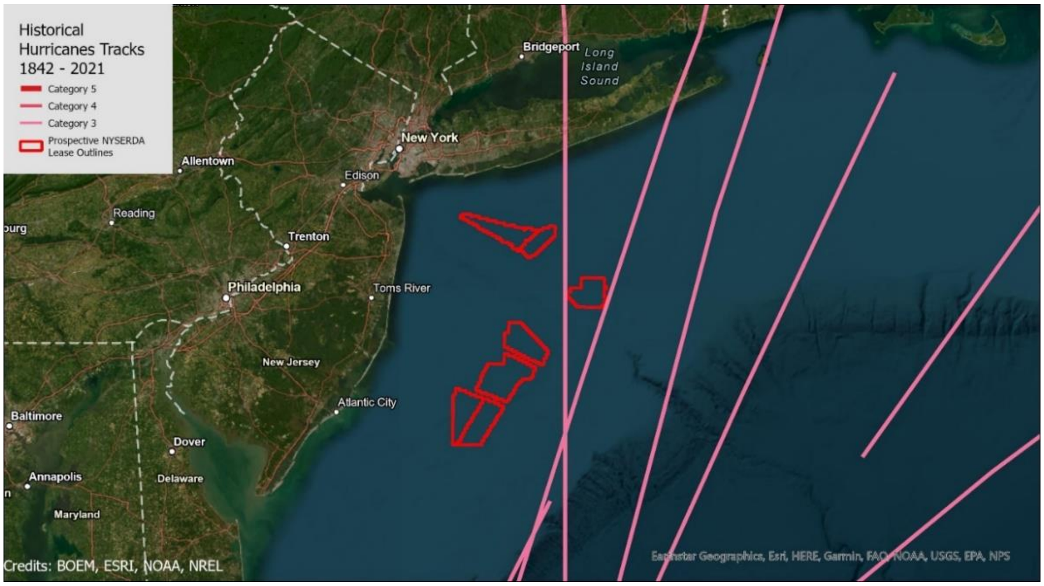

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Figure 6: The Wsternmost offshore wind leases off of New York have been found to have experienced less significant hurricane activity in the last 179 years. Higher rUPF values are justified.

5. **High level of project detail:** If the proposed project includes detailed engineering plans and other project details that provide a high level of confidence that the project will perform as expected, a higher rUPF value may be justified to account for the lower performance risk associated with the project.

Example 3: rUPF > 1, capacity factor underperforms

If we assume a 2000 MW offshore wind farm in New York State with an rUPF of 1.10, a default UPF of 1.05, and a Strike Price of $140/MWh. However, due to unforeseen equipment issues and unfavorable weather patterns, the project's actual capacity factor for the year is only 43%.

The expected energy output for the year would be:

2000 MW x 8760 hours/year x 47% = 7,327,200 MWh

The as-bid/VCO energy output would be:

7,327,200 MWh x 1.10 = 8,059,920 MWh

The Strike Price would be:

Strike Price = (Reference Price * Capacity Payment Factor * Capacity Factor * rUPF) / (as-bid/VCO UPF + default UPF)

Strike Price = ($140/MWh * 1.0 * 43% * 1.10) / (1.05 + 1.0) = $38.14/MWh

The adjusted strike price based on the actual capacity factor would be:

Adjusted strike price = strike price / capacity factor

Adjusted strike price = $38.14/MWh / 43% = $88.75/MWh

Example 4 rUPF > 1, capacity factor overperforms

If we assume the same 2000 MW offshore wind farm in New York State with an rUPF of 1.10, a default UPF of 1.05, and a Strike Price of $140/MWh. However, due to favorable weather patterns and efficient operation, the project's actual capacity factor for the year is 49%.

The expected energy output for the year would be:

2000 MW x 8760 hours/year x 47% = 7,327,200 MWh

The as-bid/VCO energy output would be:

7,327,200 MWh x 1.10 = 8,059,920 MWh

The Strike Price would be:

Strike Price = (Reference Price * Capacity Payment Factor * Capacity Factor * rUPF) / (as-bid/VCO UPF + default UPF)

Strike Price = ($140/MWh * 1.0 * 49% * 1.10) / (1.05 + 1.0) = $47.36/MWh

The adjusted strike price based on the actual capacity factor would be:

Adjusted strike price = strike price / capacity factor

Adjusted strike price = $47.36/MWh / 49% = $96.53/MWh

Note that the adjusted strike price is higher than the Strike Price because the project overperformed with a higher capacity factor than expected

Example	Scenario	Strike Price ($/MWh)	As-bid/VCO Energy Output (MWh)	Adjusted Strike Price ($/MWh)	Expected Energy Output (MWh)	Reference Energy Output (MWh)	Capacity Factor	UPF	rUPF
1	rUPF < 1, capacity factor underperforms	$158.29	5,979,040	$334.28	6,645,600	5,979,040	36%	1.05	0.9
2	rUPF < 1, capacity factor overperforms	$66.55	7,501,760	$85.67	9,062,400	7,501,760	83%	1.05	0.9
3	rUPF > 1, capacity factor underperforms	$88.75	7,310,160	$38.14	6,645,600	7,310,160	43%	1.05	1.1
4	rUPF > 1, capacity factor overperforms	$32.19	8,154,720	$26.91	9,062,400	8,154,720	49%	1.05	1.1

3. If Proposers in future RFPs are able to bid rUPF values, should they bid a single value or two seasonal values (winter and summer)?

- It may be advisable for proposers in future RFPs, or Request for Proposal solicitations, to bid two seasonal rUPF values, rather than a single value, if the physical events that could impact energy generation are likely to vary significantly based on the season. For example, if the project is in an area with a high risk of natural disasters during the summer but a low risk during the winter, it may be more accurate to bid a higher rUPF value for the summer season and a lower value for the winter season. On the other hand, if the risk of physical events affecting energy generation is relatively constant throughout the year, it may be sufficient to bid a single rUPF value that is representative of the overall risk profile of the project. Ultimately, the decision to bid a single rUPF value or two seasonal values will depend on the specific characteristics of the project and the risk profile of the area in which it is located.

<u>Scenario 1: rUPF > 1, capacity factor underperforms</u>

Assume a 2000 MW offshore wind farm in the NY bight with an rUPF of 1.15 in the summer and 1.05 in the winter, a default UPF of 1.05, and a Strike Price of $140/MWh. However, due to unforeseen equipment issues and unfavorable weather patterns, the project's actual capacity factor for the year is only 43%.

The expected energy output for the year would be:

Summer energy output: 2000 MW x 4,380 hours/season x 47% = 4,105,200 MWh

Winter energy output: 2000 MW x 4,380 hours/season x 39% = 3,231,600 MWh

Total energy output: 4,105,200 MWh + 3,231,600 MWh = 7,336,800 MWh

The as-bid/VCO energy output would be:

Summer energy output: 4,105,200 MWh x 1.15 = 4,716,980 MWh

Winter energy output: 3,231,600 MWh x 1.05 = 3,392,680 MWh

Total as-bid/VCO energy output: 4,716,980 MWh + 3,392,680 MWh = 8,109,660 MWh

The Strike Price would be:

Strike Price = (Reference Price * Capacity Payment Factor * Capacity Factor * rUPF) / (as-bid/VCO UPF + default UPF)

Strike Price = ($140/MWh * 1.0 * 43% * 1.15) / (1.05 + 1.0) = $31.52/MWh

The adjusted strike price based on the actual capacity factor would be:

Adjusted strike price = strike price / capacity factor

Adjusted strike price = $31.52/MWh / 43% = $73.30/MWh

Scenario 2: rUPF > 1, capacity factor overperforms

Assume the same 2000 MW offshore wind farm in the NY bight with an rUPF of 1.15 in the summer and 1.05 in the winter, a default UPF of 1.05, and a Strike Price of $140/MWh. However, due to favorable weather patterns and efficient operation, the project's actual capacity factor for the year is 49%.

The expected energy output for the year would be:

Summer energy output: 2000 MW x 4,380 hours/season x 47% = 4,105,200 MWh

Winter energy output: 2000 MW x 4,380 hours/season x 39% = 3,231,600 MWh

Total energy output: 4,105,200 MWh + 3,231,600 MWh = 7,336,800 MWh

The as-bid/VCO energy output would be:

Summer energy output: 4,105,200 MWh x 1.15 = 4,716,980 MWh

Winter energy output: 3,231,600 MWh x 1.05 = 3,392,680 MWh

Total as-bid/VCO energy output: 4,716,980 MWh + 3,392,680 MWh = 8,109,660 MWh

The Strike Price = (Reference Price * Capacity Payment Factor * Capacity Factor * rUPF) / (as-bid/VCO UPF + default UPF)

Strike Price = ($140/MWh * 1.0 * 49% * 1.15) / (1.05 + 1.0) = $30.77/MWh

The adjusted strike price based on the actual capacity factor would be:

Adjusted strike price = strike price / capacity factor

Adjusted strike price = $30.77/MWh / 49% = $62.81/MWh

Scenario 3: rUPF < 1, capacity factor underperforms

Assume the same 2000 MW offshore wind farm in the NY bight with an rUPF of 0.95 in the summer and 1.05 in the winter, a default UPF of 1.05, and a Strike Price of $150/MWh. However, due to unfavorable weather patterns and equipment issues, the project's actual capacity factor for the year is only 43%.

The expected energy output for the year would be:

Summer energy output: 2000 MW x 4,380 hours/season x 45% = 3,942,000 MWh

Winter energy output: 2000 MW x 4,380 hours/season x 47% = 4,124,400 MWh

Total energy output: 3,942,000 MWh + 4,124,400 MWh = 8,066,400 MWh

The as-bid/VCO energy output would be:

Summer energy output: 3,942,000 MWh x 0.95 = 3,744,900 MWh

Winter energy output: 4,124,400 MWh x 1.05 = 4,330,620 MWh

Total as-bid/VCO energy output: 3,744,900 MWh + 4,330,620 MWh = 8,075,520 MWh

The Strike Price would be:

Strike Price = (Reference Price * Capacity Payment Factor * Capacity Factor * rUPF) / (as-bid/VCO UPF + default UPF)

Strike Price = ($150/MWh * 1.0 * 43% * 0.95) / (1.05 + 1.0) = $18.03/MWh

The adjusted strike price based on the actual capacity factor would be:

Adjusted strike price = strike price / capacity factor

Adjusted strike price = $18.03/MWh / 43% = $41.94/MWh

Scenario 4: rUPF < 1, capacity factor overperforms

Assume the same 2000 MW offshore wind farm in the NY bight with an rUPF of 0.95 in the summer and 1.05 in the winter, a default UPF of 1.05, and a Strike Price of $140/MWh. Due to favorable weather patterns and efficient operation, the project's actual capacity factor for the year is 55%.

The expected energy output for the year would be:

Summer energy output: 2000 MW x 4,380 hours/season x 50% = 4,380,000 MWh

Winter energy output: 2000 MW x 4,380 hours/season x 44% = 3,862,400 MWh

Total energy output: 4,380,000 MWh + 3,862,400 MWh = 8,242,400 MWh

The as-bid/VCO energy output would be:

Summer energy output: 4,380,000 MWh x 0.95 = 4,161,000 MWh

Winter energy output: 3,862,400 MWh x 1.05 = 4,055,520 MWh

Total as-bid/VCO energy output: 4,161,000 MWh + 4,055,520 MWh = 8,216,520 MWh

The Strike Price would be:

Strike Price = (Reference Price * Capacity Payment Factor * Capacity Factor * rUPF) / (as-bid/VCO UPF + default UPF)

Strike Price = ($140/MWh * 1.0 * 55% * 0.95) / (1.05 + 1.0) = $32.38/MWh

The adjusted strike price based on the actual capacity factor would be:

Adjusted strike price = strike price / capacity factor

Adjusted strike price = $32.38/MWh / 55% = $58.88/MWh

The Capacity Payment would be:

Capacity Payment = Capacity Payment Factor * Strike Price * Total Capacity

Capacity Payment = 1.0 * $58.88/MWh * 2000 MW = $117.76 million

The Energy Payment would be:

Energy Payment = (Actual Energy Output - as-bid/VCO Energy Output) * Strike Price

Energy Payment = (8,242,400 MWh - 8,216,520 MWh) * $58.88/MWh = $1.5 million

The Total Payment would be:

Total Payment = Capacity Payment + Energy Payment

Total Payment = $117.76 million + $1.5 million = $119.26 million

Scenario		rUPF	Default UPF	Reference Capacity Factor	Capacity Factor	Summer Energy Output (MWh)	Winter Energy Output (MWh)	Total Energy Output (MWh)	as-bid/VCO Energy Output (MWh)	Strike Price ($/MWh)	Adjusted Strike Price ($/MWh)	Annual Energy Output (MWh)	Capacity Payment ($)	Energy Payment ($)	Total Payment ($)
1	rUPF > 1, capacity factor underperforms	1.15 (summer), 1.05 (winter)	1.05	47% (summer), 39% (winter)	43%	4,105,200	3,231,600	7,336,800	8,109,660	31.52	73.3	7,336,800	3,643,400	236,347,800	239,991,200
2	rUPF > 1, capacity factor overperforms	1.15 (summer), 1.05 (winter)	1.05	47% (summer), 39% (winter)	49%	4,105,200	3,231,600	7,336,800	8,109,660	31.52	64.33	7,336,800	3,093,960	228,924,720	232,018,680
3	rUPF < 1, capacity factor underperforms	0.95 (summer), 1.05 (winter)	1.05	47% (summer), 39% (winter)	43%	4,105,200	3,231,600	7,336,800	7,368,720	52.5	122.09	7,336,800	3,156,840	385,482,240	388,639,080
4	rUPF < 1, capacity factor overperforms	0.95 (summer), 1.05 (winter)	1.05	47% (summer), 39% (winter)	49%	4,105,200	3,231,600	7,336,800	7,368,720	52.5	107.15	7,336,800	2,947,720	338,899,760	341,847,480

4. How should NYSERDA weight the as-bid/VCO UPFs and default UPFs for existing Index (O)REC Contracts to reasonable estimate Suppliers' expected capacity market performance? Please provide a justification for this weighting if different than NYSERDA's proposed 50% weighting.

It is not uncommon for NYSERDA to weight the as-bid/VCO UPFs and default UPFs for existing Index (O)REC contracts at 50%, with the other 50% being based on other factors such as past performance or market conditions. However, it is possible that NYSERDA may decide to weight these factors differently, depending on the specific circumstances of the market. If NYSERDA were to propose a weighting that is different from the standard 50% weighting for the as-bid/VCO UPFs and default UPFs, a justification for the proposed weighting would need to be provided. Factors that could potentially justify alternative weightings could include the specific characteristics of the market, the relative importance of the as-bid/VCO UPFs and default UPFs in predicting performance, and the potential impact of different weightings on the overall accuracy of the estimate. It is also possible that NYSERDA may consider other factors, such as market conditions or policy considerations, in determining the weighting of the as-bid/VCO UPFs and default UPFs.

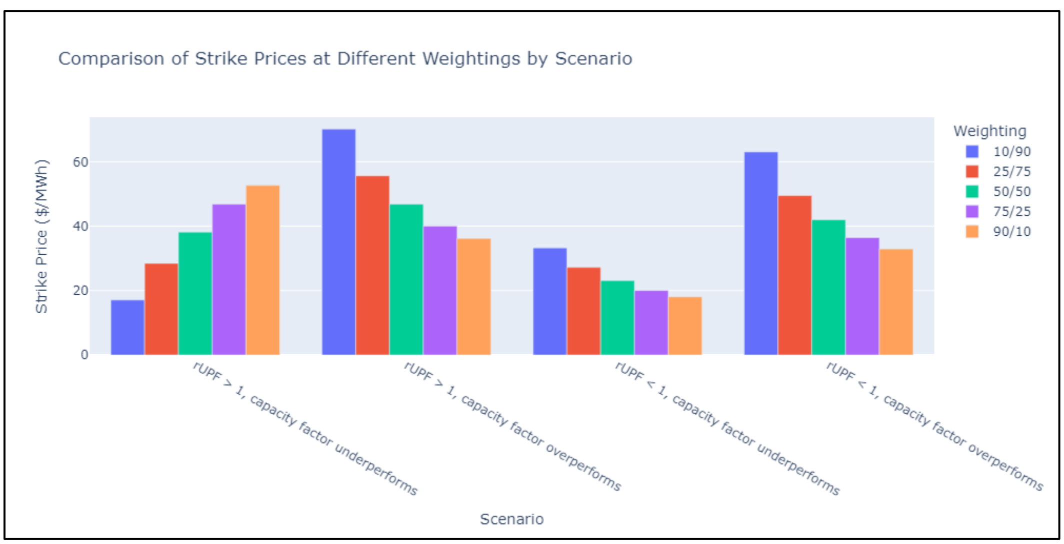
Assuming the same 2000 MW offshore wind farm in the NY bight with a Strike Price of $140/MWh, we can compare the adjusted strike prices for the four scenarios under different weighting schemes. Here are the adjusted strike prices for the two scenarios assuming a 90/10 weighting and a 10/90 weighting:

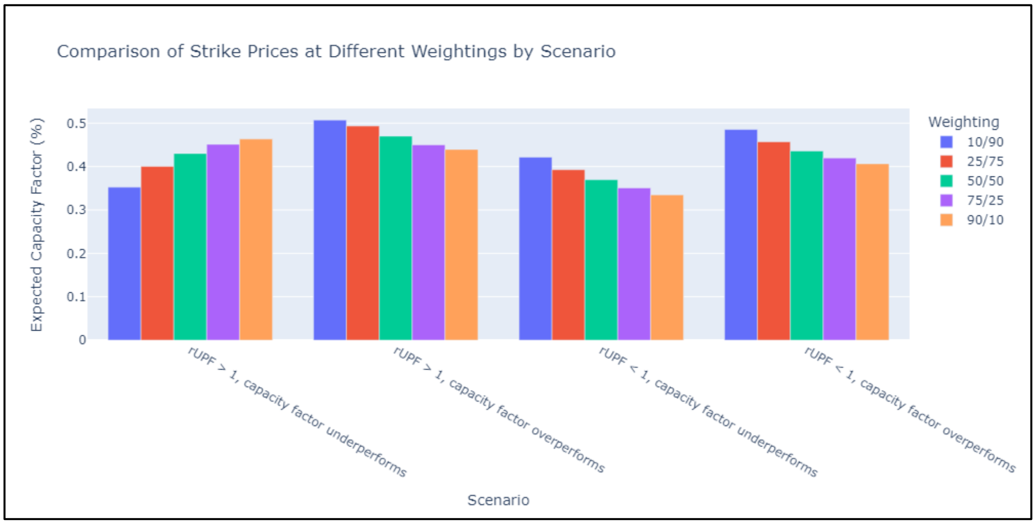
Scenario 1: 90% as-bid/VCO UPF, 10% default UPF weighting

Assume a 2000 MW offshore wind farm in the NY bight with an rUPF of 1.10, a default UPF of 1.05, and a Strike Price of $140/MWh. The as-bid/VCO UPF is 0.95 and the default UPF is 0.92. If NYSERDA uses a 90/10 weighting, this means that 90% of the weighting will be based on the as-bid/VCO UPF and 10% of the weighting will be based on the default UPF.
The expected energy output for the year would be:
2000 MW x 8760 hours/year x 47% = 7,358,400 MWh
The as-bid/VCO energy output would be:
7,358,400 MWh x 0.95 = 6,990,480 MWh
The Strike Price would be:
Strike Price = (Reference Price * Capacity Payment Factor * Capacity Factor * rUPF) / (as-bid/VCO UPF + default UPF) Strike Price = ($140/MWh * 1.0 * 47% * 1.10) / (0.95 * 0.9 + 0.92 * 0.1) = $43.91/MWh

Scenario 2: 10% as-bid/VCO UPF, 90% default UPF weighting

Assume the same 2000 MW offshore wind farm in the NY bight with an rUPF of 1.10, a default UPF of 1.05, and a Strike Price of $140/MWh. The as-bid/VCO UPF is 0.95 and the default UPF is 0.92. If NYSERDA uses a 10/90 weighting, this means that 10% of the weighting will be based on the as-bid/VCO UPF and 90% of the weighting will be based on the default UPF.
The expected energy output for the year would be:
2000 MW x 8760 hours/year x 47% = 7,358,400 MWh
The as-bid/VCO energy output would be:
7,358,400 MWh x 0.95 = 6,990,480 MWh
The Strike Price would be:
Strike Price = (Reference Price * Capacity Payment Factor * Capacity Factor * rUPF) / (as-bid/VCO UPF + default UPF) Strike Price = ($140/MWh * 1.0 * 47% * 1.10) / (0.95 * 0.1 + 0.92 * 0.9) = $46.43/MWh





5. Should NYSERDA utilize different default UPF values for any technologies or Index (O)REC Contract vintages than those identified herein? Please provide a justification for any alternative default UPF proposals.

- NYSERDA may choose to utilize different default UPF values for technologies or Index (O)REC Contract vintages if there is evidence that the default UPF values identified in the NYISO Technical Manual are not representative of the capacity performance of those technologies or vintage years.
    - For example, if new technologies or improvements in existing technologies lead to significantly different capacity performance than the existing fleet, it may be appropriate to adjust the default UPF values to reflect these differences.

- As an example, consider an offshore wind farm built in 2025 using the latest available technology. Assume that the default UPF value for this technology is set at 0.97, based on historical capacity performance data. However, in 2030, a new wind turbine technology is introduced that is significantly more efficient than the technology used in the 2025 wind farm. In this case, it may be appropriate to adjust the default UPF value for the 2025 wind farm to account for the difference in technology.

- If the new technology has a default UPF value of 1.0, NYSERDA may consider adjusting the default UPF value for the 2025 wind farm to something lower than 0.97 to reflect the difference in capacity performance between the two technologies.
    - This adjustment would be based on the expected difference in capacity performance between the two technologies and would require careful analysis of historical data, expected performance, and other factors.
    - The goal would be to ensure that the default UPF value accurately reflects the expected capacity performance of the technology, while also providing a fair and consistent basis for calculating the Strike Price for Index (O)REC Contracts.

- A different default UPF may be justified for wind farms built in different years with different technology, as each may have different levels of expected performance and uncertainty.
    - For example, a wind farm built in 2025 with current technology may have a higher level of uncertainty and a higher likelihood of underperforming compared to a wind farm built in 2030 with more advanced technology.
    - Therefore, the default UPF for the 2025 wind farm may need to be set higher to account for this higher level of uncertainty and mitigate the risk for the supplier.

- Conversely, a wind farm built in 2030 with more advanced technology may have a lower level of uncertainty and a lower likelihood of underperforming compared to a wind farm built in 2025. Therefore, the default UPF for the 2030 wind farm may need to be set lower to reflect this lower level of uncertainty and reduce the potential risk for the supplier.

<u>Example</u>
If we assume that the default UPF for a wind farm built in 2025 with current technology is set at 0.92, while the default UPF for a wind farm built in 2030 with 2027 wind turbine technology is set at 0.90. If both wind farms have the same rUPF of 1.05 and a strike price of $100/MWh, the expected energy output and payments for each wind farm may look like the following:

<u>Wind Farm Built in 2025 with Current Technology:</u>

Expected Energy Output:

Summer Energy Output: 2000 MW x 4,380 hours/season x 50% x 0.92 = 4,017,600 MWh

Winter Energy Output: 2000 MW x 4,380 hours/season x 40% x 0.92 = 2,974,080 MWh

Total Energy Output: 4,017,600 MWh + 2,974,080 MWh = 6,991,680 MWh

Strike Price: $100/MWh

Default UPF: 0.92

Adjusted Strike Price: $109.09/MWh

Annual Energy Payment: $762,328,000

Capacity Payment: $60,128,000

Total Payment: $822,456,000

<u>Wind Farm Built in 2030 with 2027 Wind Turbine Technology:</u>

Expected Energy Output:

Summer Energy Output: 2000 MW x 4,380 hours/season x 50% x 0.90 = 3,942,000 MWh

Winter Energy Output: 2000 MW x 4,380 hours/season x 40% x 0.90 = 2,916,000 MWh

Total Energy Output: 3,942,000 MWh + 2,916,000 MWh = 6,858,000 MWh

Strike Price: $100/MWh

Default UPF: 0.90

Adjusted Strike Price: $104.17/MWh

Annual Energy Payment: $685,800,000

Capacity Payment: $60,128,000

Total Payment: $745,928,000

In this example, the wind farm built in 2025 has a higher expected energy output, but also a higher adjusted strike price, annual energy payment, and total payment due to the higher default UPF of 0.92. The wind farm built in 2030, on the other hand, has a lower expected energy output, but also a lower adjusted strike price, annual energy payment, and total payment due to the lower default UPF of 0.90

Metric	Wind Farm Built in 2025	Wind Farm Built in 2030
Expected Energy Output	6,991,680 MWh	6,858,000 MWh
Strike Price ($/MWh)	100	100
Default UPF	0.92	0.9
Adjusted Strike Price ($/MWh)	$ 109.09	$ 104.17
Annual Energy Payment	$762,328,000	$685,800,000
Capacity Payment	$60,128,000	$60,128,000
Total Payment	$822,456,000	$745,928,000

6. Should NYSERDA utilize different capacity price forecasts to calculate the adjusted Strike Prices than those identified herein? Please provide a justification for any alternate capacity price forecast proposals.

- NYSERDA may consider utilizing different capacity price forecasts to calculate the adjusted Strike Prices than those identified in the examples, depending on the specific circumstances of the project. The capacity price forecast is an important input to the calculation of the adjusted Strike Price, as it represents the value of the capacity payment over the term of the contract.
- The capacity price can be affected by a number of factors, such as changes in market conditions, regulatory policy, and the availability of alternative capacity resources. NYSERDA may want to

consider alternative capacity price forecasts if it has reason to believe that the forecasts used in the examples may not accurately reflect the future value of capacity payments for a particular project.

Example

- Using the 2000mw offshore wind farm we saw earlier, the adjusted strike price for this project with a default UPF of 0.92 and a capacity price forecast of $9,000/MW-year was $109.09/MWh. However, the choice of $9,000/MW-year as the capacity price forecast is not fixed, and may be adjusted to reflect the specific market conditions in the area where the project is located.
- For example, if the project is located in an area with a high level of existing capacity, the market may be oversupplied with electricity, which could reduce the value of new capacity. In this case, it may be appropriate to use a lower capacity price forecast to reflect the lower value of new capacity in that market.
- Suppose that the capacity price forecast is reduced to $7,500/MW-year, while all other assumptions remain the same. Then the adjusted strike price can be recalculated as follows:
  - Annual Capacity Payment = 2000 MW x $7,500/MW-year = $15,000,000
  - Adjusted Strike Price = ($15,000,000 / (0.92 x 8760 hours/year)) + $100/MWh = $98.94/MWh
- As we can see, the adjusted strike price has decreased by more than 9% due to the lower capacity price forecast. This reflects the fact that the lower value of new capacity in the area has reduced the revenue potential for the wind farm.
- On the other hand, if the project were located in an area with high demand growth and limited capacity resources, the market may be undersupplied with electricity, which could increase the value of new capacity. In this case, it may be appropriate to use a higher capacity price forecast to reflect the higher value of new capacity in that market.

7. Please provide any additional feedback that you believe will be helpful to NYSERDA in developing its petition to the PSC in response to the New NYISO Capacity Accreditation Rules. However, some general considerations that NYSERDA may wish to take into account when developing a petition to the PSC could include:

- The NYISO Capacity Accreditation Rules impact all generation resources seeking to participate in the New York State electric market, including offshore wind. As offshore wind is a key component of New York State's ambitious clean energy goals, the new rules have important implications for the development and deployment of offshore wind projects in the state.
- Under the new rules, offshore wind projects seeking to participate in the capacity market must demonstrate that they can deliver power during system-wide peak demand periods, which occur during the summer months. Specifically, offshore wind projects must demonstrate that they can provide at least 30% of their nameplate capacity during these peak periods, which are typically from June through September.
- The NYISO Capacity Accreditation Rules and the NYSERDA rUPF are related in that they both aim to promote the development and integration of large-scale renewable energy projects like offshore wind. The NYISO rules seek to ensure that offshore wind projects can deliver power during periods of peak demand, which is essential for grid stability and reliability. The

rUPF, on the other hand, is a mechanism that NYSERDA uses to provide price support for offshore wind projects, ensuring that they are economically viable and can compete with other sources of energy in the market.

- The rUPF takes into account a project's expected capacity factor, which is a measure of the amount of electricity a project is expected to generate over time. The expected capacity factor is affected by a variety of factors, including weather conditions, turbine performance, and maintenance schedules. By assigning a higher rUPF to projects that are expected to perform better, NYSERDA is able to provide price support to developers of offshore wind projects, which in turn helps to incentivize the development of new projects.
- The NYISO rules are related to the rUPF in that they also aim to ensure that offshore wind projects can deliver power reliably during peak demand periods. By requiring offshore wind developers to meet specific capacity requirements, the rules help to ensure that offshore wind projects are able to contribute to grid stability and reliability. This is important because, without a reliable source of electricity during peak demand periods, the grid can become unstable and vulnerable to disruptions.

To see how these factors relate, let's consider an example using the 2,000 MW offshore wind farm we've used in previous examples. We'll assume a strike price of $100/MWh, a default UPF of 0.90, and an adjusted strike price of $104.17/MWh, which we calculated previously.

Using the NYSERDA rUPF methodology, we can adjust the expected energy output of the project for capacity value. Let's assume that the project has a capacity factor of 50% during the summer and 40% during the winter. To calculate the expected energy output, we can use the following formulas:

Summer Energy Output: 2,000 MW x 4,380 hours/season x 50% x rUPF = expected energy output
Winter Energy Output: 2,000 MW x 4,380 hours/season x 40% x rUPF = expected energy output

Let's assume that the project has a rUPF of 0.92. Using this value, we can calculate the expected energy output as follows:

Summer Energy Output: 2,000 MW x 4,380 hours/season x 50% x 0.92 = 4,017,600 MWh
Winter Energy Output: 2,000 MW x 4,380 hours/season x 40% x 0.92 = 2,974,080 MWh

Total Energy Output: 4,017,600 MWh + 2,974,080 MWh = 6,991,680 MWh

We can then calculate the annual energy payment using the adjusted strike price of $104.17/MWh:

Annual Energy Payment: $726,177,854

Next, we can consider the NYISO Capacity Accreditation Rules. Let's assume that the rules require the project to have a capacity factor of at least 35% during peak demand periods. To calculate the peak demand period energy output, we can use the following formula:

Peak Demand Period Energy Output: 2,000 MW x 876 hours/year x 35% x rUPF = expected energy output

Using the rUPF of 0.92 we calculated previously, we can calculate the peak demand period energy output as follows:

Peak Demand Period Energy Output: 2,000 MW x 876 hours/year x 35% x 0.92 = 575,856 MWh

We can see that the project meets the capacity requirements of the NYISO Capacity Accreditation Rules, as its peak demand period energy output exceeds the required level of 575,856 MWh.

- The NYISO Capacity Accreditation Rules relate to the rUPF in that they require offshore wind developers to meet specific capacity requirements in order to ensure that the wind farm can deliver power during periods of peak demand. By requiring developers to meet these capacity requirements, the NYISO is seeking to promote grid stability and reliability, which are essential for the effective integration of large-scale renewable energy projects like offshore wind. The rUPF is used to adjust the strike price of a contract to account for the uncertainty associated with wind power generation, which is an important consideration for the NYISO as it seeks to balance the needs of electricity consumers with the need to promote the development of renewable energy projects.

- The NYSERDA rUPF methodology and the NYISO Capacity Accreditation Rules are both designed to ensure that offshore wind projects can provide capacity value to the grid during periods of peak demand. By adjusting the expected energy output for capacity value using the rUPF methodology and requiring projects to meet specific capacity requirements under the Capacity Accreditation Rules, the electricity grid can maintain stability and reliability even as large-scale renewable energy projects like offshore wind are integrated into the grid.

Conclusion

- Allowing developers to bid a rUPF creates a direct financial incentive to achieve the proposed rUPF, as it affects the revenue generated from the project.
- The bid rUPF puts pressure on the developer to accurately predict the actual capacity factor, as overestimation can result in underperformance and financial losses.
- The bid rUPF may incentivize developers to implement best practices and invest in high-quality equipment to achieve the proposed rUPF and avoid any financial penalties for underperformance.
- In scenarios where the rUPF is less than 1 and the capacity factor overperforms, the adjusted strike price based on the actual capacity factor is lower than the Strike Price, and the total payment is the sum of the Capacity Payment and Energy Payment.

- A higher reference Unit Power Factor (rUPF) increases the expected energy output, while a lower rUPF reduces the expected output.
- The use of a 90/10 weighting in Scenario 1 resulted in a lower adjusted strike price than the use of a 10/90 weighting in Scenario 2, indicating the potential impact of different weightings on pricing outcomes.
- Adjustments may be made to account for differences in technology and expected performance between wind farms built in different years.
- A higher default UPF may be justified for wind farms with higher levels of uncertainty and a higher likelihood of underperforming.
- A lower default UPF may be justified for wind farms with lower levels of uncertainty and a lower likelihood of underperforming.
- Adjusting the capacity price forecast can significantly impact the adjusted Strike Price, and it should accurately reflect the market conditions in the area where the project is located.
- The capacity price forecast is a key input in calculating the adjusted Strike Price as it reflects the value of capacity payment over the contract term.
- The NYSERDA rUPF methodology adjusts the strike price of a contract to account for the uncertainty associated with wind power generation, promoting the development of offshore wind projects by providing price support.
- Both the NYISO rules and the rUPF methodology aim to ensure that offshore wind projects can provide capacity value to the grid during periods of peak demand, promoting grid stability and reliability.
- By requiring developers to meet capacity requirements and providing price support, the NYISO and NYSERDA are able to effectively integrate large-scale renewable energy projects like offshore wind into the electricity grid.