2019 NESCOE Economic Study– Follow-Up to the February 2020 Meeting

Planning Advisory Committee Meeting

Richard Kornitsky

ASSISTANT ENGINEER | SYSTEM PLANNING

Three 2019 Economic Study Requests

- Requests were submitted by the New England States Committee on Electricity (NESCOE), Anbaric Development Partners (Anbaric) and RENEW Northeast (RENEW).
  - Presented to the PAC on April 25, 2019.

Requester	Purpose of request
NESCOE	Impacts on transmission system and wholesale market of increasing penetration of offshore wind resources https://www.iso-ne.com/static-assets/documents/2019/04/a2_nescoe_2019_economic_study_request_presentation.pptx
Anbaric	Impacts on energy market prices air emissions of large penetration of offshore wind resources https://www.iso-ne.com/static-assets/documents/2019/04/anbaric_2019_economic_study_request.pdf
RENEW	Economic impact of conceptual increases in hourly operating limits on the Orrington-South interface from conceptual transmission upgrades https://www.iso-ne.com/static-assets/documents/2019/04/a2_renew_2019_economic_study_request_presentation.pdf

- Draft scope of work and high-level assumptions for each of these requests were discussed with the PAC on May 21, 2019. More detailed assumptions were discussed on August 8, 2019, and a status update was given on November 20, 2019. Preliminary NESCOE results for cases up to 6,000 MW were presented on December 19, 2019, with a Q&A on January 23, 2020, and updated results for the 8,000 MW cases on February 20, 2020. Anbaric study results were presented on March 18, 2020 as well as a detailed transmission interconnection analysis (CEII topic) for the NESCOE study.
  - Reference these presentations for more details about the study

Today's Presentation

- Building from ISO-NE's analyses performed to date related to the NESCOE Economic Study for the year 2030, further insights into the effects of incremental addition of offshore wind (OSW) were observed
  - The focus of this presentation is spillage due to over-supply and additional ways to illustrate the impacts
- This information is being presented in response to questions raised at the February PAC meeting

Summary of Results

- Additional bar charts have been developed to capture the effects of OSW additions:
  - Annual Spillage of NESCOE Unconstrained (UN) scenarios
    - Unconstrained cases used
  - Monthly demand compared with available OSW
    - 8000_2_UN scenario
  - Percent of Total Annual Energy Spilled by OSW in Each Month
    - 3000_UN scenario
    - 8000_2_UN scenario

Notes:

All results use the 2015 solar and wind profiles. The results are specific to the 2015 weather year. If a different weather year is used for profile shapes the results will differ – the trends would be similar but specific numeric results will change.

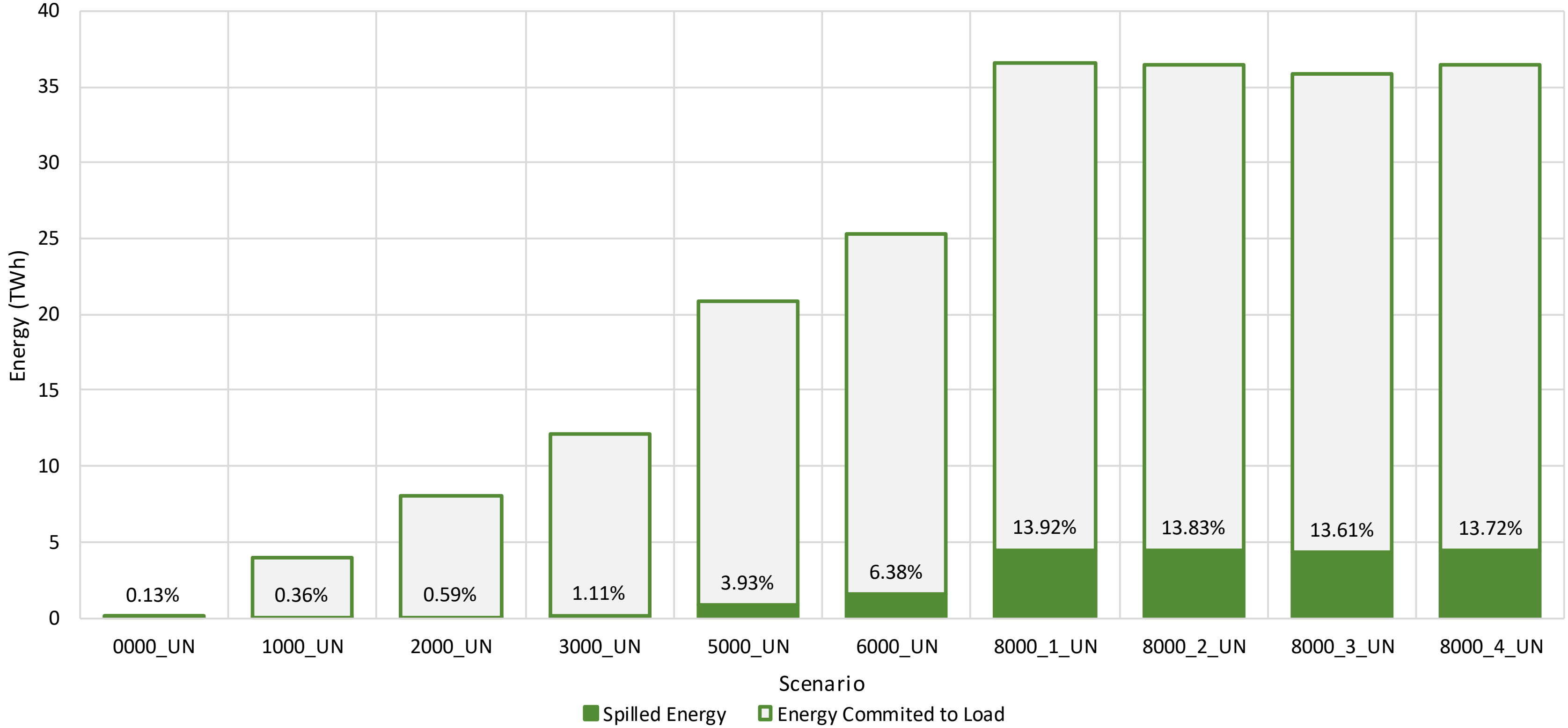
Curtailment of specific resources is driven by the threshold prices. Therefore, different prices and/or order may result in different outcomes.

Production cost simulations were performed under two conditions: Unconstrained and Constrained. Unconstrained transmission is modeled as a one-bus system while constrained transmission is modeled using the "Pipe and RSP Bubble" configuration

Key Observations

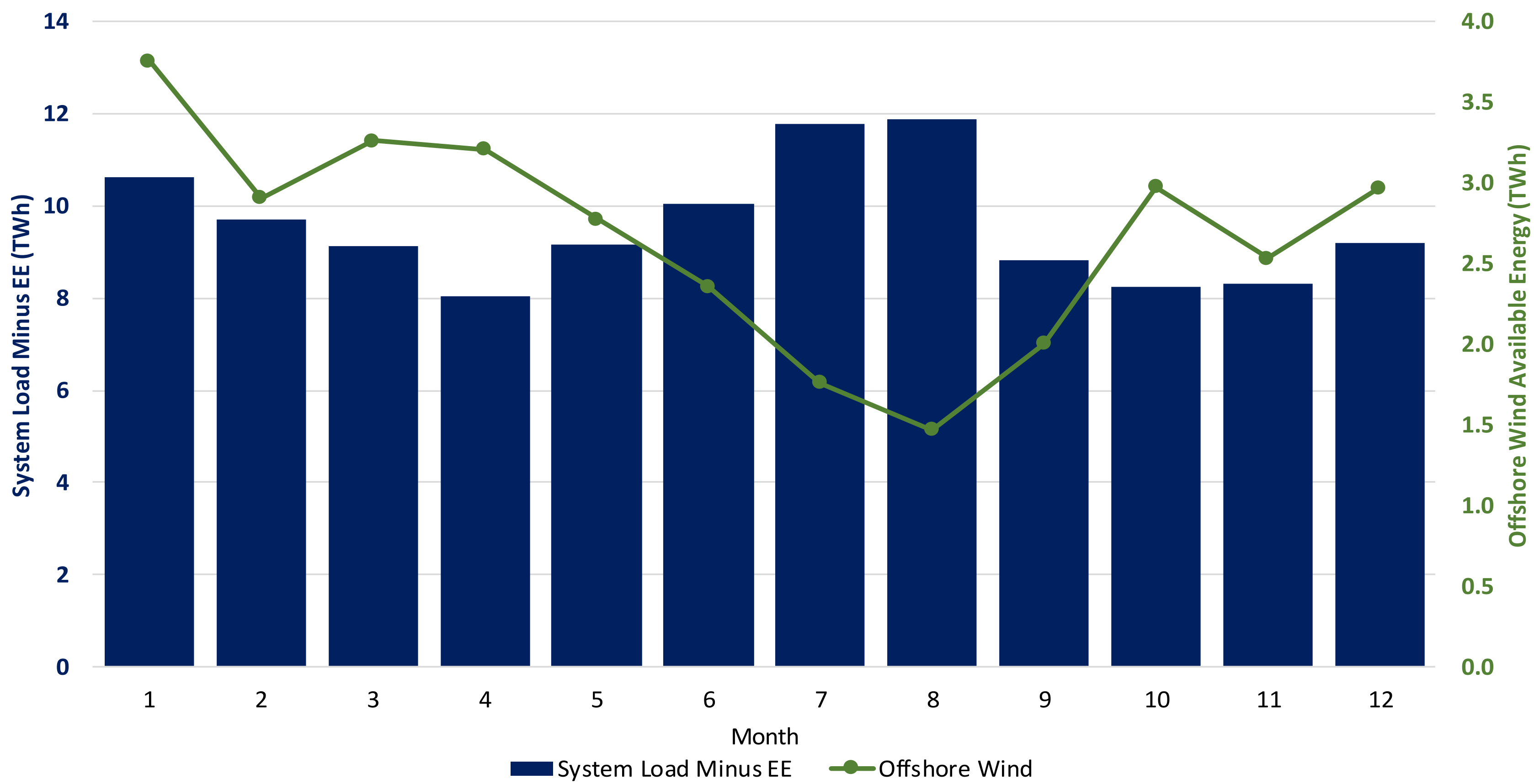
- There is a diminishing return to the incremental addition of OSW as more MW are added
  - As much as 13.9% of total available OSW energy is spilled annually
- The yearly production pattern of OSW does not follow the pattern of load, causing OSW spillage in low load periods
  - Spillage of OSW is highest during low load months and lowest during high load months
  - Higher penetrations of OSW lead to more of its available energy being spilled throughout the year

Annual Spilled Energy vs Total Available Energy of Offshore Wind for all Scenarios (0 to 8,000 MW)



- OSW spillage increases as more MW of OSW is injected into the system
- Annual percent of OSW is the total spilled OSW energy divided by the total available energy

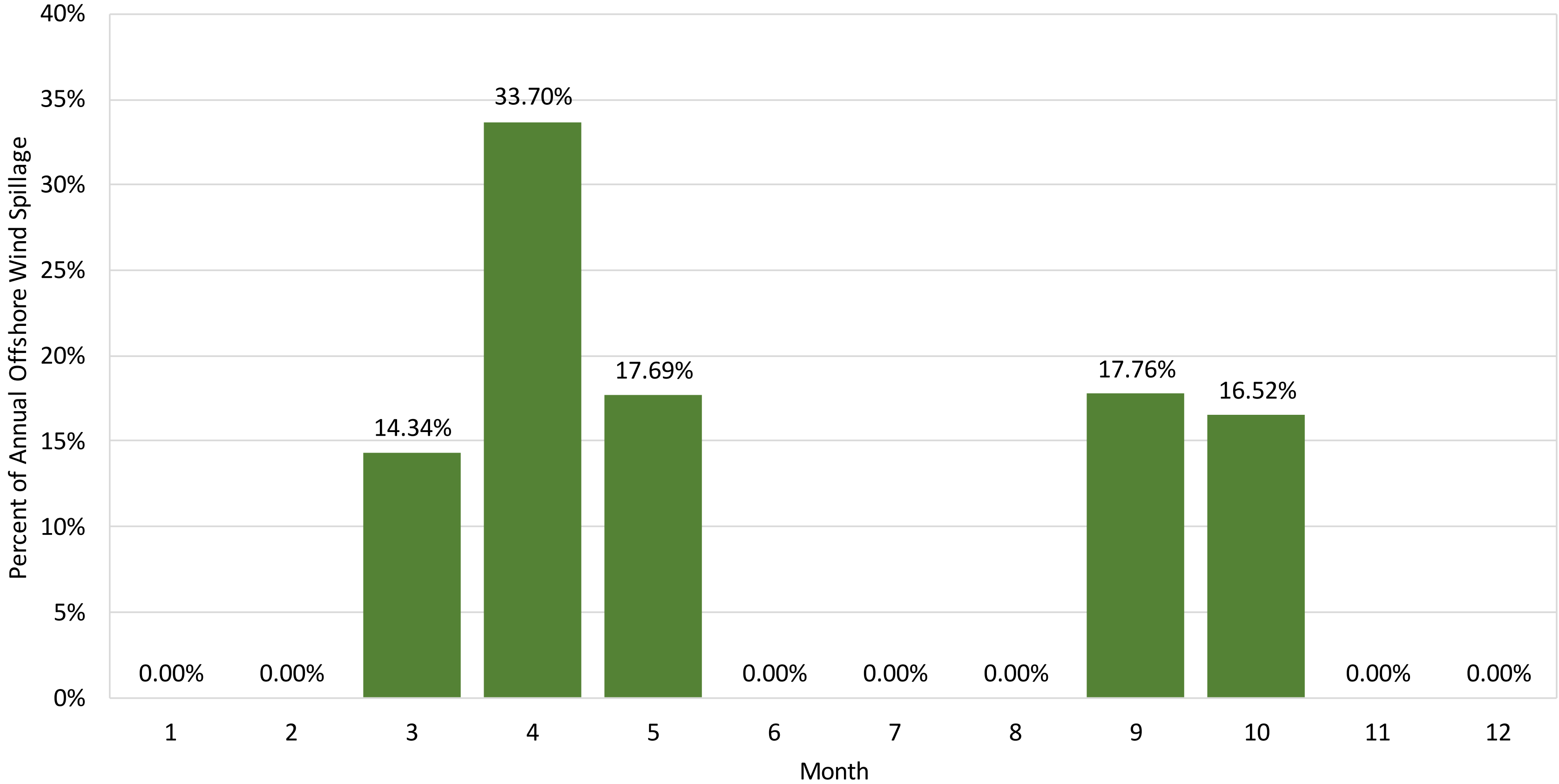
Monthly Profile of System Load Vs. OSW Available Energy 8000_2_UN (TWh)



Note: Offshore wind available energy is plotted on a separate scale than system load minus EE

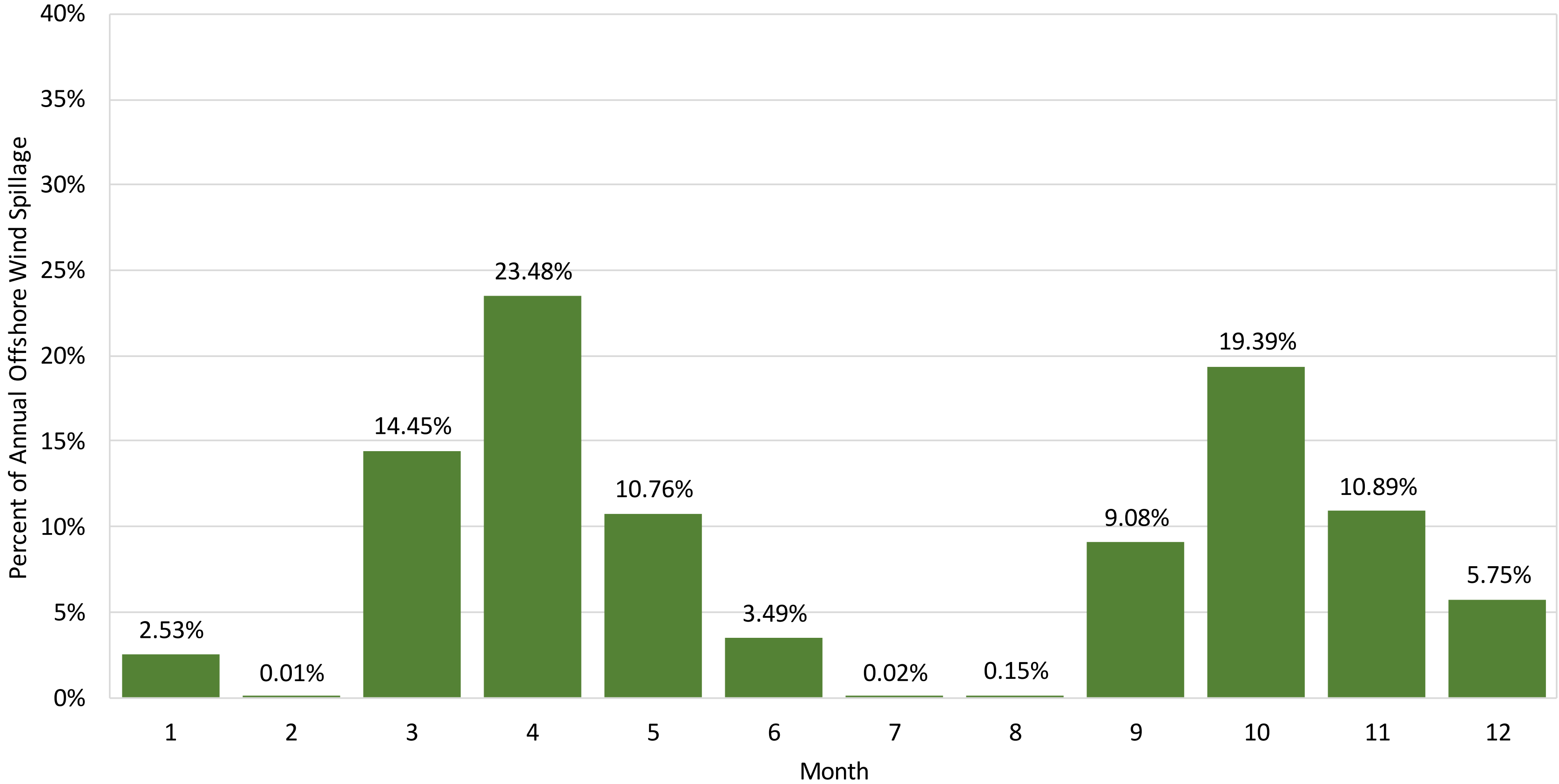
- Generally OSW production is higher during low demand months and lower during high demand months

Percent of Total Annual Offshore Wind Energy Spilled in Each Month for the 3000_UN Scenario



- Spillage of OSW due to over-supply is almost entirely during low load, shoulder months
- Percent of total annual energy spillage is monthly energy spilled divided by annual energy spilled

Percent of Total Annual Offshore Wind Energy Spilled in Each Month for the 8000_2_UN Scenario



- Like the 3000_UN scenario, spillage due to oversupply in the 8000_2_UN case is greatest during low load, shoulder months
- OSW performance is best during the winter months yet not all OSW energy can be used to meet demand
- Percent of total annual energy spillage is monthly energy spilled divided by annual energy spilled

Questions

APPENDIX

Annual Spilled Energy vs Total Available Energy of Offshore Wind for all Scenarios (0 to 8,000 MW)

Scenario	Total Available OSW Energy (MWh)	Total Spilled OSW Energy (MWh)	Percent of Energy Spilled
0000_UN	122,124	155	0.13%
1000_UN	3,958,625	14,065	0.36%
2000_UN	8,038,658	47,729	0.59%
3000_UN	11,959,724	132,600	1.11%
5000_UN	20,070,555	788,212	3.93%
6000_UN	23,798,370	1,518,843	6.38%
8000_1_UN	32,075,804	4,465,323	13.92%
8000_2_UN	31,985,000	4,423,363	13.83%
8000_3_UN	31,562,176	4,295,375	13.61%
8000_4_UN	32,008,718	4,393,065	13.72%

- OSW spillage increases as more MW of OSW is injected into the system
- Annual percent of OSW is the total spilled OSW energy divided by the total available energy

Percent of Total Annual Offshore Wind Energy Spilled in Each Month

Scenario	NESCOE_3000_UN		NESCOE_8000_2_UN	
Month	Spilled Energy (TWh)	Percent of Annual Spillage	Spilled Energy (TWh)	Percent of Annual Spillage
Jan	0.000	0.00%	0.112	2.53%
Feb	0.000	0.00%	0.001	0.01%
Mar	0.019	14.34%	0.639	14.45%
Apr	0.045	33.70%	1.039	23.48%
May	0.023	17.69%	0.476	10.76%
Jun	0.000	0.00%	0.154	3.49%
Jul	0.000	0.00%	0.001	0.02%
Aug	0.000	0.00%	0.007	0.15%
Sep	0.024	17.76%	0.402	9.08%
Oct	0.022	16.52%	0.857	19.39%
Nov	0.000	0.00%	0.482	10.89%
Dec	0.000	0.00%	0.254	5.75%
Total	**0.133**	**100%**	**4.423**	**100%**

- Spillage of OSW is almost entirely during low load shoulder months
- Like the 3000_UN scenario, spillage due to oversupply in the 8000_2_UN case is greatest during low load, shoulder months
- OSW performance is best during the winter months yet not all OSW energy can be used to meet demand
- Percent of total annual energy spillage is monthly energy spilled divided by annual energy spilled

Acronyms

- BOEM – Bureau of Ocean Energy Management
- CELT – Capacity, Energy, Load, and Transmission Report
- CSO – Capacity Supply Obligation
- Cstr. – Constrained
- DR – Demand-Response
- EE – Energy Efficiency
- EIA – U.S. Energy Information Administration
- FCA – Forward Capacity Auction
- FCM – Forward Capacity Market
- LMP – Locational Marginal Price
- LSE – Load-Serving Entity
- MSW – Municipal Solid Waste
- NECEC – New England Clean Energy Connect

Acronyms, cont.

- NESCOE – New England States Committee on Electricity
- NG – Natural Gas
- NICR – Net Installed Capacity Requirement
- NREL – National Renewable Energy Laboratory
- OSW – Offshore Wind
- PHEV – Plug-in Hybrid Electric Vehicle
- PV – Photovoltaic
- RFP – Request for Proposals
- RGGI – Regional Greenhouse Gas Initiative
- SCC – Seasonal Claimed Capability
- Uncstr. – Unconstrained