APPENDIX

New England's Offshore Wind Solution

The Region Can Ride Through Cold-Weather Demand Surges with Local Renewable Energy

HIGHLIGHTS

Wind energy off the New England coast can powerfully reinforce the reliability of the region's electric grid, particularly during winter when the system is most vulnerable to energy shortages. Combined with the energy available from onshore wind and solar resources, an offshore wind fleet can support a shift toward local solutions for winter reliability in New England, bringing consumers much-needed relief from high seasonal electricity bills.

A Union of Concerned Scientists analysis of winter 2024–2025 wind speed data shows that the energy delivered by just two offshore wind projects, totaling 1,500 megawatts (MW) of capacity, would have lowered the risk of power outages, based on a key reliability metric, by 55 percent over the course of the season. A larger fleet of 3,500 MW would have reduced the risk of outages by 75 percent. In either case, the scale of energy delivered by an offshore wind fleet would have increased the total winter energy supply from local renewable resources above the energy supply from imported liquified natural gas.

Susan Muller

February 2026

www.ucs.org/resources/new-englands-offshore-wind-solution

https://doi.org/10.47923/2026.16091

Union of Concerned Scientists

Data Sources

- Energy Shortfall Risk thresholds (350,000 MWh, 400,000 MWh, 450,000 MWh) were obtained from the ISO-NE 21-Day Energy Assessment Forecast (ISO-NE 2022).
- Demand data are from ISO-NE, "Hourly Real-Time System Demand" (ISO-NE n.d.).
- Offshore wind speed data are from ECMWF ERA5 Hourly Data Series (Hersbach n.d.).
- Power curve data are from the NREL Reference 12 MW offshore wind turbine (NREL 2023).

Methodology

Step 1: Daily Energy Demand (MWh)

Total daily energy demand was calculated by summing the hourly demand values for Hour Ending 1 ("HE 1") through Hour Ending 24 ("HE 24") for each day of the 2024–2025 winter season (December 1, 2024–February 28, 2025).

Step 2: Daily Offshore Wind Energy (MWh)

Hourly Wind Speed

Indicative hourly wind speed at approximate hub height (100 m) in the Rhode Island/Massachusetts (RIMA) Wind Energy Area was calculated by obtaining the "u100" and "v100" wind values for (40.4, -71.0) from the ECMWF ERA5 Hourly Data Series (Hersbach n.d.).

Hourly Capacity Factor

Hourly wind speed values were converted to hourly capacity factor values using the power curve for the NREL reference 12 MW offshore wind turbine (NREL 2023).

Hourly Net Power Output

Hourly capacity factors were multiplied by 1,500 MW to obtain the theoretical hourly power output of a 1,500 MW offshore wind fleet.

Hourly capacity factors were multiplied by 3,500 MW to obtain the theoretical hourly power output of a 3,500 MW offshore wind fleet.

Theoretical power output was reduced by 30 percent to obtain a high-level estimate of net power output after accounting for wake effects, electrical losses and wind plant unavailability.[1]

Total Daily Offshore Wind Energy

Daily offshore wind energy was calculated by summing the hourly net power output for "HE 1" through "HE 24" for each day of the 2024–2025 winter season.

Step 3: Daily Energy Demand Net of Offshore Wind Energy (MWh)

For each scenario, daily energy demand net of energy from offshore wind was calculated by subtracting the value in Step 2 from the value in Step 1 for each day of the 2024–2025 winter season.

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Endnote

[1] ISO New England assumes electrical and availability losses of 2.5 percent and 7 percent, respectively, for offshore wind (DNV 2024). A recent study in the RI/MA Wind Energy Area finding a year-round range of simulated wake effects from 38.2 percent to 34.1 percent noted that “smaller power deficits occur during winter . . . with faster winds that exceed rated wind speed and unstable conditions that erode wakes faster.” (Rosencrans 2024). The resulting seasonal values are broadly consistent with the observed output of the South Fork Offshore Wind project during the same time period.

https://doi.org/10.47923/2026.16091