An Assessment of the Economic Potential of Offshore Wind in the United States from 2015 to 2030

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Technical Report
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4.5 Great Lakes

4.5.1 Levelized Cost of Energy

4.5.1.1 Spatial Distribution

The *2016 Offshore Wind Energy Resource Assessment for the United States* report (Musial et al. 2016) found that the Great Lakes had about 136 GW of technical resource capacity; a low quantity because of a conservative assumption that none of the water above 60 m in depth would be feasible for development due to formation of lake ice.[35] The quality of the offshore wind resource for the Great Lakes region was found to be very good and the general absence of extreme meteorological ocean events (wind and waves) helps keep costs low. The unique design concern is with the presence of lake ice, which can add structural load burdens and hence cost. However, because of their engineering design, fixed-bottom structures are considered to be managed well in this environment. States such as Michigan, Ohio, and Wisconsin have the top resource capacity in this region.

Figure 34 shows modeled data with LCOE variations between $130/MWh and $270/MWh in 2015 across locations in the Great Lakes. In 2022, the figure shows that this range reduces to $95/MWh and $180/MWh and, by 2027, from $75/MWh to $135/MWh. The Great Lakes are relatively homogenous with respect to the physical variables considered in this assessment that might influence cost. The variability of the wind resource within the region seems to explain the majority of the variations in LCOE. The least-cost locations found are in Lake Erie, Lake Michigan, and Saginaw Bay in Lake Huron, which have multiple sites with strong wind resources that are close to shore. Note that the cost model has not yet been upgraded to include cost adders that may be needed to account for the impacts of ice exposure to the substructure, increased operating costs that may be required for accessibility in the winter, or technical availability impacts. If these cold weather variables are included, it is likely that the LCOEs for the region may increase.

[35] If the deep water exclusion were removed for the Great Lakes region, 519 GW of technical resource capacity would be available (Musial et al. 2016).

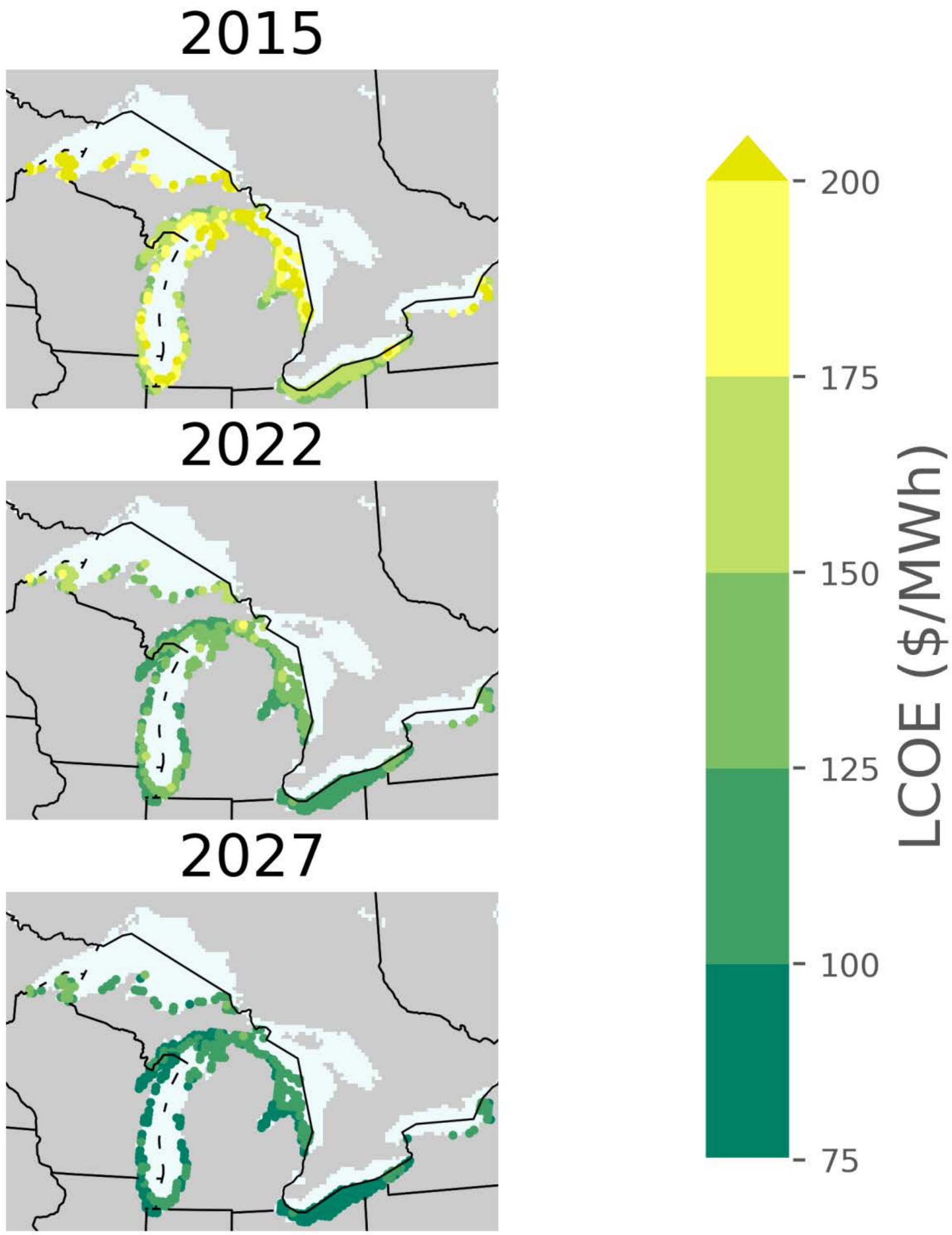
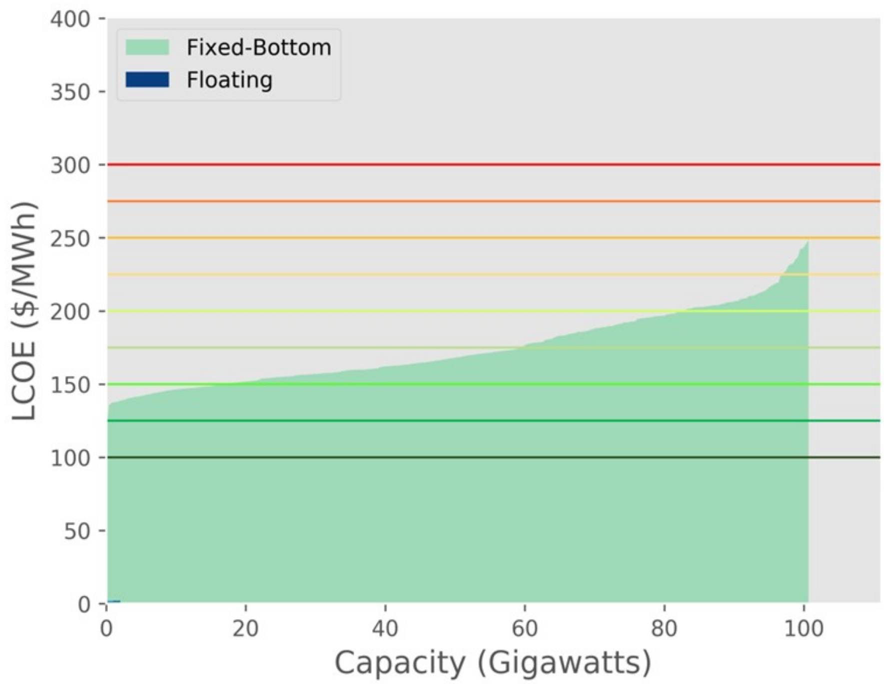


Figure 34. Great Lakes spatial LCOE distribution (2015–2027)

4.5.1.2 Supply Curves

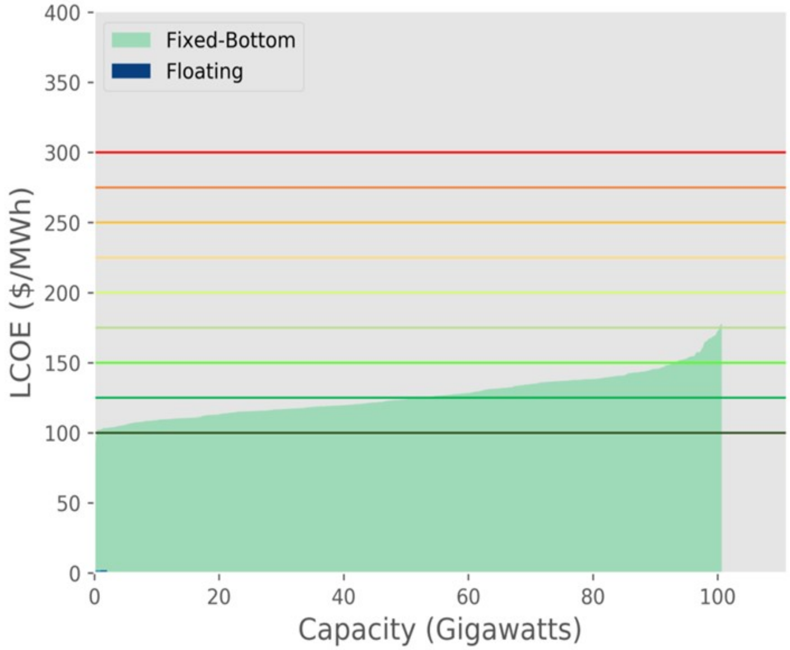
Approximately 100 GW of offshore wind energy capacity was estimated for the Great Lakes area as shown in Figures 3537. Because of the uncertainty of floating offshore wind technology's ability to survive freshwater ice floes, ice regions of the Great Lakes where depths are greater than 60 m were excluded. As a result, fixed-bottom technology comprises all of the available resource in the Great Lakes shown in these figures. Figure 35 shows that in 2015, approximately 20 GW are available below an LCOE of $150/MWh. By 2027, Figure 37 shows that areas in the Great Lakes are among those in the United States with the lowest LCOE, with 60 GW (over half) below $100/MWh and all of the resource area below $125/MWh.



LCOE ($/MWh)	Cumulative Capacity (GW)		
	Fixed Bottom	Floating	Total
<300	100	0	100
<275	100	0	100
<250	100	0	100
<225	100	0	100
<200	80	0	80
<175	60	0	60
<150	20	0	20
<125	0	0	0
<100	0	0	0

Figure 35. 2015 Great Lakes supply curve

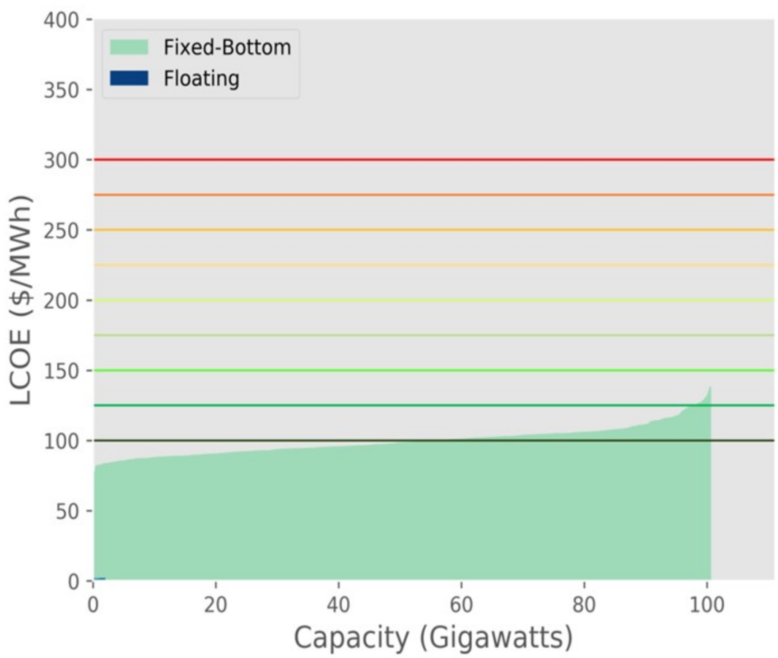
Note: Cumulative capacity in table rounded to the nearest 10.



LCOE ($/MWh)	Cumulative Capacity (GW) Fixed Bottom	Floating	Total
<300	100	0	100
<275	100	0	100
<250	100	0	100
<225	100	0	100
<200	100	0	100
<175	100	0	100
<150	90	0	90
<125	50	0	50
<100	<1	0	<1

Figure 36. 2022 Great Lakes supply curve

Note: Cumulative capacity in table rounded to the nearest 10.



LCOE ($/MWh)	Cumulative Capacity (GW) Fixed Bottom	Floating	Total
<300	100	0	100
<275	100	0	100
<250	100	0	100
<225	100	0	100
<200	100	0	100
<175	100	0	100
<150	100	0	100
<125	100	0	100
<100	60	0	60

Figure 37. 2027 Great Lakes supply curve

Note: Cumulative capacity in table rounded to the nearest 10.

4.5.2 Levelized Avoided Cost of Energy

The range of LACE increases from $42–65/MWh in 2015 to $42–72/MWh by 2027. Areas with higher levels of LACE are located in the northern parts of Lake Michigan and Lake Erie. The western parts of Lake Superior and Lake Huron are among those with relatively low LACE estimates.

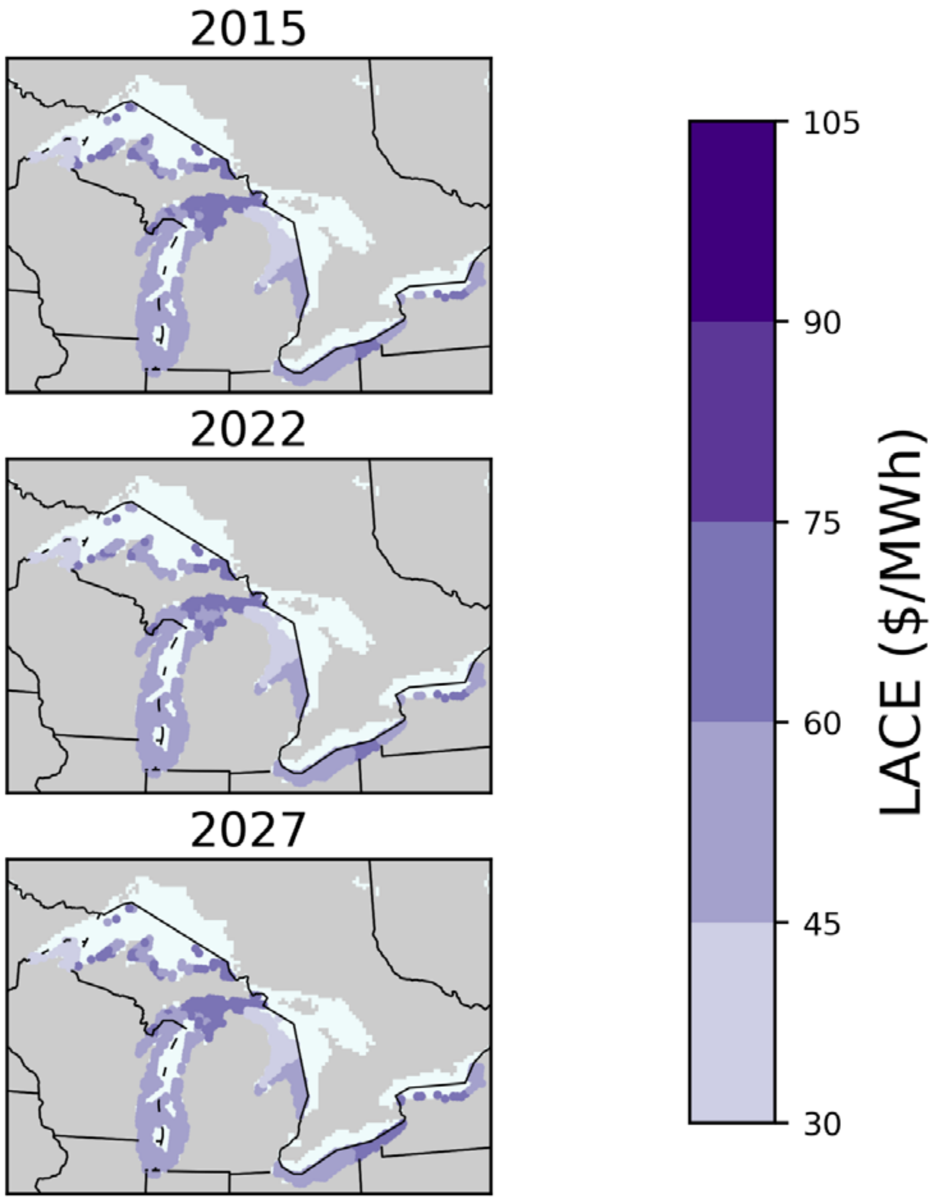


Figure 38. Great Lakes spatial LACE distribution (2015–2027)

4.5.3 Net Value and Economic Potential

Although the Great Lakes region has some of the least-cost offshore wind locations estimated in this assessment as a result of relatively high wind speeds close to shore, in the time frame considered it does not show any sites with a net value greater than zero (i.e., lack of economic potential). However, by 2027, 75 GW, or three-quarters of the available 100 GW in the Great Lakes, has a net value between -$50/MWh and -$19/MWh, which is nearing the threshold of economic viability for some sites without considering policy incentives.

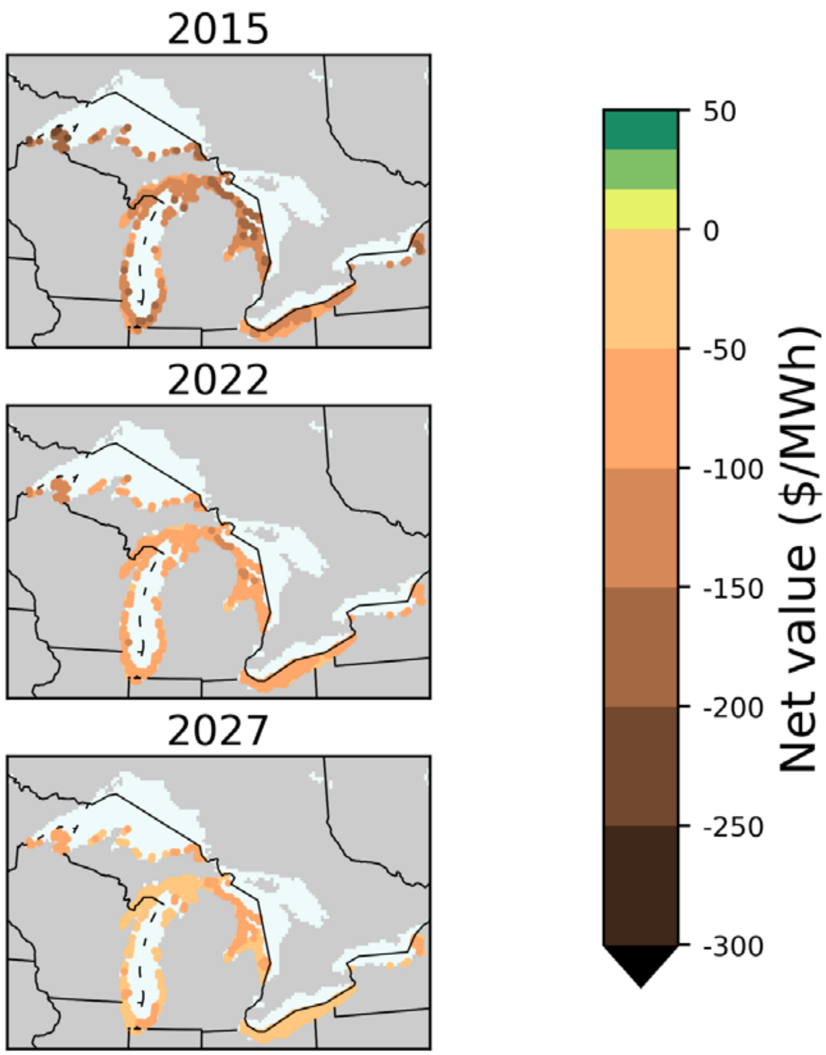


Figure 39. Great Lakes spatial net value distribution (2015–2027)

Note: Sites with economic potential (net value > 0) are depicted in shades of green.