The Potential Economic Impact of Offshore Wind Energy in the Great Lakes

By David G. Loomis, President, Strategic Economic Research, LLC
Professor of Economics, Illinois State University
Director, Center for Renewable Energy, Illinois State University

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Introduction

Offshore wind is a clean, renewable source of energy and can be an economic driver for the Great Lakes region. With no installed offshore wind projects in the Great Lakes, or U.S. waters generally, it is difficult to understand the employment opportunities and other potential regional economic impacts from offshore wind development. This report summarizes the results of a study to quantify the potential economic benefits from offshore wind using multiple scenarios.[1]

This analysis used the Offshore Wind Jobs and Economic Development Impacts (JEDI) model developed by the National Renewable Energy Laboratory (NREL) to estimate the jobs and economic development impacts to the Great Lakes region from six offshore wind scenarios.[2] Within the Offshore Wind JEDI model, region-specific multipliers, cost information, and local content information and assumptions were incorporated to determine the extent to which the scenarios would use local labor and domestic manufacturing capabilities.

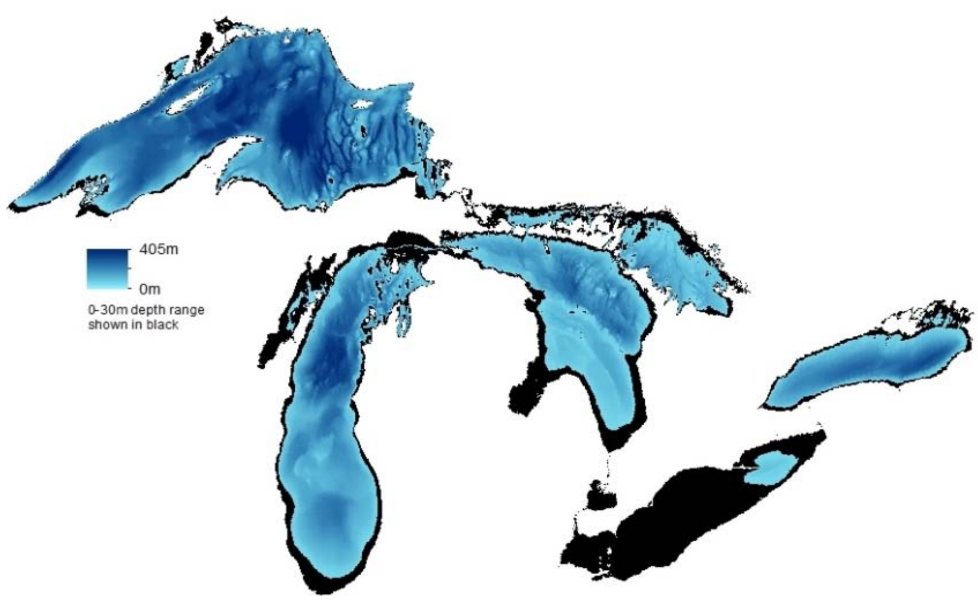
As with any scenario analysis, the results are an estimate and are highly dependent on the assumptions used. While the results do not measure project viability or predict energy futures, they do provide an indication of the jobs and economic development contribution that offshore wind could provide to the Great Lake region. The numbers of jobs are expressed as gross Full-Time Equivalent (FTE) jobs.

The Great Lakes Region

Great Lakes region is defined in this analysis as all U.S. states that touch the Great Lakes: Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, and Wisconsin. Although the Ontario and Quebec are part of the Great Lakes region, Canadian Provinces were not included in this study.

Offshore wind development and operation in the fresh water Great Lakes differs from similar activities in the salt water oceans. On the positive side, there is less wear and tear on offshore wind components in the Great Lakes because fresh water is less corrosive than salt water, and water levels do not change as frequently and considerably as do tidal waters. The water depth in the Great Lakes is also highly variable, both within lakes and from lake to lake. Most potential sites in shallow water are located in Lakes Erie and Ontario.

However, accessibility of Great Lakes installations can be limited by locks, port facilities, and icing. Icing can also limit boat access to turbines for maintenance and repairs.



Digital data provided by Great Lakes Aquatic Habitat Framework Project, 2013

Deployment Scenarios

In consultation with leading offshore wind energy development experts in the U.S. and the region, six scenarios of Great Lakes Offshore Wind deployment were analyzed using a high, medium and low deployment capacity in the years 2020 and 2030 (Table 1). The medium and high scenarios examine much higher growth rates of wind energy in the Great Lakes than those considered for a related study conducted by NavigantConsulting[3].

Table 1
Cumulative Installed Capacity (MW) Scenarios

	Years	
Scenario	**2020**	**2030**
Low	250	1,000
Medium	500	2,000
High	1,000	5,000

Assumptions

Technology

All scenarios assume the use of 3-MW turbines at a 25m water depth. The five scenarios over 500 MW assume one or more representative 500 megawatt (MW) project(s), while the low scenario in 2020 used a single 250 MW project Values for individual cost components were adjusted (ranging from 10 percent lower to 20 percent higher) from the default values in the JEDI model based on input from national and regional experts. Costs differences were due to such factors as icing, transportation cost differences and existing onshore wind turbine manufacturing.

Capital and Operating Costs

As shown in Table 2, the 2020 capital costs are expected to be $6,632 per kilowatt (kW) for all scenarios while the 2030 capital costs vary from $5,969/kW in the low scenario to $4,642/kW in the high scenario. In the higher deployment scenarios, we expect capital costs to decline more rapidly due to economies of scale in manufacturing and "learning by doing" in construction. The change in costs over time is assumed to be linear. The operating costs are assumed to be $131/kW based on the JEDI model assumptions and discussions with Great Lakes experts; we have assumed no change in these costs from 2020 to 2030. However, it is reasonable to assume that operating costs could go down as the industry matures and there are increased efficiencies in repairing and maintaining offshore wind facilities and as the capacity to repair them increases with more wind installations demanding these services. At this time, it is hard to estimate how much operating costs might decline and when that might happen.

Table 2
Capital Costs ($/kW)

	Years	
Scenario	**2020**	**2030**
Low	$6,632	$5,969
Medium	$6,632	$5,306
High	$6,632	$4,642

Local and Regional Content

The difference in scenarios is not only important for the total amount of wind capacity that will be built but also for the percentage of materials and labor that will be developed within the region to support these wind projects. The low scenario assumes 0-25 percent local content from the Great Lakes region by 2030. The medium scenario has 0-50 percent local content and the high scenario has 50-75 percent local content on most major cost elements. More sustained capacity (e.g., installed wind) will likely result in a higher percentage of the materials and labor coming from within the region.

Results

A scenario's overall economic impacts will depend on the level of development, the decline in capital costs and the portion of expenditures made within the Great Lakes region. Overall, this study showed that, using local and regional cost adjustments, construction costs could be about 10 percent higher for the Great Lakes region than would otherwise be estimated using JEDI default values. This is primarily due to differences in the physical features of the Great Lakes. However, operation and maintenance costs would be about the same.

Figures 1, 2 and Table 3 represent the jobs that could possibly be created within the Great Lakes region under the three different scenarios.

Under the **low** scenario, over 12,500 (FTE) jobs could be supported by 2030 during construction and 750 long-term (FTE) jobs could be supported by 2030 during operation. The number of long-term jobs could be supported by 2020 under the medium scenario is 368 but this would rise to over 1,500 (FTE) jobs by 2030.

The number of jobs supported during construction under the **medium** scenario ranges from 3,971 by 2020 to 31,016 by 2030.

Finally, under the **high** growth scenario, almost 121,700 (FTE) jobs could be supported by 2030 with almost 3,900 long-term jobs during operations. This result should be considered an aggressive scenario of what is possible by 2030 if the right policies were enacted.

Figure 1
Jobs (FTE) Created during the
Construction Period for Each Scenario

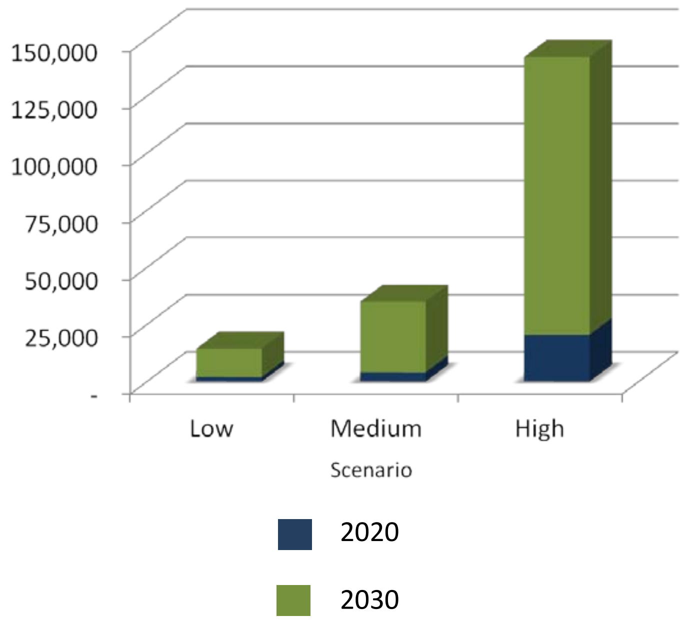
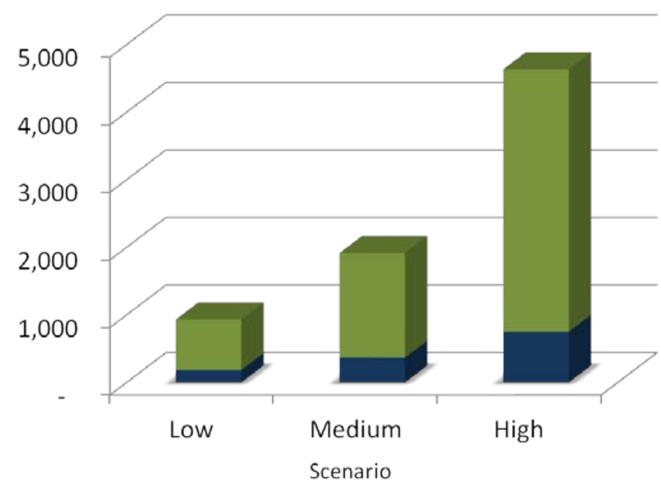


Figure 2
Jobs (FTE) Created during the
Operation Years for Each Scenario



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[1] This study was funded by the Great Lakes Wind Collaborative with funding support from the U.S. Department of Energy.
[2] The JEDI models are based upon the industry standard IMPLAN model and are available at http://www.nrel.gov/analysis/jedi/download.html
[3] Navigant Consulting, 2013. *U.S. Offshore Wind Manufacturing and Supply Chain Development*
U.S. Offshore Wind Manufacturing and Supply Chain Development. Burlington, MA .

Table 3

Detailed Jobs (FTE) Created for Each Scenario

Scenario			2020	2030
Low	Construction	**Project development and onsite labor**	**469**	**4,133**
		Construction and interconnection labor	*324*	*3,561*
		Construction related services	*145*	*572*
		Turbine and supply chain	**642**	**3,650**
		Induced impacts	**757**	**4,743**
		Total impacts during construction	**1,868**	**12,526**
	Operation	**Onsite labor**	**15**	**70**
		Local revenue and supply chain	**104**	**421**
		Induced impacts	**63**	**258**
		Total impacts during operation	**182**	**749**
Medium	Construction	**Project development and onsite labor**	**622**	**7,641**
		Construction and interconnection labor	*324*	*6,489*
		Construction related services	*298*	*1,152*
		Turbine and supply chain	**1,705**	**11,410**
		Induced impacts	**1,644**	**11,965**
		Total impacts during construction	**3,971**	**31,016**
	Operation	**Onsite labor**	**32**	**165**
		Local revenue and supply chain	**209**	**853**
		Induced impacts	**127**	**530**
		Total impacts during operation	**368**	**1,548**
High	Construction	**Project development and onsite labor**	**5,074**	**27,860**
		Construction and interconnection labor	*4,451*	*25,060*
		Construction related services	*623*	*2,800*
		Turbine and supply chain	**7,567**	**47,410**
		Induced impacts	**7,794**	**46,415**
		Total impacts during construction	**20,435**	**121,685**
	Operation	**Onsite labor**	**70**	**420**
		Local revenue and supply chain	**421**	**2,135**
		Induced impacts	**258**	**1,330**
		Total impacts during operation	**749**	**3,385**