The Role of the **Great Lakes-St. Lawrence Seaway Ports** in the Advancement of the **Wind Energy Industry**

Great Lakes Wind Collaborative

Great Lakes Commission September 2010

Acknowledgments

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Cover Photo: A tug assists a freighter entering the port in Menominee, Mich. Photo © Dick Lund.

The Great Lakes Wind Collaborative is a multi-stakeholder group working to facilitate the sustainable development of wind energy in the Great Lakes region. Products of the group are approved by consensus of its Steering Committee and thus do not necessarily reflect and are not necessarily endorsed by the individuals, organizations, companies or agencies represented on the Steering Committee. The Great Lakes Wind Collaborative does not endorse particular companies, technologies, or ports.

Executive Summary

The transportation sector has played a key role in ensuring sustainable and economically efficient advancement of the wind energy industry in the United States, and more particularly in the Great Lakes region. The Great Lakes Wind Collaborative (GLWC) surveyed ports in the Great Lakes St. Lawrence Seaway (GLSLS) region to assess their readiness and willingness to handle wind turbine cargo. Their responses indicate that the GLSLS ports not only have the requisite infrastructure but also have ample experience and interest to handle the unique needs of the wind energy industry. The GLSLS ports are well-situated to facilitate and advance the growth of the wind energy industry. This document provides a general overview of the Great Lakes wind energy industry as well as a discussion of the role of the GLSLS ports in advancing the industry. The attached appendix provides detailed information about the individual ports and/or port operators who responded to the GLWC survey including contact information, infrastructure specifications (handling equipment, staging and dockage area), bimodal transportation options, and past experience handling wind turbine components.

Introduction[1]

The economic health and vitality of the states and provinces in the Great Lakes-St. Lawrence Seaway region[2] is integrally tied to the economic success of its ports. In the Great Lakes region, port cargo has traditionally been dominated by bulk cargo (e.g. iron ore, coal, petroleum, aggregates and grain) with smaller yet dependable quantities of general cargo (e.g. steel products and forestry goods). Due to the decline of traditional manufacturing

Figure 1: Map of the Great Lakes-St. Lawrence Seaway system, highlighting the locations of several major ports, including but not limited to the ports featured in the attached appendix.

1 The individual ports use a variety of measures to record their wind turbine handling history. Since the information was reported both in terms of volume and weight, it is difficult to convert and standardize the reporting. Thus, this document reports the measurements in the same form as they were submitted to the GLWC by the ports.

2 The Great Lakes-St. Lawrence Seaway Region is comprised of the states of Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania and Wisconsin; and the provinces of Ontario and Québec.

Wind turbine blades being unloaded at the port in Menominee, Mich. Photo © Dick Lund.

in the Great Lakes region over the last two decades and the severe economic recession in 2008-09, the GLSLS ports have been making a concerted effort to meet the challenges posed by the changing economy. They are diversifying their cargo base, forging new relationships, and upgrading their facilities in order to provide improved service to new sectors of cargo movement while retaining existing customers.

Wind turbine components are one of the more specialized non-traditional commodities now moving through GLSLS ports. In the last quarter of 2009, the Great Lakes Wind Collaborative (GLWC) surveyed major ports in the binational Great Lakes region to assess their readiness and willingness to handle wind turbine components. The survey results, as documented in this report, demonstrate the role of GLSLS ports in attracting the fastest growing segment of renewable energy in North America—wind. This report discusses the growth of the wind energy industry overall and provides a more detailed description and analysis of information provided by ports that responded to the GLWC survey, including an overview of their capabilities and experience in handling wind turbine components. The appendix provides contact information and details about the handling capabilities of each participating port, including infrastructure specifications (handling equipment, staging and dockage area), bimodal transportation options, and past experience handling wind turbine components.

The Growth of the Wind Energy Industry

U.S. and Canadian ports have the potential to fill a unique niche in both the regional and worldwide expansion of the wind energy industry. As transportation costs can comprise up to a quarter of the total cost of installing a wind turbine, improper handling or transportation delays can considerably increase the overall cost to a developer.[3] Prior to 2004, little to no wind energy project cargo was moving through the GLSLS system, but over the last half decade the GLSLS ports have become an integral stakeholder in the wind turbine industry by facilitating the movement of wind turbine components from their initial manufacturing point to their final deployment location. Nearly all of the ports surveyed in the Great Lakes region recognize this opportunity to play a pivotal role in the growth and development of the wind energy industry and thus categorize the handling of wind cargo as a high or very high priority for their port or facility's cargo development plans.

Between 2004 and 2010, the Port of Duluth's annual handling of wind turbine components rose 150 fold from 2,047 freight tons to over 300,000 freight tons a year.

Over the last decade the global wind energy industry has burgeoned. The worldwide total capacity of installed wind increased from around 24,000 MW in 2001 to 159,213 MW in 2009.[4] In the Great Lakes-

3 Ozment, S. and T. Tremwel (Oct. 2007) *Transportation Management in the Wind Industry: Problems and Solutions Facing the Shipment of Oversized Products in the Supply Chain* citing Aubrey, C. (2007) *Supply Chain: The race to meet Demand* Wind Directions, EWEA, Jan/Feb.

4 World Wind Energy Association (WWEA). 2009. *World Wind Energy Report 2009*, page 5. Available for download at http://www.wwindea.org/home/images/stories/worldwindenergyreport2009_s.pdf.

St. Lawrence region alone, installed wind capacity has risen from around 400 MW in 1999 to 8,876 MW in early 2010. As of late 2010, all of the installed wind capacity in the region is on land, with considerable interest and movement toward developing the wind resources over the Great Lakes. The GLSLS ports have a strategically important role to play in the future installation and maintenance of offshore freshwater wind turbines.

A freighter carrying wind turbine components enters the port of Menominee, Mich. Photo © Dick Lund.

In addition to a rise in installed wind capacity, there has been a corresponding rise in domestic turbine component manufacturing reducing the need for developers to rely solely on imported components. Due to the relative ease with which existing manufacturing infrastructure can be adapted to produce wind turbine components, component manufacturers have been especially interested in operating in the Great Lakes region. The Great Lakes wind turbine supply chain includes, among other items, couplings, gearboxes, tower sections, fixtures, hubs, blades, generators, turbines, bearings, and metal fabrication.

In March of 2010, Ventower Industries broke ground for a new wind tower manufacturing facility at a former brownfield in the Port of Monroe.

The GLSLS ports have a dual supporting role in the success of the domestic wind turbine component supply chain: to facilitate the exportation of wind turbine components to domestic and international locations and to provide expertise in moving raw materials through the Great Lakes-St. Lawrence Seaway system. An individual turbine is composed of 8,000 components and requires around 480 bolts, 5.4 miles (8.7 kilometers) of rebar, 240 cubic yards (183.5 cubic meters) of concrete and at least 200 tons of steel.[5] These raw materials are bulk commodities which the GLSLS ports have had decades of experience in handling. Some ports, such as the Port of Monroe, have taken additional strategic steps to harness the increase in wind component manufacturing in the Great Lakes region by fostering direct relationships with individual manufacturers.

The overall growth of the wind energy industry is in part tied to the commitment of the Great Lakes jurisdictions to increase the production and deployment of renewable energy within their individual boundaries. The commitment is demonstrated by the fact that nine of the ten Great Lakes jurisdictions have enacted renewable energy portfolio standards or equivalent policies or regulations which support and encourage the development of wind or other sources of renewable energy.

5 American Wind Energy Association (AWEA) (2008) *AWEA Wind Power Value Chain: Building Links to a Cleaner Energy Future*, available for download at http://www.awea.org/pubs/factsheets/valu_chain.pdf (June 2010)

A Gateway for the Wind Market

The GLSLS ports provide domestic and international component suppliers, turbine manufacturers and developers with a direct connection to both domestic locations within the United States and Canada as well as with foreign markets in Europe, South America and Asia.

Intermodal linkages including truck, barge, and rail greatly expand the GLSLS ports' connection to domestic markets and access to major manufacturing and population centers. GLSLS ports are located in the vicinity of 40 provincial and interstate highways. Within a 25 mile (40.2 kilometer) radius of certain GLSLS ports, shippers can access the QEW, Thruway 55, I-71, I-75, I-77, I-80, I-90, and I-94, among others. Approximately 150 million people, nearly 45 percent of the population of the United States and Canada, reside within an eight-hour drive of a major GLSLS port (see figure 2).[6]

Between 2005 and 2009, the Port of Oswego handled 27,550 metric tons of wind turbine cargo to/from markets in the United States, Canada, Brazil, Vietnam, and Denmark.

Figure 2: One hundred fifty million people reside within the shaded area constituting an eight-hour drive from the major GLSLS ports. Source: St. Lawrence Seaway Management Corporation.

The concrete wharf at the Port of Thunder Bay has rail trackage allowing stevedores to directly unload wind turbines and their related components from marine vessels onto waiting rail cars.

Inland river and canal connections include the Upper Mississippi, Buffalo, Niagara, Cuyahoga, Fox, Calumet, Illinois, Maumee, Raisin, Detroit, and Black rivers, and the New York State Barge Canal.

The region's ports are connected to around 30 different Class I and II and short rail lines.[7] All of the GLSLS major ports are linked with at least one Class I rail line. These include the CSX, Norfolk Southern, Canadian National, Canadian Pacific, Union Pacific, and Burlington Northern Santa Fe.

At the Port of Buffalo, component suppliers, turbine manufacturers, and developers are not only linked to the Great Lakes St. Lawrence Seaway, but also to two Class I rail lines, a short line rail line, five major highways and two inland rivers.

6 St. Lawrence Seaway Management Corporation (2010) *St. Lawrence Seaway Handbook*, Section 4: The St. Lawrence Seaway-Gateway to North America. Available for viewing at http://www.media-seaway.com/seaway_handbook/flash-tour-en/tour-e.html, last accessed May 2010.

7 In the United States "The Class to which a carrier belongs is determined by comparing its adjusted operating revenues for three consecutive years to the following scale: Class I - $250 million or more, Class II - $20 million or more, Class III (shortline)- $0 to $20 million." United States Surface Transportation Board, *FAQs*, last accessed June 2010 at http://www.stb.dot.gov/stb/faqs.html.

The GLSLS ports continue to invest in intermodal infrastructure improvements in order to increase the efficiency by which wind cargo is transported through their properties. The Port of Milwaukee is planning on expanding its freeway on-ramp to a 175-foot (53.3-meter) radius in order to accommodate the wider turns required by trucks transporting wind turbine components. Also, the Port of Toledo is completing improvements to its general cargo dock rail loop to better enable rail car storage and connectivity to CSX and unit trains to access the facility through the Norfolk Southern system.

In 2008, the Port of Bécancour widened the roads entering the port area and constructed a second road specifically for trucks transporting wind turbine components in order to facilitate the maneuvering of oversize trucks and avoid traffic delays.

Great Lakes-St. Lawrence Seaway Ports Capability to Handle Wind Turbine Cargo

Due to their size, weight and unusual shape, wind turbines require specialized handling. A single commercial wind turbine is composed of around twenty separate component parts which are generally shipped in at least seven or eight[8] sections: three sections of the wind tower, two to three blades, drive train, nacelle body with generator, and hub. Table 1 provides the specifications of four different wind turbine machines as a representative sample of the immense sizes and weights of the components that make up a single machine.

Table 1: Weight and length comparison of wind turbines installed or proposed for the region.

Turbine Model and Output	Vestas V-90 1.8 MW Onshore		Vestas V-80 2 MW Onshore		V-90 3 MW On/offshore			GE 4 MW Offshore*
Blade Length	144.4 ft (44 m)		128.0 ft (39 m)		144.4 ft (44 m)			131.2-164.0 ft (40-50 m)
Blade Weight	14,771 lb (6,700 kg)		14,330.1 lb (6,500 kg)		14,771 lb (6, 700 kg)			> 15,432.4 lb (> 7,000 kg)
Nacelle Height: For Transport Installed	13.1 ft (4 m) 17.7 ft (5.4 m)		13.1 ft (4 m) 17.7 ft (5.4 m)		13.1 ft (4 m)			> 16.4 ft (> 5 m) > 18.0 ft (> 5.5 m)
Nacelle Length and Width	34.1 x 11.2 ft (10.4 x 3.4 m)		34.1 x 11.2 ft (10.4 x 3.4 m)		31.7 x 12.0 ft (9.7 m x 3.7 m)			> 36.1 x 13.1 ft (> 11 x > 4 m)
Nacelle Weight	70 MT		69 MT		70 MT			>80 MT
Hub Dimensions (diameter x width x length)	10.8 x 13.1 x 14.1 ft (3.3 x 4 x 4.3 m)		10.8 x 13.1 x 13.8 ft (3.3 x 4 x 4.2 m)		11.8 x 13.8 x 14.4 ft (3.6 x 4.2 x 4.4 m)			
Hub Weight	18 MT		18 MT		22 MT			
Tower Length	262.5 ft (80 m)	311.7 ft (95 m)	219.8 ft (67 m)	262.5 ft (80 m)	262.5 ft (80 m)/ 50 hz	344.5 ft (105 m)	Offshore (site specific)	246.1-311.7 ft (75-95 m)
Tower Weight	155 MT	205 MT	117 MT	155 MT	145 MT	255 MT		> 250 MT

* As the specifications of the GE 4. MW offshore turbine is confidential, LEEDCo has provided us with a range in which the specifications will fall.

Sources: Vestas, 2007, Turbine Overview, accessed at http://www.vestas.com/en/wind-power-plants/procurement/turbine-overview.aspx#/vestas-univers (7/2010); Dr. Lorry Wagner, President, Lake Erie Energy Development Corporation (LEEDCo), personal communication (7/2010).

8 Sterzinger, G. and M. Svrcek (September 2004), Wind Turbine Development: Location of Manufacturing Activity, Renewable Energy Policy Project.

With a variety of cranes and large staging and handling areas, GLSLS ports are amply prepared to proactively handle all wind turbines and their related components. The most common piece of handling equipment in the GLSLS system, the heavy lift crane, ranges from a maximum lift capacity of 45 to 600 metric tons. Other types of cranes in the GLSLS system include all-terrain, crawler, gantry, ship gear, shore, truck, ringer and railroad toplifter. Several of the ports, including the Port of Duluth and Port of Indiana-Burns Harbor, have the capability of working cranes in tandem to maximize their lift capabilities. In addition to cranes, individual ports have access to a variety of other specialized handling equipment to meet the unique need of wind turbine cargo, including reach stacker units, hydraulic specialized material handling units, spreader bars, magnets, and grapple arms.

In June of 2010, the Port of Toledo added two LHM 280 mobile harbor cranes which can work in tandem with one operator (via remote control) and can be discharged or loaded on vessels, rail cars or trucks anywhere in the general cargo facility. These cranes provide a high tech solution for handling wind components.

The GLSLS ports have a variety of staging and dockage options to meet each transportation need. The size of staging areas in the region ranges from less than 10 acres (4.1 hectares) to over 180 acres (72.8 hectares) and include inside and outside storage as well as paved lay-down areas. Dockage areas range from less than 500 feet (152.4 meters) up to 8,500 feet (2,590.8 meters).

In addition to 50 paved acres of outside staging area, the Port of Indiana Burns-Harbor has 8,500 linear feet of dockage capable of bearing loads up to 500 lbs per square foot.

The GLSLS ports continue to invest in capital improvements directly aimed at increasing their capacity for handling wind turbines and their related components. The most common improvements include purchasing additional or improving existing cranes (Port of Cleveland, Port of Bécancour, Port of Detroit and Port of Toledo) and expanding/improving storage area (Port of Erie, Port of Green Bay, Port of Milwaukee, Port of Ogdensburg). Both the Port of Indiana-Burns Harbor and the Port of Milwaukee have purchased spreader bars to improve their wind turbine blade handling capabilities. By the end of 2011, the Port of Monroe is expecting to complete approximately $2 million in infrastructure improvements including new fendering, crane pads, roadway, and rail expansion.

Benefits of the Maritime Transportation Mode

In almost all cases, wind turbine components will be transported over a variety of transportation modes before they reach their final location;[9] however, in certain cases, the use of waterborne transportation can greatly reduce the overall relative cost of producing and installing a wind turbine.[10] One marine ship is capable of carrying an average of 25,000 metric tons of cargo equivalent to the capacity of 225 rail cars and 870 trucks. Furthermore, the environmental footprint associated with transportation, namely energy consumption and emissions, is smaller with waterborne shipping as compared to transporting cargo by rail or truck (see Figure 3).

The Port of Ogdensburg is qualified as a Foreign Trade Zone; goods shipped to the Port "do not require formal Customs entry, payment of Customs duties, or government excise taxes which can save the international shipper time and money."

(http://www.ogdensport.com/trade.html)

9 AWEA (2009) Wind Industry Transportation Opportunities and Challenges, last accessed June 2010 at http://www.awea.org/pubs/factsheets/transportation.pdf.

10 St. Lawrence Seaway Development Corporation

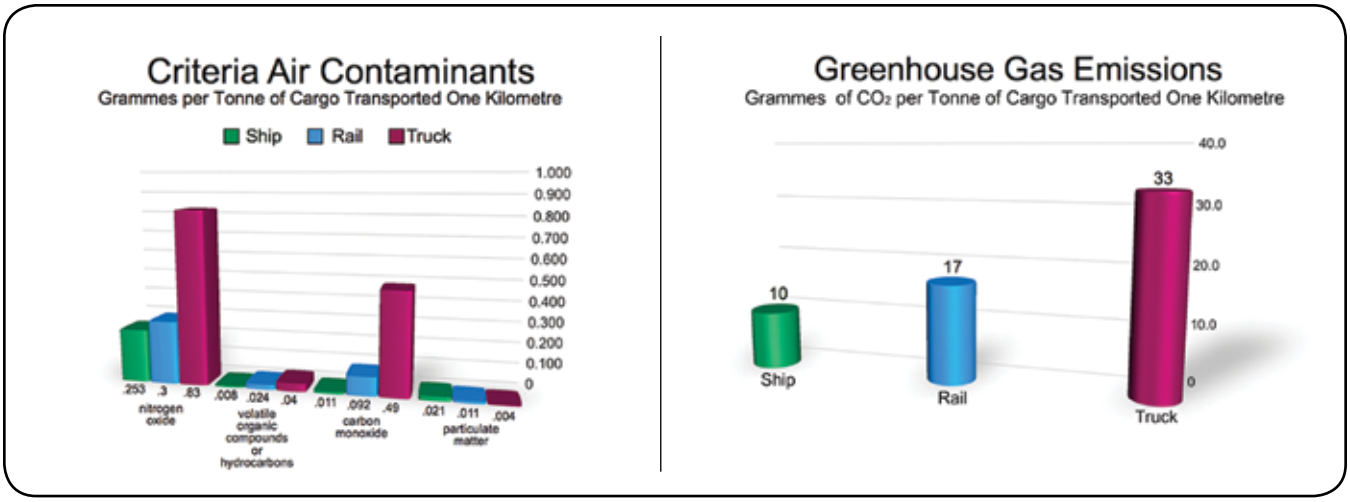

Figure 3: Comparison of environmental effects of transporting one ton of cargo one kilometer by ship, rail, and truck. Source: St. Lawrence Seaway Development Corporation; graphs generated from data in The Environmental Footprint of Surface Freight Transportation, Lawson Economic Research Inc., 2007.

In addition to providing economic benefits to the developers and manufacturers, the transportation of wind turbines and their related components through the GLSLS ports also provide an array of direct and indirect economic benefit to the ports and the port communities including increased employment and usage of local hotels and restaurants.[11]

Policies to Promote Continued Use of GLSLS Ports in the Wind Turbine Transportation Chain

Federal, state, provincial and local governmental policies are an important driver to attracting wind cargo in the GLSLS region. Although many of the GLSLS ports are taking a proactive approach to modernizing their facilities to accommodate wind turbine cargo, a number of ports acknowledged the importance of increased public and private sector investment in port and intermodal infrastructure and equipment. The Government of Québec is a prime example of how infrastructure investment can translate into economic gains. In 2008, the province awarded the Port of Bécancour $300,000 CDN through its Programme d'aide à l'intégration modale (Intermodal Integration Incentive) to help finance the addition of over 300,000 square feet (30,000 square meters) of storage area. Since that addition, the Port has handled over 56,000 metric tons of additional wind cargo.

A truck carries a tower section away from the port in Menominee, Mich. Photo © Dick Lund.

11 Francis, Mary Kate (March 2008) *View from Washington: Wind's Splash at U.S. Ports*, AWEA Windletter, 27:3, available for download at http://www.awea.org/windletter/wl_08mar.html, last accessed May 2010.



A wind turbine tower section is lowered onto a waiting truck at the port in Menominee, Mich., using the ship's cranes. The truck then moves to the staging area where tower sections are lifted by cranes and stored on the grounds. Photos © Dick Lund.

Certain ports also identified the need to modify local and/or state/provincial transportation rules in order to make the transportation of oversize/overweight components less cumbersome and costly. In 2008, the Port of Milwaukee successfully worked with Wisconsin's Department of Transportation to increase the load limits on Milwaukee County freeways to 190,000 pounds (approx. 86,000 kilograms) in order to allow the transportation of wide heavy loads of wind turbine components.

State/provincial and local financial incentives can also help encourage businesses associated with the wind energy industry to locate at or near a GLSLS port. For example, the Port of Toledo is located within a Community Reinvestment Area (CRA); businesses which settle in the Port are exempt from property taxes, and businesses which create a new job base are eligible for job creation tax credits. The Port of Monroe used a combination of tax credits offered by the State of Michigan through the Michigan Economic Development Corporation, and the City of Monroe through the Monroe Brownfield Authority, in order to attract Ventower Industries, a leading manufacturing company, to locate its facilities within the Port's property.

The Development of Offshore Wind in the Great Lakes

In addition to supporting the growth and development of onshore wind, the GLSLS ports play a fundamental role in the development of offshore wind energy in the Great Lakes region. Offshore wind turbines will likely be larger and heavier than their onshore counterparts; nevertheless, these unique ports are already well-equipped to provide the needed infrastructure to store and move offshore turbines and their related components.

The GLSLS ports also have the ability to assist in the construction and maintenance of offshore wind facilities. All vehicles servicing and/or constructing offshore wind projects in the Great Lakes will have to comply with United States and Canadian cabotage laws, the Jones Act and the Coastwise Trading Law, respectively. These laws require vessels engaged in domestic waterborne commerce to be built,[12] owned, crewed, maintained and registered in the country of

Wind turbine components in the process of unloading at the Port of Milwaukee. Photo © Dick Lund.

12 In Canada, the carrier may be built abroad, but a tariff may be imposed before that ship can enter domestic trade.

operation. Ports can capitalize on this opportunity by purchasing and leasing jack up barges, liftboats, maintenance vessels, and other specialized offshore equipment to the developers who will be engaged in the construction and operation of freshwater offshore wind projects. Additionally, ports are well-positioned to train and employ the work crews and skilled labor force needed to ensure equipment on these vessels is properly operated.

The Future of Wind Energy and the Great Lakes- St. Lawrence Seaway Ports

The binational Great Lakes region is home to more than 34 million people, and despite the current economic hardships facing the region, the Great Lakes economy remains one of the largest in the world. A number of ports have greatly benefited from a diversification of their cargo base to include wind energy cargo, and many more have expressed a keen interest in increasing their role in the wind energy industry. The ports of the Great Lakes-St. Lawrence Seaway system have played, and will continue to play, a critical role in sustaining the region's economic activity and in supporting the successful expansion of the wind energy industry. Likewise, the wind industry will increasingly play a vital role in the continued success of GLSLS ports. As the survey responses make clear, the GLSLS ports have the requisite infrastructure, intermodal relationships, experience and interest to deal with the unique needs of wind turbine cargo and to safely facilitate the movement of wind energy cargo for suppliers, manufacturers, and developers. The Great Lakes Wind Collaborative encourages stakeholders interested in the advancement of sustainable wind energy to contact the GLSLS ports directly in order to address individual cargo transportation needs.

This photo captures the final phase in the construction of wind turbines on the Thornton Bank in September of 2008. The turbines are situated 17 miles off shore, on the Belgian portion of the North Sea. Photo © Hans Hillewaert.

The attached appendix provides detailed information about the individual ports and/or port operators who responded to the GLWC survey including contact information, infrastructure specifications (handling equipment, staging and dockage area), bimodal transportation options, and past experience handling wind turbine components.

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Table of Contents

Port of Bécancour
Société du parc industriel et portuaire de Bécancour

www.spipb.com

Port Contact

Manon Blais
1000 Arthur-Sicard Blvd.
Becancour, Québec, G9H 2Z8

Tel: 819-294-6656
Fax: 819-294-9020
E-mail: blais@spipb.com

Handling Equipment

The Port of Bécancour has twelve reach stacker units (four on site and eight off site) with a maximum lift capability of 65 metric tons. It also has two shore cranes on site with a maximum lift capability of 200 metric tons.

Staging and Dockage Area

The Port of Bécancour has 151 acres (61.1 hectares) of storage area of which about 35 acres (14.2 hectares) are paved and located close to the moorings.

General cargo ship *Marlene Green* at the Port of Bécancour. Photo © Port of Bécancour.

Intermodal Transportation Connections

Rail: Canadian National
(Class I, domestic and international service)

Highway:
Thruway 30 (1.2 mi/2.0 km)
Thruway 55 (7.5 mi/12 km)
Thruway 40 (12 mi /20 km)
Thruway 320 (25 mi/40 km)

Past Experience Handling Wind Turbine Cargo

Between 2007 and 2009, the Port of Bécancour handled nearly 70,000 metric tons of turbine towers. The towers were exported from the Port to other locations within Canada and the United States. After the towers arrived at the Port by truck, the sections were transferred to a staging area and then loaded either onto vessels or trains for transport to their final destination.

Recent Improvements: In 2008, the Port of Bécancour added 7.4 acres (3.0 hectares) of additional storage area, enlarged the road entering the port area and constructed a second road dedicated to transporting wind turbine components in order to increase the efficiency by which it handles wind turbine cargo.

Port of Gaspé

www.qsl.com

Port Contact

David Rivest
961 boulevard Champlain
Québec, QC G1K 4J9 Canada

Tel: 418-522-4701
Fax: 418-522-9770
E-Mail: info@qsl.com

Handling Equipment

The Port of Gaspé has access to various off-site mobile cranes to handle wind turbine components.

Staging and Dockage Area

The Port of Gaspé has 1.6 acres (0.7 hectares) of outside storage area with additional areas available if needed. The Port also has two docks. The first is 590.6 feet (180 meter) long with a 32.8 foot (10 meter) depth and the second is 574.2 feet (175 meters) long with a 26.3 foot (8 meter) depth.

NGCC Des Groseilliers in Port Gaspé's harbor. Photo © Furet Gris.

Intermodal Transportation Connections

Highway: Route 132 (1,968.5 ft/600 m)
Route 198 (1.9 mi/3 km)

Past Experience Handling Wind Turbine Cargo

Between 2005 and 2008, the Port of Gaspé facilitated the movement of over 59,000 cubic meters of wind turbine blades, nacelles and towers. Over seventy-five percent of the Port's wind turbine cargo experience deals with wind turbine blades which the Port unloaded, installed in frames, and then reloaded onto vessels/barges. The Port also has experience with unloading complete wind turbine components which were transported to the construction site.

Port Gros-Cacouna

www.qsl.com

Port Contact

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961 boulevard Champlain
Québec, QC G1K 4J9 Canada

Tel: 418-522-4701
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E-Mail: info@qsl.com

Handling Equipment

The Port of Gros-Cacouna has access to various off-site mobile cranes to handle wind turbine components.

Staging and Dockage Area

The Port of Gros-Cacouna has 39.5 acres (16.0 hectares) of outside storage area and 2.5 acres (1.0 hectares) of inside storage area. The Port has two docks which are each 462.6 feet (141 meters) in length with a 33.5 foot (10.2 meter) water depth.

Intermodal Transportation Connections

Highway: Route 132 (1,640.4 ft/500 m)
Autoroute 20 (1.7 mi/2.8 km)
Autoroute 185- TransCanada Highway (11.2 mi/18 km)

Past Experience Handling Wind Turbine Cargo

Between 2006 and 2007, the Port of Gros-Cacouna handled over 22,000 cubic meters of wind turbine blades which they unloaded from vessels and transported to a staging area for long term storage.

Port Matane

www.qsl.com

Port Contact

David Rivest
961 boulevard Champlain
Québec, QC G1K 4J9 Canada

Tel: 418-522-4701
Fax: 418-522-9770
E-Mail: info@qsl.com

Handling Equipment

The Port of Matane has conventional cranes on-site and access to various mobile cranes off-site to handle wind turbine components.

Staging and Dockage Area

The Port of Matane offers 7.7 acres (3.1 hectares) of outside storage area with additional areas available if needed. The Port's dock is 610.2 feet (186 meters) long with a 32.8 foot (10 meter) water depth.

Intermodal Transportation Connections

Rail: Canadian National
(Class I, domestic and international service)

Highway: Route 132 (328.1 ft/100 m)
Route 195 (0.5 mi/800 m)

Past Experience Handling Wind Turbine Cargo

In 2004 and 2009, the Port of Matane handled a total of nearly 9,000 cubic meters of complete wind turbines. The blades were unloaded, stored on the terminal, and then loaded onto trucks to reach the construction site.

Montreal Port Authority (Port of Montreal)

www.port-montreal.com

Port Contact:

Daniel Dagenais
2100 Pierre-Dupuy Avenue,
Wing 1
Montreal, Québec H3C 3R5

Tel: 514-283-7026
Fax: 514-283-7060
E-Mail: dagenaisd@
port-montreal.com

The Port of Montreal has three privately operated port terminals; individual contact information for the terminals is below.

Port of Montreal. Photo © Port of Montreal.

Bickerdike Terminal:
(www.empirestevedoring.com, www.arrimage-empire.com)

Andrew Chodos, President
Empire Stevedoring Co. Ltd.
500 Place d'Armes, Suite 2800
Montreal, Québec H2Y 2W2

Telephone: 514-288-2222
Fax: 514-288-1148
E-mail: achodos@
empstev.com

Laurier and Hochelaga Terminals: *(www.logistec.com)*

Daniel Jodoin, General Manager
Logistec Stevedoring Inc.
360 St. Jacques St., Suite 1500
Montreal, Québec H2Y 1P5

Telephone: 514-844-9381
Fax: 514-842-1262
E-mail: djodoin@
logistec.com

Handling Equipment

The Bickerdike Terminal has three mobile cranes; one has a maximum lift capacity of 100 tons and the other two have maximum lift capacities of 200 tons. The Laurier and Hochelaga Terminals have four mobile cranes: one with a maximum lift capacity of 100 tons, one with a maximum lift capacity of 60 tons, and two with maximum lift capacities of 70 tons. These cranes can also be combined in order to facilitate the movement of heavier components.

The St. Lawrence Seaway Management Corporation (SLSMC) operates a floating crane, the VM/S Hercules, which has a maximum lift capacity of 250 tons. The VM/S Hercules has made the Port of Montreal its base port, berthing at section M6 of the Mackay wharf.

Staging and Dockage Area: The Bickerdike Terminal operates seven berths with dock frontage ranging from 498.7 to 656.2 feet (152 to 200 meters) long and water depth ranging from 24.9 to 35.1 feet (7.6 to 10.7 meters). All of the berths combined at the Bickerdike Terminal have a total open space staging area of 17.4 acres (7.0 hectares) and an apron area of 4.6 acres (1.9 hectares).

The Laurier Terminal has one berth which is 872.7 feet (266 meters) long with an alongside water depth of 33.5 feet (10.2 meters). The open space and apron area at the Laurier Terminal is 6.4 acres (2.6 hectares).

The Hochelaga Terminal operates three berths with docks ranging from 518.4 to 623.4 feet (158 to 190 meters) long and a water depth of 34.1 to 35.1 feet (10.4 to 10.7 meters). All of the berths combined have an open space apron of 17.0 acres (6.9 hectares) and an apron area of 2.7 acres (1.1 hectares). One of the berths at the Hochelaga Terminal also has a roll on/roll off ramp, allowing wheeled cargo to be efficiently and expediently loaded and unloaded off the vessels.

Intermodal Transportation Connections

Rail: Montreal Port Authority Rail Network
Canadian National (Class I)
Canadian Pacific (Class I)
Note: The berths at the Bickerdike and Hochelaga Terminal all have rear rail access. Additionally, one of the berths at the Bickerdike termial has rail track alongside the face of the wharf and one of the berths at Hochelaga has apron rail access.

Highway: The Port of Montreal's facilities are located just minutes away from a network of highways leading to major centers throughout North America.
Note: Toronto and the farthest regions of Central Canada are only hours away and less than one hour separates the Port of Montreal from New England and the state of New York. No less than 25 trucking companies serve the Québec, Ontario and U.S. Northeast markets out of the Port of Montreal.

Past Experience Handling Wind Turbine Cargo

None, but the Montreal Port Authority rates the handling of wind turbine cargo as a high priority.

Other Information

The Montreal Port Authority operates its own highly efficient rail network on port territory. This network offers direct access to almost every berth, with over 60 miles (100 kilometers) of track and six locomotives. The port's railway network is directly linked to the yards of both transcontinental railways. This advantage eliminates the intermediate transshipment that is unavoidable at many other ports, and allows for rapid loading of standard as well as double-stack and spine cars. With connections reaching far into the U.S., Canadian railways head for their destinations in a virtually straight path.

Port of Ogdensburg, NY

www.ogdensport.com

Port Contact:

John A. Rishe
One Bridge Plaza
Ogdensburg, NY
13669

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Fax: 315-393-7068
E-Mail: jrishe@ogdensport.com

Handling Equipment

The Port of Ogdensburg has five to ten heavy lift cranes which are located off-site.

Staging and Dockage Area

The Port of Ogdensburg offers 31.5 acres (12.8 hectares) of storage within the Port of Ogdensburg Foreign Trade Zone, and an additional 100 acres (40.5 hectares) of nearby, unimproved storage area. The Port has a 1,200 foot (365.8 meter) dock on which to load and unload wind turbine components.

The Port offers a total of over 2.3 acres (0.9 hectares) of cargo warehousing.

Aerial photo of the Port of Ogdensburg.
Photo © Port of Ogdensburg.

Intermodal Transportation Connections:

Rail: CSX (Class I, domestic and international service)
New York & Ogdensburg
(Short Line connection to CSX)

Highway: Route 37 (1 mi/1.6 km)
I-81 (36 mi/57.9 km)
Note: Both highways have a 105,000 lb (47,627.2 kg) load restriction and a 13.5 ft (4.1 m) height restriction.

Past Experience Handling Wind Turbine Cargo

In 2008, the Port of Ogdensburg unloaded 11 vessels of wind turbine components from Denmark, totaling 32,500 tons of nacelles, hubs, blades, and towers. The components were then reloaded onto trucks which transferred the components to barges to export to Wolfe Island, Ontario. The Port facilitated the movement of 100 barge trips in order to safely transfer all of the components to the project site.

Recent Improvements

In 2010, the Port of Ogdensburg will be paving additional laydown areas in order to expand its storage capacity.

Port of Oswego

www.portoswego.com

Port Contact

Jonathan Daniels
1 East Second Street
Oswego, New York
13126-1165

Tel: 315-343-4503 ext 109
Fax: 315-343-5498
E-Mail: jdaniels@portoswego.com

Handling Equipment

The Port of Oswego operates ten heavy-lift cranes which are located off site and each of which is capable of lifting up to 600 metric tons of cargo.

Staging and Dockage Area

The Port of Oswego offers shippers 20 acres (8.1 hectares) of storage area and 1,900 feet (579.1 meters) of lakefront dockage.

Intermodal Transportation Connections

Rail: CSX (Class I, domestic and international service)

Highway: I-81 (20 mi/32.2 km)
U.S. Rt. 481 (1,320 ft/402.3 m)
U.S. Rt.104 (1,320 ft/402.3 m)

Inland River: New York State Barge Canal (12 ft/3.7 m maximum water draft; 21 ft/6.4 maximum air draft)
Note: The Canal operates from May to November.

Past Experience Handling Wind Turbine Cargo

Between 2005 and 2009, the Port of Oswego has handled around 28,500 tons of wind turbine blades, hubs, nacelles, and towers. The Port was responsible for transferring the components from the vessels to the staging area and then placing them safely onto trucks.

Port of Buffalo

buffalocrushedstone.com

Port Contact

James F. Pfohl
Gateway Trade Center/Gateway Metroport
544 Clinton St.
P.O. Box 880
Buffalo, NY 14224

Main Office: 716-826-7310
Cell: 716-523-6665
Fax: 716-826-1342
E-Mail: info@
portofbuffalo.com

Handling Equipment

The Port of Buffalo has two heavy lift cranes on-site, one of which can lift up to 181 metric tons and the other which can lift up to 45 metric tons. The Port also has an all-terrain crane on-site which can lift up to 13.6 metric tons.

Staging and Dockage Area

The Port of Buffalo offers 50 acres (20.2 hectares) of on-site covered storage and a 4,000 x 2,000 foot (1,219.2 x 609.6 meter) dock for wind turbine storage and handling needs. Furthermore, the Port has heated warehouse space.

Intermodal Transportation Connections

Rail: CSX (Class I, domestic and international service)
Norfolk Southern (Class I, domestic service)
Southern Buffalo Rail Road (Short Line, domestic service)

Highway: I-90 (5.0 mi/8.0 km)
QEW (3.0 mi/4.8 km)
NY 219 (7.0 mi/11.3 km)
U.S. 5/U.S. 20 (1.0 mi/1.6 km)

Inland River: Buffalo River (23 ft/7.0 m maximum water draft; 110 ft/33.5 m maximum air draft)
Niagara River (27 ft/8.2 m maximum water draft; 120 ft/36.6 m maximum air draft)

Past Experience Handling Wind Turbine Cargo

Between 2005 and 2007, the Port of Buffalo handled 300 tons of wind turbine blades and 1500 tons of wind turbine towers from Denmark and Indonesia, respectively. The Port was responsible for unloading the equipment of ships, moving the cargo to a storage site, and then reloading the cargo onto trucks to be transported to their final destination.

Cleveland-Cuyahoga County Port Authority

portofcleveland.com

Port Contact

Garth Woodson
1375 E 9th Street, Suite 2300
Cleveland, OH
44114-1790

Tel: 216-377-1351
Fax: 216-241-8016
Email: Garth.Woodson
@portofcleveland.com

Handling Equipment

The Port of Cleveland has one heavy lift crane on site with a 150 metric tons lift capacity, 265 degree turning radius and 85 foot (25.9 meter) reach from center. The Port also has three crawler cranes on site each of which has a 65 metric ton lift capacity, 360 degree turning radius, and 40 foot (12.2 meter) reach from center.

Staging and Dockage Area: The Port of Cleveland offers 20 acres (8.1 hectares) of secure storage. It also has a dock that is 2,500 feet (762 meters) long and can bear 1,000 pounds per square foot.

Intermodal Transportation Connections

Rail: CSX (Class I, domestic service)
Norfolk-Southern (Class I, domestic service)

Inland River: Cuyahoga River (23 ft/7.0 m upper and 27 ft/8.2m lower maximum water draft; 98.6 ft/30.1 m maximum air-draft at LWD; 670 ft/204.2 m vessel length restriction)

Highway: I-90 (1.0 mi/1.6 km)
I-71 (5.0 mi/8.1 km)
I-77 (4.0 mi/6.4 km)
U.S. Route 2 (2,640 ft/804.7 m)
Notes: Ohio Highways are regulated by Ohio Code 5577 and have height restrictions of 15 ft 6 in (4.7 m).

Past Experience Handling Wind Turbine Cargo

None, but the Cleveland-Cuyahoga Port Authority rates the handling of wind turbine cargo as a very high priority.

Recent Improvements

The Port plans to add a 30 ton overhead crane to Warehouse A.

Port of Erie

www.porterie.org

Port Contact

Tod Eagleton
Erie Sand & Gravel Co.
2 East Bay Drive,
Port Access Road
P.O. Box 179
Erie, PA 16507

Tel: 814-453-6721 x227
Fax: 814-453-5138
E-Mail: tod.eagleton
@carmeusena.com

Handling Equipment

The Port of Erie has three heavy lift cranes on site. One heavy lift crane is fixed and has a 272 metric ton lift capacity a 60.0 foot (18.3 meter) reach from center. The Port also has two Manitowoc 4100W heavy left cranes with a 170 metric ton lift capacity and a 109.9 foot (33.5 meter) reach from center.

Staging and Dockage Area

The Port of Erie has between two to seven acres for staging and 1,400 feet (426.7 meters) of dock frontage.

Intermodal Transportation Connections

Rail: CSX (Class I, domestic and international service)

Highway: I-90 (6.0 mi/9.7 km, accessed via I-79)
I-79 (1,0 mi/1.6 km)

Past Experience Handling Wind Turbine Cargo

None

Recent Updates

The Port of Erie is currently seeking funding to expand its dockage and storage/operational space.

Other Information

The Port of Erie has a natural harbor with full Seaway depth; no tug assistance is required.

Lorain Port Authority

www.lorainportauthority.com

Port Contact

Richard Novak
611 Broadway Avenue
Lorain, OH 44052

Tel: 440-204-2265
Fax: 440-244-1872
E-Mail: rnovak@
lorainportauthority.com

Handling Equipment

The Port of Lorain does not have any cranes on site but has abundant experience facilitating the operation of cranes owned by private companies.

Staging and Dockage Area

The Port of Lorain offers 20 acres (8.1 hectares) to stage wind turbine components and has access to two private docks totaling 28 feet (8.5 meters).

Intermodal Transportation Connections

Rail: CSX (Class I, domestic service)
Norfolk-Southern (Class I, domestic service)

Inland River: Black River (28 ft/8.5 m maximum water draft; 97 ft/ 29.6 m maximum air draft at the 21st High Level Bridge)

Highway: I-90 (4.0 mi/6.4 km)
I-80 (8.0 mi/12.9 km)
State Rte. 611 (2,640 ft/804.7 m)
State Rte. 57 (adjacent)
U.S. Rte. 6 (adjacent)

Past Experience Handling Wind Turbine Cargo

None, but the Lorain Port Authority rated the handling of wind turbine components as a very high priority.

Recent Improvements

No current plans, but the Lorain Port Authority would conduct improvements if a project so needed.

Port of Monroe

www.portofmonroe.com

Port Contact

Pam Stanley
2929 E. Front Street
PO Box 585
Monroe, Michigan 48161

Tel: 734-241-6480
Fax: 734-241-2964
E-Mail: mail@portofmonroe.com

Handling Equipment

The Port of Monroe does not currently have any cranes on site. The Port has the flexibility to contract with a company's choice of logistic or shipping firms to arrange the appropriate machines to handle any given cargo.

Staging and Dockage Area

The Port of Monroe has 20 acres (8.1 hectares) for storage on site and over 100 acres (40.5 hectares) located a quarter mile (0.4 kilometers) away at the Port Industrial Park. The Port also has three docks. The River Raisin dock is a natural bank dock that is 1,500 ft (457.2 meters) long. The second dock is a 1,043 ft (317.9 meter) turning basin dock with a concrete and steel sheet pile dock, and the third dock is a 460 ft (140.2 meter) turning basin dock with a steel sheet pile dock.

Intermodal Transportation Connections

Rail: Canadian National (Class 1, domestic and international service)
Norfolk Southern (Class 1, domestic service and partners with Canadian National to provide international service)

Inland River: River Raisin (21 ft/6.4 m maximum water draft in channel, 18 ft/5.5 m maximum water draft in turning basin)

Highway: I-75 (3,960 ft/1,207 m; Front Street (Class A) to access I-75)
I-94 (25 mi/40.2 km)
US-23 (20 mi/32,2 km)

Past Experience Handling Wind Turbine Cargo

None, but the Port of Monroe rated the handling of wind turbine components as a very high priority.

Recent Improvements

The Port of Monroe is working with Ventower Industries to build a new wind tower component manufacturing facility on the Port's industrial property. In 2011, the Port of Monroe will make approximately $2 million in infrastructure improvements including adding new fendering/crane pads and roadway/rail expansion.

Toledo-Lucas County Port Authority

www.toledoseaport.org www.toledoportauthority.org
www.midwestterminals.com

Port Contacts

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Toledo-Lucas County Port Authority
One Maritime Plaza
Toledo, OH 43604

Tel: 419-243-8251
Fax: 419-243-1835
E-Mail: jcappel@
toledoportauthority.org

Jason Lowery
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Midwest Terminals
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Toledo, OH 43605

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mwtti.com

Unloading wind turbine parts at the Port of Toledo.
Photo © Port of Toledo.

Handling Equipment

The Port of Toledo has two heavy lift cranes located on-site. The Big Lucas has a 99 metric ton lift capacity, 360 degree turning radius and 35 foot (10.7 meter) reach from center. The Little Lucas has a 65 metric ton lift capacity, 360 degree turning radius and a 36 foot (11.0 meter) reach from center. The Big Lucas and Little Lucas can be used in tandem to have a combined 131 metric ton lift capacity, 360 degree turning radius, and 37 foot/11.3 meter) reach from center. Both cranes can be extended individually or in tandem up to 100 foot (30.5 meter) radius, but the maximum lift capacity decreases as the reach is extended.

The Port of Toledo has two LHM 280 Liebherr Mobile Harbor Cranes located on-site each with an 84 metric ton lift capacity, 360 degree turning radius and a 49.2 foot (15.0 meter) reach from center. The crane can be extended to 131.2 foot (40.0 meter) radius but the maximum lift capacity decreases as the reach is extended.

If a project needs specialized handling, the four on-site cranes can be equipped with a spreader bar for containers and project cargo, grapple, clam shell, and/or magnet.

The Port of Toledo can also access off-site ship gear cranes which are located on specialized heavy lift vessels serving the Great Lakes-St. Lawrence Seaway and can be maneuvered shore side. These ships have "virtually unlimited lifting ability" and have discharged single pieces up to 480 tons at the Port of Toledo from vessel to specialty rail cars.

Staging and Dockage Area

The General Cargo Facility at the Port of Toledo offers 15.3 acres (6.2 hectares) of indoor storage and 110 acres (44.5 hectares)of outdoor storage area, approximately two-thirds of which is paved. The Ironville Dock is currently under development and will offer an additional 180 acres (72.8 hectares) of secure storage space. The Port of Toledo offers 4,100 feet (1,250 meters) of dock frontage on which there are seven ship berths. The load limits of the dock are very high as single pieces weighing over 480 tons have recently been handled in this manner.

The Port of Toledo's mobile harbor cranes, material handlers, and other heavy equipment allow for storage of wind turbine components throughout the 110 acre (44.5 hectare) facility.

Staging and Dockage Area

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Intermodal Transportation Connections

Rail: Canadian National (Class 1, switching access to general cargo)
CSX (Class 1, on dock at General Cargo facility)
Norfolk Southern (Class 1, on dock at Ironville with switching access to general cargo)

Highway: I-280 (4.9 mi./7.9 km)
I-75 (7.5 mi/12.1 km)
I-80/I-90 (13.5 mi/21.7 km)
U.S. 23 (21.2 mi/34.1 km)
Note: Check with Ohio Department of Transportation for restrictions. Michigan Heavy Load routes run from the Port of Toledo up to Michigan and allow 154,000 gross lbs. Heavier loads are allowed by permit depending on the route.

Past Experience Handling Wind Turbine Cargo

In 2007, the Port of Toledo handled 1530 tons of wind turbine towers which were unloaded from the ocean vessel with shore side cranes and stored at the terminal. The cargo was then loaded and shipped onto tractor-trailers to the final destination in Indiana.

Recent Improvements

The Port of Toledo added two LHM 280 mobile harbor cranes in June of 2010; these cranes can discharge or load vessels, rail cars or trucks anywhere in the general cargo facility. The two cranes can work in tandem with one operator (via remote control) to provide a high tech solution for handling wind components. The Port is also upgrading its general cargo dock rail loop to improve rail car storage and connectivity to CSX.

Other Information

The Port of Toledo is located in a City of Toledo Community Reinvestment Area (CRA) which offers property tax exemption on real capital investment in new construction and/or rehabilitation of existing commercial and industrial structures. Companies operating within the Port of Toledo may also be eligible for the City of Toledo's Municipal Jobs Tax Credit Program, which grants municipal income tax credits to businesses that create a minimum of 25 new, full-time jobs within three years.

Port of Detroit (Nicholson-Terminal)

www.nicholson-terminal.com

Port Contact

Daniel Deane
P.O. Box 18066
River Rouge, MI 48218

Tel: 313-842-4300, Ext. 214
Fax: 313-843-1091
E-mail: dand@nicholson-terminal.com

Nicholson-Terminal is a privately owned facility located in the Port of Detroit.

Handling Equipment

The Port of Detroit has a range of heavy lift cranes available to handle the unique needs of wind turbine cargo. There are three cranes housed at the Detroit Terminal: two Crawler 4100 with a 200 ton lift capacity and one Crawler 4100, Series II with a 230 ton lift capacity. There are also two cranes housed at the Ecorse Terminal: one Gantry-Clyde with a 70 ton lift capacity and one Gantry-American with a 72 ton lift capacity. Both gantry cranes have a 40 foot (12.2 meter) reach from center. The Port of Detroit can secure additional crane capacity from outside sources.

Port of Detroit. Photo © Nicholson Terminal.

Staging and Dockage Area

The Port of Detroit has two available terminal locations for wind component handling. The Ecorse terminal has 47 acres (19.0 hectares) of lay down area and a 3,400 foot (1,036.3 meter) dock. The Detroit terminal has 30 acres (12.1 hectares) of lay down area and a 2,150 foot (655.3 meter) dock. The dock at both terminals has a maximum load bearing limit of 500 tons.

Intermodal Transportation Connections

Rail: Canadian National North America (Class I, international service)
CSXT (Class I, international service)
Norfolk Southern (Class I, international service)
Delray Connecting Railroad (Class III, common carrier-short line)

Highway: I-75 (1.0 mi/1.6 km)
I-94 (1.5 mi/2.4 km)
I-96 (5.0 mi/8.1 km)

Inland River: Detroit River (27.5 ft/8.4m maximum water draft)

Past Experience Handling Wind Turbine Cargo

In 2009, the Port of Detroit unloaded and handled 104 pieces of nacelles and hubs equaling 4,399 tons of wind turbine cargo. The Port was involved in unloading the cargo from rail and temporarily storing and reloading the cargo onto trucks for transportation to its final destination.

Recent Improvements

In 2010, the port plans to modify the two Crawler 4100 cranes to Series II cranes to increase their lift capacity to 230 tons.

Other Information

The Port of Detroit has entered into a partnership with the Detroit Wayne County Port Authority to secure additional terminal space and to participate in federal and state of Michigan grant programs. Nicholson Terminal & Dock Company has significant experience with many heavy lift cargos and projects for a variety of customers. Nicholson-Terminal also maintains floating equipment to transfer crane capacity to its two terminals and facilitate cargo movement over water.

Port of Windsor (Morterm Limited)

www.morterm.com

Port Contact

Terry Berthiaume
Vice President and COO
Morterm Limited
PO Box 24025
5353 Maplewood
Windsor, ON N8Y 4Y9
Canada

Tel: 519-973-8200, Ext 238
Fax: 519-973-7234
E-Mail: tjb@morterm.com

Morterm Limited is a privately owned facility located in the Port of Windsor.

Handling Equipment

Morterm Limited has a full-range of heavy material-handling equipment including a Manitowoc 2250 with a 400 ton maximum lift capacity, access to several smaller cranes used in truck-loading and heavy-duty lift trucks (up to 80,000 pounds/36,287.4 kilograms capacity), that have been modified to handle all of the components of a wind turbine.

Aerial view of the staging area at Port of Windsor.
Photo © Morterm Limited .

Staging and Dockage Area

The Port of Windsor has 89 acres (36.0 hectares) of outside and 3.4 acres (1.4 hectares) of inside storage area with additional area available if required.

Intermodal Transportation Connection

Rail: Switching is by a sister company, the Essex Terminal Railway, connecting with:
Canadian National (Class I)
Canadian Pacific (Class I)
CSX (Class I)
Norfolk Southern (Class I)
Notes: In addition to on-site rail facilities, Morterm Limited has access to additional railcar storage in close proximity.

Highway: Highway 3, Highway 401, Highway 18, Ojibway Parkway, E C Row Expressway
Note: Major routes are easily accessible requiring only 2 turns.

International Crossing: The Detroit-Windsor Truck Ferry is adjacent to Morterm providing easy access to the U S Midwest.

Past Experience Handling Wind Turbine Cargo

In 2008 and 2009 Morterm Limited handled 28,247 kilo tons of wind turbine components (well over 100 complete units) from various European origins. Morterm's services include stevedoring, marshalling, storage and ancillary services such as handling shipping-frames and deck grinding and cleaning.

Recent Improvements

Twelve acres (4.9 hectares) of premium lay-down area was recently added.

Other Information

Morterm Limited is a Canada Customs Marine Sufferance facility; thus, turbines and towers arriving from offshore origins can be stored at its facility without payment of duties or taxes pending further shipments to U. S. destinations or release into Canada.

Port of Chicago

www.qsl.com

Port Contact

Stephen Mosher
9301 South Kreiter Ave.
Iroquois Landing Terminal
Port of Chicago
Chicago, IL 60617

Tel: 773-734-4885
Fax: 773-734-4831
E-Mail: info@qsl.com

Handling Equipment

The Port of Chicago has one heavy lift crane on site with an 80 ton lift capacity and a 98.5 foot (30 meter) reach from center. It also has two specialized terminal handling machines on-site with 45 ton lift capacities and 19.7 foot (6 meter) reaches from center.

Staging and Dockage Area: The Port of Chicago has 90.2 acres (36.5 hectares) of outside storage space. It also boasts 2,700 feet (823.2 m) of dock frontage.

Intermodal Transportation Connections

Rail: Canadian National
(Class 1, domestic and international service)
SCIHB (Short Line, domestic service)

Highway: I-90 (1.0 mi/1.6 km)
I-94 (4.0 mi/6.4 km)
I-57 (5.0 mi/8.1 km)

Inland River: Calumet (maximum water draft 9 ft/2.7 m, maximum air draft 16 ft/4.9 m)
Note: The Calumet River connects to the Illinois and Mississippi River waterways (9.5 ft/2.9 m maximum water draft on both the Illinois and Mississippi rivers)

Past Experience Handling Wind Turbine Cargo

In 2008, the Port of Chicago handled a 2,500 cubic meter shipment of nacelles and components which they unloaded from the vessel and stored on the terminal; they then loaded the units on trucks to be transported to the final destination.

Port of Indiana-Burns Harbor

www.portsofindiana.com

Port Contact

Peter LamanPort Director
Port Director
6625 South Boundary Drive
Portage, Indiana 46368

Telephone: 219-787-8636
Fax: 219-787-8842
E-mail: plaman@
portsofindiana.com

Handling Equipment

The Port of Indiana-Burns Harbor has four crawler cranes on site. Two of these are Manitowac 2250 cranes which have a 150 ton maximum lift capacity and a 55 foot (16.8 meter) reach from center. The Manitowac 2250 can be worked in tandem to achieve a 171 ton maximum lift capacity. The Port also has two Manitowac 4100 cranes with a 60 ton maximum lift capacity and a 131.2 foot (40 meter) reach from center.

Staging and Dockage Area: The Port of Indiana-Burns Harbor has 50 acres (20.2 hectares) of outside paved storage area. The Port also offers 8,500 feet (2590.8 m) of dock frontage which can handle up to 500 pounds per square foot.

Intermodal Transportation Connections

Rail: Indiana Harbor Belt Rail Road (Class 1)
Norfolk Southern (Class 1)

Inland River: Calumet (maximum water draft 9 ft/2.7 m, maximum air draft 19 ft/5.8 m at Mile 200.6)
Note: The Calumet River connects to the Illinois and Mississippi River waterways (9.5 ft/2.9 m maximum water draft on both the Illinois and Mississippi rivers)

Highway:
Hwy. 249 provides a 2.0 mi (3.2 km) connection from port to I-94
I-94 (10.0 mi/16.1 km, I-94 provides access to I-80, I-90 and I-65
Hwy. 12 (1.0 mi/1.6 km, provides heavy-haul and wide-load access)
Hwy. 20 (2.0 mi/3.2 km, provides heavy-haul and wide-load access)

Past Experience Handling Wind Turbine Cargo

The In 2009, the Port of Indiana-Burns Harbor handled three different shipments of wind turbine cargo including 5,357 tons of nacelles, 2,113 tons of turbine hubs and 822 tons of wind turbine blades.

Recent improvements

The general cargo stevedore at the Port of Indiana Burns-Harbor has purchased a special spreader bar specifically designed to handle long wind turbine blades.

Port of Green Bay

www.portofgreenbay.com

Port Contact

Dean Haen
2561 S. Broadway Street
Green Bay, WI 54304

Tel: 920-492-4950
Fax: 920-492-4957
E-Mail: haen_dr@co.brown.wi.us

Handling Equipment

The Port of Green Bay has one heavy lift crane site with a maximum 500 ton maximum lift capacity and can access numerous off-site heavy lift cranes with various lift capacities and extension capabilities.

Staging and Dockage Area

The Port of Green Bay offers 17 acres (6.9 hectares) of storage area and a 500 foot (152.4 meter) dock with a steel dockwall.

Intermodal Transportation Connections

Rail: Canadian National
(Class 1, domestic and international service)

Highway: I-43 (1,320 ft/402.3 m)
I-41 (1,320 ft/402.3 m)

Inland River: Fox River (6 ft/1.8 m maximum water draft)

Past Experience Handling Wind Turbine Cargo

None, but the Port of Green Bay rates the handling of wind turbine cargo as a very high priority.

Recent Improvements

In 2009, the Port of Green Bay added flat surface storage area.

Other Information

The Port of Green Bay is the westernmost port in the Lake Michigan Basin.

Port of Menominee, Michigan

www.kkil.net

Port Contact

Cynthia K. Feller
PO Box 395
501 Fourth Avenue
Menominee, MI, 49858

Tel: 906-864-5512
Fax: 908-863-7302
E-Mail: cfeller@kkil.net

Handling Equipment

The Port of Menominee, Michigan has six heavy lift cranes on site; one has a 300 ton lift capacity, three have 140 ton lift capacities and two have 100 ton lift capacities. The Port also has one hydraulic specialized material handler on site with a cycle time of less than 60 seconds.

Staging and Dockage Area

The Port of Menominee, Michigan has 50 acres (20.2 hectares) of on-site, finished lay-down area for storage of wind components and other product. All lay-down areas are secured with fencing, lighting, and security cameras. The Port also has two vessel berths with a total of approximately 1,200 feet (365.8 meters) of loading/unloading dock frontage.

Port of Menominee. Photo © Port of Menominee.

Intermodal Transportation Connections

Rail: Canadian National (Class 1, domestic service)

Highway: U.S. 41 (1 mi./1.6 km)
Note: U.S. 41 offers "excellent oversize access"

Past Experience Handling Wind Turbine Cargo

Between 2007 and 2008, the Port of Menominee, Michigan handled approximately 80,000 tons of wind turbine towers, blades, nacelles and hubs arriving from Canada, Europe and Brazil. The Port facilitated the movement of the components from vessels to on-site storage, provided inventory services, and loaded the components to truck for delivery to final destination. The Port also accommodated the on-site needs of the carriers and their drivers and escorts to ensure a satisfactory experience and successful transport.

Recent Improvements

During the summers of 2007 and 2008, the Port of Menominee, Michigan leveled, finished, and graveled the on-site laydown area to greatly expand the storage capacity. The Port also purchased additional cranes for optimum operation times and simultaneous vessel discharge and truck load out.

Other Information:

The Port of Menominee is a privately owned and operated facility. The Port operates 7 days a week and provides flat rate pricing so there are no additional costs for overtime, holidays, weekends, or minimum charges.

Port of Milwaukee

www.milwaukee.gov/port

Port Contact

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Handling Equipment

The Port of Milwaukee has six cranes on-site. The heavy lift crane has a 200 metric ton lift capacity with a 52 foot (15.9 meter) reach from center. The gantry crane has a 63.5 metric ton lift capacity, a 38 foot (11.6 meter) reach from center and the ability to revolve. The Port's three crawler cranes each have a 108 metric ton lift capacity and a 26 foot (7.9 meter) reach from center. The Truck Crane has a 22.5 metric ton lift capacity and a 25 foot (7.6 meter) reach from center.

An aerial view of wind turbine parts on the docks of the Port of Milwaukee. Photo © Port of Milwaukee.

Staging and Dockage Area

The Port of Milwaukee offers 15 acres (6.1 hectares) of storage and four docks with a total length of 4,925 feet (1501.1 meters) of dock frontage. The four docks are referred to as the City Heavy Lift Dock, the Bulk Transfer Dock, South Pier 1 and South Pier 2.

Intermodal Transportation Connections

Rail: Union Pacific (Class 1, domestic service)
Canadian Pacific (Class 1, domestic and international service)

Inland River: Illinois River (accessible through SE Lake Michigan)

Highway: I-94 (two entrances: 660 ft/201.2 m with 175 degree ramp radius and 2.0 mi/3.2 km; 14 ft 3 in/4.3 m height restriction)
I-794 Pkwy (660 ft/201.2 m, 15 ft 9 in/4.8 m height restriction)
NOTE: Wisconsin highways are regulated by WI Code 254,255.

Past Experience Handling Wind Turbine Cargo

The Port of Milwaukee is one of the original ports involved in the wind turbine cargo transportation chain. Since 2004 the Port has handled 14, 649 tons of cargo including nacelles, blades, hubs, and tower sections traveling to and from Illinois, New York and local destinations in Wisconsin. The Port has experience in storing wind turbine components as well as unloading and discharging the cargo to and from ships, trucks and barges.

Recent Improvements

In the fall of 2009, the Port of Milwaukee received two Mi-Jack forklifts which are fitted with special spreader bars. In 2010, the Port leveled eight additional acres of storage specifically for wind components and expanded its freeway ramp to a 175 degree radius to facilitate the inbound and outbound movement of wind turbine components.

Other Information

Prior to 2008, no high or wide loads were allowed on Milwaukee County Freeways. The Port of Milwaukee worked with the Department of Transportationto receive approval for interstate permits that allow high/wide loads with a maximum load limit of up to 190,000 pounds/86,182.6 kilograms.

Port of Muskegon

Port Contact

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Port City Marine Services	Fax: (231) 726-6636
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Unloading at the Port of Muskegon. Photo © Port of Muskegon.

Handling Equipment

The Port of Muskegon has access to a variety of mobile cranes with up to 600 tons of capacity stored near sites.

Staging and Dockage Area

The Port of Muskegon has two docks each with a 27 foot (8.2 meter) water draft. The Mart Dock is 2,500 feet (762 meters) of heavy piled dock frontage and has 20 acres (8.1 hectares) of lay down space and 4.6 acres (1.9 hectares) of indoor storage. The Cobb Dock has 1,000 feet (304.8 meters) of steel piled dock frontage with 18 acres (7.3 hectares) of lay down space.

Intermodal Transportation Connections

Rail: Michigan Shoreline Railroad (Short-Line) connects with: CSX (Class I)

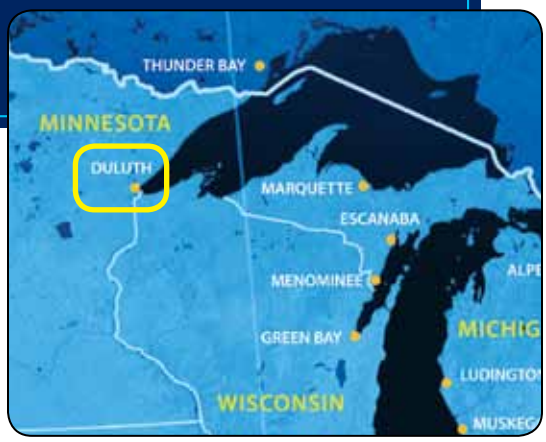
Highway: I-94 (5.0 mi/8.1 km)
US-31 (1.5 mi/2.4 km)

Past Experience Handling Wind Turbine Cargo

None, but Port of Muskegon rates the handling of wind turbine cargo as a high priority.

Duluth Seaway Port Authority

www.duluthport.com



Port Contact

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Handling Equipment

One of the Port of Duluth's docks has two gantry cranes which can lift 81 metric tons individually or 120 metric tons if worked in tandem. The Port can also order a variety of shore or ship cranes as needed.

Unloading at the Port of Duluth. Photo © Port of Duluth.

Staging and Dockage Area

The Port of Duluth has 40 acres (16.2 hectares) of storage space of which 8.3 acres (3.4 hectares) are located indoors. The Port can also access more outdoor storage space when necessary. The Port has three working docks which have a history of handling extremely heavy items including processing equipment which weighed over 800 metric tons. One of the docks is a roll on/roll off dock, allowing wheeled cargo to be efficiently and expediently loaded and unloaded off the vessels.

Intermodal Transportation Connections

Rail:
Burlington Northern Santa Fe
(Class 1, domestic and international service)
Canadian National (Class 1, domestic and international service)
Canadian Pacific (Class 1, domestic and international service)
Union Pacific (Class 1, domestic and international service)

Highway:
I-35 (1,320 ft/402.3 m)
U.S. 2 (2.0 mi/3.2 km)
U.S. 53 (1,320 ft/402.3 m)

Past Experience Handling Wind Turbine Cargo

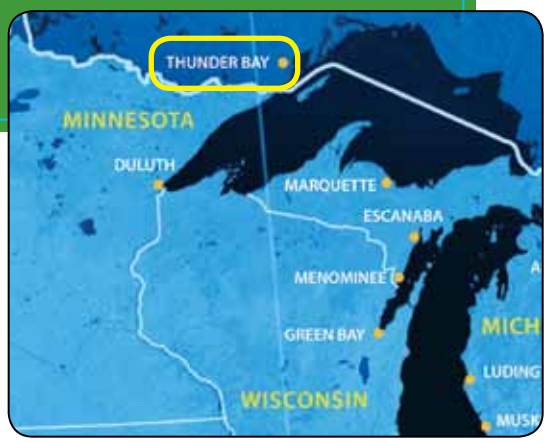
The Port of Duluth is one of the most experienced ports in facilitating the import and export of wind turbine components, handling over 800,000 freight tons of wind cargo between 2004 and 2009. The port has direct loaded the cargo to rail and truck as well as provided shuttle service to and from a laydown yard.

Other Information

The Port of Duluth has an excellent relationship with the Minnesota Department of Transportation permit section and with the Department of Public Safety which manages the highway patrol.

Port of Thunder Bay

www.portofthunderbay.ca



Port Contact

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Handling Equipment

The Port Authority of Thunder Bay owns and operates a railroad toplifter which can lift up to 24 tons and has been used by the port to handle wind turbine blades. The Port also has access to numerous mobile cranes on-site which are matched to the weight needs of a project; the Port has utilized the mobile cranes to offload nacelles.

Docked at the Port of Thunder bay. Photo © Port of Thunder Bay.

Staging and Dockage Area

The Port of Thunder Bay has 8 to 10 acres (3.2 to 4.1 hectares) on immediate outside staging and storage area. The Port also owns 4.6 acres (1.9 hectares) of inside storage area. The Port operates two berths each in excess of 650 feet (198.1 meters). A third berth is available for other break bulk commodities. Overall wharf length exceeds 2,500 feet (762 meters). The outer 30 feet (9.1 meters) of the ocean freighter wharf has a maximum load capacity of 1,350 pounds per square foot.

Intermodal Transportation Connections

Rail: Canadian National (Class 1, domestic and international service)
Canadian Pacific (Class 1, domestic and international service)
Note: The concrete wharf has on-site rail trackage to efficiently and directly move blades and components from vessel to railcar.

Highway: TransCanada Highway (1,320 ft/402.3 m)

Past Experience Handling Wind Turbine Cargo

Between 2009 and 2010, the Port of Thunder Bay handled almost 55,000 cubic meters of wind turbine blades, nacelles, generators, and other components headed to Alberta and British Columbia. The Port has experience in offloading turbine blades and components directly from marine vessels to rail cars spotted on the concrete wharf trackage and in storing turbine components on paved storage areas until they were transported by trucks to Western Canada project sites.

Other Information

The Port of Thunder Bay can create additional engineered staging area within 30 days of receiving marine shipment confirmation if a project requires more than the available 10 acres (4.1 hectares).

Great Lakes
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