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**Landmark Study Helps American Manufacturers Compete
in a Globally Competitive Wind Industry**

GLWN rolls out groundbreaking competitive analysis report that compares U.S. turbine suppliers to their global counterparts.

(Access the Report Executive Summary at www.GLWN.org)

CLEVELAND, OHIO (September 5, 2014) -- Since the resurgence of the wind industry over the past decade, one burning question has plagued U.S. manufacturers that supply components for domestic wind turbine installations: How can manufacturers effectively compete on a global scale with their European and Asian counterparts?

To answer that question, Cleveland-based GLWN (Global Wind Network) recently completed a groundbreaking study that sheds new light on foreign competition and the factors that will keep American supply chain manufacturers competitive here at home.

The goal of the 18-month Department of Energy funded study was to develop a greater understanding of the key factors that contribute to wind energy component manufacturing costs and pricing on a global basis, with the objective of enhancing the competitiveness of U.S. manufacturers and reducing installed system costs.

To do that, the GLWN team, led by principal investigator Patrick Fullenkamp, worked alongside representatives from the National Renewable Energy Laboratory and Sandia National Labs to develop standardized component specifications and manufacturing drawings for the next-generation, large-scale wind turbine (5MW), and distributed those specs in bid form to 22 manufacturers in Europe, Asia and the U.S.

The result was a first-of-its-kind, apples-to-apples comparison of cost breakdowns and manufacturing processes between global competitors from each region, and a revealing "snapshot" look at the factors that drive success for those suppliers.

The study focused on a cost breakdown competitive analysis of four primary component categories vital to wind turbine manufacturing: the tower, jacket foundation, blade and permanent magnet (PM) generator, with detailed cost breakdown of material, labor, burden, SGA (sales, general, administrative), engineering and logistics to a common port of reference in the U.S.

The comparison study was accompanied by plant tours conducted by the team in the U.S., Germany and China, which produced a value stream mapping of the various manufacturer processes, from receipt of customer



order to material purchases, through the plant manufacturing process to final preparation and shipment to the customer.

With this sample data, the team was able to make determinations to identify global cost leaders, best current manufacturing processes, key factors determining competitiveness, and potential means of cost reduction.

Determining the Global Cost Leader: China was the lowest cost manufacturer among the data sample in three of the four product categories (towers, foundations, generators). U.S. manufacturers maintained the lowest cost on blades and second lowest on towers & foundations, and highest on generators. Germany was the high cost manufacturer in half of the categories.

Determining the Best Current Manufacturing Process: In general, the U.S. had the most efficient manufacturing processes on towers, blades and generators based upon the lowest number of total man hours, the highest value-added to non-value-added ratio, and the highest rate of return. Germany was the most efficient on foundations. China had the highest rework and non-value-added process times.

Key Factors that Determine Competitiveness: Chinese manufacturers clearly had the advantage in the lowest material, labor and burden cost in all product categories except blades. With their focus solely on volume production, Chinese manufacturers will go offshore to purchase the latest process technology and component designs as needed for their facilities. Examples include generator coil winding machines purchased from Germany, and roll mills purchased from elsewhere in Europe.

Potential Means for U.S. Cost Reduction: U.S. manufacturers are within reach of “Best Overall” competitiveness, which could potentially be achieved through a 1) Focus on purchased material that meets customer product specifications and is cost effective for all; 2) Focus on product and process design for lean serial production (even flowing process with waste eliminated); and 3) Investment in facilities that are able to produce large parts for marine transport to coastal or offshore wind farms.

U.S. Wind Industry Supply Chain Scorecard

GLWN was also tasked with developing a Wind Industry Supply Chain Scorecard that reflects U.S. manufacturers’ readiness to supply the next generation of wind turbines (3MW and 5MW), for land-based and offshore applications. The Scorecard provides not only an overall view of the readiness of U.S. manufacturers to supply the wind industry, but also establishes a baseline for discussing current and potential supply chain gaps, such as those industry sectors that would benefit from further analysis or investment to advance the sector’s competitiveness and ability to participate in the global market.

GLWN’s overall score of U.S. manufacturers’ readiness to supply the next generation wind industry key components for both land-based and offshore applications was summarized as follows:



- **Capabilities exist in the U.S. to manufacture key components for next generation 3MW wind turbines,** particularly for towers, blades, generators, gearboxes, composite housings and fabricated support bases.
- **U.S. manufacturers of forged rings, forged shafts, cast hubs and cast support bases, while capable, are not competitive in the global supply chain for wind.** Investments in casting and forge industry sectors will be necessary if the U.S. wants to recapture these markets for both land-based and offshore applications. Further detailed analysis of the forge and casting industry is recommended to determine the root cause of this loss of market and non-competitive position.
- **Investment in facilities and equipment is required within all of the industry sectors for scaling up to the 5MW requirements.** Current tower and blade manufacturers in particular will require moderate-to-high investments in equipment and facility upgrades to support 3MW and larger turbines for land-based applications. For 5MW and larger offshore applications, the investment needed will be substantial assuming a new facility, located port side, is the most desirable for the larger components.
- **Road and rail infrastructure constraints keep the majority of wind industry suppliers from being competitive.** The U.S. wind industry and supply chain is concentrated in the central and Midwest United States. Location of the suppliers, current and potential, was taken into account when considering a manufacturers ability to supply the offshore industry. For several of these key components, the manufacturers' current distance from the coastal regions, would likely render them non-competitive, and that is if the component could even be transported given current road and rail infrastructure constraints. For the offshore industry, investment in new facilities is needed in coastal regions, preferably located at major ports equipped to support the offshore wind industry.
- **Offshore wind will bring new market opportunities with jacket and monopole foundations.** Capabilities exist with U.S. heavy fabricators but moderate-to-high investments will still be necessary to address this new product line, serial production for higher volumes required by wind farms, and potentially new coastal facilities.
- **Sub-sea cable manufacturing, sufficient for offshore utility wind farm applications (continuous line cable) does not exist in the U.S.** New portside facilities will be needed.

Patrick Fullenkamp (patrick@glwn.org) of GLWN is available for interview on this piece, and can be reached at (216) 920-1956. The executive summary for "U.S. Wind Energy Manufacturing and Supply Chain: A Competitiveness Analysis" can be downloaded from the GLWN website at www.GLWN.org.

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About GLWN™: As the country's leading supply chain developer in the wind industry, GLWN's mission is to grow the industry by identifying critical needs, conducting focused educational workshops, providing vital research, and connecting manufacturers and suppliers to new business opportunities in the U.S. and abroad. GLWN works with wind farm developers,

press release -- page 4 of 4

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OEMs and economic development departments to increase the domestic content of America's wind turbines. For information about GLWN, visit www.glwn.org.

GLWN is an initiative of WIRE-Net, a non-profit economic development organization located in Cleveland, Ohio. To learn more, visit www.wire-net.org.