

GROWTH IN WIND TURBINE MANUFACTURING AND TRADE

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The U.S. wind turbine manufacturing industry is expanding due to new investments in production, a growing domestic market, and a recent period of stable tax policy. The industry is capable of meeting an increasing portion of U.S. demand through domestic production. U.S. manufacturers may be positioned to take advantage of investment and export opportunities in China and the Americas.

GLOBAL LEADER IN WIND TURBINE INSTALLATIONS

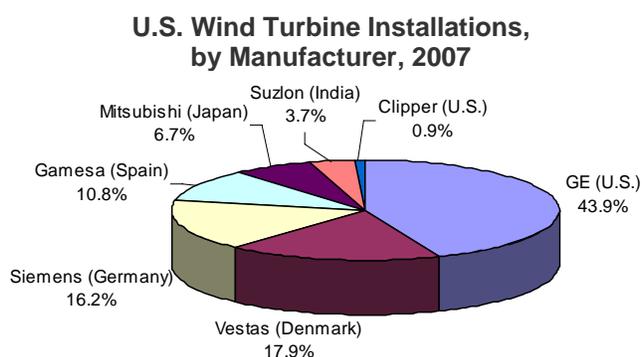
The United States is the global leader in both total installed capacity and annual installations of utility scale (>100 kW) wind turbines. Wind turbine installations are increasing due to:

- *Demand:* Wind is a clean, renewable source of energy that can be installed on a large enough scale to meet a significant percentage of rising energy demand.
- *Production Tax Credit (PTC):* The PTC is a tax credit of \$0.021/kilowatt-hour that makes the price of wind energy competitive.
- *Renewable Portfolio Standards (RPS):* 28 states and D.C. have RPS requiring a minimum percent of electricity (usually 10 to 25%) from renewable sources.

Leading Countries, New and Total Wind Capacity, 2008, Megawatts		
	New 2008	Total
U.S.	8,358	25,170
China	6,300	12,210
India	1,800	9,645
Germany	1,665	23,903
Spain	1,609	16,754

Source: Global Wind Energy Council.

MARKET SHARE OF TURBINE MANUFACTURERS



Source: American Wind Energy Association.

Note: Total may not equal 100 percent due to rounding.

The global wind turbine market is dominated by a small number of original equipment manufacturers (OEMs), but market competition is increasing as new OEMs enter the industry.

- General Electric Co. (GE) is the leading company in the U.S. market and was second in the world in installed wind capacity in 2007. GE has manufacturing plants in Canada, China, Germany, Spain, and the United States.
- Most OEMs are Asian and European companies. These OEMs generally have benefited from stable domestic markets, early market entry, and/or government incentives.

VERTICAL INTEGRATION

OEMs assemble the wind turbine nacelle (the nacelle houses the generator and gearbox). Towers and blades are built to the OEM's specifications, either in-house or by outside suppliers. The extent of vertical integration varies by company and component. For example, GE's U.S. supply chain for blades includes in-house production in Florida and supply agreements with Brazilian manufacturer Tecsis and U.S. manufacturers Molded Fiberglass and TPI Composites. GE does not produce towers in-house.

EXPANSION OF DOMESTIC MANUFACTURING BASE

U.S. manufacturing production is rapidly expanding due to both foreign and domestic investment:

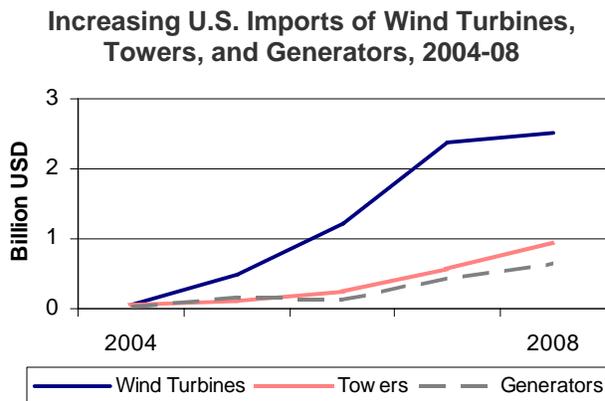
- The number of OEMs assembling nacelles in the U.S. increased from one in 2004 (GE) to five in 2008. U.S.-based Clipper Windpower started domestic production in 2006. Spanish OEMs Acciona Windpower and Gamesa opened plants and U.S.-based Composite Technology Corporation began production under newly acquired subsidiary DeWind. Five more OEMs are planning to build new U.S. manufacturing plants.

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- There are at least 11 blade manufacturers and 16 tower manufacturers with plants open or planned in the United States. These companies include OEMs with in-house blade and/or tower production (e.g., GE, Siemens, and Vestas), established European and Asian suppliers to OEMs (e.g., Danish blade producer LM Glasfiber), and U.S. companies that entered the industry from related areas (e.g., TPI Composites).
- New U.S. manufacturing plants announced in the first three quarters of 2008 alone could add 4,000 jobs in the long term. Wages in new plants generally average between \$13 and \$20 per hour.

RISING U.S. IMPORTS OF TURBINES AND COMPONENTS

- Wind turbine imports rose from \$60 million in 2004 to \$2.5 billion in 2008 due to the rapid U.S. market growth.
- Imports of AC generators (primarily used in turbines) increased from \$38 million in 2004 to \$645 million in 2008 as a result of the increase in domestic turbine assembly.
- Imports of towers (primarily used for turbines) increased from \$46 million in 2004 to \$944 million in 2008.
- The major sources of U.S. wind turbine imports in 2008 were Denmark (28%), Spain (27%), Japan (15%), Germany (12%), and India (7%).

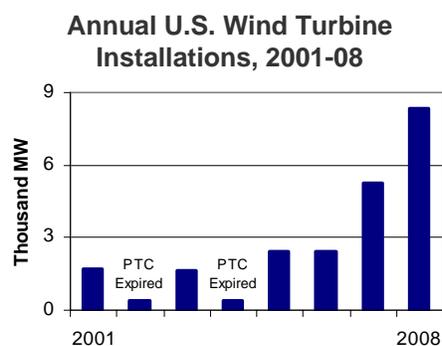


Source: USITC, Dataweb.

LIMITED U.S. EXPORTS

- U.S. exports of wind turbines increased from \$4 million in 2004 to \$22 million in 2008.
- The largest export markets for U.S. producers in 2008 were China (73% of exports) and Brazil (27%).
- China is the second largest global wind market. Due to local content requirements, high shipping costs, and sufficient demand to justify local production, some U.S. companies are entering the Chinese market by investing in local production.
- There is anecdotal evidence that U.S. exports to North and South America are rising. Many of the new U.S. manufacturing plants are intended to serve both these markets and the U.S. market.

CONSTRAINTS ON GROWTH



Source: American Wind Energy Association.

Despite the rapid growth of wind energy, several factors may constrain its growth:

- **Transmission:** Additional transmission capacity is needed to link wind farms with population centers.
- **Transport:** A complicated permitting process can make it difficult to ship turbines, blades, and towers.
- **Certainty/Stability:** Periodic expirations of the PTC have contributed to declines in wind installations.
- **Financial Crisis:** The financial crisis has reduced the number of investors with the capital to invest in wind and resulted in a reduction in demand. Some manufacturers have announced layoffs.

The American Investment and Recovery Act (Stimulus Bill) mitigates some of these constraints by extending the PTC through 2012, investing in transmission and the electricity grid, providing tax incentives for manufacturing investment, and making new wind power projects eligible for a 30% investment tax credit (ITC) or a grant equal to the value of the ITC.

Sources: American Wind Energy Association; BTM Consult ApS, *World Market Update 2007*; Global Wind Energy Council; Joanna Lewis and Ryan Wisler, *Fostering a Renewable Energy Technology Industry*, LBNL-59116, Lawrence Berkeley National Lab, November 2006; NC Solar Center, Database of State Incentives for Renewables & Efficiency; and USITC, Dataweb.