



Global Wind Energy Analysis
Blue Energy Consulting Co., Ltd.

- Excerpt -

Blue Energy

1.0 Executive Summary

Scope and Intent

Service Provider will complete a market analysis of the wind energy market in specified sectors in the following countries:

- China
- India
- South Korea

Service Provider's analysis will focus on the following client-specified sectors:

1. Turbine manufacturing for both onshore and offshore installations in the following ranges:
 - a. 1.5 to 2.5 MW
 - b. 2.6 to 3.5 MW
 - c. 3.6 to 5.0 MW
 - d. 5.1 to 8.0 MW
2. Primary components manufacturing—specifically generator and power converter manufacturing

Key Takeaways

In 2011, 40.5 GW of new wind power was added around the world, representing approximately US \$75.1 billion in revenue. Forecasts indicate that an additional US \$44.8 billion in revenue will be added to the wind power industry by 2021.

The top five countries in terms of installed wind capacity are China, the United States, Germany, Spain, and India—accounting for 86% of the world's capacity. In 2011, these five countries combined added approximately 75% of new installed wind energy.

China:

- China is the world leader in wind power with 62,364.2 MW of power generating capacity and more than 50 GW in annual wind capabilities, representing more than 26% of the world's share. Currently, China has 446 wind farms, two of which are located offshore. **(Section 3.0)**
- In 2011, China connected an additional 17.4 GW of wind power, accounting for 43% of total newly installed wind energy capacity around the world. **(Section 3.0)**
- There are approximately 80 wind turbine manufacturers based in China, 26 of which are manufacturing onshore turbines in the 1.5 MW to 8.0 MW range, and 10 of which are manufacturing offshore turbines in the 1.5 MW to 8.0 MW range. **(Section 3.1-3.2)**
- China is projected to add roughly 106 GW of wind power capacity over the next five years, and is forecasted to see the strongest growth for turbines in the 1.5 MW to 2.5 MW range for both onshore and offshore turbines. **(Section 3.3)**

India:

- India holds the fifth largest capacity for wind energy, accounting for 6.8% of the installed global wind energy capacity with 16,179 MW across 407 wind farms. India

achieved 23% year-over-year growth in capacity in 2011. (Section 4.0)

- There are 22 Indian wind turbine manufacturers producing 54 models of onshore wind turbines in 14 different sizes. (Section 4.1-4.2)
- Although India plans to have offshore installations operating in the coming years, forecasts indicate that no offshore wind power will be operational in the next five years. Onshore installations are projected to reach nearly 13 GW by 2016. Turbines in the 1.5 MW to 2.5 MW range are projected to see the strongest growth. (Section 4.3)

South Korea:

- South Korea imports 97% of its energy needs, and traditionally relies on imports for wind energy projects from Western manufacturers, such as Vestas (Denmark), Acciona (Spain), and Gamesa (Spain). Currently, South Korea holds 0.17% of installed global wind capacity. (Section 5.0)
- South Korea has nine domestic wind turbine manufacturers with 26 models of wind turbines in production, and eight models under development. (Section 5.1-5.2)
- South Korea is in the early stages of creating the world’s largest offshore wind farm—2.5 GW—spurring US \$9 billion investment by the South Korean government. South Korea currently has 407 MW of installed wind energy capacity spread over 32 wind farms. (Section 5.3)
- South Korea is projected to gain an additional 672 MW of installed an operational wind power over the next five years. South Korea will witness the strongest growth in onshore turbines with a range of 1.5 MW to 2.5 MW, and the strongest growth in offshore turbines with a range of 5.1 MW to 8.0 MW. (Section 5.3)

Turbines are manufactured on a build-to-order basis, and the size and wind speed of a wind farm’s property determines the appropriate turbine size. There are several dominant original equipment manufacturers (OEMs), such as Vestas, Goldwind, Enercon, Suzlon and Siemens, but the turbine manufacturing industry is highly fragmented at the component level. No company is fully vertically-integrated.

Turbines consist of approximately 8,000 moving parts. Table 1 outlines the 16 essential components of a typical turbine, which account for roughly 90% of the cost.

Table 1: Average Costs of Wind Turbine Components

Component	Description	Average Cost Percentage
Tower	Range from 40-100 meters in height. Usually manufactured in sections from rolled steel	26.3%
Rotor Blades	Manufactured in specially designed molds from composite materials, usually a combination of glass, fiber and epoxy resin	22.2%
Gearbox	Gears increase the low rotational speed of the rotor shaft in several stages to the high speed needed to drive the generator	12.91%
Power Converter	Converts direct current from the generator into alternating current to be exported to the grid network	5.01%
Transformer	Converts the electricity from the turbine to higher voltage required by the grid	3.59%
Generator	Converts mechanical energy into electrical energy	3.44%
Main Frame	Made from steel, strong enough to support the entire turbine	2.8%

Component	Description	Average Cost Percentage
	drive train, but not too heavy	
Pitch System	Adjusts the angle of the blades to make best use of the prevailing wind	2.66%
Main Shaft	Transfers the rotational force of the rotor to the gearbox	1.91%
Rotor Hub	Made from cast iron, the hub holds the blades in position as they turn	1.37%
Nacelle Housing	Lightweight glass fiber box covers the turbine's drive train	1.35%
Brake System	Disc brakes bring the turbine to a halt when required	1.32%
Yaw System	Mechanism that rotates the nacelle to face the changing wind direction	1.25%
Rotor Bearings	Some of the many different bearings in a turbine, these have to withstand the varying forces and loads generated by the wind	1.22%
Screws	Hold the main components in place, must be designed for extreme loads	1.04%
Cables	Link individual turbines in a wind farm to an electricity sub-station	0.96%

The top 10 turbine manufacturers account for 75.4% of the global market share. Vestas maintains the number one spot with significant gains in the American and German markets, while Siemens climbed four spots in 2011 with increased offshore installations throughout the EU. **Figure 1** illustrates the leading turbine manufacturers with respect to global market share.

Figure 1: Top 10 Turbine OEMs



