HIGHLIGHTS

INDUSTRY OVERVIEW
World Overview
Product Segmentation
Application Segmentation
Technology Trends
Environmental & Regulatory Issues
Trade

INDUSTRY TRENDS & FORECASTS
Market Environment
Product Forecasts
Application Forecasts

INDUSTRY STRUCTURE
Industry Composition
Industry Leaders
Additional Major Companies Cited

RESOURCES

November 2010
HIGHLIGHTS

- Turbine and related product (i.e., turbine-based engines, and generators and generator sets) demand in the US is projected to increase 5.5 percent per year from 2009 to $30.8 billion in 2014. Gains will be driven by rising aerospace equipment shipments and an acceleration in electric power generation and gross fixed investment activities.

- Demand for turbines is forecast to grow 5.3 percent annually through 2014 to $15.6 billion and will remain the leading product segment. Wind turbines are expected to account for the largest share of turbine demand and will benefit from their environmentally benign methods of generating electric energy.

- Turbine generator and generator set demand is forecast to rise 6.2 percent per year through 2014, the fastest pace of any product segment, to $3.8 billion. Advances will be fueled by continuing expansion of the electric power sector.

- Turbine product demand in electric power generation applications is projected to expand 5.5 percent annually through 2014 to $19.3 billion and will remain the leading application segment. Gains will benefit from product developments such as offshore wind farms and smaller-scale, standalone wind turbines suitable for distributed power applications.

- The US had a trade surplus in turbine products of $3.5 billion in 2009 after growing 13.0 percent annually from 2004.

- Among the leading suppliers of turbine products to the US market in 2009 are General Electric, United Technologies and Honeywell International.
INDUSTRY OVERVIEW

World Overview

Global demand for turbine products totaled $98.7 billion in 2009, with Western Europe representing the largest region, followed closely by the Asia/Pacific and North America regions. Together, these three regions represented 89 percent of turbine product demand, with Eastern Europe, Central and South America, and the Africa/Mideast regions accounting for the remainder.

Growth in turbine markets is determined by two interrelated forces: regional demand dynamics; and the outlook for the applications in which turbines are used -- predominantly power generation and aircraft engines. The two forces are interrelated in that the countries and regions that feature the largest, most developed markets for turbines and related products also tend to be the ones where the major consuming industries are best established. Thus, industrialized nations of North America, Western Europe and the Asia/Pacific region boast advanced industrial infrastructures that consume massive quantities of energy and feature significant air carrier and/or aerospace equipment manufacturing sectors, and as a result comprise major markets for products such as turbines. While industrialized nations tend to exhibit the largest and most mature turbine markets, the fastest growing markets are usually found in the developing nations of Asia, Central and South America, and the Africa/Mideast region.

Source: The Freedonia Group, Inc.
Product Segmentation

Demand for turbine products in the US grew 10.2 percent per year from 2004 to $23.6 billion in 2009, while shipments rose 10.6 percent per year over the same period to $27.0 billion. This report includes turbines and related products (i.e., turbine-based engines, and generators and generator sets). Excluded from the scope of this report are turbine blades and other separately sold parts and components.

![Turbine Product Demand by Type, 2009 ($23.6 billion)](image)

Source: The Freedonia Group, Inc.

**Turbines:** Demand for turbines rose a strong 28.2 percent per year during the 2004-2009 period to $12.1 billion. This segment includes wind, gas combustion, and steam and hydraulic types. Between 2004 and 2009, the US turbine product market exhibited strong growth due almost entirely to wind turbines, which accounted for 79 percent of total turbine demand in 2009. It should also be noted that wind turbine demand, while growing rapidly in the aggregate, can be quite volatile on a year-over-year basis, responding in many cases to public sector incentives for installation and use. In the past decade, the US wind turbine market has seen its fortunes fluctuate in tandem with the renewal or expiration of the Production Tax Credit (PTC). The PTC was renewed for three years in 2009 after expiring in 2008. Like other types of turbines, the
integral components of wind turbines are blades (typically three) that spin in response to the kinetic energy of wind against them, thus creating force that can be used to power an electric generator. The performance and cost-effectiveness of wind turbines have been improved by the application of advanced technologies such as fiberglass materials, aerodynamic designs, electronic controls, variable-speed drives and other innovations. Individual wind turbines -- the majority of which have outputs of between 50 kilowatts (kWs) and four megawatts (MWs) -- are generally configured together into “wind farms” or “wind parks” to provide grid-connected power, and such farms create the majority of demand for wind turbines in any given year.

Gas combustion turbines, the second largest subsegment in 2009 with 18 percent of demand, are actuated by the force of compressed gases against the blades. The gases are created from the burning of fossil fuels (as opposed to steam in a steam turbine). Steam turbines extract thermal energy from pressurized steam and convert that energy into useful mechanical work, while hydraulic (or hydro) turbines are actuated by the force of falling water.

**Turbine Engines:** Demand for turbine engines -- used primarily as power plants for aircraft -- advanced 2.7 percent annually from 2004 to $8.7 billion in 2009. Turbine-based aircraft engines offer more power, greater speeds, better performance and superior aerodynamic efficiency relative to piston-based engines, which they have effectively supplanted in larger planes and are continuing to take share from in smaller aircraft. Outside of aircraft there is a small market for turbine engines in ships.

**Turbine Generators & Generator Sets:** Turbine generator and generator set demand decreased 3.9 percent per year during the 2004-2009 period to $2.8 billion. Turbines of all actuation modalities -- steam, gas, wind, hydro, etc. -- can be used to drive a generator. A generator set is a device that incorporates a generator with a prime mover -- in this case the turbine -- into a single package.
Application Segmentation

Demand for turbine products in the US totaled $23.6 billion in 2009 after annual gains of 10.2 percent from 2004. The US represents by far the largest national market in the world for these products. This reflects the presence of vast electric power generation and aerospace manufacturing sectors, which are also the largest in the world in their respective spheres. For analytical purposes, the turbine market can be segmented into three types of generic applications: power generation, aircraft (including space vehicle) engines, and marine engines and other applications.

![Turbine Product Demand by Application, 2009 ($23.6 billion)](image)

Source: The Freedonia Group, Inc.

**Electric Power Generation:** Demand for turbine products in electric power generation applications expanded 16.9 percent per year from 2004 to $14.8 billion in 2009. Gains benefited from strong growth in wind energy capacity. In 2004, the US added less than 400 MW of new wind energy capacity. In 2009, this figure totaled a record of almost 10,000 MW, in spite of the major recession affecting the country. In 2009, the world’s largest wind farm was completed near Roscoe, Texas. Total installed capacity at this 627-turbine farm exceeded 780 MW, generating enough electricity to power more than 230,000 homes. Of the 35 gigawatts of total installed wind capacity in the US in 2009,
Texas by itself accounts for ten gigawatts. The US is also home to a large number of so-called "small wind" projects, which are single wind turbines used in rural and remote locations to provide electricity. These projects typically use less powerful wind turbines in the one to 20 kW range -- compared to 50 kWs to three MWs for commercial power generating turbines. Among other electric power generation turbines, grid-based power facilities have managed to upgrade the efficiency of their operations considerably over the past half decade or so through the use of so-called combined cycle power plants. These systems burn waste heat generated from an initial gas combustion turbine cycle in a steam-electric generator to produce additional electricity, thus raising the overall efficiency of fuel use.

**Aircraft Engines:** Turbine product demand in aircraft engine applications rose 2.7 percent annually between 2004 and 2009 to $8.5 billion. The turbojet, the most basic of the turbine engines, generates significant power via highly compressed gases that are burned, reignited by afterburners for extra power (as needed) and fired out the back of the engine as exhaust, which provides high-speed propulsion. The turbofan, the most widely used engine on present generation large commercial transports, is a variation on the turbojet, whereby a ducted fan in front of the compressors allows some of the air to bypass the combustion chamber and be mixed with the exhaust gas leaving the engines. Turbofans are quieter, more powerful and more fuel-efficient than other types of gas turbine engines, and produce a cooler exhaust gas. The turboprop combines jet propulsion with propeller power, employing two turbines, one of which powers the compressor and the other the propeller.

**Marine & Other Applications:** Demand for turbine products in marine and all other applications, as an aggregate, declined 0.8 percent annually during the 2004-2009 period to $240 million. This segment consists primarily of turbine-based engines for ships, coupled with specialty industrial applications found mostly in petroleum and gas-related settings, such as gas pipeline compressor drives.
Technology Trends

Turbine producers have utilized technological innovation to upgrade the performance (along parameters such as increased power and higher energy efficiency) and enhance and streamline the design of the devices, at the same time securing a competitive advantage for themselves. In addition, producers utilize increasingly advanced manufacturing methods to improve the performance of their turbines. For example, a number of aircraft engine manufacturers and gas turbine producers utilize advanced investment casting techniques that feature molded ceramic cores and create complex cooling passages, which in turn allow the engines or generators to operate at higher temperatures. Turbine engine manufacturers are also working with customers and fuel suppliers to develop or modify engines so that they can work with various renewable biofuels. The most recent fundamental breakthrough to affect conventional turbines in the power generation area was so-called combined cycle technology, whereby steam created from the operation of a gas combustion turbine can be used to operate a steam turbine, thus increasing the energy efficiency of the overall system. Microturbines, while derived from basic gas turbine technology, represent a relatively new class of products offering still greater energy efficiency at lower emissions levels, especially in distributed power environments. In addition, a number of manufacturers are developing various types of water turbines, including tidal, wave and in-stream models.

To date, turbine technology has proven virtually unassailable from competition from alternative energy sources in settings where extremely large amounts of power are required -- especially commercial and regional aircraft engines (and their military equivalents) and baseload power generation facilities. They have, however, faced functional competition in smaller-scale electric power settings, including backup/standby electricity generation and very small aircraft, primarily from diesel and gas-fired internal combustion engines. More recently, turbines have begun to encounter competition in more traditional larger-scale power generation settings as well, primarily from photovoltaic cells and potentially from fuel cells.
Environmental & Regulatory Issues

The turbine industry is directly impacted by a broad array of regulations and standards emanating from governmental and quasi-public/private entities, such as standards-setting organizations. While some of these regulations are restrictive, many actually stimulate industry growth. For example, environmental regulations have opened up opportunities for suppliers of nonpolluting products (e.g., wind turbines) and lower polluting devices such as microturbines and natural gas-burning combustion turbines. Deregulation of electricity sectors has had a similar impact, directly stimulating demand for products that can be profitably exploited in smaller-scale settings, in particular gas turbines for combined cycle and/or cogeneration facilities. Other legal/regulatory issues impacting the turbine business include safety regulations (regarding both worker safety and safe product operation) and energy efficiency standards.

In the last decade, the US wind turbine market has seen its fortunes fluctuate in tandem with the renewal or expiration of the Production Tax Credit (PTC). When the PTC for wind energy expired at the ends of 1999, 2001 and 2003, there were significant drops in wind turbine sales in each of the following years as power companies waited for the credit to be renewed before building any new wind farms. More recently, the PTC expired in 2008, but in 2009 it received a three-year extension as part of the Recovery Act. Beyond 2012, it is therefore difficult to make any forecast with certainty for US wind turbine demand. The US wind industry has for years called for the introduction of a national renewable electricity standard (RES), which would provide a predictable and competitive market. RES policies currently exist in around 30 states, but no comprehensive policy exists at the national level. A national RES would call for 25 percent of the country’s electricity to come from renewable energy by 2025, with a shorter-term target as well. For example, the Obama-Biden New Energy for America plan to ensure rapid renewable energy deployment called for a short-term target of ten percent by 2012.
Trade

In 2009, the US had a trade surplus in turbine products of $3.5 billion, which grew 13.0 percent annually from 2004. The US industry finds key export markets in virtually all turbine-using countries, with particularly important customers located in the industrialized nations of Canada, the United Kingdom, France, Germany and Japan; and developing countries such as Brazil, China and Mexico. Despite its vast local capabilities and extensive exporting, the US also imports turbine products in extensive quantities, with major external suppliers including the major turbine producing countries of Western Europe (principally the United Kingdom, France and Germany) and Canada. US wind turbine imports have risen particularly rapidly in recent years.

The net positive trade balance figures of the US actually understate the true importance of the country’s industry in the global turbine market, as the major US producers maintain extensive production operations worldwide. By the same token, many of the world’s leading offshore-based suppliers (especially the West European ones) have manufacturing capacity in the US, allowing them to be close to the vast US market.

Source: The Freedonia Group, Inc.
INDUSTRY TRENDS & FORECASTS

Market Environment

Turbine products are integral components in electric power generation and aircraft production and maintenance, as well as in the much smaller marine vehicle and specialty industrial sectors. Many of these markets are highly cyclical, and therefore demand for turbine products is dependent upon overall macroeconomic conditions and prospects. Upper-level microeconomic variables such as energy supply and demand and gross fixed investment are also extremely salient determinants of demand, as are more sector-specific factors such as aerospace equipment industry trends, air carrier patterns and electricity generation trends. On balance, manufacturers of turbine products have little if any direct control over such variables. In addition, the legal and regulatory environment can have a substantial impact on the market environment for products such as turbines. Particularly significant are environmental laws and electricity sector deregulation. Finally, developments in turbine and related (including competitive) technologies are a critical determinant of the industry’s market environment, as are factors that affect turbine product prices.

<table>
<thead>
<tr>
<th>Item</th>
<th>2004</th>
<th>2009</th>
<th>2014</th>
<th>09/04</th>
<th>14/09</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross Domestic Product</td>
<td>13304</td>
<td>14088</td>
<td>16160</td>
<td>1.2</td>
<td>2.8</td>
</tr>
<tr>
<td>Gross Fixed Investment</td>
<td>2597</td>
<td>2280</td>
<td>3125</td>
<td>-2.6</td>
<td>6.5</td>
</tr>
<tr>
<td>Resident Population (million)</td>
<td>293.0</td>
<td>307.0</td>
<td>322.2</td>
<td>0.9</td>
<td>1.0</td>
</tr>
<tr>
<td>Manufacturing Value Added</td>
<td>1538</td>
<td>1571</td>
<td>1830</td>
<td>0.4</td>
<td>3.1</td>
</tr>
<tr>
<td>Aerospace Equipment Shipments (bil $)</td>
<td>117.6</td>
<td>149.0</td>
<td>186.0</td>
<td>4.8</td>
<td>4.5</td>
</tr>
<tr>
<td>Electric Power Generation (bil kWh)</td>
<td>3971</td>
<td>3925</td>
<td>4250</td>
<td>-0.2</td>
<td>1.6</td>
</tr>
</tbody>
</table>

Source: The Freedonia Group, Inc.
Product Forecasts

Turbine product demand in the US is projected to increase 5.5 percent per year from 2009 to $30.8 billion in 2014, while shipments are forecast to expand 5.3 percent annually through 2014 to $35.0 billion. Gains will benefit as the economy improves and gross fixed investments accelerate. However, growth will be significantly lagging the performance of the 2004-2009 period when wind turbine demand posted stellar gains.

Turbines: Demand for turbines is forecast to grow 5.3 percent annually during the 2009-2014 period to $15.6 billion. Through 2014, wind turbines are expected to account for the largest share of demand and will continue to post respectable gains, but nowhere near as spectacular as in the prior five-year period. Wind turbines (especially newer offshore varieties) represent technically advanced and/or environmentally benign methods of generating electric energy, advantages that are expected to be coveted by turbine users in the key power generation market over the next several years. However, US electric transmission capabilities need to be improved to facilitate wind development because many of the windiest locations in the US are in the center of the country. For example, the Great Plains region is highly windy but not densely populated, and therefore not an intensive power user like the east and west coasts.

The gas combustion turbine subsegment is expected to achieve the strongest rebound through 2014 (7.2 percent annually) after having suffered from the steepest declines over the historical period, but will not match the peaks attained in the early years of the century. Smaller gas combustion turbines hold favorable prospects in distributed power generation settings, as well as in combined heat and power (CHP, or cogeneration) facilities. However, further demand for gas combustion turbines will be limited by high gas prices (due in no small part to rapidly expanding energy needs in large developing markets such as China and India) and by competition from environmentally friendlier technologies such as wind turbines. Steam turbines are used in nuclear power
plants and will thus benefit from both the aging of existing nuclear plants (for aftermarket sales) and any moves to build new nuclear facilities.

**Turbine Engines:** Demand for turbine engines is expected to advance 5.5 percent annually between 2009 and 2014 to $11.4 billion. Despite a fairly weak outlook for many domestic airlines, turbine engine demand will expand respectably. This apparent contradiction can easily be explained by the strength of commercial aircraft exports from Boeing, which does final assembly of these craft -- and thus utilizes the engines -- at US manufacturing plants. Furthermore, the large number of aircraft in use will support healthy aftermarket engine demand, and prospects are also favorable in the military aircraft sector, where heightened geopolitical concerns are leading to increased defense spending.

**Turbine Generators & Generator Sets:** Demand for turbine generators and generator sets is forecast to rise 6.2 percent per year through 2014, the fastest pace of any product segment, to $3.8 billion. Continuing expansion of the electric power sector will provide opportunities. However, preventing even faster growth will be the development of wind power as wind turbines are technically a turbine generator set with an integral generator.

<table>
<thead>
<tr>
<th>Item</th>
<th>2004</th>
<th>2009</th>
<th>2014</th>
<th>09/04</th>
<th>14/09</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turbine Product Demand by Type</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turbines</td>
<td>3485</td>
<td>12070</td>
<td>15600</td>
<td>28.2</td>
<td>5.3</td>
</tr>
<tr>
<td>Turbine Engines</td>
<td>7600</td>
<td>8700</td>
<td>11390</td>
<td>2.7</td>
<td>5.5</td>
</tr>
<tr>
<td>Turbine Generators &amp; Generator Sets</td>
<td>3390</td>
<td>2780</td>
<td>3760</td>
<td>-3.9</td>
<td>6.2</td>
</tr>
<tr>
<td>+ net exports</td>
<td>1875</td>
<td>3450</td>
<td>4250</td>
<td>13.0</td>
<td>4.3</td>
</tr>
<tr>
<td>Turbine Product Shipments</td>
<td>16350</td>
<td>27000</td>
<td>35000</td>
<td>10.6</td>
<td>5.3</td>
</tr>
</tbody>
</table>

Source: The Freedonia Group, Inc.
**Application Forecasts**

Demand for turbine products in the US is forecast to advance 5.5 percent per year between 2009 and 2014 to $30.8 billion. Gains will be driven by rising aerospace equipment shipments and an acceleration in electric power generation. Through 2014, turbine demand in the power generation segment will post the same percentage gains as the aircraft engine sector.

**Electric Power Generation:** Turbine product demand in electric power generation applications is projected to expand 5.5 percent annually through 2014 to $19.3 billion. Growth will match the overall increases for turbine product demand, but will represent a major slowdown from the pace of the 2004-2009 period. This slowdown will come after a decade-long boom in wind turbine demand that saw these products move from a niche product to become a major segment of the electric power generation market. Environmental factors will promote sustained growth in wind generation systems. Product developments will also boost wind turbine demand. For instance, research is ongoing into smaller-scale, standalone devices suitable for distributed power applications. There is also an increased interest in offshore wind farms -- both due to the more favorable wind conditions at sea and because of concerns about using valuable land and obstructing natural views with large-scale wind farms. However, the cost per megawatt of generation of offshore wind power remains somewhat prohibitive for large-scale commercialization. Going forward, increases in the electric power generation segment will be fueled by further penetration by gas-fired combined cycle power generation units, especially as older coal-fired plants are retired. Over the longer term, nascent developments in tidal and in-stream hydro turbines will also provide opportunities.

**Aircraft Engines:** Demand for turbine products in aircraft engine applications is expected to advance 5.5 percent per year during the 2009-2014 period to $11.2 billion. Gains will be supported by an economic recovery, an
TURBINES

aging commercial air fleet and strong increases in the air cargo sector. In addition, both of the leading aircraft producers -- Boeing and France-based Airbus -- have developed newer aircraft that promise improvements in range and fuel efficiency and are expected to spur replacement of older, less efficient planes. The continued movement toward turbine engines in even very small aircraft will also provide opportunities for engine manufacturers. Furthermore, military spending will continue to be strong, which will provide opportunities in that sector. In the military segment, several firms, including SAFRAN’s Microturbo subsidiary (France), are developing microturbine based engines for missiles, target drones and unmanned aerial vehicles.

**Marine & Other Applications:** Turbine product demand in marine and all other applications, as an aggregate, is projected to rise 4.6 percent annually from 2009 to $300 million in 2014. Ship engine applications for turbines are mature and are expected to see only limited gains going forward, restrained by competition from alternate propulsion systems, most notably the dominant diesel piston engine. In contrast, generally favorable conditions in the oil and gas industries as energy demand remains strong will provide some turbine opportunities.

<table>
<thead>
<tr>
<th>Item</th>
<th>2004</th>
<th>2009</th>
<th>2014</th>
<th>% Annual Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turbine Product Demand</td>
<td>14475</td>
<td>23550</td>
<td>30750</td>
<td>10.2 5.5</td>
</tr>
<tr>
<td>Electric Power Generation</td>
<td>6775</td>
<td>14780</td>
<td>19300</td>
<td>16.9 5.5</td>
</tr>
<tr>
<td>Aircraft Engines</td>
<td>7450</td>
<td>8530</td>
<td>11150</td>
<td>2.7  5.5</td>
</tr>
<tr>
<td>Marine &amp; Other</td>
<td>250</td>
<td>240</td>
<td>300</td>
<td>-0.8 4.6</td>
</tr>
</tbody>
</table>

Source: The Freedonia Group, Inc.
INDUSTRY STRUCTURE

Industry Composition

With system prices ranging anywhere from several hundred thousand to hundreds of millions of dollars, the purchase of a turbine product is a major outlay for just about any buyer, and represents a substantial revenue stream for the vendor. As a result, turbine producers compete aggressively with one another for available business. At the same time, the costs and complexities involved in designing, manufacturing, marketing and servicing turbine products necessitate a degree of inter-firm cooperation in the industry that is unusually high.

As would be expected given its position as the largest producing nation in the world, the US is home base of operations for several of the major turbine producing multinational organizations. These include leader General Electric, a dominant global factor in both aircraft engines and power generation turbines; and the Pratt & Whitney subsidiary of United Technologies, whose traditional strengths are in aircraft engines, but which has also targeted the power generation segment in recent years. Other major domestically headquartered producers include Honeywell International (a leading producer of auxiliary power units for airplanes and an important supplier of turbine engines) and Caterpillar (via Solar Turbines, a major gas turbine and gas turbine generator set producer). Many leading international firms also maintain operations in the US. For example, producers such as France’s Alstom, Spain’s Gamesa, the United Kingdom’s Rolls-Royce, Germany’s Siemens and India’s Suzlon Energy operate manufacturing operations and/or subsidiaries in the US. To better serve the US market, some firms are expanding their presence. For example, Alstom opened a new facility in Chattanooga, Tennessee in June 2010 to manufacture gas and steam turbines, generators, and related equipment for the US power generation market. Additionally, in May 2010, Alstom began construction of a wind turbine nacelle assembly facility in Amarillo, Texas. This facility is expected to commence operations in 2011.
**Industry Leaders**

**General Electric Company** (NYSE: GE)

3135 Easton Turnpike
Fairfield, CT 06828
203-373-2211
www.ge.com

General Electric (GE), the leading supplier of turbine products to the US market in 2009, is a diversified services, technology and manufacturing company. In 2009, the company had sales of $156.8 billion, of which $72.5 billion were in the US, and employed 304,000.

GE is active in the US turbine industry via its GE Aviation business within the $42.3 billion Technology Infrastructure segment; and its GE Energy and GE Oil & Gas businesses within the $37.0 billion Energy Infrastructure segment. GE Aviation manufactures a range of turbine-based aircraft engines, including turbofan, turboprop, turboshaft and turbojet varieties for use in commercial aircraft, such as corporate and regional aircraft, as well as short/medium-, intermediate- and long-range aircraft; and military aircraft such as fighters, bombers, helicopters and surveillance aircraft. For example, GE Aviation’s product line includes **CFE 738** turbofan engines, which are produced via CFE, a joint venture with Honeywell International. GE Energy is engaged in the manufacture of products for energy production, distribution and management that are used mainly by the power generation, industrial and government sectors. Specific products include gas, steam, combined-cycle and wind turbines. The business also manufactures aero-derivative gas turbines; and air-, hydrogen- and liquid-cooled turbine generators that are driven by aero-derivative and heavy-duty gas turbines, and steam turbines. For instance, the company’s wind turbines include 1.5-MW, 2.5-MW and 4.0-MW models. GE Energy produces aero-derivative gas turbines through the **LMS, LM** and **PGT** series. Among other products, GE Oil & Gas produces gas and steam turbines. Examples of the business’ heavy-duty gas turbines are **MS5001** compact, single-shaft units, which are used for industrial power generation applications.
Honeywell International Incorporated (NYSE: HON)

101 Columbia Road
Morristown, NJ 07960
973-455-2000
www.honeywell.com

Honeywell International, a leading supplier of turbine products to the US market in 2009, is a diversified manufacturer that offers a variety of products, technologies and services. In 2009, the company had sales of $30.9 billion, of which $18.7 billion were in the US, and employed 122,000.

Honeywell participates in the US turbine industry through its Aerospace segment, which had sales of $10.8 billion in 2009. The segment, which operates via the Honeywell Aerospace business, produces equipment and components, and offers related services, for the aircraft manufacturing, airline, business and general aviation, military, space and airport markets. Among the business’ products are turbine propulsion engines and auxiliary power units (APUs). The company’s turbine propulsion engines include CFE 738, F124, F125, HTF 7000, ALF502, TFE731, TFE1042, AtF3 and LF507 turbofan; T800 and TPE331 turboprop; and HTS900, T53, T55, LTS101 and AGTT turboshift types. Many of Honeywell Aerospace’s turbine propulsion engines are developed and manufactured through joint ventures and other agreements with third parties. For example, CFE 738 engines are produced via CFE, a joint venture between the company and the GE Aviation business. Honeywell’s F124 and F125 engines are manufactured via International Turbine Engine, a joint venture between the company and Aerospace Industrial Development Corporation (AIDC -- Taiwan). APUs from Honeywell Aerospace feature turbine units. These products are designed to provide electrical and pneumatic power for main engine starting, electrical power generation and other operations for commercial, regional, business and military aircraft; and ground power applications. Some of the business’ APUs are designed for use on specific aircraft or by a particular aircraft manufacturer.
United Technologies Corporation (NYSE: UTX)
One Financial Plaza
Hartford, CT 06103
860-728-7000
www.utc.com

United Technologies Corporation (UTC), a leading supplier of turbine products to the US market in 2009, is a major manufacturer of building systems, aerospace products, and security and fire protection products. In 2009, UTC had sales of $52.9 billion, of which $28.3 billion were in the US, and employed 206,700.

UTC competes in the US turbine industry through its Pratt and Whitney and Hamilton Sundstrand segments. Pratt & Whitney had 2009 sales of $12.6 billion and manufactures turbine-based aircraft engines and industrial gas turbines. The segment produces turbine-based engines for commercial and military aircraft in turbofan, turboprop and turboshaft models. For instance, Pratt & Whitney’s range of turbine-based aircraft engines for military applications comprises F100, F117, F119 and F135 models. The segment produces industrial gas turbines for electrical power generation, mechanical drive, marine propulsion, gas compression and liquid pumping applications. These turbines comprise FT8, ST6M, ST18M and ST40 models. Hamilton Sundstrand, with sales of $5.6 billion in 2009, manufactures aerospace and industrial systems. Among the segment’s aerospace systems are expendable turbojet engines and APU. Expendable turbojet engines are typically used in various military applications, including decoys, tactical missiles, unmanned aerial vehicles, jammers and aerial targets. The company’s APU are gas turbine engines employed on commercial and military aircraft during aircraft ground operations to provide electricity, compressed air and shaft power for aircraft systems such as main engine start, air conditioning and electric power systems. In January 2010, UTC entered the wind turbine market with the acquisition of a 49.5-percent stake in Clipper Windpower for approximately $250 million.
**Additional Major Companies Cited**

Alstom (EPA: ALO)  [www.alstom.com](http://www.alstom.com)

Caterpillar (NYSE: CAT)  [www.cat.com](http://www.cat.com)

Clipper Windpower (LSE: CWP)  [www.clipperwind.com](http://www.clipperwind.com)

Gamesa (MAD: GAM)  [www.gamesacorp.com](http://www.gamesacorp.com)

Rolls-Royce (LSE: RR)  [www.rolls-royce.com](http://www.rolls-royce.com)

SAFRAN (EPA: SAF)  [http://safran-group.com](http://safran-group.com)

Siemens (NYSE: SI) (FRA: SIE)  [www.siemens.com](http://www.siemens.com)

Suzlon Energy (BSE: 532667) (NSE: SUZLON)  [www.suzlon.com](http://www.suzlon.com)
RESOURCES

**Trade Publications**

Diesel & Gas Turbine Worldwide  [www.dieselgasturbine.com](http://www.dieselgasturbine.com)

Flight Global  [www.flightglobal.com](http://www.flightglobal.com)

Journal of Engineering for Gas Turbines and Power  
[http://asmedl.aip.org/GasTurbinesPower/](http://asmedl.aip.org/GasTurbinesPower/)

Journal of Turbomachinery  
[http://scitation.aip.org/ASMEJournals/Turbomachinery/](http://scitation.aip.org/ASMEJournals/Turbomachinery/)

Power Engineering International  [www.powergenworldwide.com](http://www.powergenworldwide.com)

**Associations**

Aerospace Industries Association  [www.aia-aerospace.org](http://www.aia-aerospace.org)

American Wind Energy Association  [www.awea.org](http://www.awea.org)

Gas Turbine Association  [www.gasturbine.org](http://www.gasturbine.org)

International Gas Turbine Institute  [http://igti.asme.org](http://igti.asme.org)

**Study Notes**

The contents of this report are based on Freedonia Group Industry Study #2689 *World Turbines* (November 2010). The full study, consisting of 432 pages, is available from The Freedonia Group by contacting customer service at 800.927.5900, 440.684.9600 or info@freedoniagroup.com. The price of the full study is $5,900. For information on any Freedonia study, please visit our website at [www.freedoniagroup.com](http://www.freedoniagroup.com).

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without prior permission of The Freedonia Group, Inc.