AWEA Small Wind Turbine Global Market Study

YEAR ENDING 2008

AWEA
AMERICAN
WIND ENERGY
ASSOCIATION

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Table of Contents

Summary

US SMALL WIND MARKET GROWS 78% IN 2008

Industry Secures Long-Term Federal Incentive – the First Since 1985

The US market for small wind turbines – those with capacities of 100 kW[1] and under – grew 78% in 2008 with an additional 17.3 MW of installed capacity. This growth is largely attributable to increased private equity investment that allowed manufacturing volumes to increase, particularly for the commercial segment of the market (systems 21-100kW). The still-largest segment of the market, residential (1-10kW), was likewise driven by investment and manufacturing economies of scale, but also by rising residential electricity prices and a heightened public awareness of the technology and its attributes.

The industry projects 30-fold growth within as little as five years, despite a global recession, for a cumulative US installed capacity of 1,700 MW by the end of 2013. Much of this estimated growth will be spurred by the new eight-year 30% federal Investment Tax Credit passed by Congress in October 2008 and augmented in February 2009.

The market has become dominated by grid-connected units and will likely continue in this trend as these larger systems become more affordable.

The US continues to command roughly half the global market share and is home to one-third of the 219 identified worldwide manufacturers. Small wind is still in a race with the solar photovoltaic industry toward "grid parity" – price per kilowatt-hour on par with conventional forms of electricity – and now both industries enjoy nearly identical federal incentives for a more level playing field.

2008 U.S. Sales	2008 Global Sales
17.3 MW	38.7 MW
78% growth over 2007	53% growth over 2007
10,500 units	19,000 units
$77 million in sales	$156 million in sales

Other Statistics

- 80 MW of cumulative installed small-wind capacity in the US.
- US manufacturers' sales account for ½ the global market.
- $160 million in outside investment was injected into 18 manufacturers worldwide over the past three years.
- At least 219 companies worldwide manufacture small wind systems, 35% of which are based in the US.
- Industry predicts a cumulative US capacity of 1,700 MW within five years.

Survey Findings and Analysis

CURRENT MARKET STATUS

Based on a survey of leading manufacturers, 2008 growth was largely due to the availability of capital and inventory, and the evolution of manufacturing economies of scale. Private equity investment has allowed supply to catch up to a demand that has been consistently strong over recent years. Better manufacturer capitalization has led to an increase in production volumes, sales forces, and technical support within individual companies.

Leading external market factors include rising and volatile prices of conventional electricity, state incentives, consumer education, and an increased public concern for environmental issues.

Despite record growth, the residential (1-10kW) and commercial (21-100kW) market segments showed an approximate 20% downturn in late 2008 and early 2009 due to a broad economic recession, but also because of typical sales drop-offs during winter months. Despite the dip, early 2009 residential sales were still 15-20% higher than in early 2008.

Commercial-sector customers have found difficulty securing financing for the typically more expensive turbines in this market, and have found Power Purchase Agreements (PPA) to be a more attractive financing method.[2] Commercial PPAs enable businesses, schools, governments, and utilities to consume renewable electricity while avoiding high capital costs and risks associated with owning the generating equipment. The PPA model has been very popular for the solar photovoltaic (PV) industry in recent years primarily because the federal investment tax credit created in the 2005 Energy Policy Act provided a far more generous incentive (30% of the total installed system cost) for commercial applications than for residential, which was limited to $2,000. Small wind and solar now enjoy a long-term, uncapped 30% tax credit for both commercial and residential applications.

PPAs will likely become more popular in 2009 as the expanded incentive takes effet and credit remains restricted throughout the economy.

Table 1. Growth by Market Segment

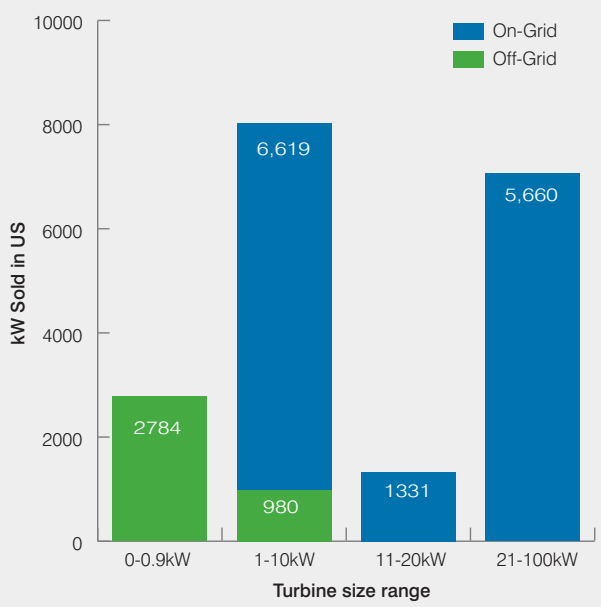
US: Units, 2008	0-0.9kW	1-10kW	11-20kW	21-100kW	Totals
Off-Grid	6,706	696	0	0	7,402
On-Grid	0	2,825	72	87	2,984
Totals	6,706	3,521	72	87	10,386

US: kW, 2008	0-0.9kW	1-10kW	11-20kW	21-100kW	Totals
Off-Grid	2,784	980	0	0	3,764
On-Grid	0	6.619	1,331	5,660	13,610
Totals	2,784	7,599	1,331	5,660	17,374

World Total 2008	Units	kW
Off-Grid	13,902	7,536
On-Grid	4,992	26,065
Total	18,894	33,601

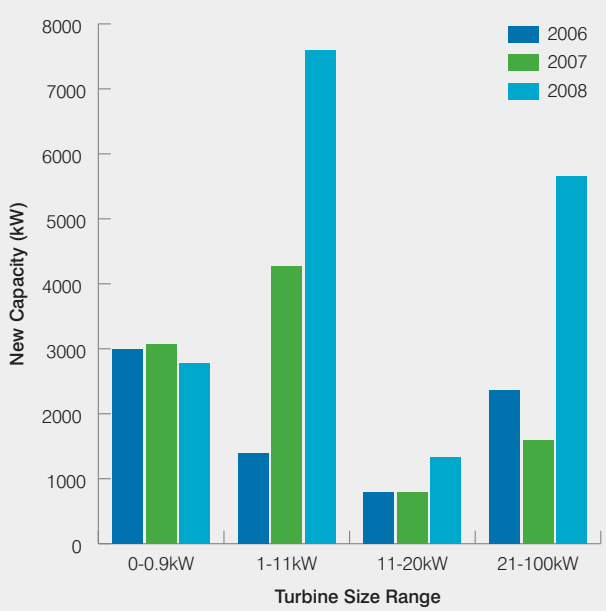
* Where confirmation was unavailable, this study assumes all turbines under 1kW, and 90% of turbines equal to 1kW, are off-grid. Several models can be used for either on- or off-grid applications.

FIGURE 1: U.S. SMALL WIND TURBINE MARKET, 2008



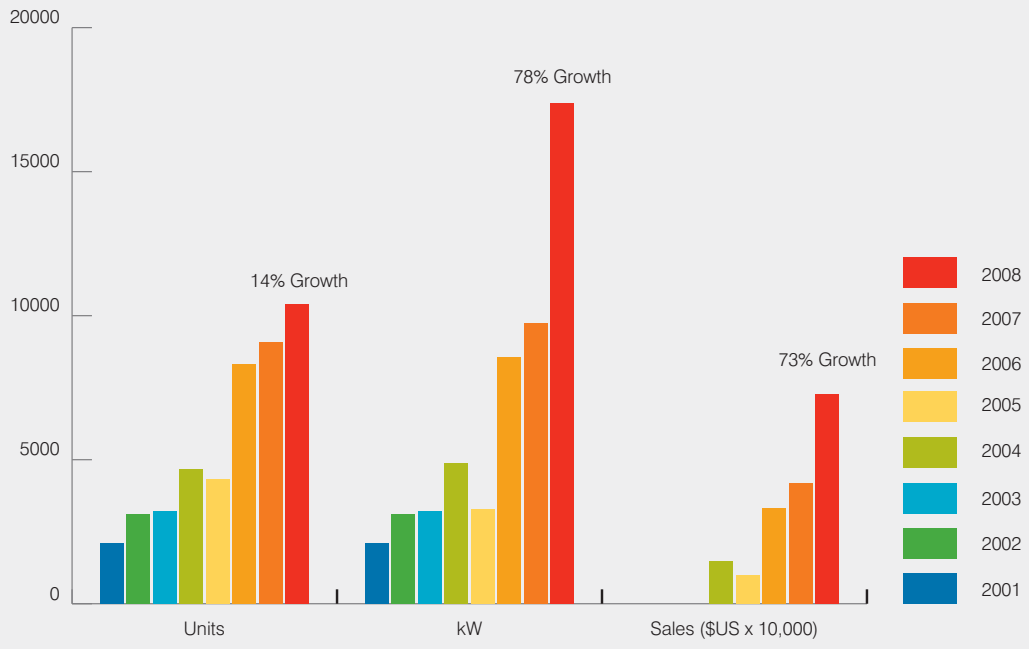
The market has become dominated by grid-connected units and will likely continue in this trend as these larger systems become more affordable and available.

FIGURE 2: U.S. MARKET SEGMENT GROWTH



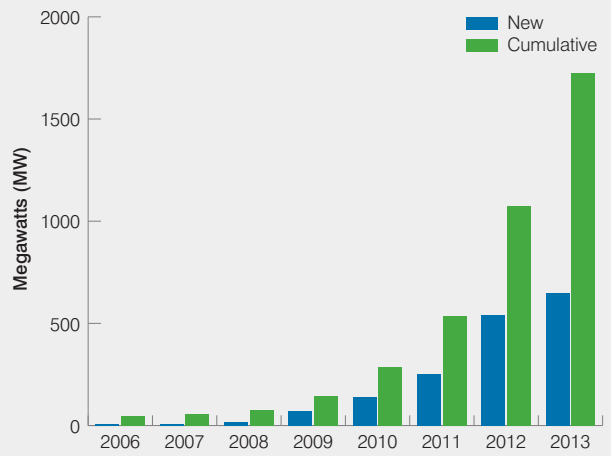
The residential and upper-commercial market segments experienced the sharpest growth in 2008.

FIGURE 3: GROWTH OF U.S. SMALL WIND MARKET



For all market segments, industry predicts that the federal investment tax credit (see "Potential Market Factors") will continue to help increase production and further reduce consumer costs. The cleantech economy sector in general has been relatively strong throughout the global recession and credit crisis, and small wind is no exception. Even amidst the downturn, economies of scale are beginning to take shape in the industry and growth projections are the strongest in the industry's 80-year history.

FIGURE 4: U.S. MARKET GROWTH PROJECTIONS



GROWTH POTENTIAL AND PROJECTIONS

Manufacturers predict a 30-fold increase in the US market in as little as five years, even under current economic conditions. Primary drivers include the eight-year 30% federal investment tax credit enacted in October 2008, recent and potential private equity investment, and greater equipment manufacturing capabilities. This growth projection is much greater than the 40-50% annual growth predicted in the 2008 study, and is far beyond the average annual growth of 14-25% year-over-year growth the industry has seen over the past decade. (See also "Potential Market Factors" and the 2008 AWEA study.)

STATES

In general, states that offer consumer incentives at a level of $2 per Watt of capacity or greater attract the strongest share of the small-wind market. Based on a survey of residential-turbine providers, states with highest sales percentages in 2008 were CA, NV, AZ, OR, NY, MA, and OH. New Jersey and Hawaii would have been added to this list, say industry members, were it not for their unusually cumbersome permitting processes which have severely restricted their markets.[3] (See also "Potential Market Factors.")

POTENTIAL MARKET FACTORS (See also the 2008 study)

New federal incentives. On October 3, 2008 Congress passed the Emergency Economic Stabilization Act of 2008, H.R. 1424, that includes a new eight-year, 30% federal-level investment tax credit (ITC) to help consumers purchase qualified small wind systems with rated capacities of 100 kilowatts (kW) and less. The amount of this credit was stringently capped, however, until the passage of The American Recovery and Reinvestment Act of 2009, H.R. 1, on February 17, 2009 which removed the cost caps. A 30% ITC is now available for small wind turbine consumers through December 31, 2016. (For a list of other incentives benefitting small wind contained in this legislation, see www.awea.org/legislative/pdf/AWEA_Summary_ARRA_Provisions_of_Interest_to_Small_Wind.pdf. See also the Database for State Incentives for Renewables and Efficiency Web site at http://dsireusa.org.)

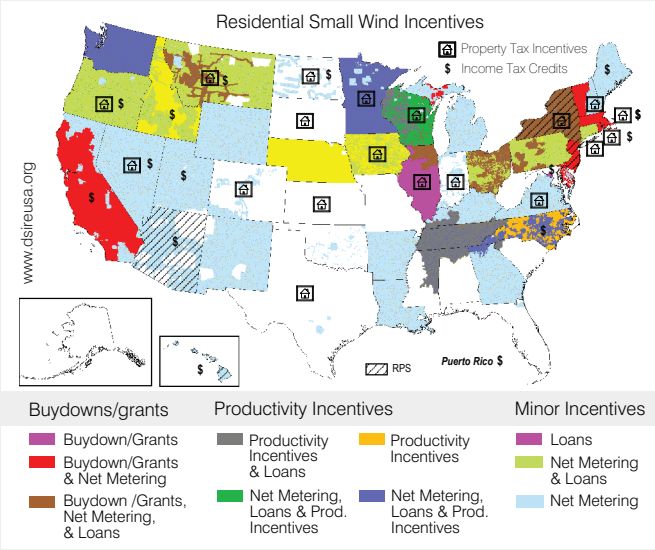
Table 2. Grid-Tied Residential Market Potential

	2010*	2020**
Homes with ½ to 1 acre of land	12.0	13.9
Homes with >1 acre of land	25.2	29.3
Gross potential number of homes for small wind turbines	37.2	43.2
Net potential number of homes for small wind turbines†	13.0	15.1

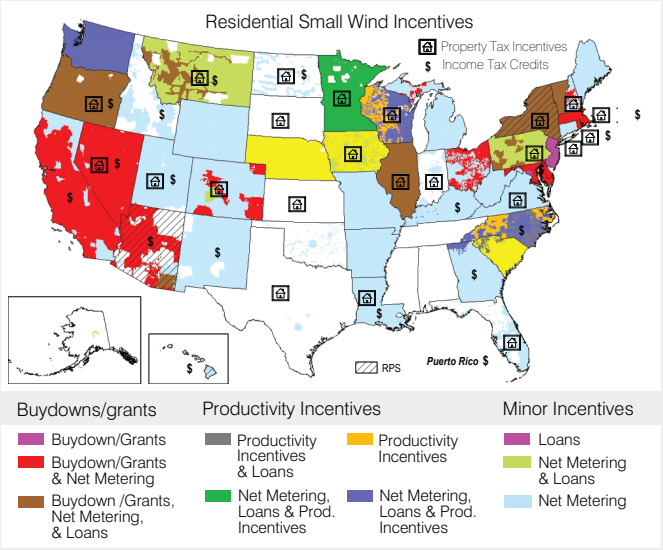
* Millions of U.S. homes connected to the utility grid
**Growth according to U.S. Census Bureau, American Housing Survey, 1998.
†Approximately 35% of these homes will have a sufficient wind resource, defined as a U.S. Department of Energy wind class of 2 or better. To meet the electrical needs of a typical U.S. home, a small wind turbine in a moderate wind regime must have a rotor diameter of 16 to 25 feet and be installed on a tower 60 to 150 feet tall. These dimensions are unsuitable for homes on small lot sizes.
†† All data in this table is taken from the AWEA Small Wind Turbine Industry Roadmap (2002).

FIGURE 5: STATE POLICIES AND INCENTIVES

May 2007



November 2008



Maps prepared by Trudy Forsyth of the National Renewable Energy Laboratory, using data from: DSIREUSA

This legislation marked the first federal incentive for the small wind industry in over 20 years and provides the industry with stable, long-term policy that has historically been out of reach for other renewables industries. Industry members value its passage as an important step toward achieving political parity with solar photovoltaics (PV) industry, small wind's market counterpart, which has enjoyed a federal ITC since 2005.

Since the federal incentive was not enacted until the end of 2008, and not expanded until early 2009, it is unlikely that it was a primary driver behind the 2008 surge in sales.

External investment. See "Investment," page 10.

Zoning/permitting. Poor or absent local permitting practices thwart an estimated 1/3 of all potential small wind turbine installations. Unnecessarily restrictive regulations, particularly height limitations, can limit a turbine's productivity, discourage customers and investment, and repel local industry-related businesses from communities. See the 2008 AWEA permitting guidebook, "In the Public Interest: How and Why to Permit for Small Wind Systems" at www.awea.org/smallwind/pdf/InThePublicInterest.pdf.

State policies and incentives. At the state, utility, and local levels, policies continue to be fragmented and constantly changing across regions and even communities, as illustrated in the maps above.

Top state, utility, and local policy goals for the industry continue to be to:

- Increase the availability and size of financial incentives,
- Streamline zoning ordinances at the local or state level,
- Standardize grid interconnection rules and procedures, and
- Implement or improve state/utility net metering policies.

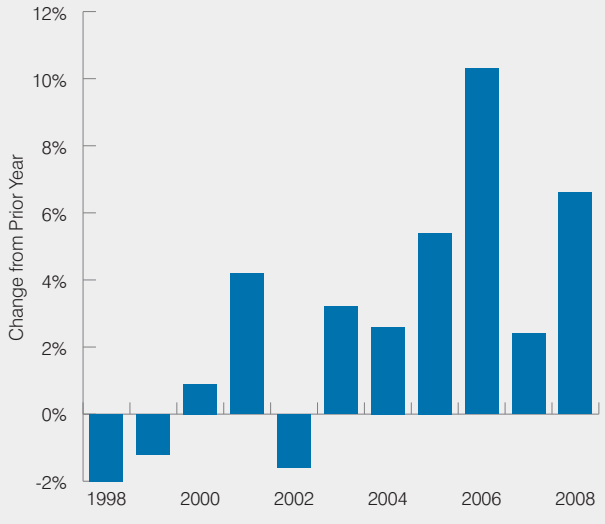
Growth not just in sales, but in the number manufacturers, dealers, installers, supply chain members, and industry advocates has led to a larger industry presence at local levels, forcing permitting issues to the fore in a greater number communities. With an estimated 25,000 different local zoning jurisdictions in the U.S.[4], however, AWEA and industry members are attempting to address permitting challenges at broader levels including at state or even federal levels of government. State and utility consumer incentive programs for renewables,

particularly solar photovoltaics, have declined in recent years due to constrained state and utility budgets and the introduction and expansion of a federal investment tax credit (ITC).[5] The same may occur for small wind, which now enjoys a federal ITC that some states see as a possible substitute for their own incentive programs. Industry sees a need for the federal and state incentives to work concurrently rather than as substitutes in order to have the desired market stimulus.

A small handful of states have chosen to reduce their incentive levels on a per-project basis in order to cut costs while assisting the same (or larger) amount of consumers. The trend is not universal, however, as other states have chosen instead to expand their incentive programs with the help of increased funds through the American Recovery and Reinvestment Act of 2009 passed in February 2009.[6]

The economic recession. Sharp drops in commodity prices in late 2008 and early 2009 have helped to lower the costs of solar photovoltaic (PV) cells considerably, which are based on the raw material polisilicon. Potential consumers have also had greater difficulty securing affordable home improvement loans since the beginning of the recession in fall of 2008, affecting the residential small-wind market. Historically, small wind has been considerably more cost-competitive than solar PV on a cost per kilowatt-hour basis, but a surge in solar investment, a head-start on federal incentives, and falling production costs will likely result in PV costs at levels more competetive with small wind.

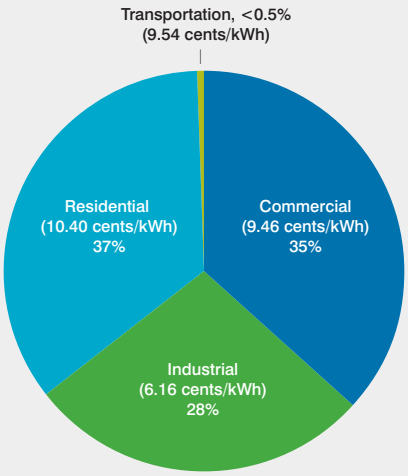
FIGURE 6: U.S. RESIDENTIAL ELECTRICITY PRICE



Source: US Department of Energy / Energy Information Administration.

FIGURE 7: % OF ELECTRICTY SALES BY SECTOR

Average Retail Price, 2006 (8.90 cents/kWh)



Source: US Department of Energy / Energy Information Administration.

Rising electricity prices. Residential electricity prices are projected to rise at annual rates of about 1.1% in 2009 and 1.8% in 2010 and will likely contribute to a boost in small-wind sales.[7] Higher prevailing rates for residential, industrial, and commercial electricity make small wind turbines more competitive with conventional electricity sources on an incremental-cost basis. Intangible benefits of small wind, such as providing a consistent and predictable supply and cost of electricity for 20-30 years, could add to its overall value to consumers.

Utility policies. Recent years have seen a slight upward trend in the quantity and quality of state/utility net metering laws and practices (see "States"), but the policy is far from standardized or universally implemented.

Grid interconnection rules and procedures will also have an increasing effect on the industry as the market continues to shift toward grid-connected systems. While balkanized and cumbersome interconnection rules and procedures rarely thwart installations completely, they often magnify installations' time, expense, and complexity. The National Fire Protection Association will likely create a section in its National Electric Code (NEC) specifically for small wind

turbines in its next revision in 2011. This will explicitly list electrical safety requirements for small wind turbines and in turn help streamline grid interconnection processes. Electrical safety has not historically presented a challenge to small wind installations under existing NEC regulations, but proponents of the advancement cite a need to establish small wind in the Code as an investment in the industry's future and as a framework for growth.

Installer and equipment certification. Programs are nearing completion to certify small wind turbine equipment and those who install them by the Small Wind Certification Council (SWCC)[8] and the North American Board of Certified Energy Practitioners (NABCEP)[9], respectively. While both programs will be voluntary, market forces are likely to institutionalize them throughout the industry. A number of states have indicated that they plan to make certification a requirement to interconnect to the electricity grid, obtain a zoning permit, and/or receive public incentive funds.

Increased public awareness. Small wind was the subject of 10% of all media inquiries at AWEA in 2008 – another record-breaking year – while still comprising less than 1% of the wind energy industry (in terms of 2008 installed capacity). Industry reports that public exposure, which has been predominantly positive, helps to highlight local policy needs and solutions, generate consumer inquiries, and present the technology as mainstream.

Federal renewable electricity standard. Legislation is expected to be considered again in 2009 that would create a nation-wide requirement for major utilities to derive a certain percentage of their generation from renewable sources by a certain date. Called a renewable electricity standard or RES, this type of policy currently exists in 28 states and over 35 countries and has created a sustained market for renewables in these areas. Depending on how the policy is structured, an RES may provide an incentive for utilities to encourage small-scale, customer-sited renewables like small wind turbines to be added to the generation mix. For more information on the RES and other legislation, see www.awea.org/legislative.

All major RES bills proposed in the recent past would allow electricity generated by distributed renewable generators, like small wind systems, to be counted as three times as valuable as electricity generated from centralized renewables. This may provide incentives for utilities to own and operate small wind systems, to encourage consumers to generate a surplus of electricity, or to buy the environmental attributes of a customer's excess generation in the form of renewable electricity credits, or RECs.

Federal climate change legislation. Congress may consider legislation in the foreseeable future that would establish a ceiling, or cap, on carbon dioxide (CO_2) emissions allowed on an economy-wide basis. Renewable energy systems like small wind turbines, which emit no CO_2, could become more cost-competitive under this law.

In order to emit greenhouse gases within the cap, entities would have to acquire pollution allowances, from the federal government, either for free or through auction. Entities that receive allowances but do not need them to offset their emissions (because they produce little or no CO_2) would then be allowed to sell their allowances to others that do need them. This system is known as "cap-and-trade."

Depending heavily on the structure (and passage) of this legislation, distributed renewable energy generation technologies like small wind systems could benefit directly and indirectly. In theory, federal auction proceeds could be used to fund consumer incentive programs, and states and utilities could receive incentives if they adopt policies that support distributed renewables.

AWEA is actively advocating for climate change legislation and that it includes provisions to help small wind. For more information see www.awea.org/legislative.

Improved resource assessment technology. Average prevailing wind speed is the second most significant factor in a turbine's rate of return on investment, behind only financial incentives (see also "Costs" in the 2008 study). Several private-sector companies have developed more advanced technologies in recent years to identify geographic regions with the greatest average wind speeds, and the US Department of Energy released a Funding Opportunity Announcement in 2008 calling for the development of a consumer-friendly "site analysis tool" to benefit distributed wind technology.[10] These new tools could help future small wind installations be more productive and offer consumers more predictability on their investment.

Plug-in hybrid electric vehicles. The American Recovery and

Reinvestment Act, passed in February 2009, authorized $14.4 billion in incentives and loans for plug-in electric hybrid vehicle (PHEV) consumers and producers.[11] President Obama also indicated in his presidential campaign his desire to have one million PHEVs and electric vehicles on US roads by 2015.[12] A growing market for this technology would transfer a degree of demand from oil to the residential electricity sector, and in turn potentially to on-site renewable electricity generators like small wind systems.

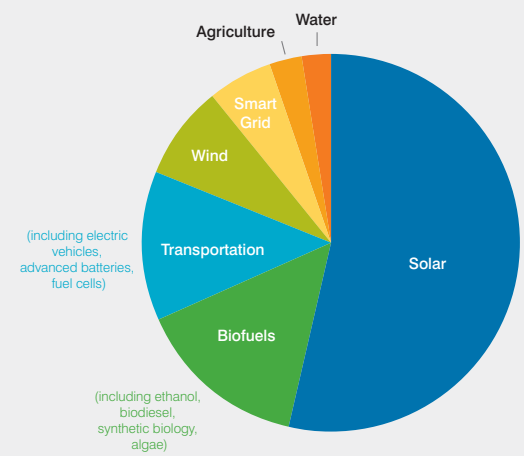
Wind-diesel hybrid systems. One quarter of turbines 50-100 kW sold in 2008 were used for wind-diesel hybrid applications in remote locations, particularly Alaska and Canada. Incentives for this application type are increasing in the US and Canada, and manufacturers in this market segment note an "unprecedented rise in demand."

INVESTMENT

The past three years have brought over $160 million in external private equity investment to over 18 manufacturers worldwide, about half of which are US manufacturers. This investment was an important driver in the industry's recent growth.

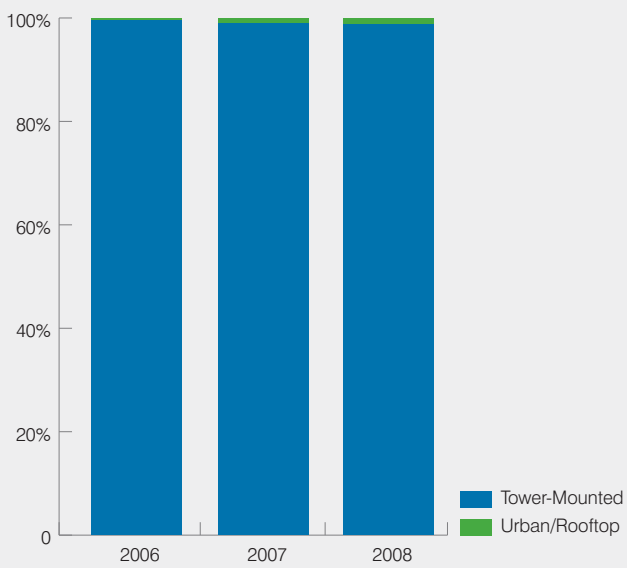
Ten percent of all venture capital in the US is invested in the clean technology sector[13] but continues to favor the solar industry, which received $1.8 billion (nearly half) of all venture funding for clean technology companies in 2008 despite a global recession and a strained credit market.[14]

FIGURE 8: TOP VENTURE CAPITAL IN 2008



Source: Cleantech Group, LLC

FIGURE 9: URBAN ROOFTOP TURBINE MARKET SHARE



JOBS

The estimated number of jobs associated with the wind energy industry, including small wind, will be released as part of a separate, comprehensive AWEA study available in late 2009 at www.awea.org.

DISPLACED CARBON DIOXIDE

A single residential-scale turbine displaces the carbon dioxide (CO_2) produced by 1.5 average cars. The 80MW of cumulative small-wind installed capacity in the US translates to:[16]

- 13,300 cars offset
- 9,200 equivalent number of homes powered
- 76,000 tons of CO_2 displaced per year

BUILDING-MOUNTED TURBINES

In 2008 approximately 200 units were sold to be used for urban or rooftop applications in the US,[17] representing less than 250kW of installed capacity. This number still represents less than 0.002% of the US small-wind market, but a slight increase over the approximately 100 units sold in 2007.

At least 10 US companies manufacture or plan to manufacture building-mounted models, a high proportion of which are of vertical-axis configuration.

Manufacturing

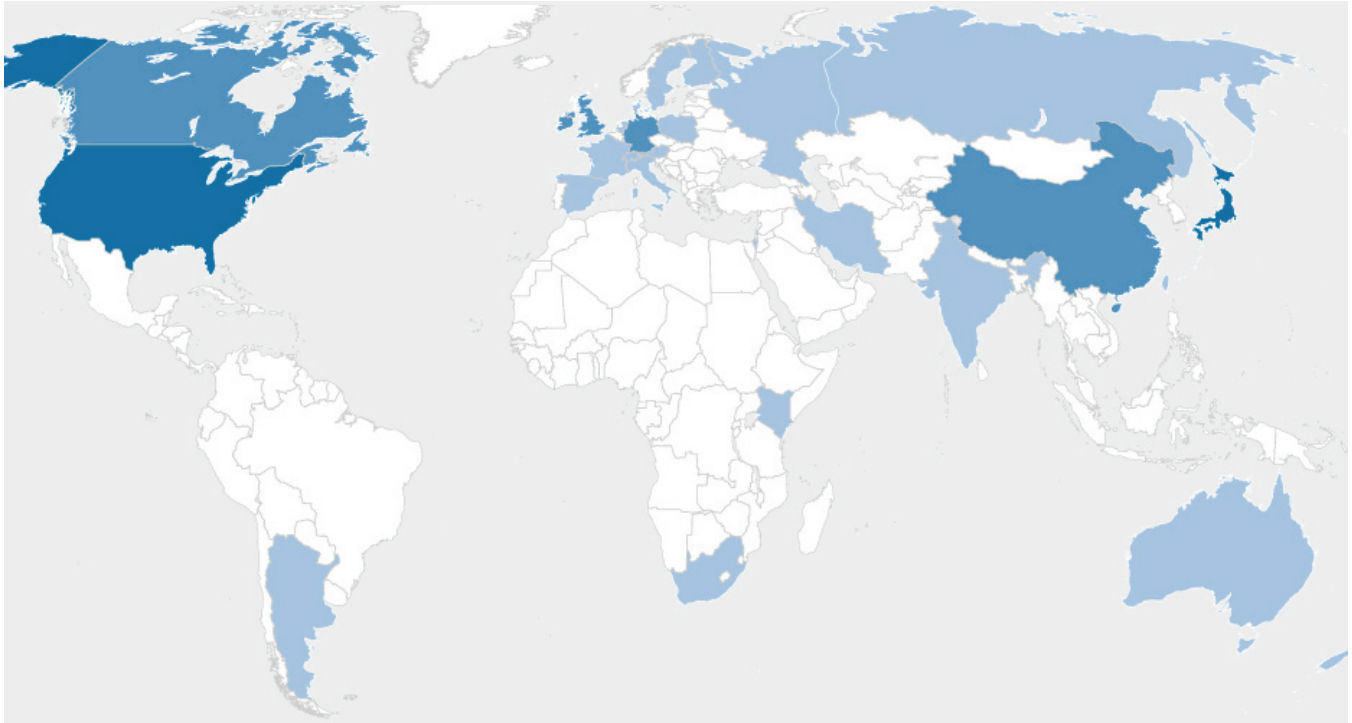
MANUFACTURER PROFILE

At least 219 companies manufacture, or plan to manufacture, small wind turbines in the world. Of these:

- Seventy-four (34%) are based in the United States.
- At least 36 (14 US) have begun sales.
- At least 45 (21 US) manufacturer or plan to manufacture vertical-axis systems.[18]
- A minimum of five manufacturers (two US) began sales in 2008.

Company	Country	kW Sold in 2008
Southwest Windpower	US (AZ)	10,000
Proven Energy Ltd.	UK (Scotland)	4,800
Northern Power	US (VT)	4,300
Entegrity Wind Systems	Canada (PE) / US (CO)	3,500
Bergey WindPower Co.	US (OK)	1,700

FIGURE 10: GLOBAL DISTRIBUTION OF MANUFACTURERS



Country (Number of Manufacturers)			
US (66)	Sweden (5)	Israel (2)	Iran (1)
Japan (28)	South Africa (4)	Italy (2)	Kenya (1)
Canada (23)	Spain (4)	Russia (2)	Poland (1)
UK (18)	India (3)	Argentina (1)	New Zealand (1)
Germany (16)	Taiwan (3)	Australia (1)	Switzerland (1)
China (14)	Finland (2)	Austria (1)	
Netherlands (7)	France (2)	Denmark (1)	

MANUFACTURING TRENDS

Manufacturing techniques hold a key to higher production volumes and lower costs. In the fall of 2008 the US Department of Energy held two workshops for stakeholders to develop a research and development action plan for the wind energy industry, including the small wind turbine sector. Stakeholders identified the following manufacturing needs from a research and development perspective, with an overarching focus of lowering a turbine's cost of energy:

Efficiency

- Blades: Improve efficiencies from approximately 32% to 42-45%
- Alternators: Improve efficiencies from 65-80% to 90-92%
- Inverters: Inverters offer less room for improvement, as most are over 90% efficient. Most inverters used in small wind turbines are adopted from those used in the solar photovoltaic industry, which has focused heavily on improving inverter efficiencies over past decades.

Design

- Continue to increase swept area[19] to capture more energy while minimizing design loads. This also may include the use of new composite materials and molding processes.
- Reduce the number of components in a system.
- Research reliability issues pertaining to lightning, corrosion, bearing lubrication, alternator winding insulation, and electronics.
- Focus on "design for manufacturing" techniques.
- Reduce the overall use of materials in terms of pounds per Watt.
- Minimize the use of moving parts and mechanical furling systems.
- Improve turbine performance in low-wind conditions.
- Consider incorporating more technology from utility-scale turbines such as gearboxes, mechanical breaks, upwind rotor designs, active yaw control, stall rotor-control, and variable-pitch blades, into commercial-scale (21-100kW) designs.

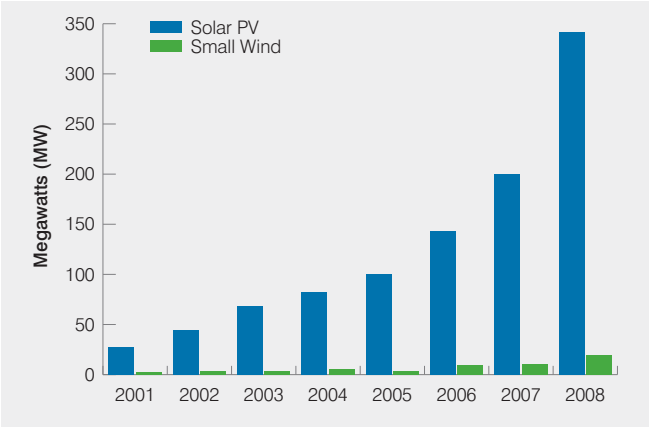
Other

- Adopt advanced tower material designs to reduce installation time and cost.
- Develop processes and tools that can more accurately predict a turbine's energy production at a given site.
- Establish robust and well-trained installer/dealer networks.
- Develop advanced tower foundations to decrease installation time.
- Develop wireless and Web-based turbine performance monitoring capabilities to minimize the frequency of site inspections.
- Continue to develop and support performance standards, certification, and third-party equipment testing sites.

The development of batteries and other forms of electricity storage were determined not to be an industry priority or focus. Market momentum is tilted heavily toward grid-tied turbines which essentially use the electricity grid as a means of "storage" and do not incorporate batteries.[20]

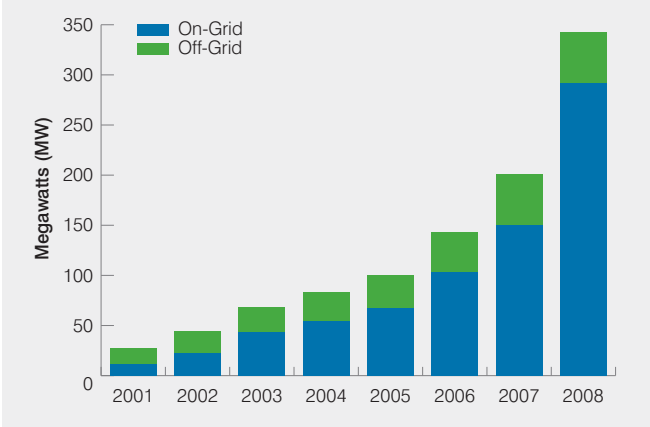
Comparison to Solar Photovoltaics

FIGURE 11 : NEW SMALL WIND VS. SOLAR PV



PV data source: Larry Sherwood; SEIA[24]

FIGURE 12: U.S. SOLAR PV GROWTH



See the 2008 AWEA market study for other trends and comparisons.

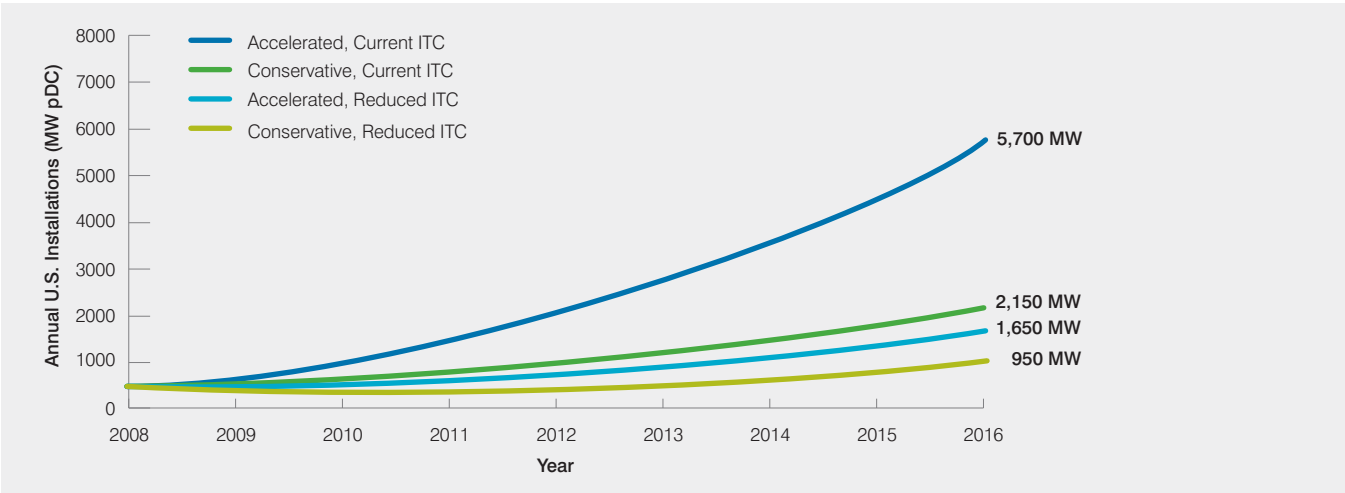
GROWTH

In as little as three years the US small wind turbine industry could match the 2007 record growth of the solar photovoltaic (PV) industry in terms of annual installed capacity.

An uncapped, eight-year 30% federal investment tax credit (ITC) is now available for both solar PV and small wind, and for both commercial and residential applications.[21] The federal government now provides nearly identical incentives for the two industries, except that the solar tax credit can be used by utilities.

The US market saw 292 MW of grid-tied solar PV capacity added in 2008 for a cumulative 792 MW. Cheaper raw materials and improved manufacturing processes are lowering prices for PV cells and panels, leading many companies to predict that solar power could become cost competitive with natural gas-fueled electricity as early as 2011.[22]

FIGURE 13 : U.S. INSTALLATION FORECASTS 2008-2016 FOR SOLAR PHOTOVOLTAICS



Source: Navigant Consulting

COSTS

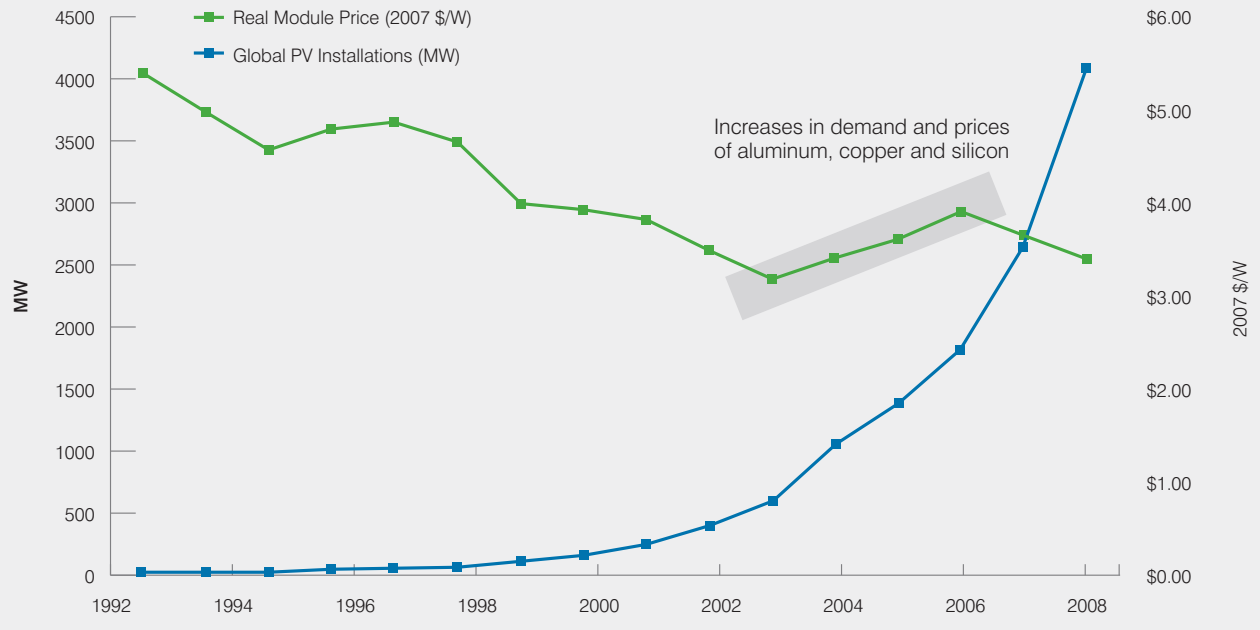
High prices of silicon-based modules in 2007 and early 2008 led to increased manufacturing investment that enabled higher production volumes. But by late 2008 falling prices of the key commodities of copper, aluminum, and especially silicon (from a decreased global demand for semiconductor-based consumer electronics) resulted in steep cost reductions for solar PV production, a projected supply surplus, and much lower consumer prices forecasted for 2009.[25]

Small wind systems are approximately 90% steel and incorporate a significant amount of copper in their generators and wiring, and are thus similarly susceptible to fluctuating commodity prices. Steel prices nearly doubled in 2008 but have dropped sharply back to near-2007 levels as of early 2009. Copper prices also dropped sharply to 2005 levels in late 2008 and early 2009, likely due to the global recession beginning that period.[26]

A Lawrence Berkeley National Laboratory study[27] reports that state incentives helped push the installed cost of solar power in the US down 28 percent between 1998 and 2007 and that costs for residential PV declined from $10.50/Watt in 1998 to $7.60/Watt in 2007. Factoring in average state/utility and federal incentives, this average price drops to $5.10/Watt. Commercial PV averaged a post-incentive $3.80/Watt in 2007, a 32% drop since 2001, largely due to the uncapped ITC the commercial PV sector has enjoyed since the Energy Policy Act of 2005.

Prices for small wind continue to be widely scattered due to the numerous factors affecting installation costs (see "Costs" in the 2008 study), but tend to gravitate between $3-6/Watt. Small wind turbine installations are far more construction-intensive than solar PV, which after its manufacture is largely an electrical project. Expanding the federal ITC to small wind will likely allow economies of scale to take effect and put downward pressure on installed small-turbine costs.

FIGURE 14: REAL MODULE PRICES AND ANNUAL GLOBAL PV INSTALLATIONS 1993-2008



Source: Navigant Consulting [23]

The Global Market

THE US POSITION

According to a 2008 AWEA survey, US manufacturers accounted for 49% of global small wind sales in 2008, maintaining their historically dominant position.[28]

Exports accounted for approximately 28% of US manufacturers' sales (measured in capacity), a decrease from 33% in 2007. An overwhelming majority (94%) of units sold in the US in 2008 were produced by US manufacturers, though this is a slight decrease from 98% in 2007. These trends may signify a growing attractiveness of the US market.

US state and government incentives have begun to catch up with those of other major turbine-producing countries. Particularly with an uncapped ITC, the US appears prepared to retain and improve its market share in the global industry.

FIGURE 15: U.S. GLOBAL MARKET SHARE (kW)

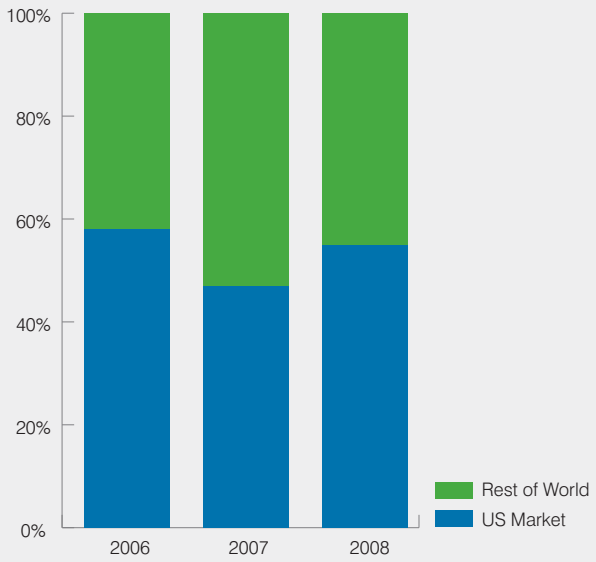


FIGURE 16: U.S. MANUFACTURERS' EXPORTS (kW)

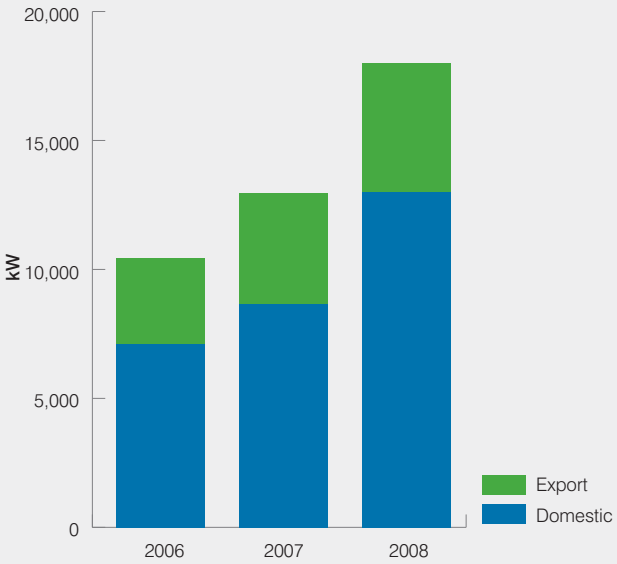
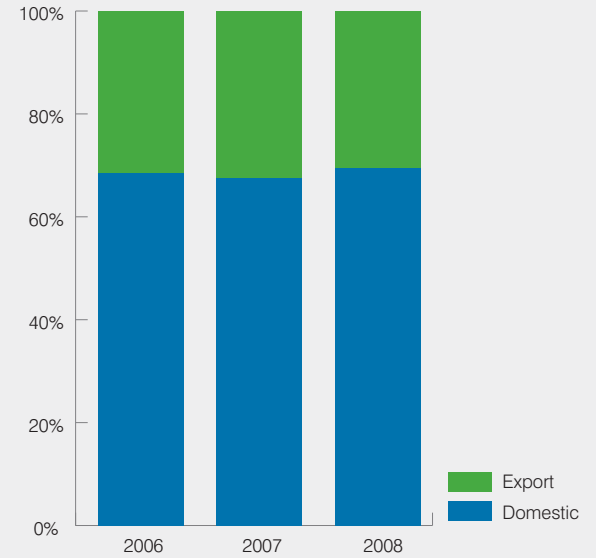


FIGURE 17: U.S. MANUFACTURERS' EXPORTS AS A PERCENTAGE OF SALES (kW)



FEED-IN TARIFFS

A growing global trend to implement feed-in tariffs (FITs), a type of production-based financial incentive for small, on-site renewable generators, has largely escaped the US policy arena to date.[29] A number of US states[30] have introduced legislation that would create a version of the FIT, but mostly for solar PV technology, and as of March 2009 none has been enacted into law specifically to benefit small wind systems.

Table 2: Feed-In Tariffs

Countries with Feed-In Tariffs	
Australia	Italy
Austria	Japan
Canada	New Zealand
China	The Netherlands
Czech Republic	Portugal
Great Britain	South Africa
France	Spain
Germany	Switzerland*
Greece	Turkey
Ireland*	Ukraine
Israel*	USA

* Specifically benefits small wind technology.

Source: Paul Gipe, www.wind-works.org/articles/feed_laws.html

UNITED KINGDOM

For information about the small wind market in the United Kingdom, see the British Wind Energy Association's annual market report at www.bwea.com/small/index.html.

CANADA

Most Canadian provinces now offer some form of a net metering policy, but all provinces but one – Saskatchewan – lack financial incentives for small-wind consumers. The Canadian Wind Energy Association (CanWEA) plans to address this need by hiring a full-time Small Wind Advocate in 2009 to work to secure federal and provincial incentives for small wind.

Given the right incentive climate, CanWEA estimates that 30% annual growth is possible in the Canadian market, particularly in the commercial, wind-diesel hybrid, and remote/off-grid community segments.

Responding Manufacturers

Every one of the 219 identified world small wind turbine manufacturers was solicited for the 2008 AWEA small wind manufacturing survey (see also "Methodology"). Of these, 44 responded and 36 had commenced production and sales by the end of 2008.

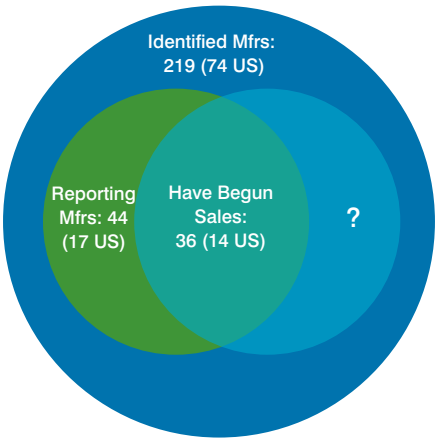


Table 3: Respondents to the 2009 AWEA Small-Wind Manufacturer Survey

Manufacturer	Primary Location
Southwest Windpower†	US - AZ
Bergey WindPower†	US - OK
Wind Turbine Industries Corp.†	US - MN
Energy Maintenance Service†	US - SD
AeroVironment†	US - CA
Abundant Renewable Energy†	US - OR
Earth Turbines†	US - VT
Northern Power†	US - VT
Mariah Power†	US - NV
Aerotecture International, Inc. †	US - IL
Endurance Wind Power, Inc. †	US - UT
Everfair Enterprises	US - FL
Marquiss Wind Power*†	US - CA
Ventera†	US - MN
Viryd Technologies, Inc. †	US - CA
Green Energy Technologies†	US - OH
Windation Energy Systems	US - CA
Eoltec	France
Iskra	UK
Gaia-Wind†	UK
Gazelle Wind Turbines	UK
Renewable Devices†	UK

Manufacturer	Primary Location
Proven Energy, Ltd. †	UK
Ampair Microwind	UK
FuturEnergy	UK
Gual Industrie	France/Spain
Windeco	Spain
Aeromax	Canada
True North Power Systems	Canada
CleanField Energy†	Canada
Entegrity Wind Systems†	Canada
Windterra†	Canada
REDriven, Inc. †	Canada
Quantum Wind	Canada
Laydon Composites, Ltd.	Canada
Wind Simplicity	Canada
Aerocatcher	Germany
Windmission	Denmark
Wind Energy Solutions†	Canada/Netherlands
Unitron	India
Kestrel Wind Turbines	South Africa
Hannevind	Sweden
Aventa, Ltd.	Switzerland
Coriolis Wind*	Israel

* = No longer in production as of 3/2009

† = AWEA member as of 3/2009

Methodology

All sales data reported in this study was obtained directly from manufacturers through telephone interviews, e-mail contact, or both. Responses were compared to previous years' sales as reported in 2007 and 2008 surveys.

For purposes of estimating installed capacity, this study assumes that each turbine sold was also installed and that the installation occurred within the same calendar year as the sale. However, depending on the manufacturer's sales cycle, a turbine's physical installation may occur after the calendar year in which it is sold.

Sales in dollar amounts are based on average turnkey installed system cost, which includes equipment, wiring, and installation. This is done to reflect the economic impact of the industry more completely than by reporting the cost of only the turbine and tower, uninstalled. The cost for a given installation can vary considerably given any number of factors (see page 9 of the 2008 AWEA Small Wind Turbine Global Market Study).

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Endnotes

1 (Installed/Rated/Nameplate) Capacity: The instantaneous rate of electricity generation at a given wind speed. "Capacity" is commonly used to compare sizes of electricity generators of various types, including wind turbines. Capacity does not indicate the amount of electricity a turbine produces over time.

Kilowatt (kW): A measure of a rate of electricity production (or consumption). A wind turbine's "size" (its production capacity) is typically measured in kilowatts and represents the rate at which the turbine can produce electricity at a given wind speed.

For more information on small wind turbine technology, see www.awea.org/smallwind.

2 A PPA is contract between a consumer and a company that owns and operates an energy generator. The PPA establishes a price and time period for which the generator owner/operator will sell electricity to the consumer. This arrangement provides the consumer a predictable, assured electricity price over an extended period of time; freedom from risks and responsibilities associated with equipment ownership; and the ability to use renewable energy without a large up-front capital investment. The PPA provides the generator owner/operator predictable cash flow on their investment and certain tax advantages.

3 For more information on permitting, see "In the Public Interest: How and Why to Permit for Small Wind Systems." AWEA, 2008. www.awea.org/smallwind

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6 Specifically, the Massachusetts Technology Collaborative, Connecticut Clean Energy Fund, Xcel Energy in Colorado, and the New Jersey Board of Public Utilities.

7 Energy Information Administration

8 See www.smallturbinecertification.org

9 See www.nabcep.org/certification/future-certifications/small-wind

10 See Topic Area 2C at https://e-center.doe.gov/iips/faopor.nsf/UNID/C53C9A2E58F125848525753000066191/$file/FINAL_FOA_PMC113_1-FOA-Grants_Gov_with_M005.pdf

11 See www.pluginamerica.org

12 "Barak Obama and Joe Biden: New Energy fo America." August 3, 2008. www.barackobama.com/pdf/factsheet_energy_speech_080308.pdf

13 Nathanial Gronewold . "Solar industry braces for heated global competition." Greenwire, February 20, 2009.

14 "Clean Tech Still Sizzles as Venture Investments Cool" by Clair Cain Miller. New York Times, January 26, 2009. http://bits.blogs.nytimes.com/2009/01/26/clean-tech-still-sizzles-as-venture-investments-cool/

15 A well-sited 10kW turbine generates about 1,090 kWh/month in 12mph average winds. In the turbine's expected lifetime of 20 years it can displace approximately 340,000 lbs. of CO2. Each kilowatt-hour (kWh) of electricity produced in the US results in 1.55 lbs. of CO2 emitted into the atmosphere, on average, reflecting the current US electricity production mix. Source: US Department of Energy. The US Environmental Protection Agency estimated in 2000 that the average passenger car emits 11,450 lbs. of CO2 per year. Average annual home energy use in the US is 10,565 kWh.

16 See the Bibliography for more information on urban/rooftop installations. The British Wind Energy Association also tracks the number of building-mounted small wind systems installed in the United Kingdom in its annual small wind systems market report. See www.bwea.com/pdf/small/

17 See www.awea.org/faq/vawt.html for more information on vertical-axis turbines or "VAWTs."BWEA_SWS_UK_Market_Report_2008.pdf.

18 "Swept area" is the surface area of a turbine rotor, $A = \Pi R^2$, where R is the radius of the rotor (i.e., the length of one blade).

19 For more information about grid interconnection, see www.awea.org/smallwind/toolbox2/grid_connecting.html

20 As defined in Internal Revenue Code sections 48 and 25D, respectively. See www.awea.org/legislative for more information on the tax credit and other legislation.

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25 See www.infomine.com and www.meps.co.uk.

26 Ryan Wiser, Galen Barbose, and Carla Peterman. "Tracking the Sun: The Installed Cost of Photovoltaics in the U.S. from 1998-2007." Lawrence Berkeley National Laboratory report LBNL-1516E, February 2009. http://eetd.lbl.gov/ea/emp/reports/lbnl-1516e.pdf

27 The estimated US global market share may be somewhat inflated because only 26 of 145 identified foreign manufacturers responded to the AWEA market survey. However, these 26 manufacturers are believed to represent the bulk of the foreign market. Confidence in market share trends over the past three years is relatively high because generally the same set of manufacturers responds to the AWEA survey.

28 A FIT for small, distributed generation works somewhat like the reverse of a Renewable Electricity Standard in that it establishes a set price at which a utility purchases electricity from a renewable generator, such as a small wind system, and lets market forces adjust the amount of energy produced (supply) and demand accordingly. Unlike up-front rebates and tax credits, this policy is based on output (cents/kWh) rather than turbine size (kW), and therefore rewards performance. And unlike net metering, all electricity generated – not just the excess – is sent into the grid and awarded payment from the utility at a price above regular retail electricity rates.

29 See www.wind-works.org/FeedLaws/USA/USAList.html#USA

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