WIND DIRECTIONS

THE EUROPEAN
WIND INDUSTRY
MAGAZINE

September 2010
Volume 29/Nº 4

EWEA
THE EUROPEAN WIND ENERGY ASSOCIATION





INTERVIEW

MÁIRE GEOGHEGAN-QUINN
EU Research Commissioner

Helping the powerless

Small wind turbines and what they can do

Small wind's steady climb

Still in its infancy, small wind power is now beginning to come on strong, providing energy far and wide

By Chris Rose



Photo: Bornay_jacuque

Small wind has got off the ground in Venezuela


Photo: Sandy Lake PA, Southwest Windpower

Depending on the wind resource, the Skystream turbine generates between 30-80% of the power required by a typical home

Considered an alternative technology two decades ago, industrial-scale wind power is now a mainstream power source, at the forefront of an ambitious new green energy economy that many experts say is needed if humankind is to survive unscathed the nascent 21st century.

Part of this phenomenal energy metamorphosis is the expanding market for small wind facilities that, according to the American Wind Energy Association (AWEA), increased globally by 10% last year and 15% in the US.

Described as those with rated capacities of 100 kW or less, small wind systems are usually used to power homes, farms and small businesses in rural and isolated areas.

AWEA's annual Small Wind Turbine Global Market Study indicated the US continues to remain the market leader for small wind, adding new installed wind power capacity of 20.3 MW in 2009, almost equal to half of the capacity installed in the world (42.5 MW) the same year.

The study notes that, despite the ongoing financial crisis and the economic downturn, 9,800 small wind turbines were sold in the US in 2009 and 21,000 were sold around the world. More than $82 million (€63 mn) was invested in the US small wind market last year while $189 million (€146 mn) was invested globally. Last year also saw US small wind power capacity reaching 100 MW, 75% from systems whose capacity is lower than 10 kW.

Half of this 100 MW milestone capacity came within the past three years, the study noted. "Manufacturers attribute this growth to a mixture of new and improved federal and state incentives, optimistic private equity investors, and sustained consumer demand," the study says.

"People wanting power for their home or business don't really care about the difference between large wind and small wind."

On the brink

Ron Stimmel, manager of legislative affairs and small systems for AWEA and the author of the study, said he is confident the small wind industry is destined for continued growth.

"A lot of things are coming together," Stimmel said, adding demand, investment, government incentives and environmental factors are driving growth. "I do have a lot of confidence [in small wind]. We're on the cusp but I see a lot of promise."

Stimmel said it is extremely difficult to get accurate totals about the industry: the study notes only 40 out of 253 identified small wind companies responded to the AWEA survey.

But he says that, based on hard data accumulated for the past four years alone, sales indicate the global small wind sector, excluding US totals, now represents a minimum of an additional 60 MW.

Noting that very few small wind manufacturers in Asia responded to the annual market survey, the study also forecasts the potential for growth — especially in China, Japan and India — as being huge.

Having said that, the study noted an estimated 100,000 small wind turbines are now installed in the world. Approximately two-thirds of all small wind systems sold globally in 2009 were made by US manufacturers.

About 250 companies around the globe manufacture or plan to manufacture small wind turbines, the study said, adding 99% have fewer than 100 employees. More than one-third of those companies are based in the US.

Talking numbers

The five largest small wind manufacturers last year in terms of kW sold world-wide were, according to the study, Southwest Windpower of Arizona, Northern Power Systems of Vermont, Proven Energy of Scotland, Wind Energy Solutions of the Netherlands and Bergey WindPower Co. of Oklahoma.

The UK and Canada are the largest identified markets for small wind after the US, according to the study.

The study notes the world's leading 15 manufacturers continue to predict exponential sales growth in the US market over the next five years, with projections of over 1 GW (1,000 MW) of cumulative installed small wind capacity in the United States by 2015.


Photo: Southwest Windpower

The small wind industry is an important source of employment



Photo: Northern Power

Every part of the turbines is inspected in the factory

"The economic recession led these manufacturers to pare down their growth projections somewhat from last year's report, but they remain optimistic about achieving their target," the study says.

Without diminishing the efforts of small wind facilities and the important role they play, especially in isolated areas with no access to electricity supplied along a grid, it should be noted that compared to industrial-scale wind power the sector is … well… still very small.

Consider: the Global Wind Energy (GWEC) reported by the end of 2009 there was a total of 158.5 GW of industrial-scale wind power capacity installed around the globe. The more than 38 GW of new global wind power capacity installed last year represented a staggering 41.5% increase over 2008.

Asia, North America and Europe each installed more than 10 GW of new capacity in 2009. By the end of the year, Europe had more than 76 GW of total installed capacity.

The GWEC report also noted the 2009 market for turbine installations was worth about €45 bn and the global wind industry now employs about 500,000 people.

Filling a hole

It is important, however, to realise that the small wind sector also continues to expand, if not in a similarly successful bombastic trajectory compared to industrial-scale wind energy, but in a quiet manner that provides desperately-needed green electricity along the way.

After all, people wanting power for their home or business don't really care about the difference between large wind and small wind; they just want to turn on a switch and have power immediately.

And, increasingly, that's just what small wind does in a world where at least one-quarter of the global population lives without electricity. (The International Energy Agency estimates 1.6 billion people are currently without electricity, while Greenpeace suggests it is more than two billion.)

Small wind definitely has a role to play in rural areas of developing countries where electrification is limited, according to EWEA's Head of Policy Analysis.

"It is positive for having access to electricity in more remote areas," Glória Rodrigues said, adding that small wind is, in terms of minimising pollution and environmental degradation, preferable to using diesel-powered generators. (For the story of how small wind energy has brought electricity to an isolated community in Nicaragua for the very first time, see p.35.)

Rodrigues also noted that small wind helps to create jobs, diversify and enrich the economy and promote regional development.

Small and very small wind turbines are emerging to meet several distinct needs, according to 'Wind Energy — The Facts', the seminal text on wind power.

The second edition of 'Wind Energy — The Facts' (WETF), published in 2009, noted that small wind power works in rural electrification projects and provides power to isolated homes, boats and telecommunication facilities. Additionally, the book said, the prospects for significant demand for "micro-generation" in urban areas is prompting technical developments in small wind design which could result in significant improvements in the economics.

"Furthermore, increasing fuel costs are encouraging developments in the technically demanding field of high-penetration wind-diesel systems," the book added.

The two main areas small wind turbines are used are in autonomous electrical systems and in distributed generation.

Also called "stand-alone," "grid-isolated," and "off-grid," autonomous systems are not connected to any larger electrical system and therefore as solely responsible for the control of voltage and frequency, WETF said.

Distributed generation occurs, meanwhile, in systems with small generators connected to a larger distribution network where a network operator is responsible for overall control. WETF notes this is often called "grid-connected" or "on-grid" connection.

"Despite the attention given to multi-megawatt wind farms, the markets for autonomous electrical systems and distributed generation using small wind turbines can be attractive if prices of conventional electricity or fossil fuels are sufficiently high, or in many developing countries, where hundreds of millions of people live without access to electricity," the book said.



A small turbine whizzes round in Venezuela

Photo: Bornay

The path to maturity

It pointed out, however, that despite the maturity reached in the development of large- and medium-sized technology for industrial-scale wind farms, at the moment, small wind turbines are far from technologically mature and economically competitive.

"Average costs for current stand-alone wind turbines vary from €2,500 to €6,000 per installed kW, while in distributed generation, a small wind turbine can vary from €2,700 to €8,000 per installed kW," WETF said."Both these figures contrast with the costs of large wind turbines, which are in the region of €1,500/kW."

Small wind turbines have great potential, the book says, but design and engineering challenges, as well as common standards, need to be addressed to produce reliable machines.

Generally speaking, in terms of isolated applications, three categories of small wind turbines exist — very small systems, hybrid systems and wind-diesel systems.

Very small systems, the book notes, usually have a generating capacity smaller than 1 kW and include mobile applications such as boats and caravans, and wind home systems used in rural electrification. Hybrid systems, which usually have a capacity of less than 50 kW, refer to applications using wind power and other generation sources such as photo-voltaic. Wind-diesel systems are typically used in larger isolated applications greater than 50 kW.

In terms of grid-connected systems, especially in areas like Europe which already have an extensive electrical grid, there is some potential for small wind applications. "The high concentration of population in urban areas provides a great opportunity for on-site distributed generation from wind power by installing small wind turbines on rooftops, even though the roughness of the urban environment can mean a reduced and more turbulent wind flow," the book says. With regard to future R&D needs, the book said all components of small wind turbines — including blades, generators, regulation systems and power converters — could be improved. The book also said new designs to integrate small wind systems into an urban environment should be efficient, pleasing to the eye, robust and extremely quiet.



The global market for small turbines went up by 10% in 2009

Small wind in the news

Just as a myriad of stories on the internet reveal an astonishing interest in large-scale wind energy, small wind facilities are also generating a lot of buzz. The influential US publication Time magazine recently published a story on small wind facilities that suggested the sector's future is robust.

"We see a time when there are six million to eight million small turbines at work in a world where people want to do something about the environment they live in," Time quoted Alexander Ellis III, a partner at RockPort Capital, a Boston-based venture-capital fund that's backing Southwest Windpower. "We believe there's a huge opportunity out there."

Another recent story, this time in the Kansas City Star, suggested small wind turbines will someday dot backyards across the US Midwest if Abigail Stutzman, an elementary school student, has anything to say about it.

"We're on the cusp but I see a lot of promise."

The Star quoted Stutzman, inspired by her school's recent installation of a turbine, as saying, "When I grow up, I want to live off the grid."

Yet another example of small wind power going global was reported recently in the Philippine Daily Inquirer which published a story saying more than 5,000 rural villages may gain access to energy after the Asian Development Bank completes the installation of small wind power systems in the Philippines, Nepal and Mongolia.



The calm factory exterior belies all the work going on within



Ongoing movement on the busy factory floor

Zooming in

Juande Bornay is the sales manager of Bornay, a Spanish small wind turbine company his father founded in 1970.

He said Bornay has five models available with a power capacity of 0.6, 0.8, 1.5, 3 and 6 kW. Prices vary with the 1.5 kW machine costing about €4,000 and the 6 kW turbine costing €9,000.

The company uses its four decades of experience to blend technology, innovation, serial production, and made-to-measure project solutions, he said, combining diverse clean sources for self-sufficiency to supply electricity and contribute to distributed generation.

He said there is increased interest in small wind turbines in Europe and around the world through grid-connection and distributed generation applications.

All of this extra attention is producing hundreds of products associated with the small wind turbine sector, he said, and new companies are appearing all the time in expectation of capturing some of the growing market.

Bornay said there is a big difference between small wind turbines and large wind turbines, with the only similarity being the name.

"Big wind turbines are designed to work in windy places where the wind resource is present and working always with the grid presence," he said. "Small wind turbines are normally bought by private users and placed where the energy is needed in places that normally do not have wind resource data."

He said one of the main obstacles to small wind turbines becoming even more popular is that in some countries the requirements to install a turbine are the same for a large 1 MW machine as they are for a 3 kW system, which is a bureaucratic nightmare that drives costs up every step of the way.

"The potential is to grow by leaps and bounds."

Another obstacle in many nations is the lack of a feed-in-tariff, he said, which reduces the economic viability of small wind turbines.

Bornay said the company, which has 18 employees and is located near Alicante, has so far installed about 5,000 small wind turbines in 45 countries.

He also said he believes small wind power has an exciting future.

"We have to do a lot of work yet but the future is very interesting," he noted.

Southwest Windpower, the world's leading small wind system company, has been in business since 1987 and is located in Flagstaff, Arizona. The company, which has about 90 employees, has had more than 160,000 small wind systems placed in at least 88 countries, marketing manager Miriam Robbins said in an interview.

Robbins said Southwest produces a variety of small turbines, ranging in size from 0.4kW, which costs about €700, to a 3.7kW grid-connected system that retails at approximately €11,600. Asked how the company became so successful, Robbins said the co-founders had an international vision for the company from the very beginning and worked hard to get Southwest products exported. She said the company also created partnerships to improve the technology.

"There's a lot of potential out there considering the world's energy needs," Robbins said. She added, however, if the small wind sector is to experience even greater growth it will have to continue educating people, companies and governments in the developing world about the sector's benefits while also lobbying to streamline permitting issues in developed nations.

Acknowledging that the sector does have to deal with a lack of certification and some technological unreliability, Robbins noted that such problems are to be expected in a rapidly growing industry.

She said she is confident that overall the small wind sector will continue to experience global growth and success.

"It has the same potential as solar world-wide," Robbins said. "The potential is to grow by leaps and bounds."

She added that Southwest now has a sales and distribution centre in Cologne, Germany to launch its grid-connected system in Europe and just appointed a managing director for the European market. ■