



Kingspan



Superwind



WWEA

World Wind Energy Association



envergate



eocycle



Endurance



Bergey

Presented by:



2016 | SMALL WIND summary | WORLD REPORT



THE 15th World Wind Energy Conference and Exhibition **WWEC2016 TOKYO**

31 October – 1 November, Technical Tour on 2 November 2016

wwec2016tokyo.com

Published by:



World Wind Energy Association

WWEA Head Office
Charles-de-Gaulle-Str. 5
53113 Bonn, Germany
Tel. +49 (228) 369 4080
www.wwindea.org

Presented by:



New Energy Husum

www.new-energy.de

Authors: Jean-Daniel Pitteloud and Stefan Gsänger

Design: Jean-Daniel Pitteloud

Data source: WWEA's Member Survey

© WWEA March 2016

Applications for permissions to reproduce or translate all or part of this publication should be made to: WWEA, Bonn, Germany

Small Wind World Market stabilizes after a difficult 2013

The world market for small wind has stabilized after the fall in 2013 both in terms of units and capacity installed. The two biggest markets, China and USA, have seen a similar growth in terms of new units as in 2013, 10% and 1% respectively. The highest growth was seen in the UK with a 19% growth in terms of units compared with only 2% in 2013. As of the end of 2014, a cumulative total of at least 945'000 small wind turbines were installed all over the world. This is an increase of 8,3% (7,4% in 2013) compared with the previous year, when 872'000 units were registered.

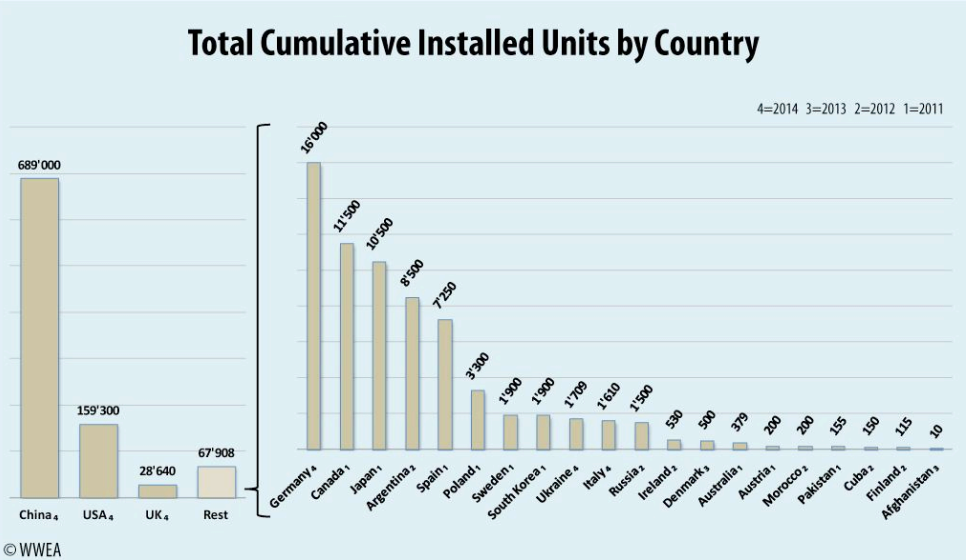


The numbers presented here are based on available figures and even exclude major markets such as India. WWEA therefore estimates an actual total number of more than one million units to be installed worldwide.

China continues to lead by far the market in terms of installed units. 64'000 units were added in 2014, 9'000 more than in 2013, reaching 689'000 units installed by the end of 2014. The Chinese market represents 72% of the world market in terms of total installed units. According to estimations, around half of the turbines continue to produce electricity in China given that this market started already in the early 1980s.

In the USA, the number of units installed in a year fell to 1'600 units in 2014, down after 2'700 units in 2013. With a total cumulative units installed of 159'300, USA is the second largest market, clearly behind China, but well ahead of a number of medium-sized small wind markets.

The small wind market in the UK saw an increase in the number of installations in 2014 despite the unfortunate changes in the Feed-In scheme introduced in the UK in November 2012. 2'237 SWTs were installed in 2014, a substantial increase compared with only 500 units installed during 2013, but still far from the numbers reached in 2012. An interesting fact is that for every turbine installed in the UK, one is also exported overseas, 2'614 units were exported to markets like continental Europe, the USA, and Asia¹.

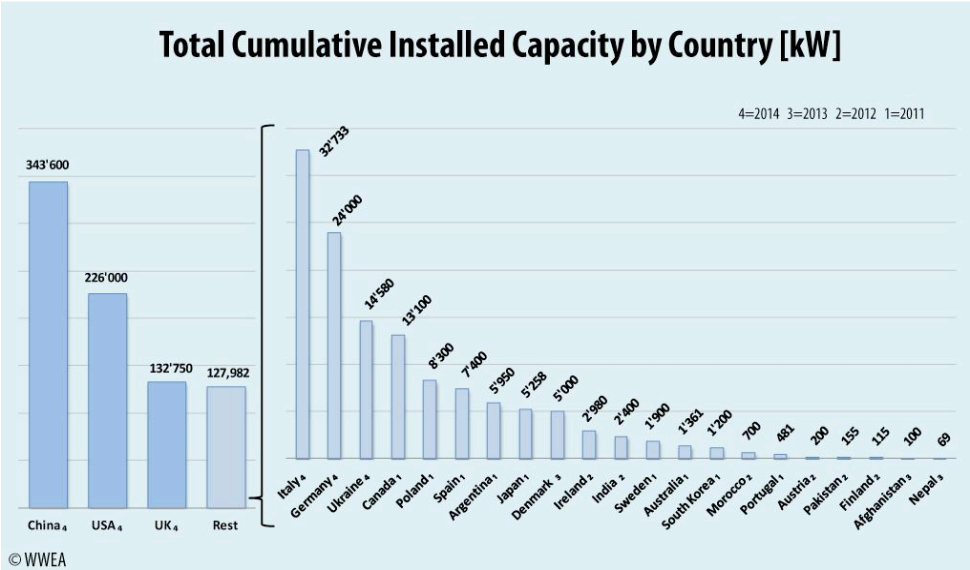


The booming market of the recent years, Italy, grew by 71% reaching 1'610 units by the end of 2014. Germany, Canada, Japan and Argentina are all medium-sized markets with total number of small wind turbines between 8'500 and 16'000 units.

¹ 2015, Small and Medium Wind UK Market Report, RenewableUK

Strong recovery in Global Small Wind Capacity

The recorded small wind capacity installed worldwide has reached more than 830 MW as of the end of 2014. This represents a growth of 10,9% compared with 2013, when 749MW were registered. The previous year's growth rates, 10,4% in 2013 and 16,1% in 2012, demonstrate a strong recovery of the world market for SWT.



In terms of installed capacity, China accounts for 41% of the global capacity, the USA for 30% and UK for 15%.

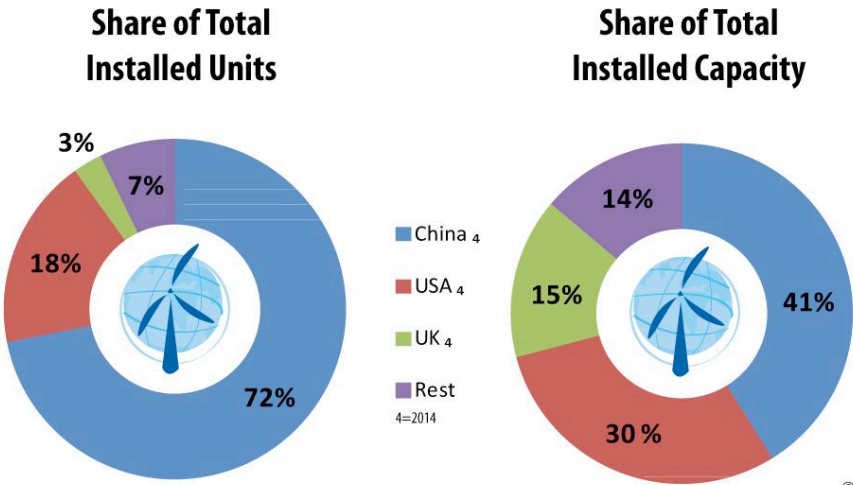
The USA small wind market grew only by 3,7MW in 2014, a 34% decline in new capacity compared with 2013 and 80% declined compared with 2012. The small wind market accounted for \$20 million in investment, \$16 million less than in 2013¹.

¹ 2014 Distributed Wind Market Report, U.S. Department of Energy

In the UK and Italy, the over-20kW segment exploded during 2014. In the UK, installed capacity in the range 15- 100kW grew by 75,6%; in Italy, the range 20-60kW grew by 85,4%. The rest of the segments remained very stable in the UK and saw small growth in Italy. In both countries, the structure of the Feed-in tariff was the impulse for the small wind sector. However, the structure of the feed-in tariff benefited larger turbines over the smaller machines.

Globally, an increase in the average size of small wind turbines can be observed: In 2010, the average installed size was 0,66kW, in 2011 0,77kW, in 2012 0,84kW, in 2013 0,85kW, and in 2014 it has already reached 0,87kW.

Country wise, the average size is quite diverse: While the average Chinese turbine has a capacity of 0,5kW, small wind turbines in the US have an average capacity of 1,4 kW and in the UK the capacity has reached 4,7kW (3,7kW in 2012). It is important to mention that the market for medium scale turbines (over 100kW) has increased rapidly in the UK during 2013 and 2014. Starting with no market in 2010, the market size for new machines in 2012 was of 9,02MW and in 2014 has already reached 69,78MW¹.



¹ 2015, Small and Medium Wind UK Market Report, RenewableUK

Small Wind Turbine Manufacturing

Five countries (Canada, China, Germany the UK and the USA) account for over 50 % of the small wind manufacturers. By the end of 2011, there are over 330 small wind manufacturers that have been identified in the world offering complete one-piece commercialised generation systems, and an estimate of over 300 additional firms supplying parts, technology, consulting and sales services.

Based on the world distribution of turbine manufacturers, the production of small wind remains concentrated in few world regions: in China, in North America and in several European countries. Developing countries continue to play a minor role in small wind manufacturing.

More than 120 new small wind manufacturers were established between 2000 and 2010 worldwide. China alone has an exceptional manufacturing capacity of more than 180'000 units per annum (as of 2011).

Technology and Major Applications

The early HAWT technology has dominated the market for over 30 years. Based on the study of 327 small wind manufacturers as of the end of 2011, 74% of the commercialised one-piece small wind manufacturers invested in the horizontal axis orientation while only 18% have adopted the vertical design. 6% of the manufactures have attempted to develop both technologies. As the majority of the vertical axis models have been developed in the past 5 to 7 years, the scale of market share remains relatively small. The average rated capacity of VAWT is estimated to be 7,4kW with a median rated capacity of merely 2,5kW. In comparison with the traditional horizontal axis orientation, the average and median rated capacity are much smaller. Out of the 157 models of vertical turbines catalogued in this report, 88% are below 10kW and 75% are below 5kW. This corresponds well with the actual market demand, as the average unit sold in 2011 had a capacity of 1,6 kW.

Despite a market trend that leans towards a grid-tied system with larger capacity, off-grid applications continue to play an important role in remote areas of developing countries. Off-grid applications include rural residential electrification, telecommunication stations, off-shore generation, and hybrid systems with diesel and solar. Over 80 % of the manufacturers produce stand alone applications. In China, off-grid units comprised 97% of the market in 2009, and 2,4 million

households still lack electricity. In USA, off-grid small wind turbines account for most of the units deployed in distributed wind applications. For these reasons off-grid systems will continue to play a significant role, in China and in many other countries with non-electrified areas.

Driving Factors

Costs

There are a many of factors that influence the project installation costs for a small wind project. These range from transportation of equipment to remote locations to permitting requirements in urban areas. Therefore, we do not recommend using the values presented in this report as a basis of comparison between small wind support policies from different countries or as a cost reference for projects in any other region.

The most recent Distributed Wind Market Report from the U.S. Department of Energy, has showed the installation cost of projects in the USA grouped in three different groups depending on their sizes. After combining the installed cost records from 2013 and 2014, the average installed costs were:

- less than 2,5 kW projects: \$8'200/kW
- 2,5-10kW projects: \$7'200/kW
- 11 – 100kW projects: 6'000/kW

Considering only the new small wind capacity installed in the USA in 2014, the average installed cost was \$6'230/kW after \$6'940/kW in 2013.

In the UK, the Small and Medium Wind Strategy presented by RenewableUK in November 2014 shows the installed costs of small wind project divided in two ranges. In the range 1,5 – 15kW, the average installed cost was 4'354 GBP/kW (about \$6'181/kW) and in the range 15-100kW an average cost of 3'436 GBP/kW (about \$4'876/kW). This represents a 10,6% cost decline from 2011, or an annual average decrease of 2,7%.

The Chinese small wind industry yielded, in comparison, a significantly lower average turnover of 12'000 Yuan/kW (1'900 USD – 1'500 EUR) in 2011.

Table. Small Wind Feed-in Tariff Pricing Worldwide

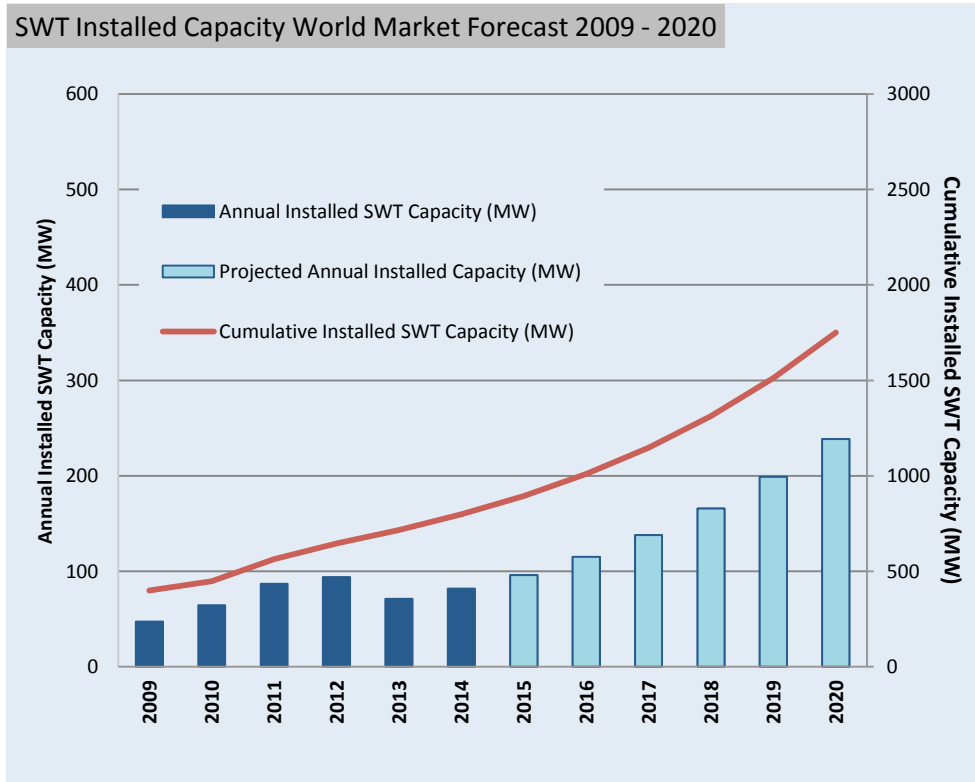
Country/ Region	Size Limit	EUR/kWh	Country/ Region	Size Limit	EUR/kWh
Bulgaria	< 30kW	0,084	Japan	< 20kW	0,464
Canada				≥ 20kW	0,185
Nova Scotia	< 50kW	0,340	Lithuania	< 10kW	0,081
	> 50kW	0,089		11-350kW	0,075
China (off-grid)	0,2–3kW	0,140		> 351kW	0,064
(on-grid)	5-20kW	0,110	Portugal	< 3,68kW	0,432
Chinese Taipei	1-20kW	0,237	Slovenia	< 1 MW	0,095
	> 20kW	0,078	Switzerland	< 10MW	0,195
Denmark	< 10kW	0,330	UK	< 100kW	0,110
	10-25kW	0,200	USA		
Greece	< 50kW	0,250	Hawaii	< 20kW	0,198
Italy	< 1MW	0,300		20-100kW	0,125
Israel	< 15kW	0,250	Indiana	3-10kW	0,209
	15-50kW	0,320		10-200kW	0,125
			Vermont	< 15kW	0,200

There are more countries with Feed-in tariffs policies which are not included in this table. Most of them are under the 0,08 EUR/KWh level.

World Market Forecast 2020

As predicted in 2015, the global small wind market stop decreasing during 2014 and it is expected that it will increase again from 2015, at least in terms of capacity installed, mainly because an increase in the size of the new turbines installed in China and Europe. A minimum growth rate of 11% is anticipated to continue until 2016. At least 115 MW of new capacity are expected in 2016. Within this time frame, individual countries and the international small wind community will be able to establish more rigorous and structured standards and policies to regulate the market and support investments. Based on a conservative assumption, the market could subsequently see a steady compound growth rate of 20% from 2015 to 2020. The industry is forecasted to reach approximately 240MW of newly installed capacity added annually in 2020 and achieves a cumulative installed capacity of about 1,75GW by 2020.

SWT Installed Capacity World Market Forecast 2009 - 2020



Definition of Small Wind

Technically, there are several definitions of small wind turbines: The most important international standardisation body, the IEC, defines SWTs in standard IEC 61400-2 as having a rotor swept area of less than 200 m², equating to a rated power of approximately 50 kW generating at a voltage below 1'000 V AC or 1'500 V DC. In addition to this standard, several countries have set up their own definition of small wind. The discrepancy of the upper capacity limit of small wind ranges between 15 kW to 100 kW for the five largest small wind countries. The major pattern of today's upper limit capacity leans towards 100 kW. This is largely caused by the leading role of the North American and European market. Over the past decades, a growing average size of the small wind capacity has been observed. This pattern is largely caused by the increasing interest in larger grid-connected systems and a comparatively diminishing market of standalone systems. Nevertheless, in order to create a standardised and healthy small wind market share, an agreeable definition of small wind should be agreed upon.

This report intends to bring forward the discussion on the definition of small wind and aims to create eventually a unanimous international classification system of small wind accepted by all parties of the industry. For the purpose of generating comparable graphs, figures and charts in this report, 100 kW is chosen as the temporary reference point. The definition, however, requires further discussion until a globally harmonised agreement is reached.

In practise, the major pattern of today's upper limit capacity leans towards 100 kW. In order to create a standardised and healthy small wind market share, an agreeable definition of small wind should be agreed upon.

Bergey Windpower

www.bergey.com**Products type:** HAWT**Products size (kW):** 1/6/ 7,5/ 10**Applications:** GC/SA**Presence:** USA, Worldwide

Bergey Windpower is the oldest and most experienced manufacturer of residential-sized wind turbines in the world.

Thirty years ago Bergey pioneered the radically-simple "Bergey design" that has proven to provide the best reliability, performance, service life, and value of all of the hundreds of competitive products that have come and gone in that time. With only three moving parts and no scheduled maintenance necessary, the Bergey 10 kW has compiled a service record that no other wind turbine can match. We back it up with the longest warranty in the industry.



City Windmills

www.city-windmills.com**Products type:** VAWT**Products size (kW):** 0,5/1/2**Applications:** GC/SA**Presence:** UK, Switzerland, USA

City Windmills has the objective to become the world leader in small wind turbines for factories, office buildings and households. The path to achieve such an objective is to provide clients with a suite of windmill products which can produce energy and optionally be used for advertisement for commercial users.

City Windmills is headquartered in the UK with operational centers also in Switzerland and USA.



dibu Wind

www.dibu-energie.de**Products type:** HAWT**Products size (kW):** 5,5,7,5/15**Applications:** GC/SA/HB**Presence:** Germany

dibu Wind production GmbH sells windturbines from 5 to 15kW. The inovative design allows most extensive maintenance, low noise, and high efficiency. In addition, dibu is a competent partner for the planning and construction of photovoltaic systems.



Endurance Wind Power www.endurancewindpower.com



Products type: HAWT
Products size (kW): 50/225
Applications: GC
Presence: Canada, Italy, UK, USA

Endurance Wind Power is a Canadian headquartered small wind turbine manufacturer with facilities in Canada, UK, Italy, Denmark and the United States. Our E and X Series turbines are designed in-house specifically for distributed wind power applications such as farms, dairies, institutions and light industry.

Endurance turbines provide economic and efficient solutions for community wind, self-generation or off-setting expensive grid power or fossil fueled electricity generation worldwide. Our lines of induction-based turbines have a zero electrical conversion loss, making the most of your production. Together our team strives to provide Endurance wind turbine owners with the best products and support in the market today!



Envergate

www.envergate.com



Products type: VAWT
Products size (kW): 20/100
Applications: GC
Presence: Switzerland, Worldwide

Envergate Energie AG develops, manufactures and sells wind turbines. Are you thinking about a classical rotor? Think vertically! Do wind turbines have to look like they usually do? They don't have to. There's a different way. More intelligent. We're convinced of it.

Our wind turbines guarantee high wind yield and above average efficiency. We research and further develop our innovative technology. Progress and growth - a dynamic process. We stay in motion. Like the wind that shows us the direction. Clean. Lean. Intelligent.



Eocycle

www.eocycle.com



Products type: HAWT
Products size (kW): 25
Applications: GC, SA
Presence: Canada

Eocycle Technologies Inc. develops, manufactures and commercializes worldwide the EOCYCLE 25, a state-of-the-art 25 kW direct-drive wind turbine for distributed wind energy applications.

Capitalizing on more than 12 years of internal R&D and prototyping, Eocycle Technologies stands out from its peers by being an integrated technology and manufacturing company.

Eocycle Technologies holds all intellectual property and commercial rights for every key component of its wind turbine, including Eocycle's patented Transverse Flux Permanent Magnet (TFPM) generator technology, which is capable of achieving - in a smaller and lighter package - much higher torque and power at lower rotational speeds than competing technologies.



Ghrepower

www.ghrepower.com

GHREPOWER

Powering Your Future

Products type: HAWT

Products size (kW): 0,3/0,5/2/3/5/10/30/50/100

Applications: GC/SA

Presence: China, Belgium, France, Italy, UK, USA

GHREPOWER is a leading wind turbines manufacturer which specializes in R&D and manufacture in China.

We have an integrated design, production, installation, commissioning, sale and after-sale service, and our products are widely applied for mobile communication, military, maritime monitor, home use, commercial business and remote area etc.

Our products export to all over the world, such as Germany, UK, France, Italy, Korea etc. The company's wind and solar hybrid energy system installed base also exceeds 10'000 units.



HY Energy

www.hyenergy.com.cn



Products type: HAWT

Products size (kW): 0,3/0,4/0,6/1/1,5

Applications: GC/SA/HB

Presence: China

HY Energy Co., Ltd is a high-tech enterprise engaged in designing, manufacturing, marketing and severing in wind-solar hybrid power system integration technique.

HY Energy Co., Ltd has made tremendous contributions to improve national wind generator manufacturing level under the breakthrough technique on wind turbine design conception and production craft since 2001.



Kingspan Wind

www.kingspanwind.com



Products type: HAWT

Products size (kW): 3/6/15

Applications: GC/SA/HB

Presence: UK, Worldwide

Born as the result of over 30 years innovation, our turbines have surpassed all expectations when it comes to delivering clean, green electricity for farms, land owners, schools, businesses and community projects.

Installed on every continent, our turbines have been delivering efficient, reliable and affordable on-site generation for customers in over 70 countries. Designed, tested, certified and manufactured in Great Britain – complemented with our specialist in-house wind team with over 25 years' experience in the International Small Wind Industry.



KLiUX energies

www.kliux.com



Products type: VAWT
Products size (kW): 1,8/3,6
Applications: GC/HB
Presence: Spain

Kliux Energies is a Spanish company, with international presence, that specializes in DISTRIBUTED ENERGY SOLUTIONS based on renewable sources. Kliux has worldwide exclusivity rights to manufacture and sell the GEO1800 VERTICAL AXIS WIND TURBINE, developed by Geolica Innovations which also integrate into hybrid system with solar photovoltaic technology. Its unique aerodynamic design results in a noiseless, energy generating turbine that also performs extremely good in architectural integration and visual impact. THE TRULY URBAN WIND TURBINE.



Superwind

www.superwind.com



Products type: HAWT
Products size (kW): 0,350
Applications: GC/SA/HB
Presence: Germany, Worldwide

The Superwind 350 is a small wind generator for professional use, which even under extreme conditions works autonomously and automatically. It is often used on sites where there is no grid available. The electric power generated by Superwind charges batteries and can be used directly for 12V- or 24 V-appliances.

Ideal fields of application for example are navigational aids, traffic control systems, environmental monitoring stations or transmitters, but also sailing yachts, campers, summer cottages and mountain shelters. Concerning the rural electrification in remote areas of developing countries, Superwind generators provide electric power for whole families.



TUGE Energia

www.tuge.ee



Products type: HAWT
Products size (kW): 10/20
Applications: GC/SA
Presence: Estonia

TUGE Energia manufactures and develops small wind turbines under TUGE® trademark. Turbine model TUGE®10 and TUGE® 20 are in serial production. TUGE® 2.5, TUGE® 10 with larger rotor area and TUGE® 50 are under development.

TUGE® is a registered trademark of TUGE Energia and turbine design has European certificate for design for harmonization in the internal markets.



DON'T MISS THE FUTURE

new
energy



16 – 19 MARCH 2017