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Smart Medium Wind Turbines
Turbines that are ready to cope with a smart grid

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Abstract

Within a few years there are not likely to be many places in the world with traditional mega or micro electricity grids. As use of renewables such as wind and especially photovoltaics increases, sometimes to more than 100%, and the energy supplies are linked to grids worldwide, there will be a need to add storage and smart control systems to enable switches between renewable energies, demand, storage or other fuels such as diesel. However, most traditionally manufactured small and medium wind turbines cannot cope with smart grids.

Objective

In 2012, after I had given a presentation at the World Wind Energy Conference (WWEC) in Bonn, participants came to me and asked 'Where can I buy a turbine of 300kW or less?'. That was the trigger for me to research which companies are manufacturing these wind turbines. My goal was to find out which manufacturers are in the market for weak and island grids, in particular where there is more than 100% supply of renewable energy and especially more than 100% wind. The research is based on manufacturers mentioned in the Small Wind World Report (SWWR2012) of the WWEA (World Wind Energy Association) (www.wwindea.org), desk research and manufacturers' presentations at international fairs and was carried out by a questionnaire. The scope of the investigation was wind turbines with a generator between 50kW and 300kW.

All over the world islands and mostly rural regions are aiming to achieve 100% renewable energy. There are places with an uncontrolled growth of photovoltaics. Islands and rural communities have weak grids in which they have to balance supply and demand. Large MW wind turbines require a strong grid and also good logistics for the turbines to be transported and installed. Therefore there is still a demand for medium and small wind turbines. In the next few years as more renewables are in use there will inevitably be a need to balance grids. Like MW wind turbines, medium and small turbines will need to become 'smart' to help keep the grid stable and clean.

As most commercial developers in wind tend to sell and use wind turbines of a megawatt or more (MW wind turbines) because these turbines give the fastest and/or largest return on investment, there is a lack of development of small and medium sized wind turbines. MW wind turbines only serve the highly populated areas in the world that have a strong grid. Over 90% of the world is rural and has a weak or island grid. For technical reasons and because of grid capacity there is usually a maximum of 300kW for feeding in electricity from wind turbines on these grids.

Manufacturing and selling small and medium windturbines need a strong base. For medium sized wind turbines there is hope. Although wind turbine manufacturers such as GE, Siemens, ENERCON and Vestas have stopped the manufacturing of medium wind turbines, companies like MAIT manufacture medium wind turbines (e.g. MAIT: 60kW) as well as MW turbines.

The research also looked at ways in which turbines can be made 'smart'. With wind energy in a grid there are three possible situations:

1. 'All available wind used' <30% wind, current situation, retrofit in time needed.
2. 'All available wind used' >30% to <100% wind, only possible with new technology (Figure with Verget turbine provides an application example).
3. >100% wind (also possible in combination with other renewable energies), only possible with new technology (Figure with WES turbine provides an application example).

Method

Main Source

Questionnaire

Excel overview manufacturers of windturbines 50-300kW. Full list will be included in the next SWWR of the WWEA

1. Argolabe
2. C&F Green Energy
3. Danvest
4. Endurance
5. Libellula-ARIA
6. Northern Power Systems
7. Norvento
8. Vergnet
9. WES Windenergysolutions
10. Windflow
11. XANT

Excerpt list of manufacturers responding the questionnaire and that have a smart windturbine or are working on a smart windturbine. (alfabetically) *not on the list? Let me know!*

MAIT: 2 MW & 60 kW foto: MAIT

Due to logistically problems at some places medium turbines are the limit. Here the ferry to Ruhnu Island (Lithuania) Foto: Danvest

Vergnet has a solution for feeding in 30 - 100% windenergy with their "Hybrid Wizard" Foto's: Vergnet, Project on Samoa

WES has a solution for more than 100%windenergy Foto's: WES, Island of st.Helena 12 x 80kW (1MW average use of electricity) and foto of installation involved. Foto: WES

What is a medium size windturbine?

What is small and what is medium? As manufacturers sell the same wind turbines in several countries under different nominal power rates and countries use different nominal power rates and rotor diameters in their regulations it is not possible to give an exact universal definition of a medium sized wind turbine. In practice it is from approximately 10kW to 1MW, divided into two ranges 10kW to 300kW and 300kW to 1MW. The definition has to be based on the use of the energy, not the size of the generator or the dimension of the rotor. The following definitions are suggested:

- Small: Just to supply one household or less, from 0.003kW to around 10kW
- Medium: Too big for a household and too small for a town, between around 10kW and 300kW
- Large medium size: Too big for a small community, mostly between 300kW and 1MW

Whereas organisations like the European Wind Energy Association (EWEA) and the Global Wind Energy Council (GWEC) focus on MW wind turbines the WWEA also has a focus on small and medium wind. In 2016 from 17–20 March in Husum, Germany, there will be the 7th World Summit on Small Wind (www.wwindea.org).

Retrofit, market of the future

For older small and medium wind turbines retrofitting is a market of the future. Older turbines that gain a second life (via marketplaces such as www.wind-turbine.com and www.bs-green.com) need to have at least a new controller. All modern wind turbines and grids produce data. In smart grids wind turbines have to deal with SCADA systems that control and balance the local grid. Information technology is changing rapidly over time. If a wind turbine is 15 years old it has the technology of a MS-DOS computer. Retrofitting is like replacing this technology with a modern laptop. Because of the rapid change in information technology, all wind turbines are likely to need to be retrofitted in time. The retrofit market is also a market of small series and flexible working processes. Manufacturers in this market segment have to deal with that. There are at least nine manufacturers outside the wind turbine manufacturing industry that develop systems to be placed on new or retrofitted wind turbines or make energy balancing systems for island and weak grids. The list of manufacturers will be incorporated in the next SWWR report to be published by the WWEA. Also on the market are companies that sell wind turbines because they want to sell their diesel generators at the same time.

- ABB www.abb.com/windpower
- Danvest www.danvest.com/danvest-power-box.pp
- Deif www.deif.com
- KK-elektronics www.kkwindsolutions.com
- Mita www.mita-teknik.com
- Saera www.argolabe.es/saera%28en%29.html
- Sopra www.alfen.com/en/products/smart-grids/sopra
- Spica spicatech.dk/products/spica-retrofit-controller
- Wicotech www.wicotech.com

At least 9 companies are on the market for retrofit and energy balancing systems.
Your company not on the list? Let me know!

Conclusions

- **Manufacturers of small and/or medium turbines are not likely to be able to sell turbines with only a mast, a rotor and an asynchronic motor as a generator any more. Turbines of all sizes need to be intelligent.**
- **Small and medium wind turbines have to cope with situations with 100% or more renewables and retrofitting costs are high.**
- **For the customer buying a cheaper model, built the old-fashioned way, will be more expensive in the end when it is necessary to refurbish/retrofit. There are no single solutions yet, and every situation is still unique. *Caveat emptor*.**

References

References: See the paper for the complete list!

- Smart medium windturbines for smart grids, Windtech-International 2015-8
- The windturbines of st. helena, *http://slidesha.re/1eBwdZl, http://bit.ly/1Gek3O9*
- Mobile Hybrid Power Supply Systems for Rural Environments, Windtech-International, *http://bit.ly/1vmkZ0a*

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