FORTIS
WIND ENERGY
GREAT IN SMALL TURBINES

# Small Wind Turbines tested: “Fortis Montana best performance”

The market for commercial wind turbines is maturing even as they get bigger and bigger, but the market for small wind turbines is quite young, with some people comparing it to the car industry early in the 19th century. Although some manufacturers have been in the business for over two decades, most suppliers are from this millennium. And that shows.

As in most immature markets, there are cowboys about. Some manufacturers claim energy yields that go beyond the limits of physical possibility. But because there is huge lack of knowledge in the market, there are still plenty of clients who believe these stories. And that is a pity, as one day they will feel betrayed and the whole market will feel the downside of this. To get more objective information about the (im)possibilities of the small wind turbines, several trials have been conducted. In this article we will look at one of them in the Netherlands.

In Schoondijke in the South West corner of The Netherlands a test is being held with small wind turbines. Eleven machines are standing in line in a reasonable open field environment. There are some trees and buildings, but for Western European circumstances it is quite open. The test is being organized by Delta, a utility company, the province of Zeeland, Zeewind as a wind cooperation and Greenlab investment company.

All turbines are standing in line, with the same hub height (12 m) so they can be easily compared. They all feed their electricity in the main grid. Wind speed is measured at one location and averaged per 5 minute interval. The site does not comply to IEC standards for measuring powercurves, but it comes quite close.

The field was opened last year October, and the first turbines came in one month later. The first conclusion was that is proved difficult to fill the 11 locations. Some manufactures did not want to participate in the test, and for others it seemed difficult to install a working model.

Because of these delays the windy winter period was not included in the official test period, which was from the 1st of April until the 30th of September. A pity, because the Montana showed that in the first 3 months of 2008 1453kWh was produced at 4.5 m/s

average wind speed. That’s an average of 16 units per day. In the 6 months official testing period over the calm summer from April to September the Montana averaged about 8

units per day in 3.5m/s wind. Peak production by the Fortis Montana was in week 4 with 30 kWh per day at 6.5 m/s average wind speed.

The whole summer period can be characterized as one with low winds and quite often coming from the East. East wind is gusty and low in speed on lower altitudes. So all in all it was not a good period for showing high results. But even considering the lower than expected wind speeds the results are quite revealing:

| Model | Actual net yield at 3.5m/s kWh* | guide price | euro/kWh at 3.5m/s wind** | GBP / kWh at 3.5m/s wind** |
|---|---|---|---|---|
| Montana | 1397 | 18508 | 0.22 | 0.17 |
| SkyStream | 774 | 10742 | 0.23 | 0.18 |
| Passaat | 261 | 9239 | 0.59 | 0.46 |
| Ampair | 76 | 8925 | 1.96 | 1.53 |
| Airdolphin | 124 | 17548 | 2.36 | 1.84 |
| WRE 060 | 212 | 39162 | 3.08 | 2.41 |
| Energy Ball | 22 | 4324 | 3.28 | 2.56 |
| Swift | 28 | 13208 | 7.86 | 6.14 |
| Turby | 43 | 21350 | 8.28 | 6.46 |
| WRE 030 | 62 | 30862 | 8.30 | 6.48 |

*Net kWh is the amount of electricity generated less the amount used while the electronics is on standby or in start up mode. So electricity use by the turbine is deducted from the production (the Turby used 60% of the produced electricity, the Montana 0.2%, the Passaat 0% and Skystream 8%).
** The cost per kWh has been calculated by merging the winter and summer results and extrapolating these results over a 20 year life.

The average wind speed in this period was 3,5 m/s which is quite low for a UK site, but typical of a central European site. It is difficult to say what would have been the results at higher wind speeds. But the figures speak for themselves.

The differences in the price per kWh are quite interesting.

The Fortis Montana and Passaat use SMA inverters to feed their electricity into the local grid. These inverters have two kind of settings. The first has to do with the AC grid side and specify the voltage and frequency ranges that the inverters will accept and use.

The test data shows, that during the testing period described above, the inverters switched off because of the grid specs where beyond the legal limit. This has nothing to do with the turbines but all with the fact that these eleven wind turbines together influence the grid. The Passaat missed out 27 kWh and the Montana 135 because of this. The above figures are corrected for this.
The second kind of settings are on the turbine side. These settings influence the behavior of the turbine. Together with SMA, Fortis are now optimizing the parameters to increase the output of the Montana. Once Fortis have finished testing on the German test site, these new settings will also be implemented in Schoondijke and the models for sale.

Initial findings suggest that 20-30% improvements in energy yields, and therefore cost per kWh are achievable. Considering that Fortis have clients using their turbine for over 20 years its realistic to state 22 Euro ct/kWh could improve to 0.15-0.18 Euro ct/kWh. At low wind speeds and without any form of grant or carbon credit this is not bad performance.

If we look at the weeks with a 5 m/s average, annual production of the Montana even without optimized settings would be over 6500 kWh/year. Leading to an electricity price of 0,14 Euroct/kWh. Without grant!

Although it is said that the new innovative designs and vertical axis machines will function better in the urban environment because they cope better with turbulent air flow, the figures above show their production in smooth “laminar” air still leaves a lot to be desired. Getting energy out of turbulent air will prove to be even more troublesome. In the 70s there were plenty of vertical axis manufacturers out there, none of them are still in existence.

Conclusions of the test period so far are that not all turbine manufacturers dare to show what their turbines really do, the ones that are on the field show that the claims they make need to be objectively verified before they can be trusted. And the final conclusion is that the classical 3 bladed design with a horizontal axis is still by far the best performing and that established manufacturers with track record are still the ones to be trusted.

On request we can forward to you an official test result document over the time; April 1st 2008 until October 31st 2011 with all detail information.
info@fortiswindenergy.com **refer to; doc._Test field_Zeeland.**