Wind Harvester Models 1.0 and 2.0

Lilla Batskar, Finland| Installed 2012, Removed 2013

In the early 2010's Wind Harvest hired Iopara Inc. to use the data from the Model 530G array to validate computer modeling of the coupled vortex effect (CVE). The results showed lower solidity H-type turbines would also benefit from the CVE when placed close together. A low solidity turbine has a significantly higher efficiency (Cp max) but would require a motor to bring the rotor up to a generating RPM. One way to achieve the lower solidity and retain the excellent performance of the 37″ cord blades of the Windstar 1066 would be to have a three-bladed rotor. But Wind Harvest had never tested a three-bladed configuration. There was concern that the longer distance between each blade in the rotor's circumference would create a problematic "torque ripple" in the energy output.

Simultaneously, the United Kingdom and Italy had opened a Feed-in Tariff that provided a high-priced Power Purchase Agreement for energy produced from wind turbine projects under 60 kW in Italy and under 100 kW in the UK. Both countries required IEC 61400-2 certification and EU electricals for wind turbines. With all of this new information, and with the close of Wind Harvest International's Series A round of financing, Wind Harvest decided to use the Intertek certification facility on Lilla Batskar in Alland, Finland, to certify an improved version of the Model 530G.

This new turbine was the Wind Harvester Model 2.0; it would have three aligned sets of 12-foot long blades, essentially three 36-foot long blades. Model 1.0 had the traditional 12 blades, 4 per set, all offset from each other. Both had 636 square feet of rotor swept area. After overcoming several problems in converting the US-designed turbine to EU steel and metrics, the turbine was installed and tested.

The results showed that the three-bladed H-type turbine would not produce a torque ripple problem. Its lower solidity would achieve the higher efficiency predicted from IOPARA's modeling. Mark Chang's design of Model 2.0's control system proved that the lower solidity Model 2.0 turbine could easily motor up and use a variable speed drive to improve energy output.

The main problem with the Wind Harvester Model 2.0 design was the price per rotor swept area, how close it was to the ground, and that the guy cables limited the possible

installation locations. The strain gauge and other data, 3-bladed design, modern controls, and more helped inspire the 3-bladed, H-type design of the Wind Harvester Model 3.0.

	Model 1.0 Specifications	Model 2.0 Specifications
Rated power (kW)	25	25
Rotor Diameter (m)	5.4	5.4
Swept Area (m^2)	59	59
Rotor Height (m)	11	11
Number of blades	12	9 acting as 3
Number of arms	24	12
Solidity	33%	24%
Generator	Induction	Induction
Gearbox	yes	yes
Mast support	Guyed	Guyed