

Section 01. Innovations in Engineering

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Bladeless wind generator

The world needs cheap and environmentally friendly electricity because hydrocarbons will end sooner or later, and they cause damage to the environment. In this light, wind power looks perspective as it is inexhaustible and environmentally friendly. But wind power stations of traditional design cannot satisfy the need in electric energy, so there is a need to search for new design solutions of more efficient use of wind energy. One of the perspective solutions is a bladeless wind generator from the Spanish company Vortex Bladeless.

This vertical bladeless wind turbine looks like a huge baseball bat fixed on a handle and swaying in the wind. The principle because of which it sways is an oscillating flow that takes place when a fluid such as air or water flows past a cylindrical body. In this flow, vortices are created at the back of the body and detach periodically from either side of the body. This effect is called *Von Kármán vortex street*. It is destructive for building structures, that is why construction engineers prevent the possibility of the structure to enter resonance.

Vortex Bladeless engineers decided to make use of this destructive effect. They specifically carried out research in the wind tunnel to find the shape of a generator that would be more responsive to resonance. Vortex's innovation comes from its unusual shape, where a fiberglass and carbon fiber mast oscillates in the wind taking advantage of the *vortex shedding effect*. At the bottom of the mast a carbon fiber rod moves inside a *linear alternator* that generates the electricity, with no moving parts in contact. Vortex has a small carbon footprint, is noiseless, has low center of gravity and allows for small foundation dimensions, so more generators can be placed in an area, at twice the density of traditional turbines.

As Vortex Bladeless say, comparing with a traditional wind power turbine of the same power, their bladeless generator will be:

- 53% off in manufacturing cost – because it requires less materials;
- 51% off in operating costs – because of absence of moving parts in contact;
- 80% off in maintenance costs – because it has simpler construction;
- 40% global power generation costs reduction – because of advantages above;
- 40% carbon foot print reduction – because it's easier in manufacturing, transportation and maintenance.

This innovative concept has other advantages. It starts to oscillate by the lower speed of the wind. It is possible to locate stations much closer to each other. Wind

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turbines of the classical design with a dense arrangement do not receive enough wind flow, but this bladeless generator only benefits from dense placement as its oscillatory effect is amplified by the vortices from the generator ahead. Also, it produces almost no harmful noise, it is safe for birds and doesn't clutter the horizon.

Vortex Bladeless is currently developing three different products. The main characteristics of the three products are:

- Vortex Atlantis: 3 meters height and 100W generation capacity, working along with solar panels, mainly to bring energy to off grid locations.
- Vortex Mini: 13 meters height and 4 kW generation capacity, mainly for small-scale/residential wind.
- Vortex Grand: 150 meters height and 1MW generation capacity, capable of generating electricity for 400 houses.

Atlantis and Mini models are planned to be introduced for private homes in developing countries, or small constructions like radio antennas with their first field tests in Avila, Spain. And by 2018, with help of crowd funding the deployment of the Vortex Grand is planned.

Until there is no final product it's hard to forecast which problems can occur, but as I think that possible problems will be: vulnerability to storm winds, and vulnerability to icing at sub-zero temperatures, what will disrupt the aerodynamic properties of the generator.

In summary, we can conclude that bladeless generators can be one of those non-standard, forward-looking solutions in clean energy. Because the era of hydrocarbons is coming to an end, nuclear power is potentially very dangerous, but people still strongly need a reliable source of clean energy.

References:

<http://www.vortexbladeless.com/>

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