

# WINDLETTER

THE MONTHLY NEWSLETTER OF THE AMERICAN WIND ENERGY ASSOCIATION

Volume 24 Issue No. 2 - February 2005

## SMALL TURBINE COLUMN:

### **The Myths & Mysticism of Vertical Axis Wind Turbines**

--Mick Sagrillo, Sagrillo Power & Light

At least several times a year, yet another announcement about a “technological breakthrough” arrives in my e-mail box. Invariably, the device being “unveiled” is a vertical axis wind turbine, and in all likelihood, it is touted as an “urban rooftop wind generator.” Included with the excited chatter is an article or two published by some local newspaper.

What is it with vertical axis wind turbines that bring out the nearly-lunatic fringe, both sellers and buyers? Before you flame me in an e-mail, or demand that AWEA sever all ties with me forever, please read on. This column is about the purveyors of such hype, their outlandish claims, and the mysticism behind these devices, and not a condemnation of vertical axis turbines *per se*.

Vertical axis wind energy devices have been around for a long time, like about 5,000 years. They are the original “wind extracting” equipment, developed in Persia and China. These designs are so simple that many backyard tinkerers and garage inventors start with them, trying to fine-tune their ideas and equipment to make them actually work. And progress has been made with some designs. But before they succeed, the inventors invariably leak word of their work, sometimes for the notoriety, sometimes to look for seed money to continue developing their devices.

Many of these “inventors” actually seek and acquire patents, another claim that they can make about the inevitable success their invention will see. They may claim that they have stumbled on a suppressed design, intimating suppression by the manufacturers of horizontal axis wind turbines. Some even accuse the horizontal axis folks of outright conspiracy against vertical axis designs.

I find it hard to believe that this portrayal is an accident. After all, we always cheer for the underdog. And easy money in a seemingly sure investment is hard to pass up. Pandering to these weaknesses in our human nature, brochures, Web sites, or newspaper articles usually include an offer for investors to get in on a technology that will revolutionize the way we make energy. “Early investors reap the largest rewards,” and that sort of thing. Or there is a hint that dealerships are available to purchase, or licenses to manufacture are available; contact the inventor for more information.

This portrayal to the unschooled in the physics of wind turbines or unsuspecting optimists who want to do “something good” with their investment dollars is my biggest problem with this entire affair. Every year, numbers of folks are bilked out of money buying into dealerships, ordering a turbine whose design is half-baked at best, or investing in a prototype that is still “under development.” In the renewable energy industry, this type of not-yet-ready-for-prime-time product is termed “vaporware”; it simply doesn’t exist – except maybe as an artist rendition on a brochure or Web site, or sitting idly at some undisclosed secret “test facility.”

Many of the “invertors” claim energy outputs and efficiencies that indicate they are in serious need of some physics lessons. For example, one often-cited advantage of vertical axis turbines is that they can be “mounted right on the ground or a rooftop,” and that they “don’t need tall towers for blade clearance as are required for horizontal axis turbines.”

Completely ignored are the two fluid dynamics reasons why horizontal axis turbines (or any serious wind generating device, for that matter) are mounted on towers: ground drag (the friction between flowing air masses and the earth, which greatly slows down wind speed) and turbulence (caused by all of the obstacles cluttering the ground). Basic fluid dynamics tells us that the power available in the wind is a function of the cube of the wind speed. Both ground drag and turbulence enormously diminish the power available at the ground level or around buildings to a point where there is actually very little extractable. It is solely due to this mathematical equation that wind turbines are mounted on towers, not blade clearance. And the taller the tower the better. Even wind turbine designers have to abide by the current laws of physics.

Actually, vertical axis turbines are rather difficult to mount on towers, which may be why their makers argue for ground mounting, or placement on a rooftop. (I wonder if anyone has considered just leaving them in the box? At least that way they won't get dirty.)

Another claim is that vertical wind turbines spin more easily than their horizontal axis counterparts, even on the ground or on top of a building. Spinning, however, is not the same as generating electricity. This industry isn't about kinetic yard art.

Yet another claim is that these small vertical axis wind turbines “don’t kill birds.” Newspapers love this kind of stuff. The implication is that horizontal axis wind turbines for residential applications do kill birds. Well, they don't. To the best of my knowledge, no small vertical axis turbine has ever been tested for bird strikes. Large commercial turbines do indeed occasionally kill birds, but let's put this in perspective. A cat kills as many birds in a week as a large commercial horizontal axis wind turbine does in two to three years.

There are actually some bona fide reasons why we don't see real operational vertical axis wind turbines available in the U.S. marketplace, and why very few successfully exist in other parts of the world. These include:

- Vertical axis wind turbines are less efficient electricity producers than their horizontal axis counterparts, and are usually poorer performers;
- The reliability of vertical axis equipment over the life of the system is less than that for horizontal axis designs. Much of this has to do with centrifugal force and the harmonics of cycling of the blades of the vertical axis rotor; and
- Vertical axis turbines simply cost more to manufacture than comparably generating horizontal axis wind turbines.

This isn't to say that vertical axis turbines cannot or do not work. FloWind kept a number of vertical axis turbines running for many years in California. But operation and maintenance costs combined with electricity generated at a higher cost than their horizontal axis counterparts could deliver caused FloWind to abandon these turbines.

The bottom line on all of this is that poor performance, lower efficiency, decreased reliability, and increased costs add up to a simple sum: well designed and tested vertical axis turbines will generate electricity, but at a higher cost than comparable horizontal axis turbines. It's that simple. If there is a conspiracy against vertical axis turbines out there, it's the conspiracy of the marketplace. If someone else

can deliver a product more reliably and cheaper than you can, you simply have no customers. Assuming that you've actually developed a real manufacturable product.

In my barn, I have an early 1980's-vintage vertical axis wind turbine that was developed under a U.S. Department of Energy grant. These turbines were sold commercially for a very short time, until reliability, warranty, price, and physics caught up with them. But it was mesmerizing to sit and watch that turbine spin. One of these days, I'm going to drag that thing out and see if I can't get it working. Even cynics have their weaknesses.

copyright 2005 by Mick Sagrillo

Editors Note: The opinions expressed in this column are those of the author and may not reflect those of AWEA staff or board.]