

# WINDLETTER

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## SMALL TURBINE COLUMN:

### “Urban Turbines” and “Kinetic Architecture”—Just What are We Demonstrating?

--Mick Sagrillo, Sagrillo Power & Light

Last December, [my column](#) discussed the hype surrounding the many new wind turbine introductions and inventions available on the Web, and the possible ramifications to the small wind industry of unfettered and outrageous claims made by many of these companies.

Allow me to expound for one more month about the problems this is creating, especially relative to high visibility demonstration installations, and some remedies. The topic becomes all the more timely and relevant, in fact, with the recent release of a landmark report.

In the past, [I've reported on the Warwick Wind Trials Project](#), a recently-completed field test conducted in the United Kingdom of small wind turbines in urban locations. In January, Encraft, the independent engineering consulting firm that conducted the Warwick Turbine Monitoring Project, released its [final report](#). The study's conclusion is no surprise: siting is essential to a turbine's performance. With the report in hand, Matthew Rhodes, managing director of Encraft, is satisfied that “when turbines are put up in the right places, they [wind turbines] are a good investment.” Now, the question becomes one of defining “the right place” for an installation or demonstration site.

In spite of the growing data showing the need to properly locate small wind turbines, “breakthrough technologies” continue to abound—in the marketplace and at all-to-visible “demonstration” sites—that make dubious claims concerning both their performance and their ability to be sited in locations otherwise considered to be poor. The consequence, of course, is a blemish on the industry.

#### Real-World Performance Data Surfaces

Most of the turbines monitored in the Warwick Trials were not installed at the best sites, but in places surrounded by trees and buildings that cause high turbulence, inevitably leading to a considerably compromised wind resource. As a result, turbines underperformed expectations by a factor of 15-17 times, an incredible discrepancy between what was estimated and reality.

The average capacity factor—i.e., the average output of a turbine as a percent of its rated capacity—for a well-sited small wind turbine ranges from about 15% to 24%. “Well sited” means that the turbine is located in an open rural setting on a tower suitable to clear the area's ground clutter. However, the majority of the turbines monitored in the Warwick Trials yielded stunningly poor capacity factors, averaging between 0.85% and 4.15%. Some of the turbines were not even able to generate the parasitic power consumed by the system's electronics, meaning the wind turbines were actually net *consumers*, not net *producers*, of electricity.

The resulting payback period for such installations is centuries—in other words, never, given the life of the turbine. Many will never even generate enough clean energy to offset the energy put into manufacturing the system, actually making them *negative* contributors to addressing global warming concerns. In contrast average payback periods for well-sited small turbines can be measured in months to a handful of years and make important contributions to the fight against global warming.

Performance data for urban and building-integrated turbines, “architectural” wind turbines, and vertical axis wind turbines (VAWTS) is also beginning to leak out. As was the case with the Warwick trials, performance for many of these systems is extremely poor, especially relative to the optimistic and overstated claims made by the manufacturers or purveyors of such systems. And herein lies the crux of the issue.

### **The looming problem**

According to an interview in *New Energy Focus* magazine, the consulting firm Encraft states that it was “taken aback by the discrepancy between manufacturers’ claims and actual performance.” Matthew Rhodes, the company’s managing director, observes that “the gap between average expectation and reality is much larger than people could reasonably expect—in fact, the average performance of a building-mounted wind turbine in situ is between 5% [and] 10% of manufacturers’ claims.” Further, this reality is exacerbated by manufacturers “who would rather keep the data secret,” he says. According to Rhodes, “[T]he failure of some, not all, of the companies promoting building-mounted micro wind has not been in the design or manufacture. It has been in failing to market their products ethically.”

Indeed, the Warwick report indicates that even turbines mounted on very tall buildings which tower over the landscape may perform at perhaps 25-50% of the expected electricity output from a similar turbine installed at a good rural site. The performance estimates appear to be based on “perfect laboratory conditions” which do not consider the turbulence at the site from building and trees. Most of this performance discrepancy is due to inflated turbine power curves (i.e., graphs of estimated output at given wind speeds) provided by the manufacturers, coupled with an overestimation of a site’s wind speed.

But my experience is that such exaggerations are not the sole domain of manufacturers of building-mounted micro turbines, as reported in the Warwick Trials. Plenty of VAWT manufacturers, as well as some manufacturers of conventionally configured horizontal axis wind turbines (HAWTS), are also guilty of overly-optimistic performance estimates for their products, some crossing the line into outright fraud.

### **Why is this happening?**

I see a number of factors that have aligned to result in this worrisome trend:

**Rising fuel costs**, which squeeze the pocketbooks of consumers, send them on a search for any sort of energy-generation panacea. After all, the wind energy is “free”, ignoring the cost of equipment to capture it. Remarkably, whenever the price of gas at the pump goes up, installers are inundated with phone calls from people interested in putting up a wind turbine for reasons of “energy independence.”

- **Public concerns about global climate change** have led to a widespread desire to be part of the solution. Many baby boomers, now nearing retirement and far more financially flush than in their earlier careers, are interested in renewables as a way to put their dollars where their values are. Others are exploring ways to lock in some of their monthly expenditures by generating their own electricity, essentially prepaying their electric bill for the next few decades.
- **The overwhelming success of wind farms** has brought an understandably high profile to wind energy and its viability, as it has become able to compete favorably with conventional fossil- and nuclear-generated electricity. While the economies of scale of small wind cannot currently compare to a wind farm, many people are nonetheless enthused by the prospects of using wind energy and want to capture part of that success for themselves.

- **The products available today** from a handful of successful U.S. and foreign manufacturers has bestowed small wind with a level of respectability not enjoyed by the industry for several decades. Reliability has increased with some turbines due primarily to simple designs, improvements in the materials used in the turbines, and millions of collective hours of operating time on some models.

All of these circumstances have opened the door to creative entrepreneurs to invent products and launch Web sites specifically aimed at taking advantage of the current political and economic climate. Expanding on the comment about a “failure to market their products ethically,” Rhodes states that customers “under pressure to make a quick return on investment, [with] enthusiasm to do something to help the environment and lack of familiarity with wind technology, [have] been exploited.” The Warwick Report concludes that “aggressive and over-optimistic marketing by suppliers of building-mounted wind turbines could damage the credibility of the wind industry as a whole.”

I see this not as an indictment of the small wind industry, but rather as a wake-up call to regulate itself internally before poorly conceived products swamp the market—or what will remain of the market.

### **Demonstration sites**

Let me reiterate that I am not opposed to experimentation—that’s how we learn and progress. Experimentation is how small wind turbines successfully evolve from concepts to reliable products as they are fine tuned. And there are many products on the horizon that offer great promise. But let’s be honest about much of what is surfacing today.

The January/February 2009 issue of *Distributed Energy* magazine reports on interviews of a number of manufacturers of unconventional small wind turbines, i.e., those that are not established HAWTS, but VAWTS, building-integrated urban wind turbines, and similar unproven concepts. One disturbing thread seems common to many of these new devices: the overriding objective to develop and sell wind turbines as “kinetic architecture,” or “architectural wind turbines”—in other words, appealing, eye-catching designs irrespective of whether the device would produce significant electricity. Such designers pride themselves in “thinking outside the box” or being part of a “new paradigm shift.” Unfortunately, many never considered taking the principles of fluid dynamics as they apply to the wind resource on planet Earth out of the box with them.

These “eye candy” designs certainly have captured the attention of the public and the media.

What is even more troubling is *where* some experimental wind turbines are being installed. One of the most enthusiastic and willing markets is termed “demonstrations sites”—that is, any high-profile location or end user intended to generate media and public attention. This strategy is certainly not unique to wind; it is a common ploy in nearly all sales industries.

Prime demonstration targets include schools, public institutions, or any high-traffic, high-visibility location. The host entities invariably have little-to-no expendable cash to fund such installations, but often have benefactors willing to donate to the cause, or grant programs tuned to their missions that they can tap.

No money available? No problem! The manufacturer may even foot the bill if the willing host site has high visibility. A free wind generator and free electricity! What more could you ask?

Unfortunately, half-baked experiments or concept wind turbines inevitably don’t generate electricity as promoted and, even worse, break down all too soon after installation. Meanwhile, money for upgrades, maintenance, or repairs is simply not available from the benefactors or grants that originally funded the installation. Nor does the demonstration host, who was unable or unwilling to purchase the turbine with its own money in the first place, have the dollars or commitment to put more, or any, money into the project for maintenance or repair. The results are incredibly damaging images of small wind turbines that are “demonstrated” by non-spinning, non-productive installations.

What’s really being demonstrated by these projects?

## **My suggestions**

It is largely up to the small wind industry to solve such challenges. Manufacturers should not give away wind turbines, no matter how seemingly good the cause or, more likely, how high the traffic or visibility. With no investment in the project, and typically no operation and maintenance or repair budget, the host is certainly not going to invest in maintaining the project, as they have no financial reason to spend their money on it. So inevitably, a turbine installed under such circumstances just sits there, inoperable, and for all to see. Logic dictates that, for the project to be successful, the owner must have a financial stake in the installation, which is their only motivation to keep the system operating.

Urban locations, especially when the site is compromised by ground clutter, are simply not “the right places” to demonstrate small wind technology. Neither are locations where tower height is restricted to unreasonably short heights due to zoning rules. Moreover, systems that offer short towers as the only option are not acceptable. These wind installations are invariably poor performers.

While such systems do generate media attention and sales inquiries, little electricity, if any, is actually produced. If the only function of a demonstration turbine is to spin and attract attention, consider that whirly gigs are a far more cost-effective option. That way no one is deluded into believing whirly gigs will make us energy independent or help solve our global climate problems.

If it's an experiment, the manufacturer needs to call it an experiment. They must not deceive the host or the media with theoretical projections of electricity-generating performance, or hype about the turbine being an innovative technology breakthrough. Rather than seeking high-visibility demonstration sites, the manufacturer should install the experiment where it will get a good workout with a qualified staff that can monitor output and operating conditions and evaluate overall performance. Experiments understandably need tear-downs and tweaks to fine-tune operation and performance. Inventors and innovators need to do this at their own sites and on their dime, not with public dollars or in the “high profile” locations.

Transparency is crucial if manufacturers hope to have any credibility with state renewable energy programs, Congressional members and staff providing support for a federal consumer incentive for small wind turbines, or a more sophisticated buying public. Documented performance and output are absolutely necessary for a wind product to become successful. There are only a limited number of fools out there willing to buy or fund demonstration small wind turbines, and it is only a matter of time before everyone catches on. Once the word is out that a bogus idea or product is barely half-baked, the producer will be out of business. Unfortunately, many people will have been bilked out of their money in the process, and small wind's reputation will have been tarnished.

Competition in the marketplace is good. It keeps participants honest and leads to better products regardless of rotor configuration or orientation. However, the focus should be renewably generated electricity as a solution to our global climate change crises, not a series of “innovative” designs as sales gimmicks created to attract attention. The real “paradigm shift” envisioned by some will happen if, and only if, that which is created and sold is actually a long-lived, reliable, useful product.

We in the small wind turbine industry need to be far more outspoken about demonstration projects. What is being demonstrated, especially with experimental equipment at poor wind sites? And why? What are the subsequent ramifications to our industry? Another message that “wind doesn't work?”

We don't need that. Let's be responsible about what we fund and demonstrate!

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Mick Sagrillo, Sagrillo Power & Light, is a small wind consultant and educator, and serves as the Wind Energy Specialist for Focus on Energy, Wisconsin's renewable energy program.

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