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SMALL TURBINE COLUMN:

"Silver Lining" in Poorly Performing Turbines

There is a rush currently going on in small wind right now. Due to the recently enacted federal investment tax credit in combination with many states offering grants for renewables in their public benefits programs, many companies are frantically trying to get their equipment in the public eye by installing them as "demonstration projects" for all to see. Yet some of these installations are in compromised locations at best, while other installations feature turbines that are nothing more than beta machines. Most of these installations, touted as "urban turbines" are located in populated areas to garner the most media attention they can. And they certainly do get media attention.

In May's column, I talked about the dangers of highly visible, but poorly conceived small wind turbine installations. Poorly performing or poorly sited turbines do little but advertise the misconception that "wind doesn't work." In this column, I'll explore the potential bright side of such an ill conceived installation—that is, how such installations illustrate that location is all-important—which comes only if the turbine's performance is fully recorded, disclosed, and transparent.

Putting it to the test

In the May column, I used an example of one of the very few "urban turbine" installations that is actually being monitored for performance with the results reported on the Internet. The turbine is a Windside vertical axis Savonious rotor, rated at 10 kW. The turbine was touted by the installer as being able to generate enough electricity to power 2-3 average homes (www.wkowtv.com/Global/story.asp?S=9317398). The manufacturer claims that the turbine will start generating electricity at 4 mph, which any conventional wind turbine cannot do, and reach full output at 35 mph.

Since the average home in Madison, Wis., where the demonstration is located, consumes about 1,000 kWh/month, it would be reasonable for a reader to conclude that this particular small wind device would generate 24,000 to as much as 36,000 kWh per year. The cost of the installation on a 30-foot pole was $40,000, a very attractive price compared to other more traditional 10-kW wind systems on the market that have track records for cost and performance.

The local utility, Madison Gas and Electric (MGE), installed the Windside turbine as a demonstration project because so many of their customers have been inquiring about "urban turbines," both on short towers and rooftop units. MGE set up a Web site, www.mge.com/Environment/Innovative/urban.htm, to inform their customers about the project.

The most interesting part of the Web site is the "live data reporting" link. http://view2.fatspaniel.net/MadisonGasElectric/mckeefarms/HostedAdminView.html This is a Fat Spaniel monitoring package that gives both instantaneous as well as historic production of the system.

In the interceding eight months since MGE commissioned the turbine and has been documenting output, the 10 kW Windside turbine has seen no down time for repairs, yet has only generated a paltry 42 kWh. And this has been during the windy winter and spring seasons in Wisconsin. Extrapolating this performance to one year, it is not unreasonable to calculate that this particular turbine will generate all of 63 kWh per year or just over 1/6 kWh per day. This installation has a capacity factor of 0.0007% (read: seven ten thousandths of one percent). At an average cost of electricity for MGE customers of $0.12 per kWh, this $40,000 wind turbine has a payback of a mere 5,291 years. As I said in May about such paybacks, we're approaching the half life of some radioactive elements here.

The extrapolated cost of electricity (COE) for this Internet wonder over the presumed 20-year life of the turbine? $31.75/kWh. And this does not include any operation and maintenance over those five-plus millennium.

Digging further, MGE reports that this "urban turbine" has peaked at 600 watts, not anywhere near the 10 kW it is rated at. Far from being able to power two to three average homes, 1/6 kWh per day translates to the ability to light a 100-watt incandescent light bulb for 1.6 hours a day. If we are concerned about using our electricity more efficiently, we could opt for a 25-watt compact florescent light bulb and get an overwhelming six and a half hours of light a day out of this $40,000 "urban turbine."

By comparison…

A mere 63 kWh per year is not a lot of electricity, to say the least. By comparison, a 10-kW Bergey XL wind turbine on a 120-foot tower in a relatively open rural setting outside of Madison, not at the site of this demonstration, with just over a 12.5 mph average annual wind speed at hub height would come close to generating 12,000 kWh per year. And the cost? About $65,000 with all costs, including permits, shipping, all labor and materials, everything. In other words, 62% more money for 190 times the electricity. But not in this urban location.

On the other hand, if all you needed was 63 kWh per year, or what the Windside will actually generate at this site, you could install a 60 watt photovoltaic (PV) system in Madison. That cost? It would actually be quite expensive to install just one PV panel in a utility inter-tied system, since the labor to equipment ratio would be so out of kilter. But you'd be hard pressed to spend more than about $2,000 with all costs, or 1/20 the dollars, to generate the same amount of electricity with a PV system.

The logic of urban turbines

Something is obviously wrong with the MGE installation, and it is not necessarily the vertical axis technology, although Savonious rotors are known to be mediocre performers when it comes to generating electricity. The real problem with this installation is the location: a short tower in an urban setting surrounded by miles of buildings and trees. Any trained wind site assessor would have nixed the location and tower height based purely on common sense, let alone best practices for siting a residential wind system. You simply don't install a wind turbine where there is little, if any, usable fuel.

But many purveyors of "urban turbines" don't seem to want to operate by the same rules that the rest of the wind industry operates under. They talk about a "paradigm shift," rethinking distributed generation, or empowering (or lack thereof) energy independence.
They also seem to think that they are exempt from the laws of physics and fluid dynamics that the rest of planet Earth is saddled with.

These poorly placed turbines do a great job in one respect: illustrating how no turbine, regardless of technology, will function successfully unless it is sited properly.
Best practice for siting a wind turbine dictates that the entire rotor of the turbine be sited at least 30 feet above tree line in the area. While that would certainly get the rotor above the zone of severe turbulence caused by buildings and trees that obstruct wind flow, it is still well understood that urban areas have very poor wind resources. The surface roughness of cities and suburban areas is simply so great that the movement of air masses over those areas is seriously impeded and compromised—at least for any tower that would be considered a reasonable height for a more open rural area, say, in the 80-140 foot range.

The invariable final chapter for such non-cost effective installations is that, after operating for a couple of years, the owner simply gives up as soon as the first repair bills roll in. Faced with repairs, or even the cost of inspections and maintenance, the owner looks at the installation and inevitably decides that investing more money in something that will not pay off for centuries or millennia is simply senseless. This begs the question as to whether the turbine will even last that long. Disillusioned, the owner gives up, and the turbine is decommissioned. The turbine's legacy? "Wind doesn't work!" Not "this particular turbine in this particular location doesn't work," but *wind* doesn't work. Such urban-turbine installations are one reason why much of the public is still not convinced that small wind is a viable renewable energy solution.

That said, I actually think that demonstration projects like the MGE urban turbine are an outstanding idea—provided that installation costs, performance of the turbine, and wind speed data are documented and posted on a Web site for all to see. Full transparency will go a long way towards exposing the urban-turbine craze for exactly what it is: ill-conceived and wishful thinking at best, folly and gouging the hopeful but unsuspecting consumer at worst. Likewise, with such "bad examples" out there, the same kind of transparency using demonstration projects of *properly sited* small wind turbines becomes all the more important for the public to understand the true power of the technology.

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