

## Innovative wind turbine designs

Although a lot of people are excited about wind energy, few are excited about the pinwheel-shaped machines that often produce it. Branded as noisy, blamed for spoiling bucolic views and proven deadly to some bats and migrating birds, the giant, white-bladed horizontal axis wind turbines that now dot the landscape of the American West have earned a fair number of detractors--even among environmentalists who generally favor renewable power.

But what if you turned the idea sideways, and created a turbine that could spin like a carousel? And what if you made a turbine small enough to sit on top of a building or inside an urban park? Could the result produce enough power to really matter?

The idea isn't a new one--people have been playing with windmill designs and experimenting with alternatives to the horizontal axis turbine for almost a century now. But in the last two decades, a flurry of interest in expanding renewable energy in cities has attracted the attention of a large number of inventors and artists, many of whom see the vertical axis wind turbine as promising.

There is no single design for these upended wind catchers, but all share one key aspect: the blades turn around an axis that points skyward. And unlike their horizontal brethren, the components and associated generators of a vertical turbine are placed at its base, giving it a lower center of gravity. Most are also relatively small, and unlike horizontal units, they can be grouped very closely together to optimize efficiency.

In many large cities, including New York, San Francisco, Boston and Chicago, city officials and scientists have been studying vertical axis turbines and contemplating their use. Paris has embraced the notion with enthusiasm, even allowing two giant turbines of this type to be installed within the steel latticework of the Eiffel Tower, which might someday generate enough electricity to power the ground floor of the tourist attraction. Some private firms worldwide have begun integrating vertical axis turbines into architectural plans for commercial buildings.

"You can make a [vertical axis wind turbine] that will produce electricity," says Robert Preus, a researcher at the National Renewable Energy Laboratory in Colorado who helped develop certification criteria for small wind turbines in the U.S. "The question is whether or not you can do so competitively."

There is, however, an abundance of people willing to experiment, sometimes via shaky financial backing, with the emerging turbine technology. The Internet is littered with websites for now-bankrupt companies, proclaiming the glory of these machines and their capabilities, as well as an almost endless list of enthusiastic articles, often full of myths about them. In some cases, those stories may be overstating their potential, or using outdated information to present an inaccurate portrait of them.

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One of the most popular misconceptions, says engineer Richard Cochrane from Exeter University in the UK, is that all vertical axis wind turbines are silent, or at least less noisy than all of their horizontal counterparts on large wind farms.

"There are some vertical axis machines that are very noisy, because they didn't put into so much effort into the aerodynamics of the machine," Cochrane says. There are also some newly developed horizontal axis turbines that are incredibly quiet.

Some engineers have voiced skepticism, for example, about the potential of harnessing wind power in built-up areas. Buildings and trees tend to cause turbulence and reduce steady currents, especially at ground level or on rooftops. But there were several locations on the outskirts of towns and near the seaside where Cochrane and his team were able to get strong, steady, reliable wind, even on top of buildings.

Either way, the vertical design seems to inspire a lot of sculptural engineering. Horizontal blades turning toward a person on the ground may set off a subconsciously intimidating feel. But vertical blades, by contrast, are often said to be mesmerizing, peaceful and relaxing to watch. They are often mistaken for public art.

Cochrane recalls that one of his former study sites was in a parking lot outside of a busy grocery store. When a relatively small horizontal turbine was put into place there, customers parked far away from it. But when that machine was replaced with a vertical axis turbine, the store's manager noticed that everyone would park underneath it and look up.

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