PUBLICATION

Assessing wind resources in our cities

By youris.com GEIE

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The 43-story **Strata tower in London** was one of the first buildings in the world to incorporate wind turbines into its structure. It has three small turbines – each with a rated capacity of 19 kilowatt hours – built into its roof. The developers claim that these can generate approximately eight percent of the energy that the building uses.

The skyscraper, however, hasn't been met with universal acclaim. In 2010 – as well as more prestigious awards – it won the Carbuncle Cup, an annual prize for Britain's ugliest new building. And there have been reports that the turbines don't turn and accusations of greenwashing.

Greenwashing, according to Greenpeace, is "the act of misleading consumers regarding the environmental practices of a company or the environmental benefits of a product". Mark Runacres, a physicist and wind energy expert at Vrije Universiteit Brussel in Belgium, explains: "Essentially a company might put a wind turbine on their roof less for the fact that it contributes in a meaningful way to renewable energy and much more for image building and reputation." **Because they are so visible, ineffective wind turbines can damage the reputation of wind energy**. "Every time I see a wind turbine that doesn't move, I think damn that is really bad advertising," says Runacres.

Unfortunately the Strata tower isn't the only example of wind turbines that appear to be more gimmick than green. **The two five metre high, 3.2 kilowatt vertical axis wind turbines installed inside the Eiffel Tower in 2015** have also been met with accusation of greenwashing. According to the company that designed and installed the turbines, Urban Green Technology, they are expected to produce around 10,000 kilowatt hours of electricity per year, but this is less than 1% of the 6.7 gigawatt hours the tower is estimated to consume annually. In a press release, Jan Gromadzki, an engineer who oversaw the project, even said: "This installation is definitely more symbolic."

Small wind turbines are generally defined as those with capacities below 100kW. Runacres says that they have a bad reputation because many small wind turbines on the market, "are no good at all and are installed in places where there is not enough wind". However, this doesn't mean that small urban wind energy is not viable.

In Brussels, for example, Runacres and his colleagues have found locations with very good wind conditions. These are on the tops of very tall buildings and along the city's canals, which are orientated in the right direction to pick up the dominant wind from the south-west. To highlight suitable sites for urban wind turbines local wind measurements are combined with computer modelling to analyse wind patterns around buildings and the local terrain. These surveys are known as **wind resource assessments**.

"One of the biggest challenges is where to install the wind turbine, just in terms of productivity," confirms Leo Subías, at the Research Centre for Energy Resources and Consumption (CIRCE) in Spain. "**Wind in urban environments is turbulent with big differences between two – or more – locations relatively close to each other**."

"The air flow impacting a small wind turbine installed in an urban area is **much more influenced by the building's shape, distance to the roof and walls, size of the parapets, than by the general terrain**," adds Julien Berthaut-Gerentes, at renewable energy company Meteodyn, in France. "Thus, software able to model such local details is crucial."

Berthaut-Gerentes and Subías are developing new methodologies and software for wind resource assessments in urban locations, as part of the European **SWIP** project. For more than a year wind resource assessments have been carried out in Choczewo village in northern Poland, to test these new techniques.

As well as local measurements, wind resource assessments can use data from meteorological stations, which are then transferred to the turbine location. Berthaut-Gerentes says that it is also important **to consider the thermal stability of the "atmospheric boundary layer",** the lowest part of the atmosphere that is in direct interaction with the Earth's surface. "These thermal effects can make a stratified atmosphere which will modify drastically the wind flow," he explains.

The SWIP project, explains Berthaut-Gerentes, will look at the impact of thermal effects in the atmospheric boundary layer on air and wind flow, and will propose a way to incorporate this information into wind resource assessments that use data from meteorological stations.

“Installing wind turbines in urban environment appears to be challenging: each situation has to be analysed individually and has lots of potential reasons for failure,” says Berthaut-Gerentes. “Nevertheless, a situation with no solution at all is quite rare. Most urban environments can have their own wind energy solution.”

By Michael Allen