
New developments in Building-Integrated Wind Turbines

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Can an individual building aid in providing sustainable energy to its occupants? Although it is beyond doubt that large-scale sustainable energy sources are required to address the finiteness of fossil fuels, local small-scale initiatives can support global solutions (such as large off-shore wind farms and solar farms) and raise awareness by ‘generating locally what is spent locally’. As is the case for the large-scale solutions, solar panels and wind turbines are best suited for sustainable building-integrated applications. In this paper we show that small wind turbines have become an interesting alternative to solar panels for retrofitting on existing buildings.

Studies have shown that the wind potential in city centres on top of high rises is often good. We have conducted a wind measurement campaign on four locations in Brussels (Belgium), at the ground level as well as on medium and high buildings. The measurement period varied between 7 months and 1 year, and the results were corrected with the Measure Correlate Predict (MCP) method to account for climatic variations. Specifically for Belgium, our measurements indicate that the wind potential for small wind turbines on top of high rises is as good as the most windy Belgian sites near the North Sea.

The impact of rooftop-mounted small wind turbines on occupants and the environment is relatively small. The biggest concern are the vibrations that are produced by the wind turbine and transmitted to the building. These vibrations can lead to accelerated wear and damage of the building (e.g. when near resonant frequencies of the building or a structural component), or extraneous noise production (structural vibrations of building components that reradiate acoustically). We have measured loads and vibrations on two ground-mounted small wind turbines to build a dynamic model of the turbine. The first bending modes of a small turbine are in the 0 – 10 Hz range, thus overlapping with the resonant frequencies of typical tall buildings. We suggest how a turbine mounting set-up should be designed to reduce the transmitted vibrations.

We conclude that when the location is carefully chosen with respect to the wind potential, and when an appropriate mounting set-up is used, a small wind turbine is an interesting investment and should be considered as a viable alternative for solar panels.