Estimation of wind power generation in dense urban area
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ABSTRACT
There is great potential in the use of urban wind energy to form electricity generation modules over a distribution network to maximize wind power production in densely urbanized areas. The objective of this study is therefore to develop computational fluid dynamics (CFD)-based evaluation procedures to determine potential mounting sites of wind turbines and obtain estimates of wind power by taking into consideration the details of the local urban topography and boundary conditions of micro-environments. The predictions, including those of the wind velocity and direction as well as turbulence intensity, are compared with field measurements via ultrasonic anemometers and thermal flow velocity probes at 10 monitored sites over five different floors inside an objective building to validate the computational model as well as attain a better understanding of the interaction of the wind with buildings in a complex terrain. The predicted power density and turbulence intensity profiles are then used to analyze the power density, turbulence intensity and lowest mounting height for optimising the potential mounting sites and estimates of wind power. The suggested deployment solution of using CFD for wind turbines on the studied site is clearly different from those suggested in the literature and their deficiency in providing optimum mounting sites in micro-environments. Moreover, an improved roof design with a rounded shape is proposed for the enhancement of wind power density with relatively lower turbulence intensity.

Keywords: Urban wind power, Micro wind turbine, Computational fluid dynamics

REFERENCES