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Harnessing Wind Power in Urban Environments

What is the Potential for Harnessing Wind Power in Urban Environments?

Wind power is a vital renewable resource that is abundant within the UK. Therefore, with the push to achieve carbon net zero by 2050, harnessing any renewable energy that is available on site should be considered. However, there are difficulties associated with urban wind that have slowed the uptake of turbines in these locations. For example, the turbulent nature of air flow, low wind speeds, and strict planning laws.

The speed of air flow in cities is between 20-30% lower than in countryside areas. This is due to the uneven terrain of urban environments when compared to open fields. This then creates increased frictional drag on the air as it passes buildings, thereby resulting in turbulent flow.

Standard three-blade utility-scale turbines, which are mounted on a horizontal axis (Horizontal Axis Wind Turbines (HAWT)), struggle to effectively harness the energy in turbulent wind due to their design. However, Vertical Axis Wind Turbines (VAWT) can do so but have overall lower efficiency and require more frequent maintenance.

True innovation in urban wind power appears to be some years off, but systems are in development that tackle the issues detailed above. These include the O-Wind turbine, a 2018 James Dyson award winner, and Wind Assure, which uses the Bernoulli Principle and Venturi effect to move aerofoils in small distances.

Zoe Parminter, Innovation Gateway, December 2019

Key Considerations

- Urban environments, which have multiple high-rise structures, appear to generate wind tunnels between buildings that could be harnessed for additional renewable energy.
- When the air in urban environments is turbulent, it appears to make it difficult for traditional turbine designs to take advantage of the power.
- It is also relatively low in power compared to offshore wind speeds, which makes for a challenging business case.
- Although vertical axis wind turbines are more capable of harnessing this wind, however, they have several drawbacks to their operation that appears to make them a less viable prospect.
- Omnidirectional turbines that can deal with turbulent wind appear to have the best chance of success in urban environments, but these are still in development.

Links

- Small-scale wind energy - Policy insights and practical guidance from The Carbon Trust is available at: https://www.carbontrust.com/media/77248/ctc738_small-scale_wind_energy.pdf
- Urban Wind Resource Assessment in the UK is available at: http://www.urban-wind.org/pdf/Reports_UrbanWindResourceAssessment_UK.pdf
- O-Wind is available at: https://www.jamesdysonaward.org/2018/project/o-wind-turbine/
- Danish Wind Industry Association is available at: http://xn--drmstrre-64ad.dk/wp-

content/wind/miller/windpower%20web/en/tour/wres/cp.htm

- Urban Climate and Risk - Teodoro Georgiadis is available at: https://www.oxfordhandbooks.com/view/10.1093/oxfordhb/9780190699420.001.0001/oxfordhb-9780190699420-e-11