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Increasing Clean Energy Generation using Diffuser Augmented Wind Turbines (DAWT) for Urban Cities



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Summary

This project has been funded by EXPO 2020 under the "Innovation Impact Grant Program" in 2019. Under the supervision of Dr Hassam Chaudhry, a PhD researcher: Arouge Agha and five of our UG Architectural Engineering students have worked on this project: Akshaya Sankaran, Rinku David, Shravan Venkatachalapathy, Suvarna Sanal Kumar, Atheefa Jakir Hussain. As part of this project, a working model of a 'Diffuser Augmented Wind Turbine' (DAWT) for roof-top residential use has been developed and tested at Heriot-Watt University Dubai Campus. Using a Rutland FM910-4 Furlmatic Windcharger wind turbine, a light-weight diffuser made of Styrofoam was retrofitted to streamline incoming wind velocities and therefore increasing wind turbine efficiency by up to 71%. The DAWT provides an advantage over conventional wind turbines, as it can accelerate air movement over the rotor even while operating on low-rise structures, and low cut-in wind speeds normally found in urban areas.

Conclusions highlight

1. Computational Fluid Dynamic (CFD) modelling to successfully design the DAWT and investigate the wind and pressure profiles.
2. Full-scale commissioning of the DAWT using Styrofoam for real applications.
3. Wind speed augmentation of up to 71% when wind direction is perpendicular to the rotor.

Publications

1. H.N.Chaudhry, A.Agha, Wind accelerator for roof mounted wind turbines in urban clusters, Innovation Arabia 13 Annual Conference 2020, February 24-26, Dubai, U.A.E., 2020
2. A.Agha, H.N.Chaudhry, F.Wang, Determining the Augmentation Ratio and Response Behaviour of a Diffuser Augmented Wind Turbine (DAWT), Sustainable Energy Technologies and Assessment (2020) Article in Press
3. A.Agha, H.N.Chaudhry, F.Wang, Diffuser Augmented Wind Turbine (DAWT) Technologies: A Review, International Journal of Renewable Energy Research, 8 (2018) 1369-1385