

Abstract

Masters of Engineering Degree (Mechanical)

Project Title:

Influence of Building Geometry on Wind Power Potential

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Abstract:

Wind flow behavior is influenced by obstacles in the environment. Altering the geometry of buildings yields certain flow characteristics that are important in evaluating the performance of wind energy harvesting systems mounted on a structure. By varying the angle of a building's façade relative to the horizontal, we are able to accelerate the flow and maximize the available wind power for wind energy harvesting. Wind tunnel testing was done in a simulated boundary layer with both a basic rectangular model and a 30 degree sloped model. Utilizing hot wire anemometry, data was gathered along the center-line of each model. It was found that there was a velocity increase between 16% and 35% at the sloped model's rooftop leading edge resulting in an increase in power production between 56% and 150%. The region of interest corresponds to an area no more than one and a half inches of height above the model, equating to twenty-five feet in real-world height using our scale factor of 1:200. Additionally, the turbulence intensity was negligibly affected by the sloped model. We conclude that altering the geometry of buildings in this manner can be extremely beneficial to energy production using small wind turbines at the leading edge of structures.