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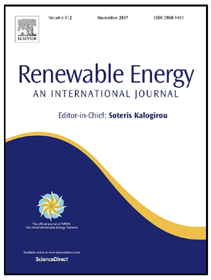

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Cross Indicator Analysis between Wind Energy Potential and Urban Morphology

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Abstract

Wind energy potential in built environment can be exploitable in a proper condition. With improvement of computer science, CFD simulation with complex building configuration or city models becomes accessible. This paper's main task is to analyse the relationship between urban wind energy potential and urban morphology through indicator studies in order to promote urban wind energy development.

Six typical real urban forms in neighbourhood scale were selected from the primary wind potential evaluation with urban morphological character analysis. A set of morphological indicators that are potentially correlated with wind environment were defined. Wind energy potential over the roofs of the highest buildings in each urban tissue was evaluated. Simulation results show that the two wind energetic indicators, wind potential capacity *M'* and wind potential density *D'* vary with different urban tissues and different wind conditions. Through the correlation analysis, we found that several urban morphological indicators have significant correlation with the two wind potential indicators. With help of these morphological indicators, we can compare much accurately and easily the output of wind potential over roof of different urban tissues, before taking the time-consuming CFD simulation for many complex urban forms.

Keywords

urban form, CFD, urban wind energy, morphological indicator, wind energetic indicator.

Nomenclature

U Test point wind velocity
Z Test point height from the ground
U_0 Reference velocity at reference height H_0= 100 m
α Power law exponent in the profile of vertical wind velocity
L_b Cell size for the faces of the building
N_f Number of inflation layers for both ground and building
T_g First layer thickness from the ground
r_g Ground inflation transition ratio
T_b First layer thickness from the building wall
r_b Building inflation transition ratio
N Number of iteration of simulation
λ_p Floor area ratio (FAR)
λ_a Plot ratio (PR)
$\overline{H}$ Average building height
σ_h Standard deviation of the building heights
$\overline{V_b}$ Mean building volume
λ_c Mean aspect ratio
R_a Absolute Rugosity
R_r Relative rugosity
P_o Porosity (absolute)
S_θ Sinuosity
O_a Actual Occlusivity
O_v Average Occlusivity

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