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Study of Variation of Winds Behavior on Micro Urban Environment with Use of Fuzzy Logic for Wind Power Generation: Case Study in the Cities of Arraial do Cabo and São Pedro da Aldeia, State of Rio de Janeiro, Brazil

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Abstract : This work provides details on the wind speed behavior within cities of Arraial do Cabo and São Pedro da Aldeia located in the Lakes Region of the State of Rio de Janeiro, Brazil. This region has one of the best potentials for wind power generation. In interurban layer, wind conditions are very complex and depend on physical geography, size and orientation of buildings and constructions around, population density, and land use. In the same context, the fundamental surface parameter that governs the production of flow turbulence in urban canyons is the surface roughness. Such factors can influence the potential for power generation from the wind within the cities. Moreover, the use of wind on a small scale is not fully utilized due to complexity of wind flow measurement inside the cities. It is difficult to accurately predict this type of resource. This study demonstrates how fuzzy logic can facilitate the assessment of the complexity of the wind potential inside the cities. It presents a decision support tool and its ability to deal with inaccurate information using linguistic variables created by the heuristic method. It relies on the already published studies about the variables that influence the wind speed in the urban environment. These variables were turned into the verbal expressions that are used in computer system, which facilitated the establishment of rules for fuzzy inference and integration with an application for smartphones used in the research. In the first part of the study, challenges of the sustainable development which are described are followed by incentive policies to the use of renewable energy in Brazil. The next chapter follows the study area characteristics and the concepts of fuzzy logic. Data were collected in field experiment by using qualitative and quantitative methods for assessment. As a result, a map of the various points is presented within the cities studied with its wind viability evaluated by a system of decision support using the method multivariate classification based on fuzzy logic.

Keywords : behavior of winds, wind power, fuzzy logic, sustainable development
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