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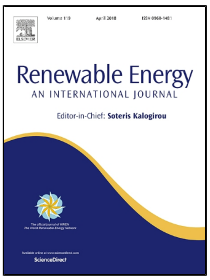

Sustainable development enhanced in the decision process of electricity generation expansion planning

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Sustainable development enhanced in the decision process of electricity generation expansion planning

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Abstract

The dissemination of distributed electric power generation is increasing despite some current technical, commercial and regulative limitations. Its development is a new reality which proper consideration is required in the planning of the expansion of the electric matrix. The use of renewable sources, smaller generation units and local availability of energy are characteristics that need to be considered in the planning process due to their impacts beyond the grid and energy supply when aspects of sustainable development are regarded. In order to strengthen distributed generation's contribution for sustainable development, this paper introduces additional social and environmental variables that are evaluated in conjunction with the technical and economic aspects in the indication of potential sites for deployment of wind turbines. Therefore, selected indicators corresponding to each of the dimensions of the sustainable development were used as inputs for multi-criteria evaluation techniques such as Rank Sum, Analytical Hierarchy Process and Weighted Linear Combination, and fuzzy logic. The techniques were applied and then compared in a case study for screening appropriate locations which are favorable to the wind turbines installation under the perspective of sustainable development. Actual data and wind characterization of the state of São Paulo, Brazil, were used and as a result state's municipalities with higher potential for installation of wind generators at 50 and 100 m height were identified according to each evaluation technique. It was noted that each technique promotes a specific trade-off between the criteria while balancing the evaluation output, however with a significant result convergence. Thus, the use of an objective methodology to incorporate dimensions involved in the sustainable development is effective and a valuable tool to support important decisions during the planning process in the generation expansion.

Distributed generation; sustainable development; sustainability indicators; interdisciplinary matrix; multi-criteria analysis; fuzzy logic.

1. Nomenclature

AHP	Analytical Hierarchy Process
$a_{i,j}$	Importance of the criterion of row i in relation to the criterion of column j
ANEEL	*Agência Nacional de Energia Elétrica* (Brazil)
CAPES	*Coordenação de Aperfeiçoamento de Pessoal de Nível Superior* (Brazil)
c_j	Criterion score of constraint j (with $j = 1, ..., k$)
CR	Consistency Ratio
CONAMA	*Conselho Nacional do Meio Ambiente* (Brazil)
DG	Distributed Generation
DG_POSSIBILITY	DG Possibility
EC_INDEX	Economic Criterion Index
ECLAC	*Comisión Económica para América Latina*
ECMWF	European Centre for Medium-Range Weather Forecasts