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Fuzzy GIS-based MCDM solution for the optimal offshore wind site selection: The Gulf of Maine case

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Resumen

This paper describes a multi-criterion decision-making approach for optimal off-shore wind location assessment by including fuzzy geographical information systems to prioritize the different locations and alternatives. The multi-objective framework involves a variety of elements, such as climatic, geographic, social, environmental, location, and economic factors. The proposed decision-making solution is based on a multicriteria evaluation method divided into two steps: an analytic hierarchy process and a prioritization of the alternatives in comparison to a parallel approach based on a fuzzy geographical information system solution. The Gulf of Maine (USA) is considered as a case example, owing to the relevant offshore wind potential of such an area. A descriptive statistical evaluation of the wind resource was previously carried out to characterize this area with wind speed field measurements for 10 years (2010–2019). A design proposal for a 1 GW offshore wind power plant is used in a case study based on a 15 MW variable speed wind turbine prototype recently proposed by the IEA Wind Task 37. The results include prioritization of optimal offshore wind power plant sites, levelized cost of electricity estimation, and avoided emissions in comparison to traditional supply side scenarios, mainly based on fossil fuel generation units.

Palabras clave

Wind off shore, Optimal selection, AHP, Fuzzy GIS, Multi-criteria selection, Energy transition