

Title of Diploma Thesis

Site Selection of Wave Energy Systems in Greece

Author

Chrisostomi Anagnostara

Academic Year

2020-2021

ABSTRACT

This thesis focuses on a form of renewable energy, which has a great potential for further exploitation in the near future; the wave energy. Wave energy could be strategically employed by the European Union in order to cope with the constantly rising energy demands, the saving of conventional energy sources and European countries' energy autonomy. The process of site selection is a crucial step towards the establishment of this form of renewable energy, as it affects both the performance of the wave energy project as well as the project's impacts on the environment. On the other hand, the site selection of a wave energy project corresponds to a complex, multidimensional process, that considers a variety of conflicting in many cases, criteria, related to technical, economic, environmental and sociopolitical parameters.

Along these lines, the objective of this thesis is to determine the appropriate marine areas in Greece, where wave energy could be appropriately exploited through the realization of Wave Energy Converter (WEC) projects. For this purpose, a relevant methodological framework is developed, which combines two Multi-Criteria Decision Analysis (MCDA) methods, AHP and TOPSIS, and Geographic Information System (GIS). The framework consists of three phases.

In particular, the 1st Phase of the analysis excludes all areas that satisfy exclusion criteria related to environmental and marine usage restrictions. In the 2nd Phase, evaluation criteria with a direct impact on the performance of a WEC project are quantified for all the eligible marine areas resulted from the 1st Phase. Furthermore, the weight of each evaluation criterion is determined for two different scenarios, which are realized by exchanging the weights of the two most important evaluation criteria (water depth and wave energy potential). Finally, in the 3rd Phase, the eligible areas are prioritized for the two scenarios based on all the evaluation criteria. The objectivity of the two first Phases is achieved through the appropriate digitalization of the exclusion and the evaluation criteria and the deployment of GIS. Finally, the ranking of the eligible areas is implemented through the combined use of the two MCDA methods, AHP and TOPSIS.

Keywords: Wave energy, Wave energy systems, Site selection, Geographic Information System (GIS), AHP, TOPSIS.