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Editorial

Marine Renewable Energy and the Transition to a Low-Carbon Future

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The changes in the Earth's climate have become more obvious in the last few decades, and research in recent years has indicated more severe impacts than initially expected. Thus, climate change represents one of the most significant global threats to human kind and our planet. Offshore renewable energy (ORE), including offshore wind, wave, tidal, and solar energy, is abundant, and there are large areas in both offshore and coastal environments that could be considered for its extraction. The development of technologies related to harvesting offshore renewable energy represents an important issue in achieving the expected targets in terms of both energy efficiency and mitigating the effects of climate change. Onshore wind represents a relatively mature technology, and is considerably different to offshore wind. However, outstanding success in this sector has been noted since 1991, when the first offshore wind farm became operational. Moreover, important advances are also expected in other technologies related to ORE extraction. On the other hand, there are still important challenges that must be overcome regarding the implementation of cost-effective technologies that can survive in harsh marine environments. From this perspective, the goal of this Special Issue is to contribute to the renewable energy agenda by presenting high-quality scientific and multi-disciplinary works, aiming to improve knowledge and performance in extracting offshore renewable energy. This Special Issue entitled '*Marine Renewable Energy and the Transition to a Low-Carbon Future*' includes nine contributions [1–9] published during 2022–2023.

In [1], both hindcast ERA5 data for the 41-year period of 1979–2020 and future projections until the end of the 21st century are considered to estimate the performance of new wind turbines with rated power in the range of 15–25 MW, which are currently under development. The first dataset was provided by the European Centre for Medium-Range Weather Forecasts, while the second was obtained from climatologic atmospheric models, under three different climate scenarios (RCP 2.6, RCP 4.5, and RCP 8.5). In [2], a new original computational fluid dynamics approach to predicting the performances of horizontal-axis wind turbines is developed and presented. Although the proposed paper could provide a large spectrum of applications for these wind turbines, offshore wind energy extraction is particularly targeted by this approach, since a high level of development in this sector is foreseen in the near future.

The wave energy sector is also discussed in this Special Issue. In [3], an evaluation of wave energy is carried out in the offshore coastal area of Morocco. The results obtained using a wave-modelling system, using WW3 (Wave Watch 3) for wave generation and SWAN (Simulating Waves Nearshore) for coastal wave transformation, are considered. The conditions in five particular locations are analyzed in relation to the expected performance of the six different types of wave energy converters.

An emerging sector in offshore renewable energy is represented by solar power. The study presented in [4] describes a boundary element approach to the hydrodynamic analysis of pontoon-type floating structures with photovoltaics on deck. Although the main target area of the study is the nearshore region of Greece, there is a high degree of generality, allowing for the application of the results to many others coastal environments.

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A different vision related to the same sector of solar energy is presented in [5]. This work discusses recent applications of solar energy as the main power source in the maritime sector. The current state of the art and main applications of solar energy-powered boats are also discussed.

In [6], a wind tunnel experiment for assessing ships' ventilation ducts is described. Various alternatives for improving airflow are simulated using computational fluid dynamics and compared with experimental data. The possibility of refining wastes and petrochemical derivates for producing marine fuel oil is another important research direction, and is discussed in [8]. Such technology represents a viable solution to the problem of waste disposal and may also contribute to cost reduction for ship owners.

Besides their military applications, maritime unmanned systems are very important for hydrographic surveys, providing support for maintenance operations, and conducting surveys in the offshore renewable energy sector. The authors of [8] describe the performance of an unmanned surface vessel (USV) prototype belonging to the Unmanned Survey Solutions (USS) corporation. Finally, Ref. [9] describes the effects of the carbon intensity index rating system for ships. The geographical area targeted is the Northeast Passage, which represents an important alternative route to the Suez Route for connecting Europe and Asia.

The above-mentioned works critically review technologies related to ORE extraction, identifying some of the most significant challenges and developments expected in the near future. Furthermore, they provided solutions that can enable readers to more easily understand the concepts introduced and the outcomes of the studies. The editor is confident that the works included in this Special Issue, entitled '*Marine Renewable Energy and the Transition to a Low Carbon-Future*', will be useful to many researchers in the area of marine renewable energy, as well as the industry sector.

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