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Techno-Economic Analysis of Offshore Hybrid Energy Systems with Hydrogen Production

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Abstract : Even though most of the electricity produced in the entire world still comes from fossil fuels, new policies are being implemented in order to promote a more sustainable use of energy sources. Offshore renewable resources have become increasingly attractive thanks to the huge entity of power potentially obtained. However, the intermittent nature of renewables often limits the capacity of the systems and creates mismatches between supply and demand. Hydrogen is foreseen to be a promising vector to store and transport large amounts of excess renewable power by using existing oil and gas infrastructure. In this work, an offshore hybrid energy system integrating wind energy conversion with hydrogen production was conceptually defined and applied to offshore gas platforms. A techno-economic analysis was performed by considering two different locations for the installation of the innovative power system, i.e., the North Sea and the Adriatic Sea. The water depth, the distance of the platform from the onshore gas grid, the hydrogen selling price and the green financial incentive were some of the main factors taken into account in the comparison. The results indicated that the use of well-defined indicators allows to capture specifically different cost and revenue features of the analyzed systems, as well as to evaluate their competitiveness in the actual and future energy market.

Keywords : cost analysis, energy efficiency assessment, hydrogen production, offshore wind energy
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