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Hybrid Wave and Offshore Wind Farms: a Comparative Case Study of Co-located Layouts

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Abstract

Marine energy is one of the most promising alternatives to fossil fuels due to the enormous energy resource available. However, it is often considered uneconomical and difficult. Co-located offshore wind turbines and wave energy converters have emerged as a solution to increase the competitiveness of marine energy. Among the benefits of co-located farms, this work focuses on the shadow effect, i.e. the reduction in wave height in the inner part of the farm, which can lead to significant savings in operation and maintenance (O&M) costs thanks to the augmented weather windows for accessing the wind turbines. The aim of this study is to quantify the wave height reduction achieved within a co-located wave-wind farm. Different locations and a large number of layouts are analysed in order to define the optimum disposition.

Keywords: Wave energy; Wind energy; Co-located wind–wave farm; Weather windows for O&M; Shadow effect; Wave height.

1. Introduction

If wave energy is to become a viable alternative to fossil fuels, its competitiveness must be enhanced. Combining this promising marine renewable with a more consolidated renewable like offshore wind energy is a solution of great interest [1]. According to the degree of connectivity between the offshore wind turbines and Wave Energy Converters (WECs) combined wave-wind systems can be classified into: co-located, hybrid and islands systems [2]. According to the current state of development of both