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PROFITABILITY ASSESSMENT OF WINDFARM OVERPLANTING IN SPAIN

Juan Manuel ROLDAN FERNANDEZ[1*], Javier SERRANO GONZALEZ[2], Rufino MOHEDAS LOPEZ[3], Fernando FUENTES SEVILLANO[4], Manuel BURGOS PAYAN[5], Jesus Manuel RIQUELME SANTOS[6]

[1–6] *Universidad de Sevilla, Camino de los Descubrimientos, Sevilla, Spain*

[*] ***Corresponding author.*** *E-mail address: jmroldan@us.es*

Abstract – The efforts made by European institutions to decarbonise the electricity system over the last decade have led Spain to become the fifth country in the world in terms of wind power plant capacity in 2021. This major achievement is still far from being able to contain and limit CO_2 emissions. By 2030, it is expected that, together with photovoltaic energy, Spain will reach 74 % of renewable generation in its electricity system. Wind technology is currently very mature in onshore wind farms and its relatively low cost makes this technology attractive to investors. However, the best wind sites were the first places to be occupied by the first turbine generations. On the other hand, newer wind farms occupy sites with less wind resource but have more efficient turbines. To improve the profitability of the wind farm and increase its production, the feasibility of other alternatives such as overplanting or storage is beginning to be investigated. Overplanting aims to optimise the use of the transmission system by increasing wind capacity above the transmission capacity limit. In this work, we measure the profitability of an overplanting strategy by quantifying the parameters that make profitable the investment. The developed model optimised the production of energy taking into account technical and financial parameters in order to cover a wide range of *situations*. We analysed the case of a specific site with 25 2 MW turbines with the Python tool PyWake. The results obtained show that for each new turbine the annual energy produced (AEP) grows by around 3.87 GWh per turbine added (a cut of 1.69 GWh due to congestion of the transmission system). The study shows improvements in profitability when the electricity price exceeds 70 €/MWh.

Keywords – Capacity optimization; overplanting; wind energy

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