Assessing the Market Value of Power Forecasting of Hybrid Power Plants in the Iberian Electricity Market

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***Abstract*— This study evaluates the technical and economic performance of wind power plants hybridised with solar photovoltaic (PV) under two 2030 Iberian electricity market scenarios dominated by renewable energy, developed within the Man0EUvRE project. A power forecasting model was optimised to maximise their market value, considering participation in both day-ahead and balancing markets. Compared to wind-only power plants, hybridisation improves forecast accuracy due to the complementary generation profiles of wind and solar PV. As a result, revenue losses due to imbalance penalties decrease by 15–28%, enabling the prices captured to increase by up to 6%. The hybrid configurations also achieved the highest market remuneration. However, as the share of low marginal cost technologies increases in the electricity markets, captured prices are expected to decline. These results demonstrate the benefits of hybridising the existing wind power plants, which can provide a short-term and efficient solution to support the ambitious European decarbonisation targets while enhancing both operational performance and their market value.**

Keywords— Day-ahead and balancing markets, Hybrid power plants, Iberian electricity market, Power forecast, Renewable energy.

I. INTRODUCTION

Wind and solar photovoltaic (PV) technologies are expected to dominate future power systems (and electricity) mixes in Europe to achieve the decarbonisation targets [1]. However, as variable renewable energy sources (vRES), they depend on weather conditions, cannot store their primary resource, and exhibit high variability and uncertainty - especially over longer horizons. This uncertainty affects the security of supply, increases flexibility needs, and creates operational and economic challenges across electricity markets. Accurate power forecasts are therefore essential for large-scale integration, while supporting the participation of different players in the electricity markets.

Probabilistic power forecasting has emerged as a critical tool to support this integration [2]. Instead of providing a single expected value, probabilistic forecasts quantify the full range of possible outcomes, enabling market participants and system operators to assess risk exposure, optimise bidding strategies under uncertainty, and make more informed operational decisions.

As renewable penetration increases in power systems, concepts such as virtual power plants and renewable hybrid power plants (HPPs) are gaining attention to address the intrinsic variability of vRES [3], [4]. Renewable-based HPPs combine different technologies - often including energy storage - at a shared point of common coupling. This concept also foresees the hybridisation of existing assets to enable a more efficient use by exploring local generation complementarity [4], [5]. By aggregating technologies with different temporal profiles, HPPs reduce output variability, improve supply reliability, and enhance forecast accuracy when compared to standalone wind or solar plants [6]. Indeed, from a market perspective, studies using periods with reduced share of vRES show that hybridising existing wind plants can increase market value by up to 5% and total remuneration by as much as 30% compared to standalone operation [6].

The literature on power forecasting for hybrid power plants (HPPs) remains relatively limited. For example, Lindberg et al. [7] used probabilistic forecasts to investigate how aggregation affects forecasting accuracy in HPPs combining wind and solar technologies. Their results showed that a mix of approximately 50-60% wind power alongside solar PV provides the most accurate forecasts. Similarly, Couto et al. [8] analysed the market value and remuneration of different HPP configurations by hybridising existing wind power plants with solar PV, using a probabilistic forecasting approach. As anticipated, the economic performance of the HPP improved compared to the original wind-only plant.