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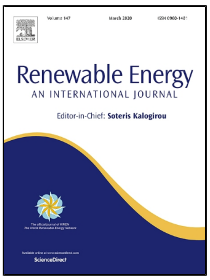

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Optimal Active and Reactive Power Cooperative Dispatch Strategy of Wind Farm Considering Levelised Production Cost Minimisation

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Abstract: Owing to the large number of wind turbines (WTs) and long transmission lines in large wind farms (WFs), the wake effect and power loss in a WF have a more significant impact on the active output of the WF. The improper operation of WTs decreases their lifetime and increases their maintenance costs. To minimise the levelised production cost of a WF, this study proposes an optimal active and reactive power cooperative dispatch strategy that considers the minimisation of total WF power loss, maximisation of WF lifetime, and maximisation of total WF power generation. The proposed strategy is compared with a traditional control strategy in a 125 MW WF, and the simulation results prove the effectiveness of the proposed strategy.

***Index Terms*—Wind farm operation strategy, wake effect, power loss, lifetime, levelised production cost.**

1. Introduction

With the increasing penetration wind power in the energy sector, the randomness, volatility, and uncertainty of wind resources impact the economics and safe operation of power grids. The operation strategy of a wind farm (WF) is directly related to the power flow distribution, network loss, and voltage stability of the system [1] [2]. If the impact of wind resource volatility on these indicators is not dealt with, a poor wind power grid connection will lead to a decrease in power quality and system stability [3]. Many researchers have studied the operation strategies of WFs, which can be divided into active and reactive power operation strategies.

Due to the rapid changes in and randomness of wind in nature, the active power output of a WF changes accordingly. When large-scale WFs are connected to the grid, the safe and stable operation of the power system will be threatened and challenged to some extent [4]. Therefore, the active power control strategy of a WF is necessary. To ensure the power balance and stability of the power system, the grid code requires that WFs should have active power regulation capabilities [5]. There are two main optimisation