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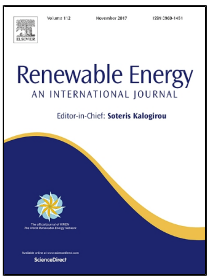

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INVESTIGATING THE ROLE OF LOCAL PUMPED-HYDRO ENERGY STORAGE IN INTERCONNECTED ISLAND GRIDS WITH HIGH WIND POWER GENERATION

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Abstract

On the basis of comparative analysis of alternative "development scenarios" for future electricity generation, this work investigates the role of local energy storage and large-scale Wind Energy (WE) production in the Interconnection (IC) of an island (i.e. Lesbos) with the Mainland (ML) grid. The economic viability of two main scenarios (i.e. Large-scale WE development and island's IC with the ML grid, with or without local energy storage) is evaluated by calculating their Levelized Cost of Energy (LCOE), while the influence of specific energy and financial parameters on the cost-effectiveness of each of the examined solutions is also investigated through a sensitivity analysis. According to the results obtained, the "costly" project of island's IC can turn into an economically attractive solution if it is combined with local large-scale WE development. Moreover, the addition of a Pumped-hydro Storage (PHS) unit is found to bring reductions in the WE rejected amounts, while part of energy imports from ML can be replaced by Hydro Turbine(s) (HTs) operation. Although islands' IC facilitates the massive deployment of RES-based applications, full exploitation of the vast Renewable Energy Sources (RES) potential may eventually include −under certain conditions− a combination of the two technologies, i.e. IC and energy storage.

Keywords: Renewable energy sources; Wind energy; Pumped-Hydro storage; Submarine interconnection; Levelized cost of energy; Lesbos island