H2-based energy storage systems in remote areas: the REMOTE project

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H_2-BASED ENERGY STORAGE SYSTEMS IN REMOTE AREAS: THE REMOTE PROJECT

Paolo Marocco[1]*, Domenico Ferrero[1], Marta Gandiglio[1], Andrea Lanzini[1], Massimo Santarelli[1]

1: Department of Energy
Politecnico di Torino
Corso Duca degli Abruzzi, 24, 10129 Torino (TO)
e-mail: paolo.marocco@polito.it, http://www.steps.polito.it

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Abstract

The REMOTE project has the objective to demonstrate the techno-economic feasibility of hydrogen-based energy storage solutions in isolated micro-grids and off-grid remote areas. Four DEMOs will be installed in four different location across Europe: Ginostra (South of Italy), Agkistro (Greece), Ambornetti (North of Italy) and Froan Island (Norway). The four sites will be characterized by different types of renewable sources (i.e., solar, wind, biomass and water fall) and user loads (i.e., residential and/or industrial), which will affect differently the design and management of the hybrid storage solution. The variety of the DEMO cases can thus provide a robust demonstration of the benefits derived from these innovative storage systems paving way for their deployment at large.

According to the 'Power-to-Power (P2P)' solution, renewable energy exceeding the electric demand, rather than being curtailed, is supplied to an electrolyzer for hydrogen production. In the four cases under consideration, the alkaline and PEM technology are considered for the electrolysis section. In case of renewable power shortages, PEM fuel cell stacks are then employed for hydrogen conversion into electricity. A battery bank is also coupled with the hydrogen section because of its short-term and quick response capability. Local Renewable Energy Sources (RES) can be therefore better used allowing to reduce or even eliminate the intervention of traditional diesel generators and avoid unstable connections to the grid, if present.

The aim of the presented work is to demonstrate the effectiveness of the H_2-based P2P solution in reducing the usage of external sources (e.g., diesel genset) by maximizing the exploitation of local RES. Operation strategy models have been developed in order to perform energy balance simulations on a yearly basis. Results showed the usefulness of the P2P operation: in Ginostra, for example, the intervention of diesel generators can be reduced to less than 5% of the total load. Hydrogen was found to be particularly effective as a longer term energy storage solution. Economic considerations are also provided to outline the economic viability of the suggested RES and H_2-based scenario.