

Innovative Self-Optimizing Control of a Building Microgrid Exploiting Hydrogen Multiple Services Potential

LAB: ESTIA-Recherche

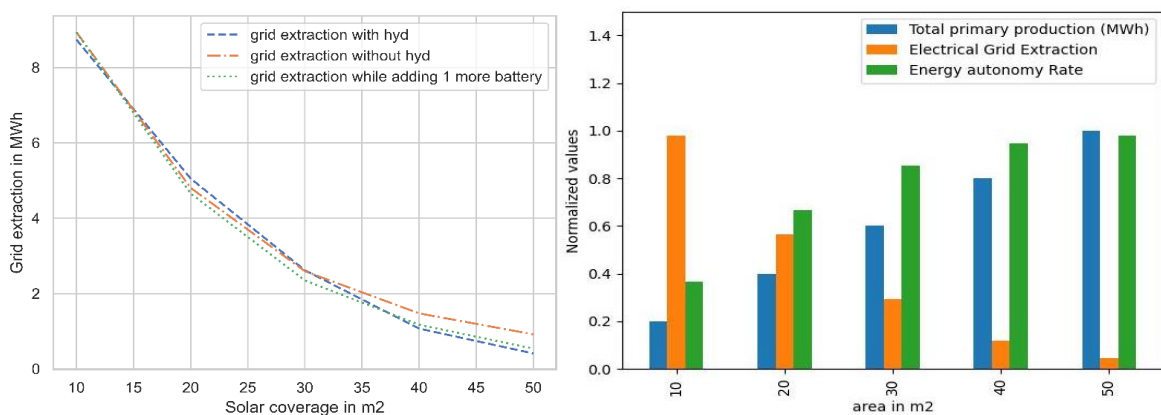
Abstract

Based on the current energy transition for homes, it is necessary to offer a solution that can meet the energy needs of consumers while accelerating the local penetration of renewable energy resources. While there are numerous energy storage solutions, each comes with its own caveats. This thesis focuses on hydrogen-based storage system for residential applications. In order to efficiently run a microgrid based on hybrid storage, it is necessary to have an energy management system (EMS) that can optimize energy storage and improve system efficiency. This thesis is done in collaboration with a French enterprise H2gremm¹ which focuses on developing energy solutions for households. As a part of the research, the goal of the thesis is to develop energy management strategy optimized for local conditions keeping in mind the physical and local constraints of the system.

Design and Feasibility of Hydrogen-Based Hybrid Microgrids for LV Residential Service.

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With the increased penetration of renewables, energy storage has become a critical issue in microgrid and small household applications. Accordingly, this paper undertakes a feasibility study the varying limitations from conventional batteries in residential buildings, such as capacity-loss over time and aging, as well as the alternative application and challenges of hydrogen-based storage for the domestic sector. The paper considers a test case study where an analysis is performed on the practicality of hydrogen-based storage, in addition to lithium-ion battery storage. Various scenarios are considered based on solar installation sizes, self-consumption, battery capacity, autonomy rates and grid extraction. A detailed analysis is carried out on both thermal and electrical demands of a residential household, which also includes the energy performance and applications of heat pumps. While the obtained results from various scenarios are compared and analyzed, these anticipate that the potential integration of hydrogen can improve the autonomy rate of residential buildings. The cost of hydrogen storage is expected to reduce significantly, opening opportunities for hydrogen application



¹ www.h2gremm.com