Storing electrochemical and thermal energy: influence of design on performance parameters

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The increasing demand for energy-efficient buildings requires innovative solutions for energy management and storage. The integration of electrochemical and thermal storage systems offers significant potential to improve the energy performance of buildings reducing greenhouse gas emissions. This work assesses the influence of electrochemical and thermal storage system design on the key energy performance parameters in buildings.

A residential building model is proposed to simulate various design configurations for thermal and electrochemical storage. Additionally, different energy usage scenarios (e.g. varying the number of electric vehicles) and climatic conditions are considered to evaluate the effectiveness of the proposed solutions. Model predictive control is employed to ensure optimal energy management within the residential building.

Results highlight that the optimal design of the storage system can significantly increase the overall energy efficiency of the building as well as the renewable energy exploitation. Additionally, the combination of electrochemical and thermal storage has shown a significant reduction in peak loads and an improvement in energy flow stability characteristics.

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