# Distributed Co-simulation for Smart Homes Energy Management in the Presence of Electrical Thermal Storage

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## Metadata

**Abstract:**

Distributed generation and energy storage technologies have helped SmartGrid projects gain great momentum over the last decade. However, despite a large number of pilot and demonstration projects, low-level information is often unavailable. Therefore, tools for defining and building different operation scenarios are required. These tools can facilitate adopting novel approaches to multi-domain energy management. This paper proposes a distributed, flexible co-simulation framework to integrate simulators from separate domains and platforms. Particularly, the proposed scheme enables the development of hybrid thermal-electric systems for smart buildings. In this study, an object-oriented approach to modeling electrical thermal storage (ETS) units is also suggested. The evaluation process is carried out using real-world data. A case study is practiced by designing a residential agent that performs model predictive control (MPC) of residential heating load in the presence of ETS. The results show that proper integration of ETS into Home Energy Management Systems (HEMSs) can achieve economic savings of up to 45 %. The findings of this study demonstrate ETS's high potential for reducing customer bills while satisfying users' comfort. Furthermore, they recommend practical strategies for short-term planning of smart grids by increasing their flexibility based on ETS-integrated Demand Response (DR) programs.

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