

Autonomous Demand Response Control using Heat Pumps in Residential and Commercial Buildings

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Abstract:

The energy used for heating and cooling has significant impact on the electricity bills of residential and commercial buildings, and heat pumps have been installed as a solution to reduce these costs. In Europe, around 11% of the buildings already have heat pumps installed, but there is still a lack of optimization of their usage profile to maintain the thermal comfort of the buildings and the equipment efficiency. Moreover, buildings with photovoltaic (PV) energy generation have additional flexibility that can be explored, but the operational complexity also increases, which makes finding the optimal profile to enhance self-consumption challenging. Techniques for energy optimization and building modeling can help to identify the best energy profile in an automated way, facilitated by IoT devices and advanced communication infrastructure. The objective of this paper is to provide a framework to perform autonomous demand response control actions and demonstrate a use case for improving the usage of heat pumps. This includes the data to be collected for the simulation of thermal patterns and to create the optimal curve of energy usage in two real scenarios. The achievements of this study show that remote access to the system data can allow for enhanced energy usage, through the utilization of building modeling and electric energy optimization models.

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