

P3DSM

Practical and Privacy Protecting Demand Side Management with Domestic Water Heaters

Programm / Ausschreibung	FORPA, Forschungspartnerschaften NATS/Ö-Fonds, FORPA OEF2020	Status	abgeschlossen
Projektstart	01.10.2021	Projektende	31.12.2024
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Projektbeschreibung

As the share of renewable sources in the energy mix of both electrical and thermal grids continues to increase, a clear need has arisen to improve approaches to address the short-term unpredictability of many renewable energy sources. Demand Response (DR, a form of Demand Side Management) is seen as a key technology in this regard, allowing non time critical demand to be moved to periods where other demand is lower, and reduction of demand in response to supply shortfall. Domestic electric hot water heaters (DEWHs) are an attractive target for DR for the electricity grid, due to their combination of high stored energy and high electrical load. However, they present some unique challenges, as the total available potential is spread among a large number of devices. In order to utilise the potential of DEWHs, there are two key challenges to be addressed. First, a method is required to actuate control, while at the same time ensuring that hot water is available for use when required. Second, a method is required to aggregate a large number of devices into a pool representing sufficient load to have a meaningful impact in a DR scheme.

In the area of ensuring that sufficient hot water is available, most previous research relies on temperature instrumentation on the hot water tank, which would be disruptive and costly to install for existing installations. For aggregation of DEWHs specifically most approaches have focused on centralised Direct Load Control schemes, which in addition to being potentially computationally intensive for the central controller, requires the transfer of data which could reveal household living habits. This project aims to expand on the state of the art in both aspects. An improved method of estimating the state of charge and future hot water demand of a DEWH will be developed, taking advantage of low-cost hardware that can both control the boiler and measure its power consumption to provide a cost-effective path to retrofit. Physical models of hot water storage tanks will be combined with machine learning techniques to create a system that can use only power consumption data to estimate periods when the DEWH can be isolated without impacting user comfort.

An agent-based Demand Bidding aggregation approach will be elaborated and modelled. In this method, user agent software connected to the state of charge and demand estimation models, will offer DEWH flexibility to an aggregation market, where larger volumes of load curtailment can be purchased by commercial entities.

The methods will be implemented on prototype hardware and tested in the laboratory.

Projektpartner

- AEE - Institut für Nachhaltige Technologien (kurz: AEE INTEC)