

Preparation of Abstract for 2014 IERE-GDF SUEZ Brussels Workshop “Energy at home”

The potential of active demand response with residential wet appliances in Belgium

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Abstract

Linear is a large-scale demonstration project where residential demand response is implemented with 250 households in the region of Flanders. The consumers' appliances are controlled to respond to varying pricing schemes, remove unbalances in wind prediction and support the LV grid voltage. This paper discusses the scaling up of the measurement data to estimate the potential in terms of power at a regional level. In order to do so, the electricity consumption of 1363 households was measured, combined with a survey with 415 participants, allowing social segmentation of the participants of the demonstration.

The up-scaling approach is depicted in the figure and requires representative groups of the total population, social segmentation and the project data to scale up.

These representative groups are found by applying Expectation Maximization clustering to the electricity demand of a large group of households (n=1363, data obtained from DSOs). A subset of those households (n=415) responded to a survey to determine properties of the representative groups, such as appliance ownership rates and attitude towards active demand.

Within the Linear project, both total electricity demand as the electricity demand of the wet appliances are measured. In this study, only shiftable loads, i.e. washing machines, tumble dryers and dishwashers, are considered. The model, i.e. the representative groups, found by the clustering algorithm (Expectation Maximization) is adapted for data up-scaling by relaxing the cluster memberships. The load curves of the households of the Linear project are presented to the adapted model found by the clustering algorithm, resulting in probabilities of belonging to the representative groups. The appliance measurements are scaled with those probabilities to find how the appliances are used within the representative groups, hence spreading the measurements of the individual appliances over the various representative groups.

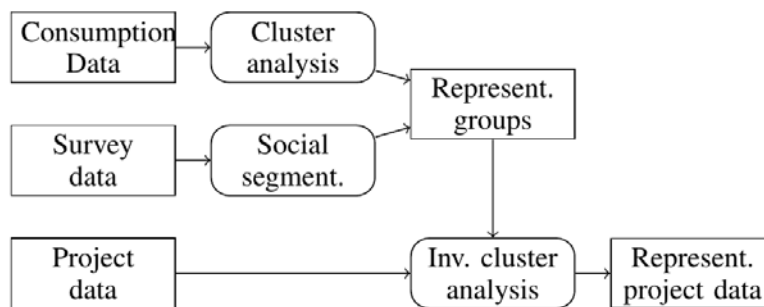


Figure 1: Approach

The recombination of representative groups, i.e. the electricity demand per wet appliance type, the ownership rates of the appliances and the attitudes towards active demand, results in the potential of active demand. The potential is found to be 4% of the residential electricity demand if 29% of the households take part. Active demand by wet appliances is in the magnitude of the power reserves, but does not meet the requirements because of the low response time (approx. 30 minutes) and the availability requirements. Active demand with wet appliances can however be used as a last resort for balancing.

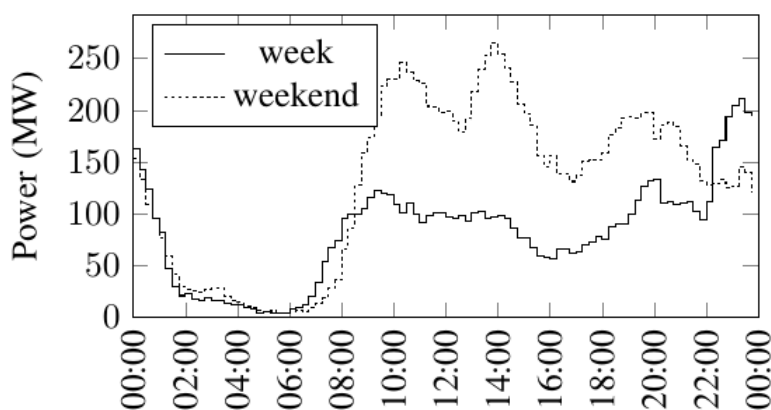


Figure 2: Potential of active demand with wet household appliances

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