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Imbalance reduction of a Virtual Power Plant in a field test with 150 heat pumps

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Abstract

A Virtual Power Plant, consisting of 150 agents representing an identical amount of heat pumps in an apartment building, an agent representing a distribution station and an imbalance agent connected to a wind farm representing the imbalance in the grid, is studied in a field test aimed at investigating the imbalance reduction opportunities, with and without peak shaving of the distribution station. The operation of the heat pumps can be shifted in time in order to balance the difference between the forecasted and actual power generated by the wind farm. To detect whether any user comfort infringement occurs in the building the indoor temperature, set point and status of the heat pump of each apartments are measured.

The field test covers a ten months period of continuous operation and an analysis is carried out which specifies the flexibility and reliability of response of the smart grid towards the imbalance signal as a function of outdoor temperature; also the results of monitoring the indoor temperatures and heat pump operation will be presented.

Load duration curves with and without imbalance reduction are compared and based on certain assumptions regarding the market size of the Dutch imbalance market an analysis will be presented to quantify the amount of money which can be saved by the retailer with a VPP like the apartment of Couperus in The Hague..

Thus, important characteristics regarding the business case of imbalance reduction by Virtual Power Plant are revealed and their potential for the smart grid assessed.