

Svenska Kraftnät and Fortum – Flexible households

Participants: Svenska kraftnät, Fortum, Relacom

IEA categories: Customer-side systems

Time plan: March – April 2017

Web: <https://www.svk.se/siteassets/om-oss/rapporter/2017/slutrappport-pilotprojekt-flexibla-hushall.pdf>

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Location: Stockholm area

Possible to visit: No

Background

The frequency in the power system is a measure of how well-balanced generation and consumption are in the system and should ideally be kept at exactly 50 Hz. When there is a deviation from 50 Hz, there are systems in place to either increase or reduce the energy in the system, to balance the frequency back to 50 Hz again. When the frequency falls below 50 Hz, total energy in the system needs to be increased either by increasing electricity generation or decreasing consumption.

In this project, the goal was to investigate if households can offer flexibility that can be sold at the balancing market, by allowing for their water heaters to be controlled. While each heater is small, a large number of heaters aggregated together can have significant influence on the electricity consumption. If the aggregated consumption can be regulated down in a controlled and automated manner, this allows for the aggregator to sell this decrease in consumption on the balance market.

Implementation of the project

Roughly 100 households in the Stockholm area participated in the project, and had equipment installed by Relacom. This equipment allowed for Fortum to monitor and control the water heater in each household and turn it on and off remotely. The idea was to offer a bid of 0,1 MW for select hours, and if the bid was activated, to turn the water heaters off to decrease electricity consumption. The customer should ideally not notice any change in comfort even if their water heater is turned off for shorter periods of time.

The project showed that it is possible to sell frequency stabilisation service with this method, but also that there still are some challenges that still need to be overcome. For example, there were instances where water heaters needed to be turned on some hours in advance to allow for them to be turned off when the bid was activated some hours later. This runs the risk of increasing the overall energy use to be able to fulfil the promised flexibility. In the project, there were also some lessons learned regarding the number of customers needed for this kind of flexibility to be a useful resource.

Benefits

The stability of the power grid relies heavily on hydro power in Sweden, which is because hydro power is well suited for this. However, increasing penetration of intermittent power sources such as solar and wind will see an increased demand on balancing services. If frequency stability can be helped by aggregators allowing for customers to allow for flexibility, this is a service that has a good potential of making the power system more robust. A more diverse set of balance services also makes the power system less vulnerable and can help driving down the price on balance.

Scalability

Water heaters as a flexibility resource has its limitations in that each heater is small. However, the same principle can be used for other household appliances as well, for example electrical vehicle chargers or heat pumps. The viability of this ought to be thoroughly analysed.

Interoperability

New equipment needed to be installed at each household to be able to monitor and control the water heater. There were problems with interoperability between the new equipment and the fuses at certain customers,

that could not participate in the project. If this kind of user flexibility becomes more common, that kind of interoperability problems is very likely to be addressed. There are also improvements to be made between the aggregator and the TSO's system.

Investment horizon

From this pilot alone, it is hard to draw any conclusions regarding the investment. More data is needed.

International potential

The concept of user flexibility is possible to use in any grid.