

Virtual Power Plant for Smart Grid Ready Buildings and Customers

In tomorrow's electric system, a considerably more flexibility "Smart Grid" is needed for the electricity customers and the interaction between the different energy systems must be utilized to a much greater extent than today. In addition, customers need to be involved to become a useful asset in the demand response of the smart grid. To be successful, the involvement of the customers must be based on other incentives than just the economic one.

The aim of the project is to make a large residential complex and its customers "Smart Grid Ready". Control and demand response potential of all controllable energy use (and potentially also of the local electricity generation) must be monitored by the building's own Virtual Power Plant (VPP). Subsequently, the VPP of the building can pool and offer the overall demand response potential to a global VPP at a higher tier in the hierarchy. From here, a given aggregator responds and acts to balance the electrical grid and to participate in the pricing on the electricity market.

The project methodology is a participative approach in which the various users and other stakeholders in the future of smart grid are involved in needs analysis and development of solutions. The project focuses on the interdisciplinary cooperation and works with iterative development processes where identified user needs will form the basis for the development of solution concepts. In user studies mainly use qualitative methods such as interviews and workshops. A newly constructed low-energy building with 159 apartments where the energy consumption is measured for each apartment has been chosen as case study.

The outcome of the project will be a feasibility study on how to use larger building complexes (residential) as an integrated part of the smart cities via the building's smart grid functions. Furthermore, the results will be used to formulate a recommendation on how to construct future buildings and how existing buildings can be "smart grid-improved". Additional results will be used in a recommendation on how to involve customers to make them an important and useful asset in future electricity networks to become the "Smart Grid Ready" customers of the future.

The project is carried out by Aarhus University in collaboration with Municipality of Aarhus, Alexandra Institute, Grundfos Holding, GreenWave Reality, and DONG Energy. The contribution from Department of Environmental Science, Aarhus University is to provide meteorological forecast and air pollution service to be used as input in a smart building control.

Project period is 2013 to 2016.

The project is funded by ForskEl (www.forskel.dk) with a total budget of DKK 11.2 million.

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