Building as a Power Plant (BaaPP):

The use of buildings to provide demand response

National Centre for Energy Systems Integration

Introduction

Buildings are complex thermodynamic objects that account for a large proportion of energy consumption in developed and developing countries. The flow of energy in buildings are complex and with increasing size and functionality of a building, it becomes more critical to have metering mechanisms that help quantify where and how energy is used and if areas of improvement can be identified.

At the same time aging electricity infrastructure in the UK and much of the developed world are undergoing radical changes that are driven by decarbonisation needs, renewable integration and distributed storage, electric vehicle support and operational reliability [1]. It would be impossible to achieve all these without a greater emphasis on demand response, where the consumers of electricity can modulate their own consumption in aid of grid operators to achieve 'supply stability'.

Figure 1 USB building is a living laboratory with complex services engineering that can facilitate urban sustainability research

Building as a power plant research (EP/P034241/1)

Newcastle University's Urban Science Building (USB) was designed and built with advanced metering infrastructure (AMI) in order to provide a platform for a multitude of research questions, among which is the examination of the role of a Building as a Power Plant (BaaPP). This project aims to undertake a complete audit of the energy consumption of the USB building, and identify and model loads that are potentially 'interruptible' for relatively short periods of time. These 'interruptible' building loads can then be turned up, down, shifted or completely switched off with practically no impact on the occupant's sense of comfort, productivity and the building's security the integrity of all operations.

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Funder:

- Engineering & Physical Research Council
- (EP/P034241/1)

Project partners:

- Bowmer and Kirkland Ltd
- Buro Happold
- Hawkins\Brown Architects LLP
- Keepmoat
- Newcastle City Council
- Newcastle University
- Northern Powergrid
- Siemens

EPSRC Engineering and Physical Sciences Research Council · Newcastle University · Durham University · Heriot-Watt University · University of Sussex · The University of Edinburgh

Distribution Network Operator Challenge

- The ramp rate is limited to around 0.2% of capacity per second for frequency rate of change of 0.1Hz/s.
- How quickly and how long the building can provide FR
- Extensive Lit. Rev. to outline market review arrangements regarding helping building owners understand the value of interaction with the grid.

References

[1] Ipakchi, A. and F. Albuyeh, Grid of the future. IEEE Power and Energy Magazine, 2009. 7(2): p. 52-62.

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