Energy Flexible Buildings

ANNEX 67

The foreseen large deployment of renewable energy sources may seriously affect the stability of energy grids. It will be necessary to control energy consumption to match instantaneous energy production. The built-in Energy Flexibility in buildings may be utilized for stabilizing the energy grids and allow for a larger roll out of renewable.

The Energy Flexibility of a building is the ability to manage its energy demand and generation according to local climate conditions, user needs and grid requirements. Energy Flexibility of buildings will thus allow for demand side management and load control and thereby demand response based on the requirements of the surrounding grids.

Energy Flexibility may be obtain in several ways. All buildings have e.g. thermal mass embedded in their constructions, which makes it possible to store a certain amount of heat. Depending on the amount, distribution, speed of charging and discharging of the thermal mass, it is possible to postpone active heating or cooling for a certain period without compromising thermal comfort in the building. And if, prior to the shutdown of the heating or cooling system, the thermal mass is pre-heated or pre-cooled, but still within the comfortable room temperature range, it may be possible to prolong the shutdown period.

Currently there is, however, no overview or insight into how much Energy Flexibility different building types and their usage may be able to offer to the future energy systems. The aim of the Annex is thus to increase knowledge on and demonstrate the Energy Flexibility buildings can provide for the energy grids, and to identify critical aspects and possible solutions to manage this Energy Flexibility.

In-depth knowledge of the Energy Flexibility that buildings may provide is important for the design of future Smart Energy systems and buildings. The knowledge is, however, not only important for the utilities it is also necessary for companies when developing business cases for products and services supporting the roll out of Smart Energy networks. It is further important information for policy makers and government entities involved in the shaping of the future energy systems.

The project beneficiaries are:
– the building research and education communities,
– district system operators (DSOs), transmission system operators (TSOs) and aggregators,
– architects and design companies, engineering offices and consultants,
– building component, HVAC-system and controls developers and manufacturers, and
– policy and decision makers and their advisors involved in shaping future energy systems.

Objectives
The project objectives are:
- the development of common terminology, a definition of ‘energy flexibility in buildings’ and a classification method,
- investigation of user comfort, motivation and acceptance associated with the introduction of energy flexibility in buildings,
- investigation of the energy flexibility potential in different buildings and contexts, and development of design examples, control strategies and algorithms,
- investigation of the aggregated energy flexibility of buildings and the potential effect on energy grids, and
- demonstration of energy flexibility through experimental and field studies.

Deliverables
The following project deliverables are planned:
- source book: Principles of Energy Flexible Buildings,
- technical report: Terminology, definition and Flexibility indicators for characterization of Energy Flexibility in buildings,
- technical report: Guidelines on modelling of Energy Flexibility in buildings,
- technical report: User perspectives,
- technical report: Control strategies and algorithms,
- technical report: Test procedures and results,
- technical report: Design examples on optimization of Energy Flexibility in buildings.
- Project Summary Report

Recommendations for government policy makers

A stable energy and power supply is of the utmost importance for a modern society. The transition towards energy systems based entirely on fluctuating renewable energy challenge, however, the stability of the energy networks. Future high penetration of variable renewable energy sources forces thus a transition from generation on demand to consumption on demand in order to match the instantaneous energy generation. In practice, this means that the energy consumption needs to become flexible. Buildings are foreseen to be able to deliver part of the necessary flexibility.

- Annex 67 will give important knowledge on energy flexibility of buildings for use in the plans for the future energy systems
- the knowledge from Annex 67 may give guidance on how to include requirements for energy flexibility in national building regulations
- the outcome of Annex 67 may form the basis for labelling schemes regarding flexibility of buildings

Progress

The project working phase was approved in June 2015.

Literature reviews on existing terminologies, definitions and flexibility indicators, on user needs, motivation and barriers and on applied and tested control possibilities are currently being carried out and will be concluded I 2016. This will form the basis for the work in the Annex.

A common simulation exercise has been started in 2015. It will give the first impression on how to characterize Energy Flexibility in buildings. The object of the exercise is a single family house with a heat pump and a PV system.

Meetings

- The 1st definition workshop took place in Basel, Switzerland, September 2014.
- The 2nd definition workshop took place in Brussels, Belgium, March 2015
- The 1st working meeting took place in Lisbon, Portugal, September-October 2015

Project duration

2014 – 2019

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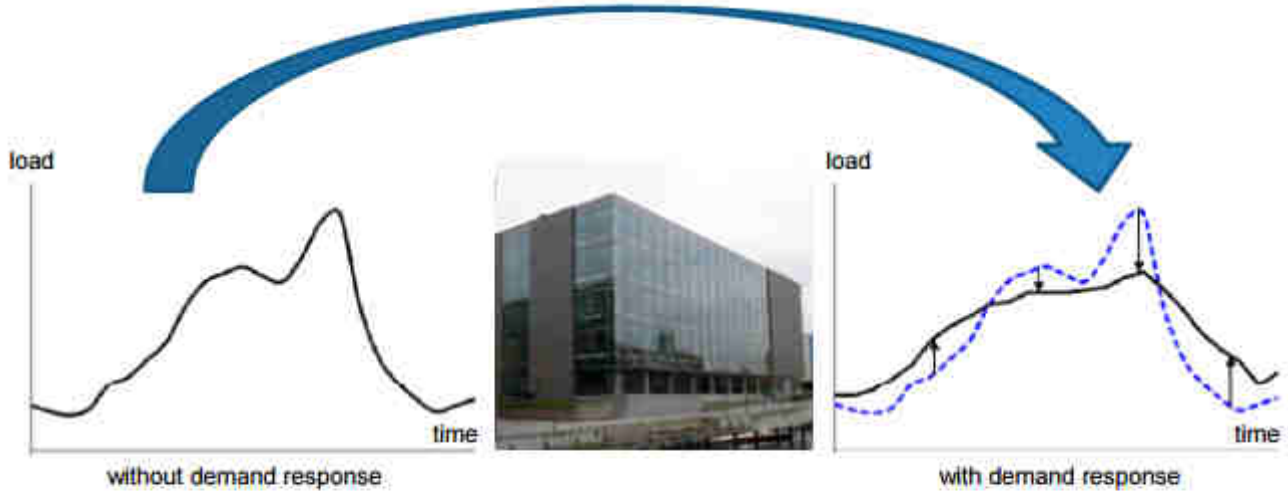
Participating countries (provisional)

Austria, Belgium, Canada, Czech Republic, Denmark, Finland, Germany, Italy, The Netherlands, Norway, Portugal, Spain, Switzerland, UK

Further information

www.iea-ebc.org



The energy flexibility of a building can be applied for peak shaving, i.e. high peaks in energy demand during the day are moved to periods with low usual energy demand.
Source: EBC Annex 67