MINUTES

CITIES WP3 Flexibility and Buildings Workshop

7 September 2015

Present

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Program

10.00-10.20: Alfred Heller, DTU Byg, *'Getting the perspective of flexibility for CITIES WP3'*

10.20-10.40: Per Bromand Nørgård, DTU Elektro, *'Characterisation and quantification of flexibilities in the energy exchanges between buildings and the energy system(s)'*

10.40-11.00: Henrik Madsen, DTU Compute, *'Using Models and Control for Balancing the Fluctuating Wind and Solar Power'*

11.00-11.20: Pierre Vogler Finck, NeoGrid Technologies, *'Towards a more optimised control of heating in households'*

11.20-11.40: Steffen Petersen's group, Aarhus University, *'On the smart energy potential of buildings'*

11.40-12.00: Christian Holm Christiansen, Danish Technological Institute, *'Retrofitting Existing Buildings for Energy Flexibility'*

12.00-13.00: Lunch

13.00-13.30: Per Heiselberg, Aalborg University, '*Potential heating demand flexibility in residential buildings using the thermal mass for short term heat storage'*

Anna Joanna Marszal, Aalborg University, *'Flexible buildings in low-voltage network environment – preliminary studies and ideas for future work'*

13.30-15.00: Per Dahlgaard Pedersen, NeoGrid Technologies, *'TotalFlex demonstration'*

15.00-15.10: Break

15.10-16.00: Discussion of possible cooperation and follow-up, conclusion

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Agenda

Alfred Heller (DTU Byg): Why is flexibility a topic of CITIES project? Research question: Can a more proactive building energy management help stabilize the overall energy system?

Carsten Rode (DTU Byg): Welcome note and presentation of the agenda. The CITIES project focuses on flexibility and this is pointed out by the frequency that the term 'flexibility' is met in CITIES project description.

Per Nørgård (DTU Elektro): Characterization and quantification of flexibilities in the energy exchanges between buildings and the energy system(s)

Flexibility is required, hence has a value. What are its characteristics and which value does it have for customers and for utilities?
What energy services do we ask for? (i.e. indoor climate). Building design is the most important. Also, urban planning pays a significant role when talking about flexibility in the energy network.

Henrik Madsen (DTU Compute): Olympic Peninsula project. The main source of flexibility is heating/cooling. Price responsivity: flexibility is activated by adjusting the setpoint. A standardized price was used because of the very much changing prices in general. The impact of price change varies over one day, but generally users did react on low prices.

Pierre Vogler-Finck (NeoGrid): Why optimize heating? Benefits are obvious in tests on large buildings. Savings up to 20% can be expected but depend on weather and insulation of thermal envelope. Thermal comfort is the main constraint to HVAC control. Simple thermal models are key in control applications. Predictive control has a large potential to allow more efficient heating in large buildings – extension to houses is worked upon.

Steffen Petersen (Århus University): On the smart energy potential of buildings. The READY project: demonstration of a balanced and holistic approach towards energy-retrofitting in housing areas of Växjö and flexible combined grid balancing/electricity storage solutions for buildings and energy systems. An important finding regarding smart building operation is that we do not need night setback. Also, through MPC we consume more energy but we save money in the energy bill.
Theis Pedersen (PhD) is examining the smart grid potential in existing residential buildings (different occupancy profiles and predictive control). Thermal mass is very important to prevent thermal discomfort. A key input for predictive control is occupancy. Michael Knudsen (PhD) is working on model-based control of HVAC for demand response.

Christian H. Christiansen (TI): Experience shows that there are little savings by time control in residential buildings. Monitoring in 12 houses with stopping heat pumps for 4 to 36 hours was applied to test variation of room temperatures. Temperature boost to reduce heat-up-time has the drawback that COP reduces as well. Weather/load forecast is required day ahead in order to plan flexibility/moving energy. Overall, lack of heating capacity can reduce flexibility, but electric heating panels or coils in ventilation units may add extra flexibility. The strategy of the varying set point (23-26 °C) has significant energy savings, which usually have a short payback time.

Anna Marszal (Aalborg University): How can operational bottlenecks in the interaction between Near Zero Energy Building and the power grid interaction be avoided and what performance indicators can optimize NearZEB design for an intelligent interaction with the power grid? Energy-load model is treated as an empirical probabilistic bottom-up model. Time resolution plays an important role: when using 1 h resolution, the load peaks are leveled out. Indicators to evaluate flexibility: at building level and at transformer level.

Per Heiselberg (Aalborg University): quantification of flexibility of different terminals for heating in terms of storage and heat release. Two different houses (passive house and single family house from the 80s) and different types of heating system were examined. Underfloor heating in passive house had a high risk of overheating if there is no model predictive control. Lessons learned from simulations: a) importance of time-step and type of solver (CTF/FDM), b) sizing of heating system is important. What is the influence of controller?

Per D. Pedersen (NeoGrid): TotalFlex demonstration. Solutions for increasing electricity consumption: smoothen power consumption during the day and grid reinforcement. Flexibility market involves balancing between production and consumption, TSO/DSO grid load and consumers. Utilization of flexible types of demand (refrigerator, AC, EV). Flexibility requires a comfort range. Sources of flexibility can be HVAC, freezing, battery charging, water pumping etc. The flexible offer (FlexOffer) represents flexible demand (and supply) in the unified way. FlexOffer is initially aggregated and then disaggregated before being distributed back to the prosumers.

Laurynas Šikšnys (AAU): TotalFlex demonstration-Aggregator role. Aggregator acts a Commercial Virtual Power Plant (CVPP) providing visibility and real-time control of DERs. It collects and manages flex-offers from prosumers. In the market bid generation, bid prices are estimated based on prosumer contracts / bills. Via the flex-offer concept, all available flexibility is utilized, independent of size.

Konstantinos Kouzelis (AAU): TotalFlex- DSO challenges and benefits. A DSO is responsible for the reliable supply of electricity to consumers. He is able to control or request control of the loads due to their flexibility potential. The DSO would buy as little flexibility as possible in order to alleviate his grid limit violations. TotalFlex supports existing energy markets (simple intra hour market clearing was presented).