IEA EBC Annex 67 – Energy Flexible Buildings

A Brief Overview

A. Susanne Metzger

Institute of Computer Engineering, TU Wien

Automation Systems

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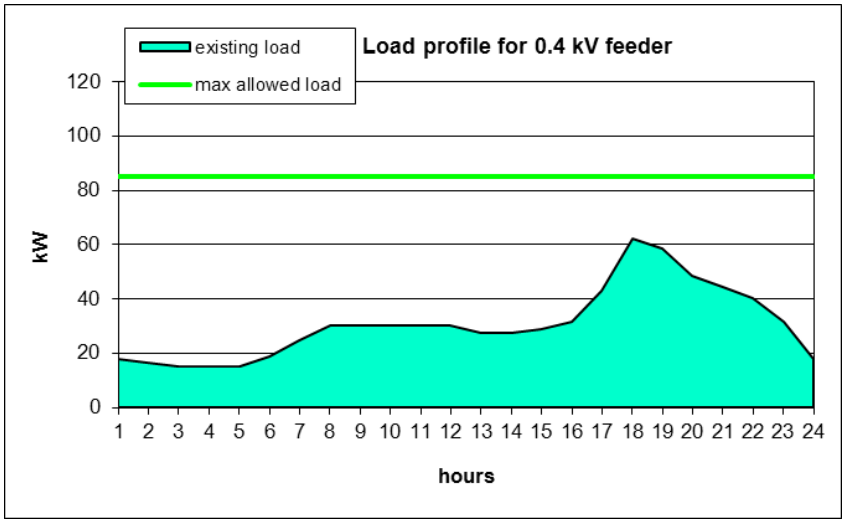
Demand-response perspective of buildings

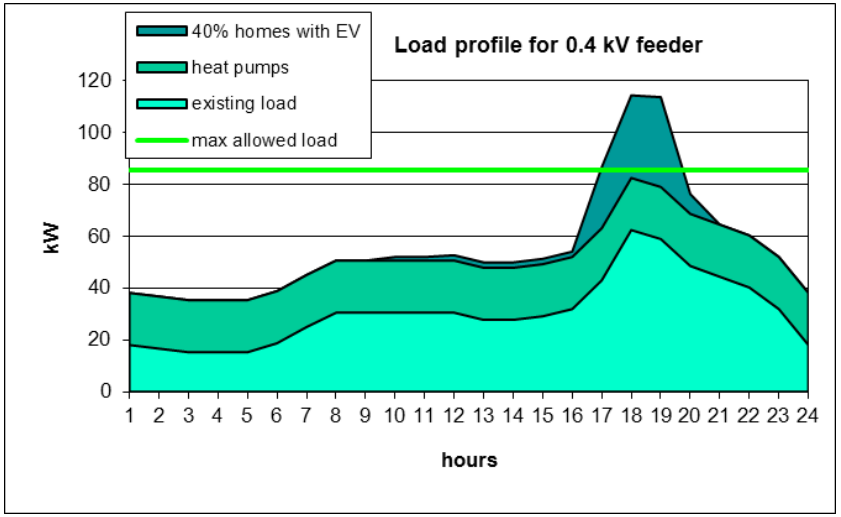


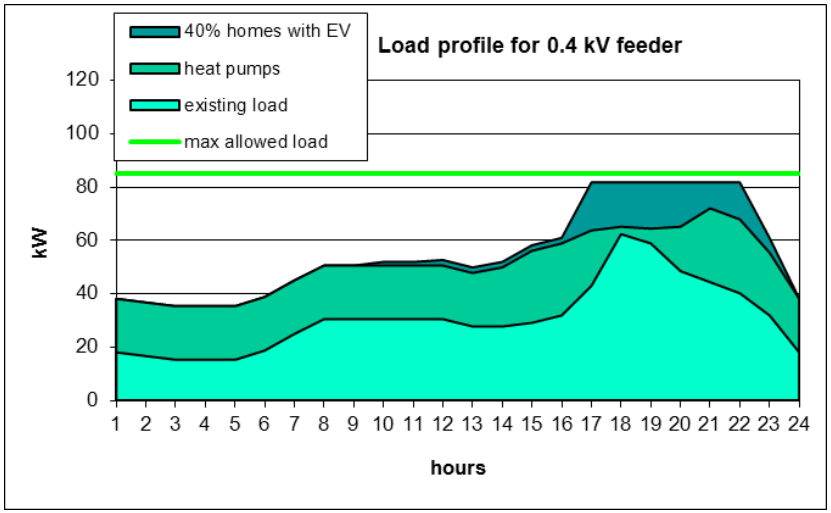
Smart grid example

Danish study: Impact of heat pumps and electric vehicles on grid utilization

Building perspective needed:

How much demand control is available in different buildings types and operations?





Source: IEA EBC Annex 67 Energy Flexible Buildings. Søren Østergaard Jensen, Anna Marszal-Pomianowska, Roberto Lollini, Wilmer Pasut, Armin Knotzer, Peter Engelmann, Anne Stafford and Glenn Reynders. EBC special issue of Energy and Buildings, October 2017.

Annex 67 work program

Organisation

- Søren Østergaard Jensen (Operating Agent)
- 16 participating countries
- 2016 – 2019
- www.annex67.org

*"The **Energy Flexibility** of a building is the ability to manage its demand and generation according to local climate conditions, user needs and grid requirements."*

Subtask A: Definitions and Context

- Common terminology and definition of Energy Flexibility in buildings
- Methodology for characterization of Energy Flexibility in buildings
- User needs, motivation and barriers for application of EF in building
- Market analysis

Subtask B: Analysis, Development and Testing

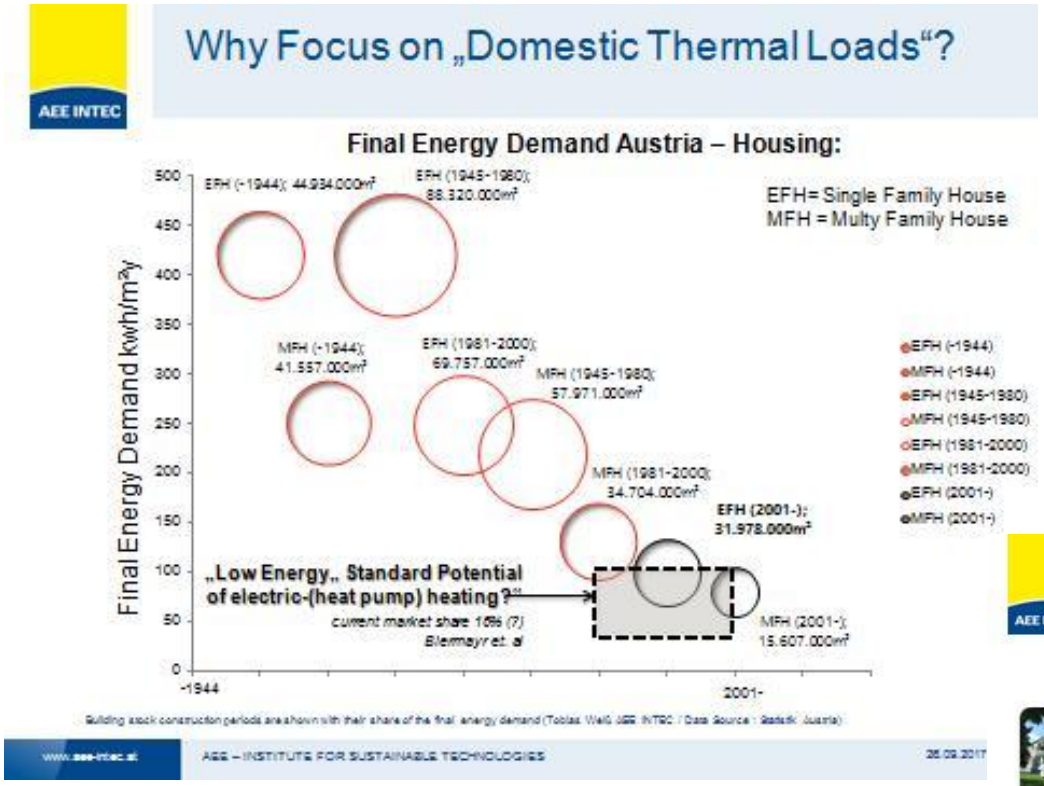
- Simulation of Energy Flexibility in single buildings and clusters of buildings
- Control strategies and algorithms
- Laboratory tests of components, systems and control strategies
- Example cases and design examples

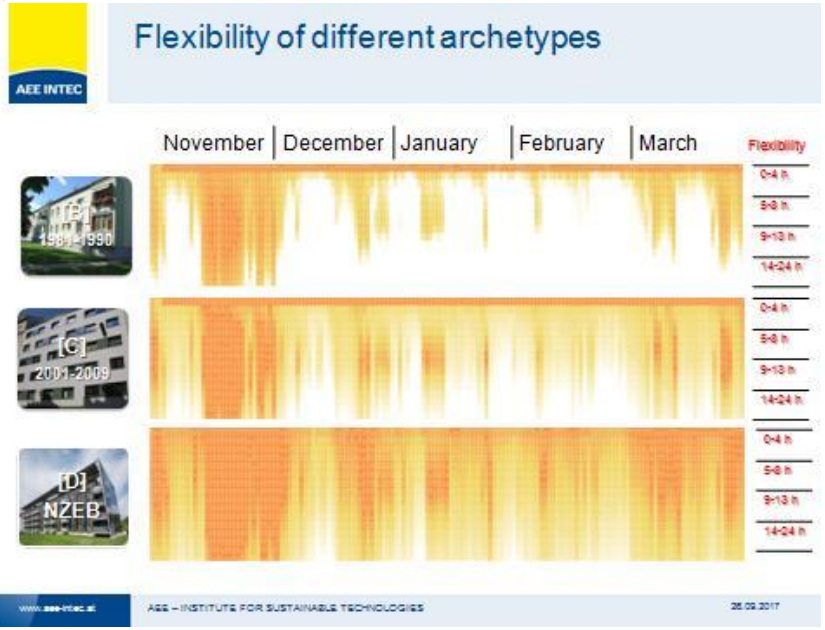
Subtask C: Demonstration and User Perspectives

- Measurements in existing buildings
- Demonstration of Energy Flexibility in real buildings and clusters
- User motivation and acceptance

Source: Energy Flexible Buildings. IEA EBC Annex 67. Søren Østergaard Jensen. Presentation at the workshop Energy Flexible Buildings. TU Wien. Vienna, Austria. 2017.

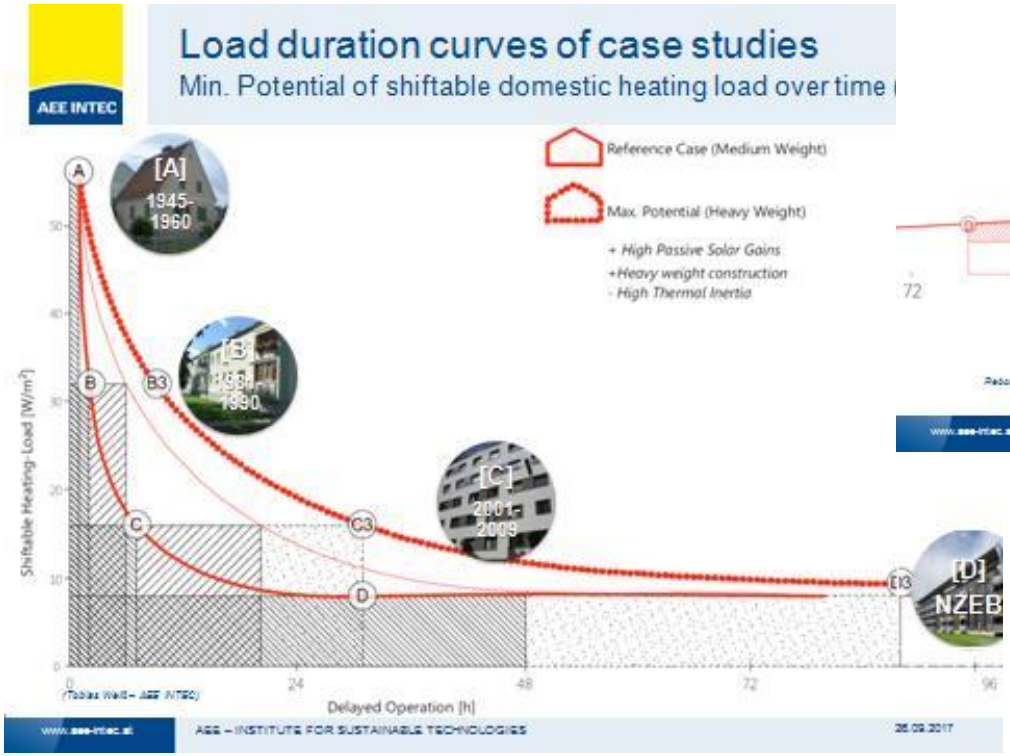
WIP: Simulation of the Austrian building stock

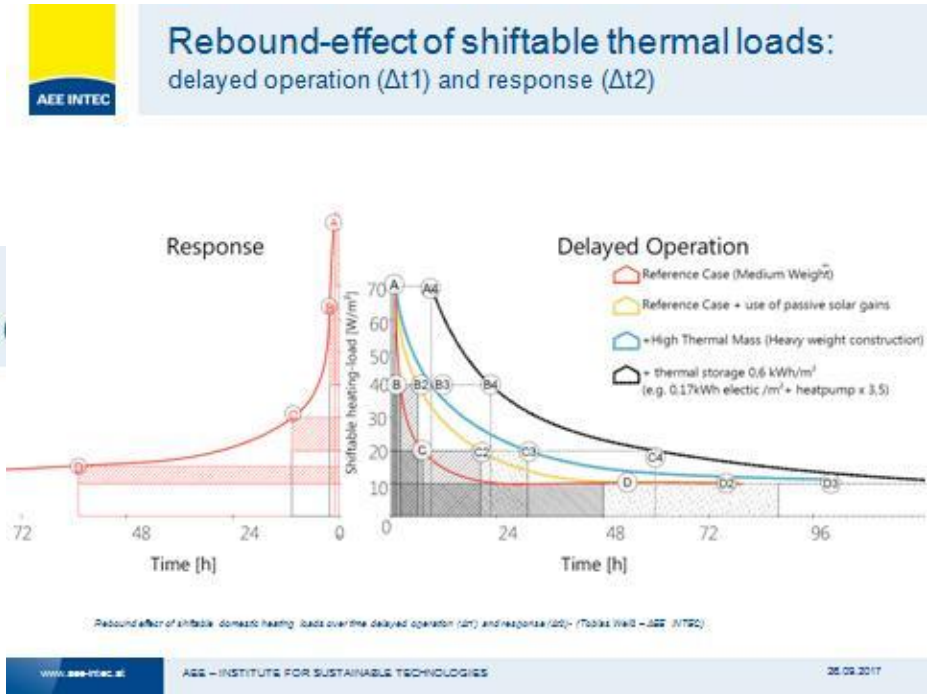




Source: The potential of energy flexibility based on the Austrian typology. Tobias Weiss, Armin Knotzer. Presentation at the workshop Energy Flexible Buildings. TU Wien. Vienna, Austria. 2017.

WIP: Simulation of the Austrian building stock





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DR improvement with complex information models

Forecasts for a frequent building typology

- 6 apartments on 3 stories
- Cluster of 500 units in Vienna, Austria
- Electrical convection heater
- ✓ *Improvement in > 30% of DSM events*

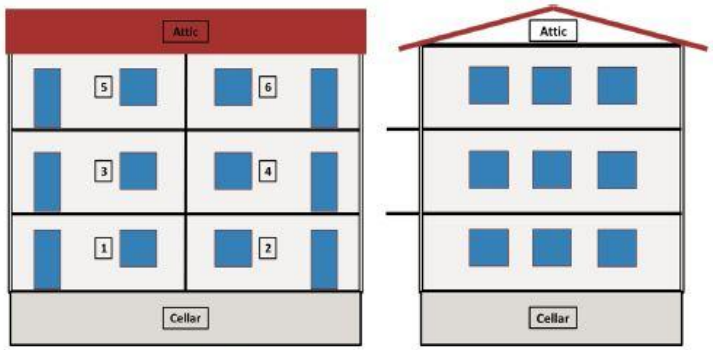


Figure 4: Sketch of the building model implemented in Dynbil: south side (left) and east side (right)

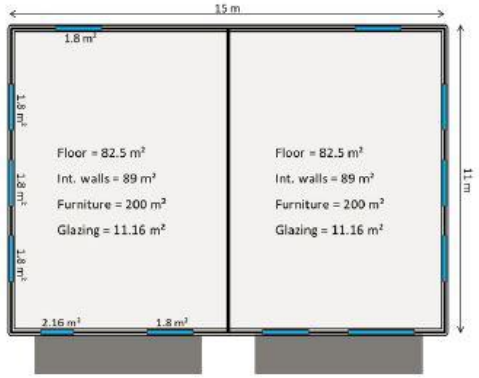
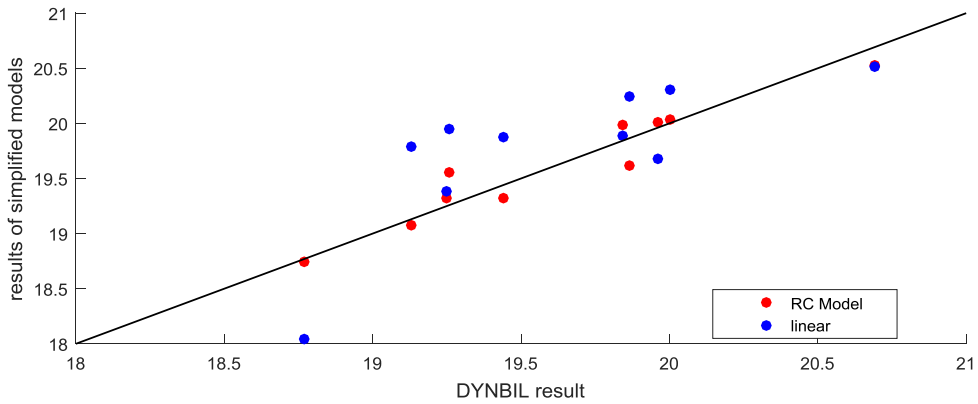


Figure 5: Sketch of one floor with the two dwellings

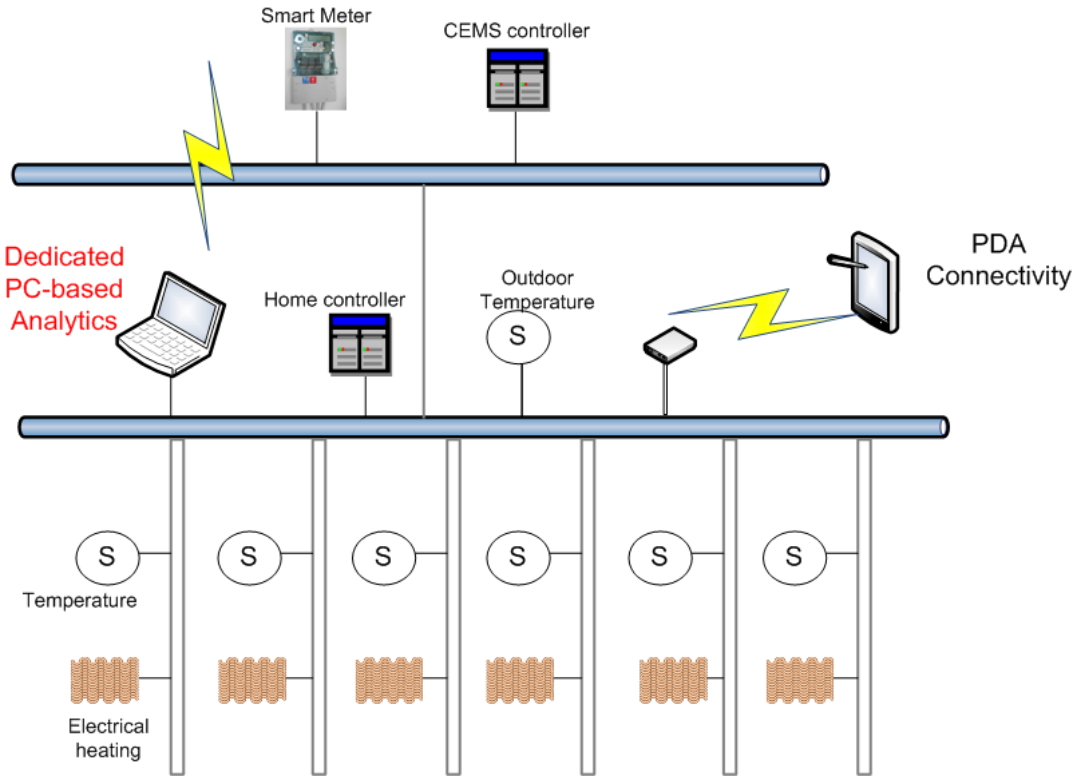


Simulation results of DYNBIL compared to the simplified models

Source: Building-based load forecasts for demand-side management. Metzger AS, Kastner W, Rojas-Kopeinig G, Calabrese T, Judex F, Stefan M, Bacher P, Madsen H, and G Reynders. Final Report. Project No. 848910. Energy Research Program. Austria. In press.

WIP: Integration of information models

- Validation of parameters
- System architecture typologies for validation



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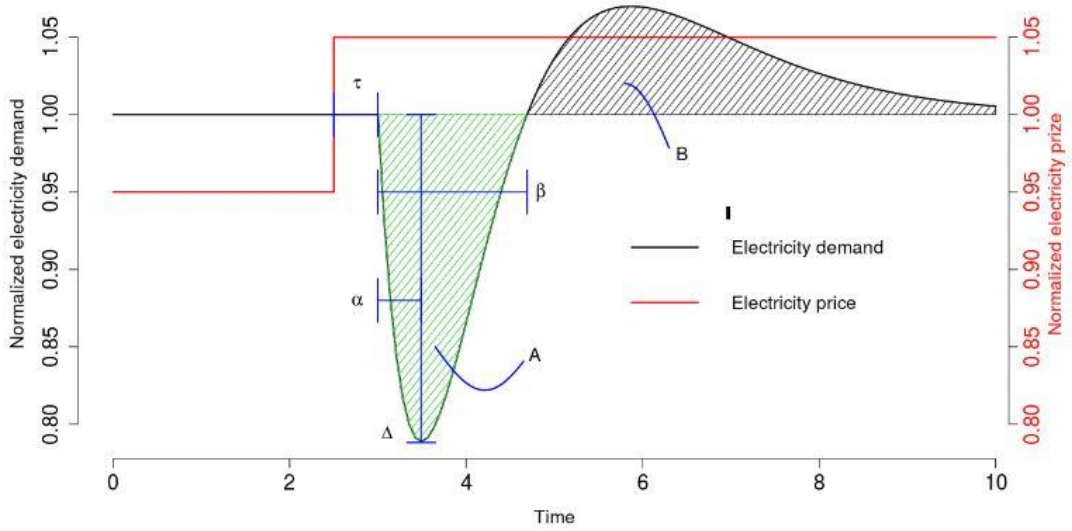
Annex 67 contribution to EPBD

Smartness indicator (EPBD)

a rating for buildings' ICT and electronic systems for optimization of building operation and interaction with smart grids ("winter package")



Where: τ is the time from the signal is submitted to an action starts
α is the period from start of the response to the max response
Δ is the max response
β is the duration of the response
A is the shifted amount of energy
B is the rebound effect for returning the situation back to "reference"

Source: Energy flexibility as a key asset in a smart building future. Contribution of Annex 67 to European smart building initiatives. Position Paper. November 2017.

Annex 67 proposal

- a physical data and simulation based approach for quantification of services in use
- idea: standardization of the external penalty signal enables comparability of energy flexibility among different buildings

Summary and Conclusion

- In Annex 67, a methodology for quantification of energy flexibility will be developed
- Work in progress: Development of missing knowledge on thermal building loads and information models for different building typologies of the Austrian building stock
- Annex 67 work is a contribution to smart readiness of buildings as per EU EPBD (Energy Performance of Buildings Directive)

References

IEA EBC Annex 67 Energy Flexible Buildings. Søren Østergaard Jensen, Anna Marszal-Pomianowska, Roberto Lollini, Wilmer Pasut, Armin Knotzer, Peter Engelmann, Anne Stafford and Glenn Reynders. EBC special issue of Energy and Buildings, October 2017. http://www.sciencedirect.com/science/article/pii/S0378778817317024

Energy Flexibility of Domestic Heat Loads – A Building Typology Approach of the Residential Building Stock in Austria. Tobias Weiß, Anna Fulterer and Armin Knotzer. Submitted to Advances in Building Energy Research.

Homepage of IEA EBC Annex 67 "Energy flexible buildings". www.annex67.org

Energy flexibility as a key asset in a smart building future. Contribution of Annex 67 to European smart building initiatives. Position Paper.November 2017. http://www.annex67.org/publications/position-paper/

Building-based load forecasts for demand-side management. Metzger AS, Kastner W, Rojas-Kopeinig G, Calabrese T, Judex F, Stefan M, Bacher P, Madsen H, and G Reynders. Final Report. Project No. 848910. Energy Research Program. Austria. In press.

Energy Flexible Buildings. IEA EBC Annex 67. Søren Østergaard Jensen. Presentation at the workshop Energy Flexible Buildings. TU Wien. Vienna, Austria. 2017.

The potential of energy flexibility based on the Austrian typology. Tobias Weiss, Armin Knotzer. Presentation at the workshop Energy Flexible Buildings. TU Wien. Vienna, Austria. 2017.

Thank you!

angelika.metzger@tuwien.ac.at

Institute of Computer Engineering
Automation Systems
Vienna University of Technology
Vienna, Austria

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https://www.auto.tuwien.ac.at