CIBW062 Haarlem 2017

# Energy demand simulation using SIMDEUM® for design of tap water heating systems

### Andreas Moerman Mirjam Blokker







### Content

- Focus / link to keynote speech
- Evaluating heating efficiency for single households
- Future work and possible applications



### Focus One aspect of water demand





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# Energy demand simulation using SIMDEUM® for design of tap water heating systems

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# Importance understanding hot water energy use

### A. Current building standards

- Support decision making for specific drinking water installation designs (best fit heater).
- Current standards can cause significant under- or overestimation of the tap water energy demand
  - > discomfort or inefficient heating
  - $\succ$  especially for houses with novel technology (driven by renewable energy) sources or storage systems).





# Importance understanding hot water energy use

### **B.** Future building standards

Dutch case: future without natural gas as energy source for water heating

> Energy transition

Issues:

- > Novel concepts for room heating are not obviously applicable for water heating Different power demand patterns
- > Use of heat pumps (HPs) to bridge temperature levels
- > District heating systems based on renewable energy sources / low temperature More vulnerable to hot water peak demands





# Why to use **SIMDEUM** to solve these issues?

- Enhance understanding of energy demand for:
  - > specific user groups and situations
  - $\succ$  current and future scenario's to improve decision making in DWI design.
- **Balance**:
  - 1. System robustness (e.g. storage capacity)
  - 2. Heating efficiency and cost



# Methodology







### **Final energy** SIMDEUM-HW (Hot Water): final energy









# **Results: Efficiency and yearly cost**

Total efficiency and costs HP (ventilation air) medium household (3-4 pers.)





### Bandwidth shows the 10-90 percentile

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### Results (2) SIMDEUM-HW vs. EPC-method (area based)

1a. Apartment 60 m<sup>2</sup>, 1 inhabitant (age 65+) DWI class: standard plus (0+)

1b. Apartment 60 m<sup>2</sup>, 2 young inhabitants (age 25) DWI class: standard plus (0+)

2a. Tarraced house 124 m<sup>2</sup>, elderly couple (65+) DWI class: standard (0)

2b. Tarraced house 124 m<sup>2</sup>, young family, 3 kinderen DWI class: standard (0)



### **Results: SIMDEUM-HW vs. EPC-method**





### Bandwidth shows the 10-90 percentile

# Conclusions

- With SIMDEUM-HW, natural variation of hot water energy demand was modelled and studied.
- SIMDEUM is an stochastic model which is creates excellent possibilities to calculate demands for all kinds of user specific situations.
- **Opportunities for better design of drinking water installations:** 
  - > Balancing robustness vs. energy efficiency & cost



# Possible applications and future work

- Evaluation of heater application for single households (e.g. online tool)
  - Saving potential for e.g. use of shower heat recovery, water-saving technology.
  - > Heating efficiency check, especially for novel technologies
- Energy demand simulation of multiple households for design of future district heating systems
  - Peak demand / demand patterns
- Applying functionality of SIMDEUM-HW for non-residential purposes.





### Take home...

**SIMDEUM®** is a flexible methodology to simulate hot water energy demand for all kinds of scenarios (user behaviour, drinking water installations) considering natural variation to improve current and future design of drinking water installations.





More information

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