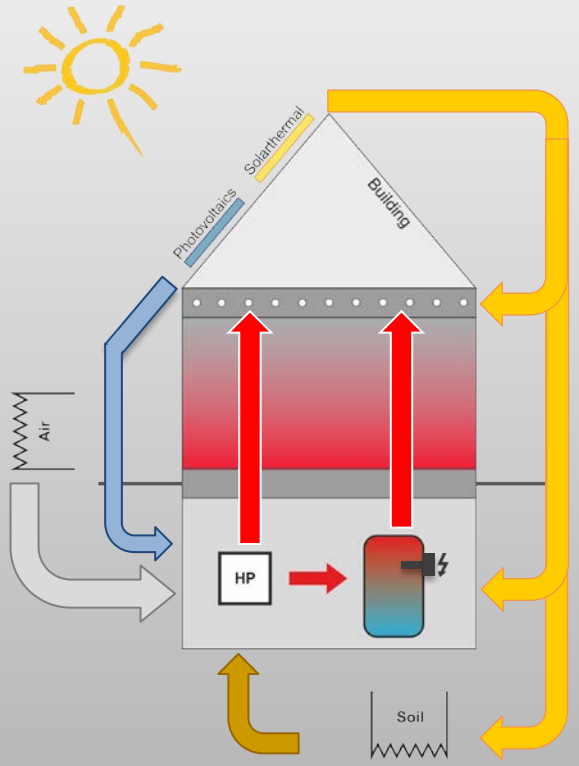
High solar fraction by thermally activated components in an urban environment

Highlights of Energy Research 2018
System Integration and Sector Coupling



Werner Lerch, Richard Heimrath, Thomas Mach

Graz University of Technology, Institute of Thermal Engineering, Inffeldgasse 25/B, 8010 Graz, Austria

Introduction

- Project „solSPONGEhigh“ (national austrian project)
  - Solar heated buildings with high solar fractions
  - Reduction of the water storage volume on the basis of the additional component activation (concrete)
  - Simulation study
    - Compare buildings with/without component activation (concrete)
    - Two different insulation standards
    - Single, multi-functional and non-residential buildings
    - Location, climate Graz (Austria)

Motivation

Why thermal component activation?

- Volatile energy supply by sun and wind
- Time shifts between application and demand
- Increase the efficiency by lowering the system temperatures
- High comfort through large heat areas

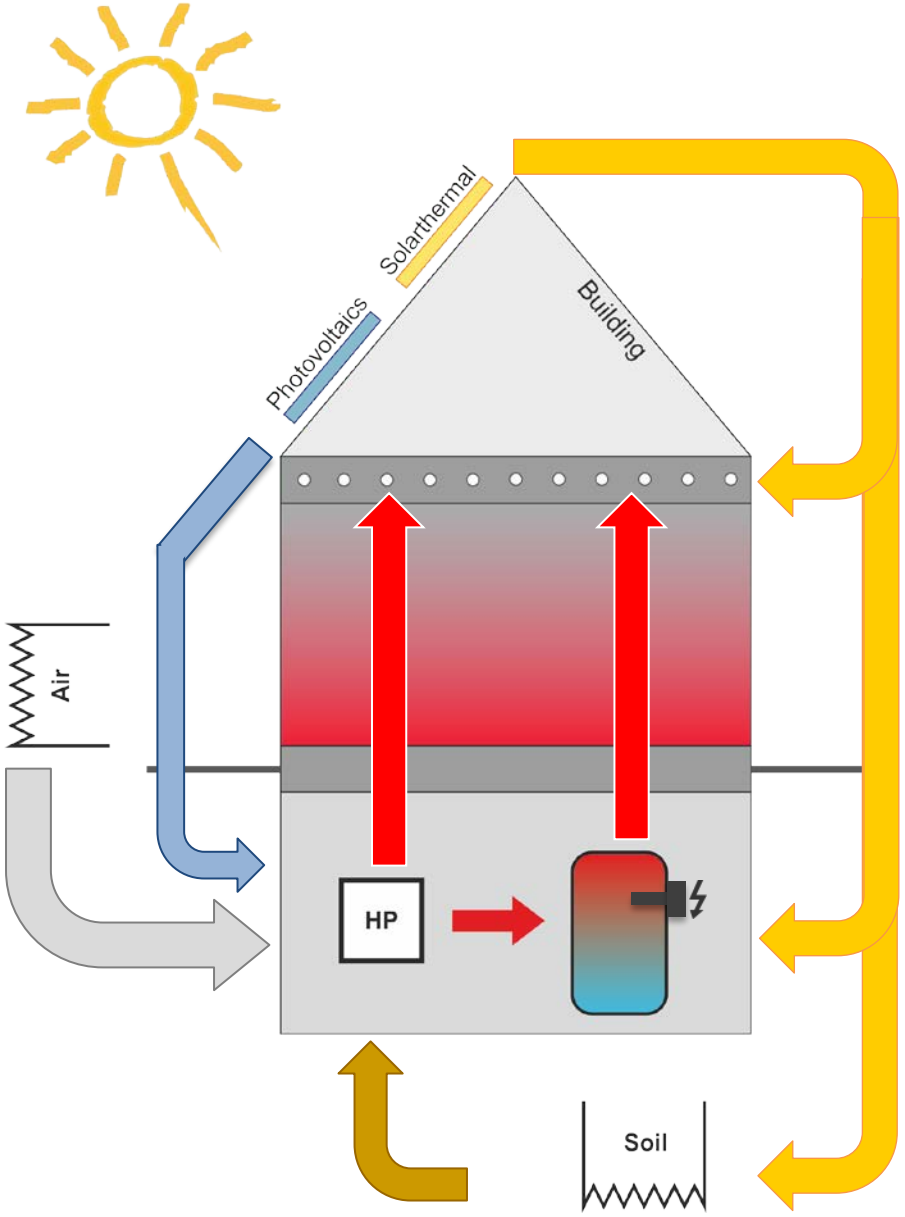
The objectives of the Project solSPONGEhigh

- Intensive use of thermal activation of components
- Consideration of different building types (single, multi-functional and non-residential buildings) and insulation standard
- Use of solar technologies (solar thermal and PV)
- High solar fractions (close to 100%)
- Integration of heat pumps (air / water HP, brine / water HP, electric heater)

Dynamic building and system simulation

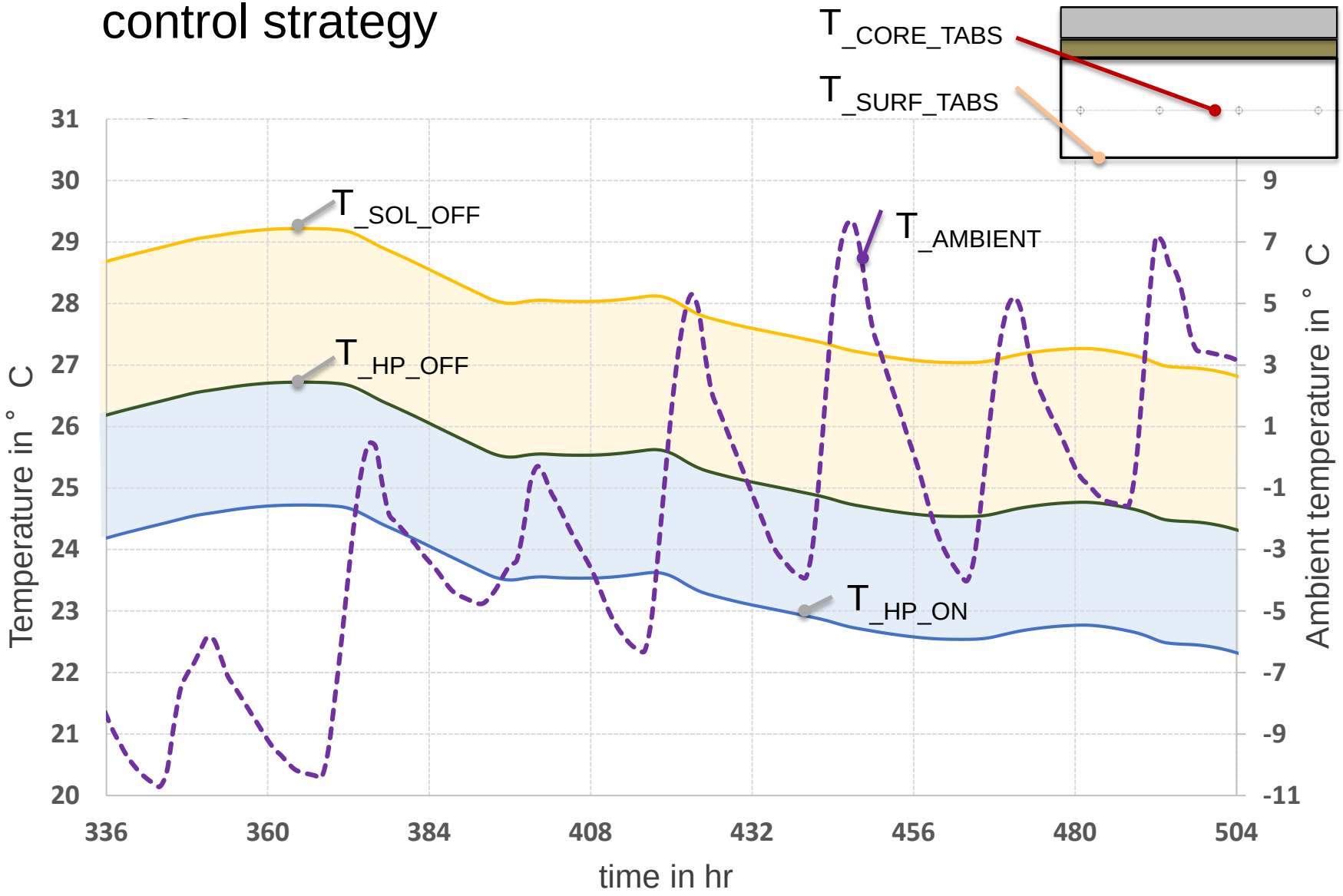
Simulation model

- TRNSYS 17
- Flexible structure
  - Different heat sources (solar thermal / photo-voltaic)
  - tabs / floor heating
  - different insulation standards (buildings)
  - different control strategies



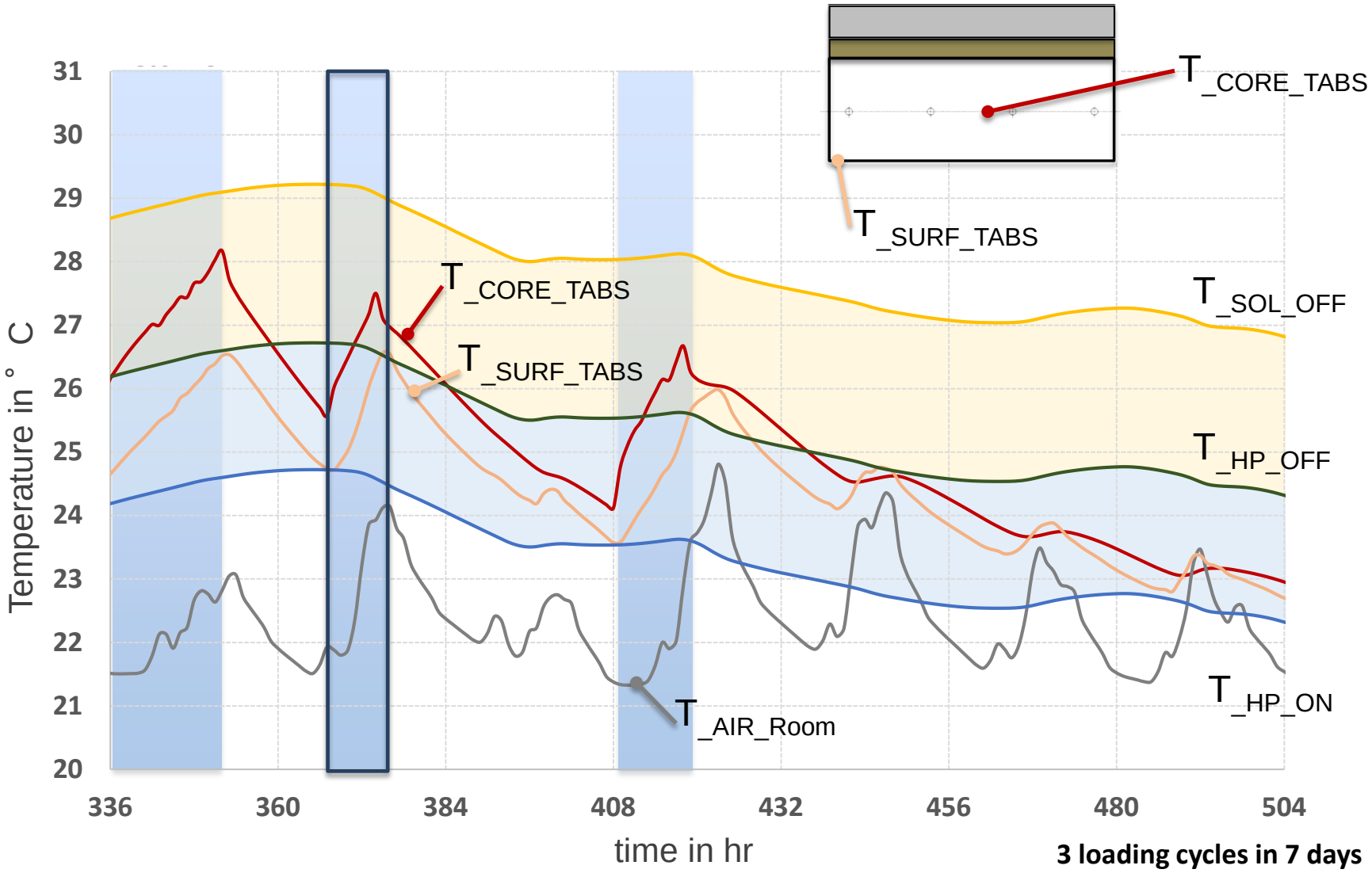
Dynamic building and system simulation

control strategy



Dynamic building and system simulation

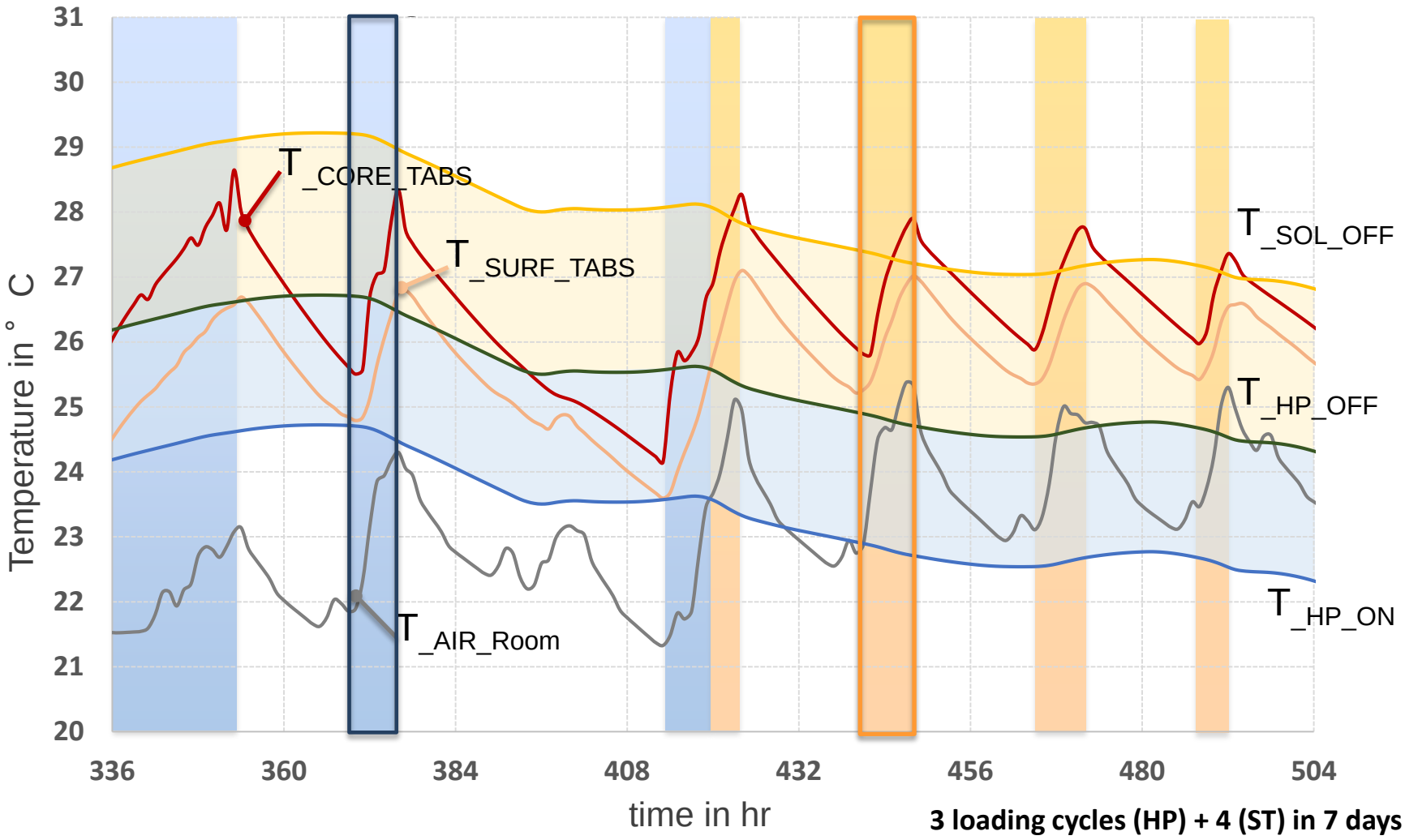
concrete core: conventional loading (cl)



3 loading cycles in 7 days

Dynamic building and system simulation

concrete core: solar loading (sl)

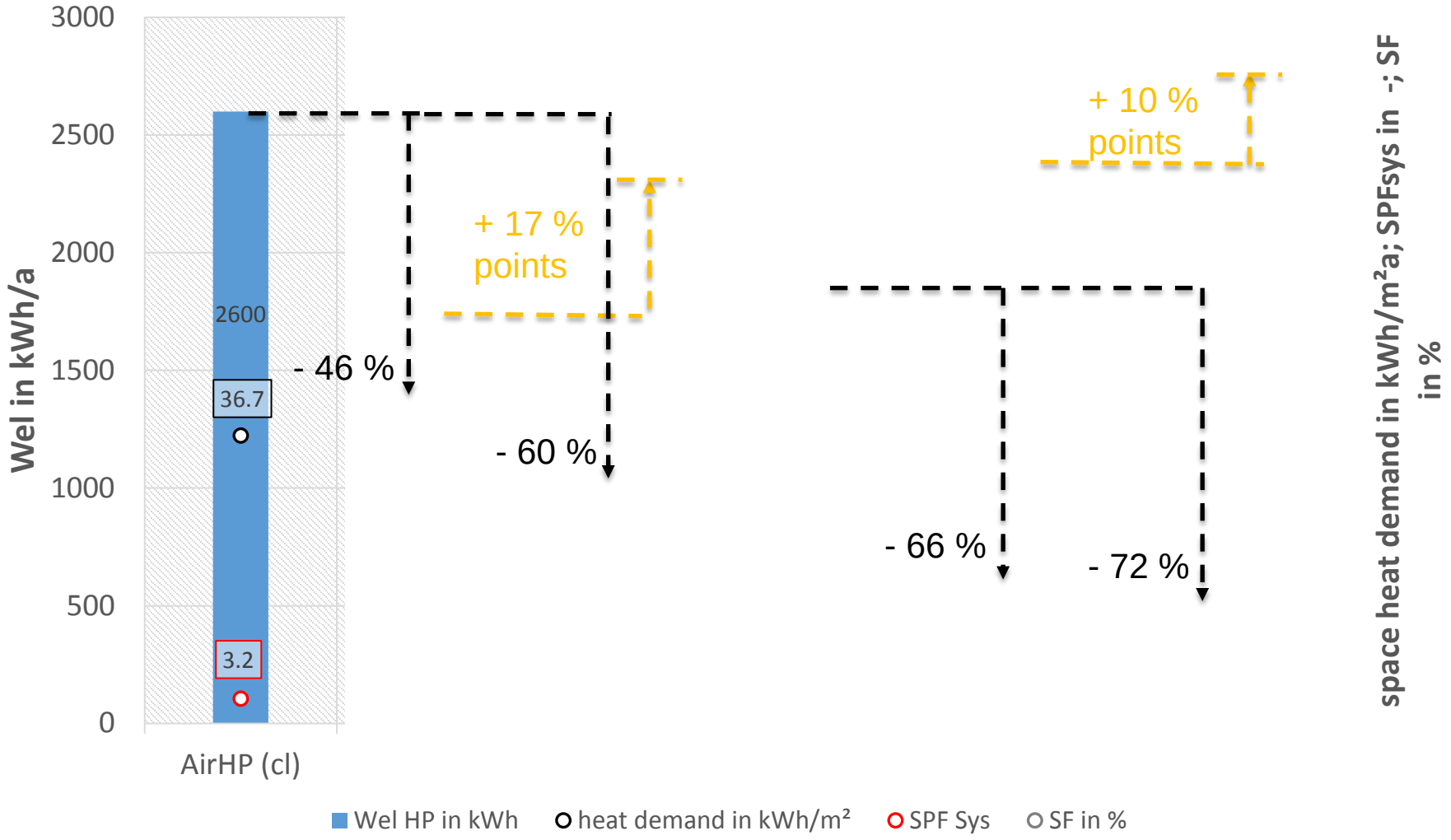


3 loading cycles (HP) + 4 (ST) in 7 days

Dynamic building and system simulation

Results

SFH (LEB/NZE, 120 m²): AirHP, AirHP & 40 m² SolTh & 1 m³ WaterSt



Summary

- The thermal behaviour of activated components (TABS) could be analyzed in detail for several building types, insulation standards and supply systems using transient simulation models (building / system).
- It has been shown that with solar thermal- or photovoltaic systems TABS can be loaded very efficiently.
- The capacity of the supply system for the TABS system can be reduced.
- TABS reacts very sensitively to the selected heating system.
  - Integration of the solar thermal / PV system
  - Loading strategy

Outlook

- Economic and ecological evaluation
- Completing the final report

Thank you for your attention!

Das Projekt solSPONGEhigh wurde im Rahmen des Forschungs- und Technologieprogramms Stadt der Zukunft gefördert.

STADT der Zukunft

bmvit
Bundesministerium
für Verkehr,
Innovation und Technologie