High solar fraction by thermally activated components

Thomas Ramschak

AEE - Institute for Sustainable Technologies (AEE INTEC)
8200 Gleisdorf, Feldgasse 19, AUSTRIA

Motivation

Thermal component activation

- Efficient integration of fluctuating renewable energy
- Increase the efficiency by lowering the system temperatures
- High comfort through large heat areas

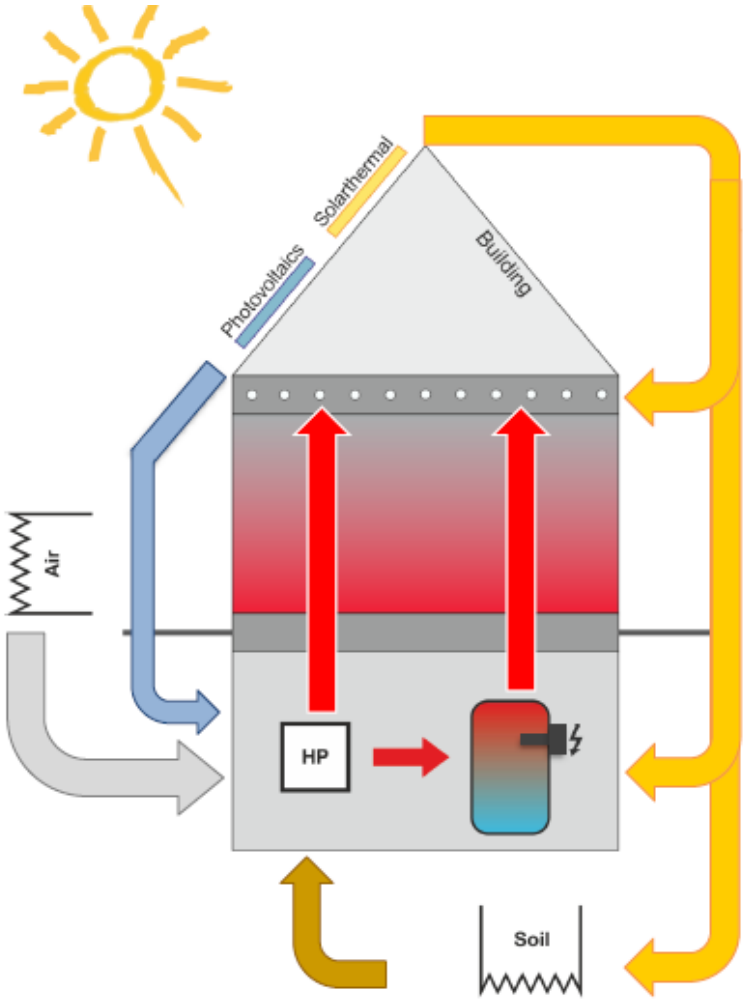
The objectives of the project solSPONGEhigh

- 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)

Dynamic building and system simulation

Simulation model

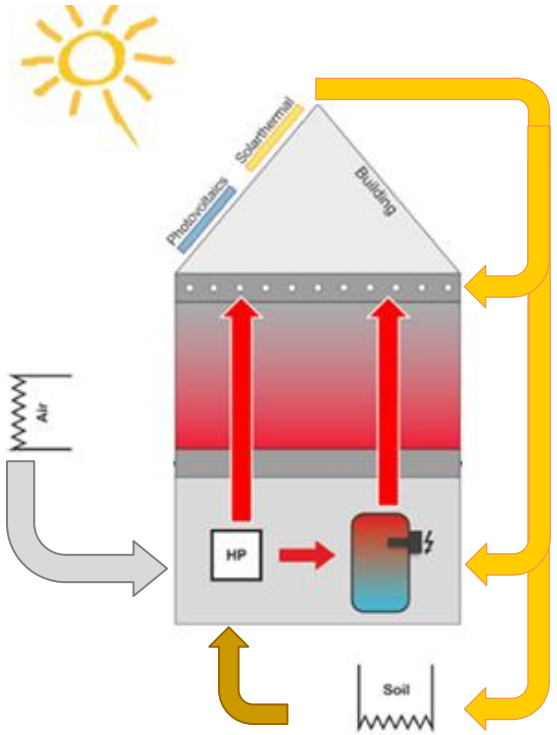
- TRNSYS 17
- Flexible structure
  - different heat sources (solar thermal / photovoltaic)
  - TABS
  - different insulation standards (building)
  - different control strategies



Considered system concepts

Solar thermal - Energy systems

- Solar thermal
  - Water storage
  - TABS
  - Soil
- Second heat source
  - air/water HP
  - Soil/water HP
- Hydraulic concept
  - Indirect-System
  - Direct-System

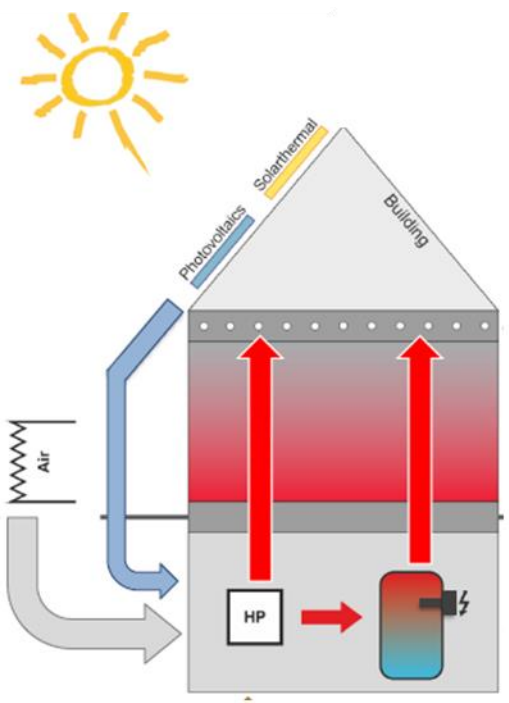


Considered system concepts

Photovoltaic - Energy systems

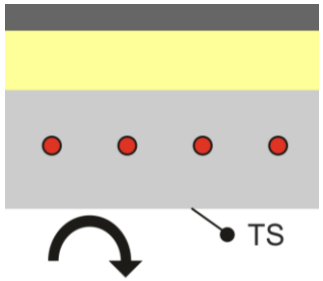
- Photovoltaik (PV)
  - HP
    - Water storage
    - TABS
  - gird

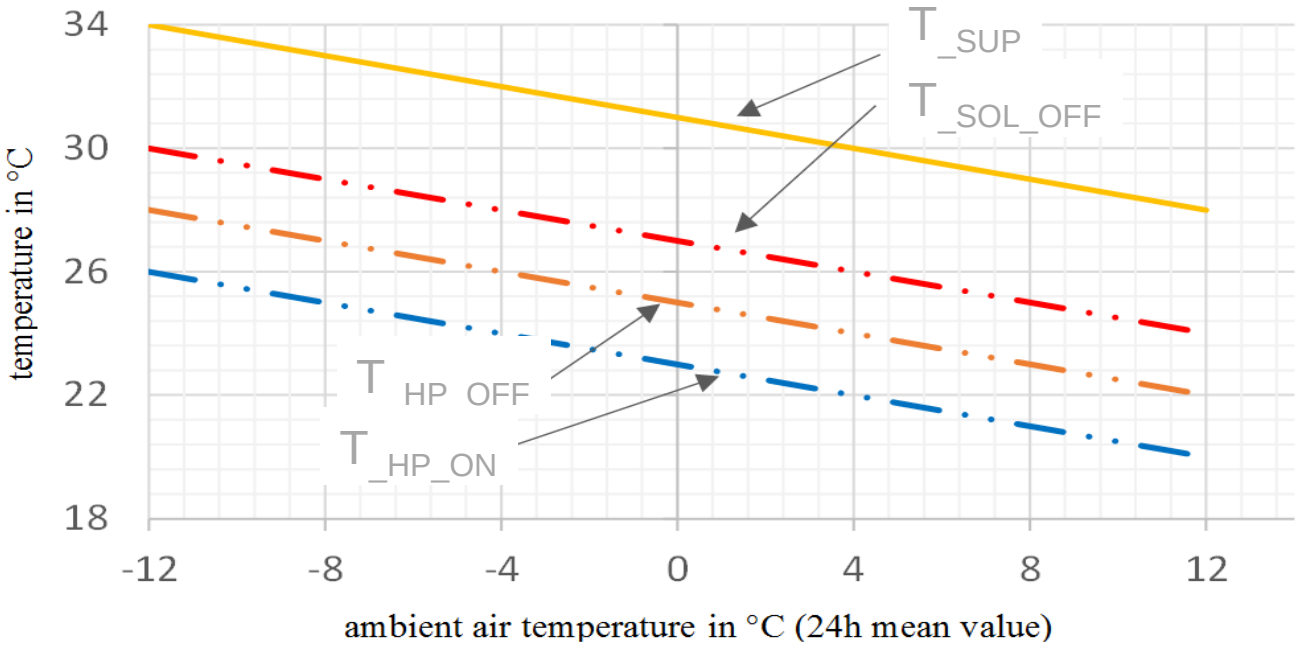
- Heat source
  - air/water HP



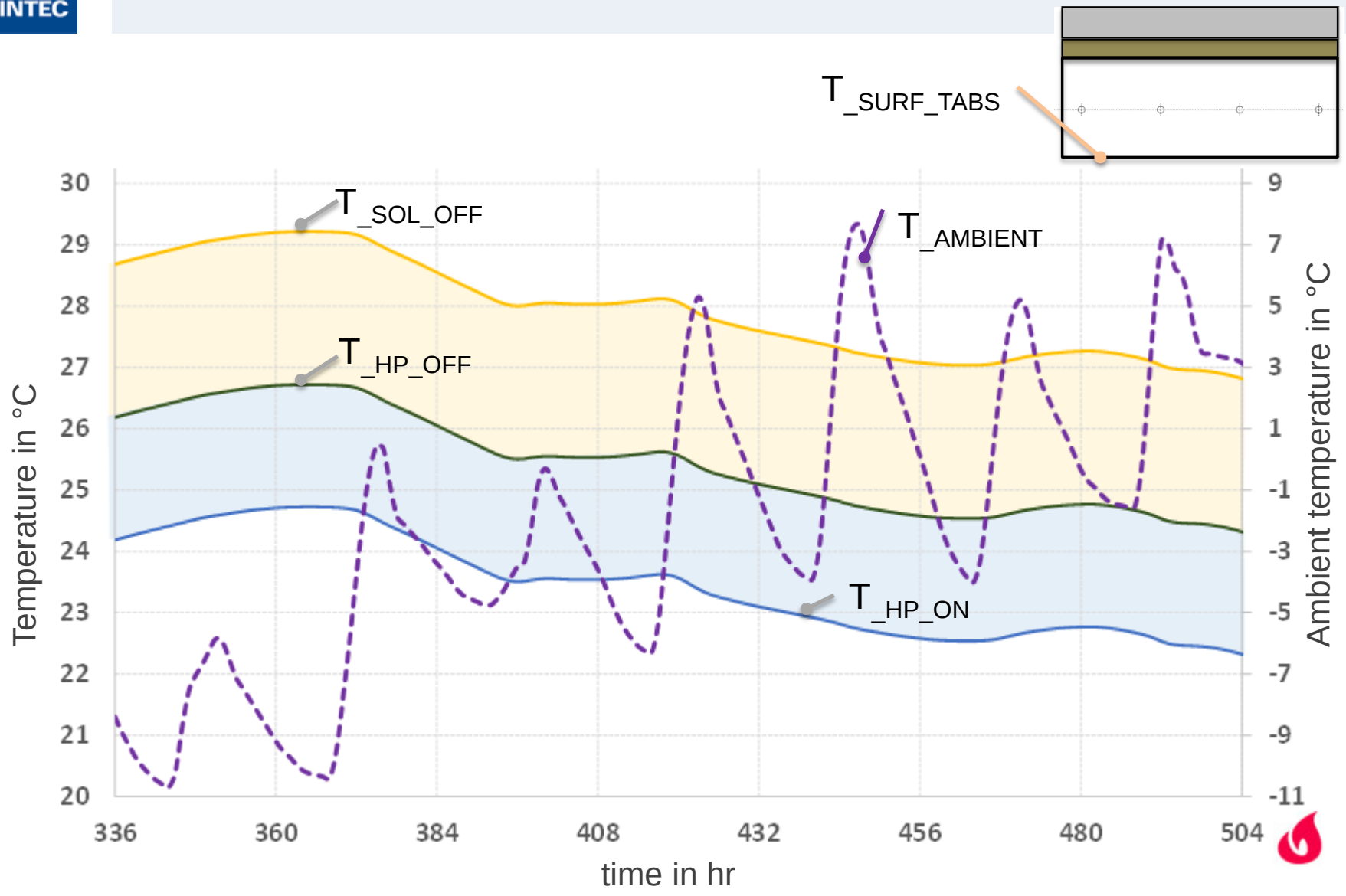
Control strategy

- Supply- and control temperature depends on the mean ambient air temperature
- Loading cycle depends on the surface temperature
- Change in the Temperature hysteresis for charging

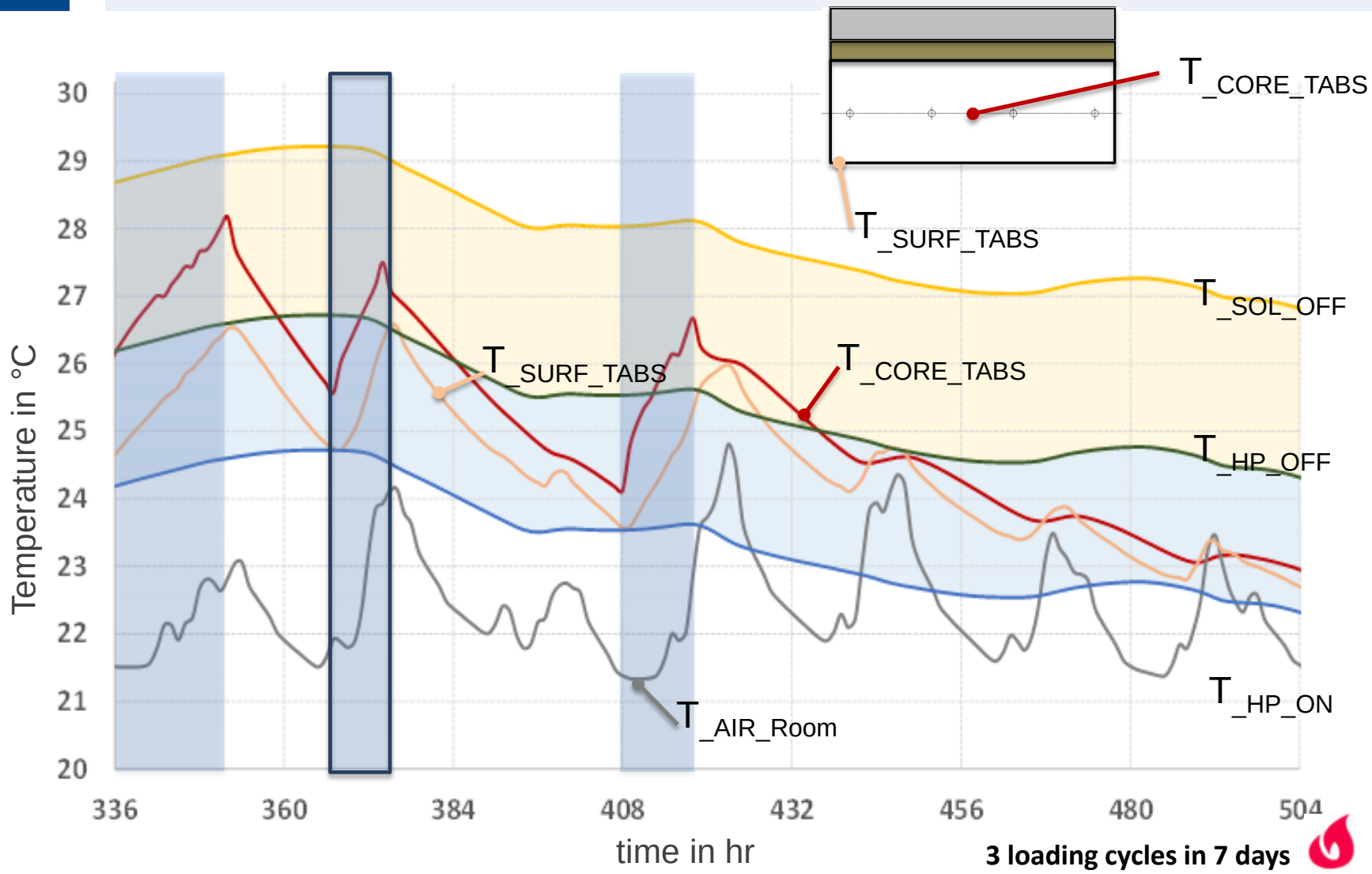




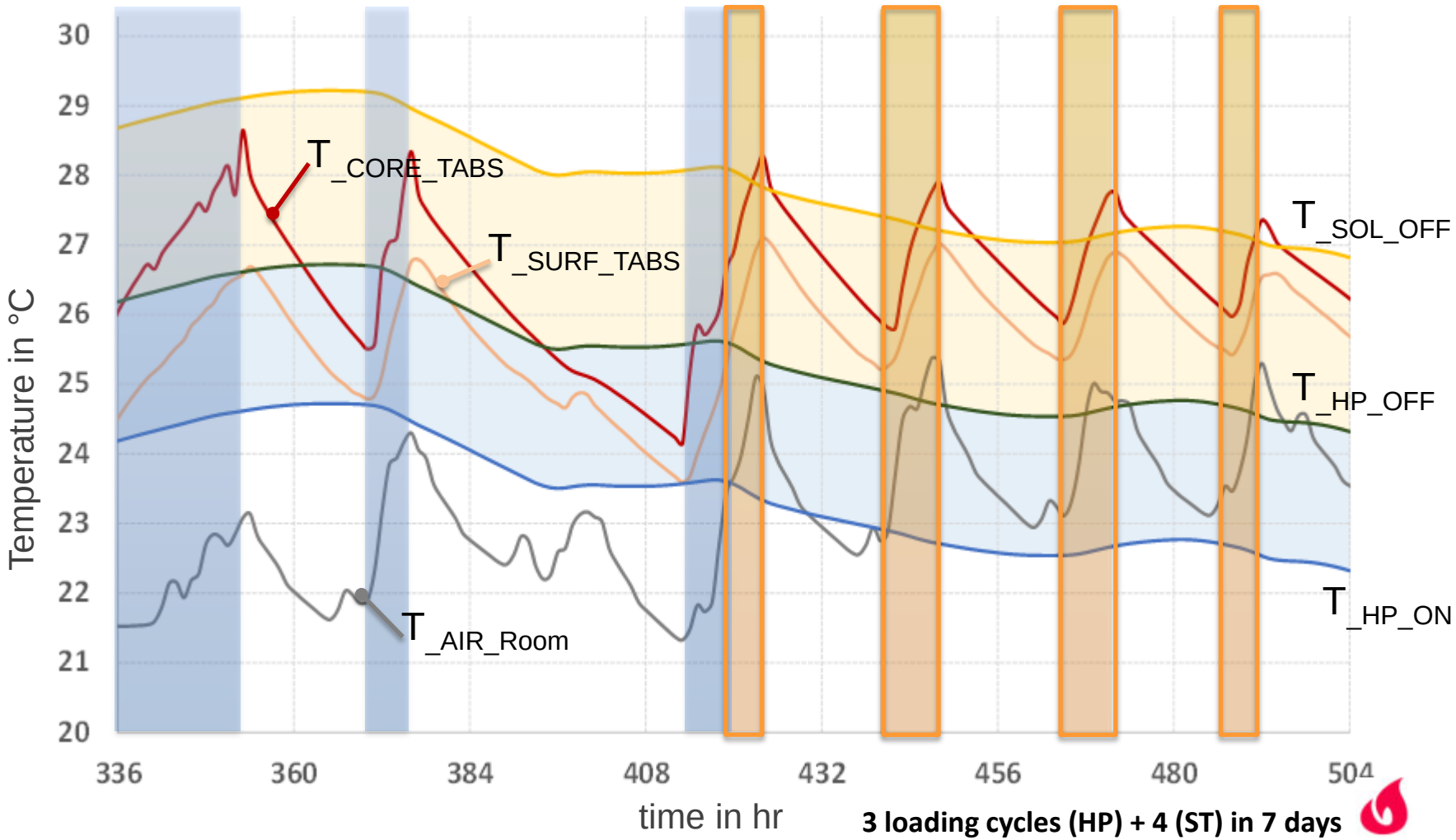
Control strategy



Control strategy conventional loading

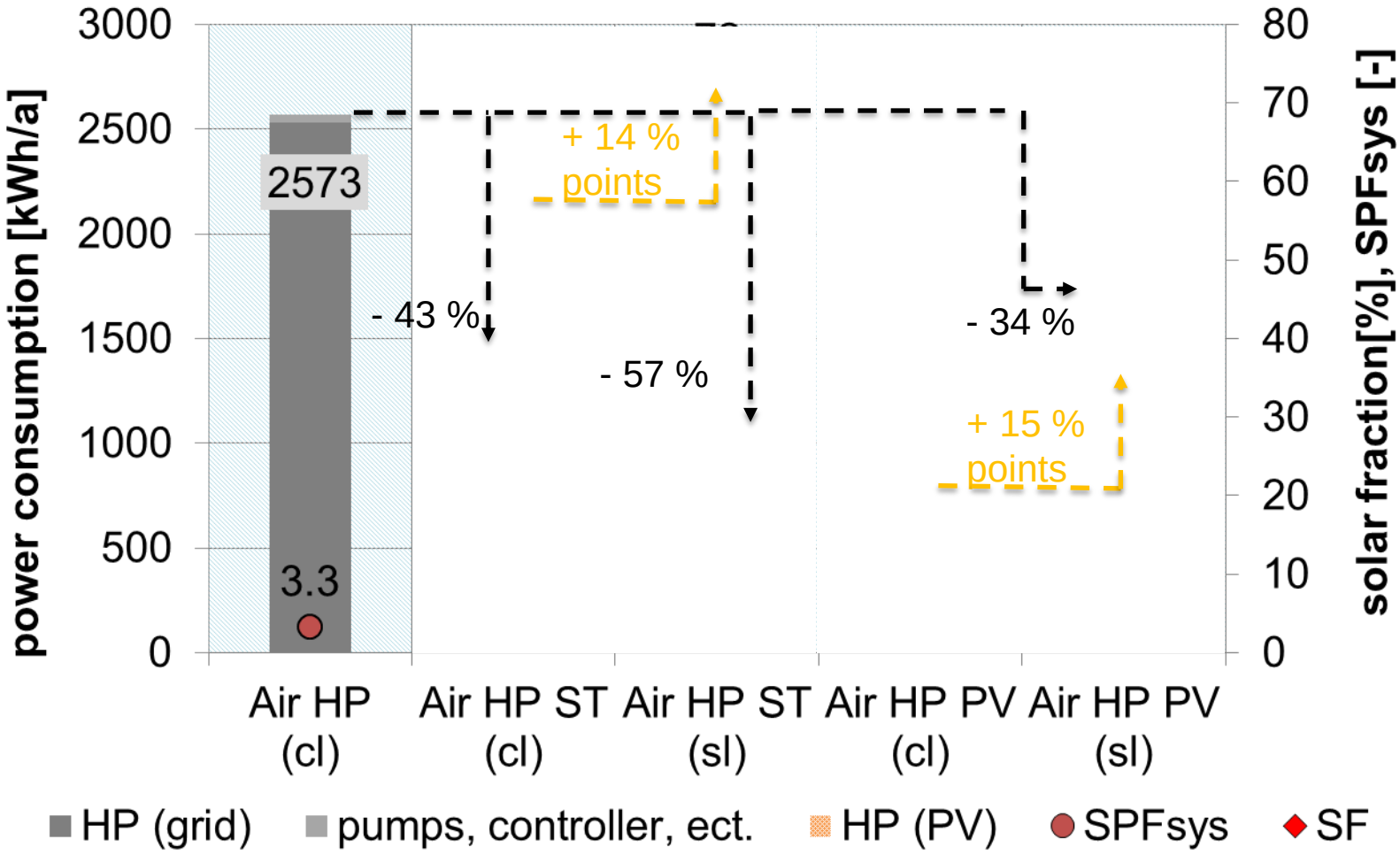


Control strategy solar loading



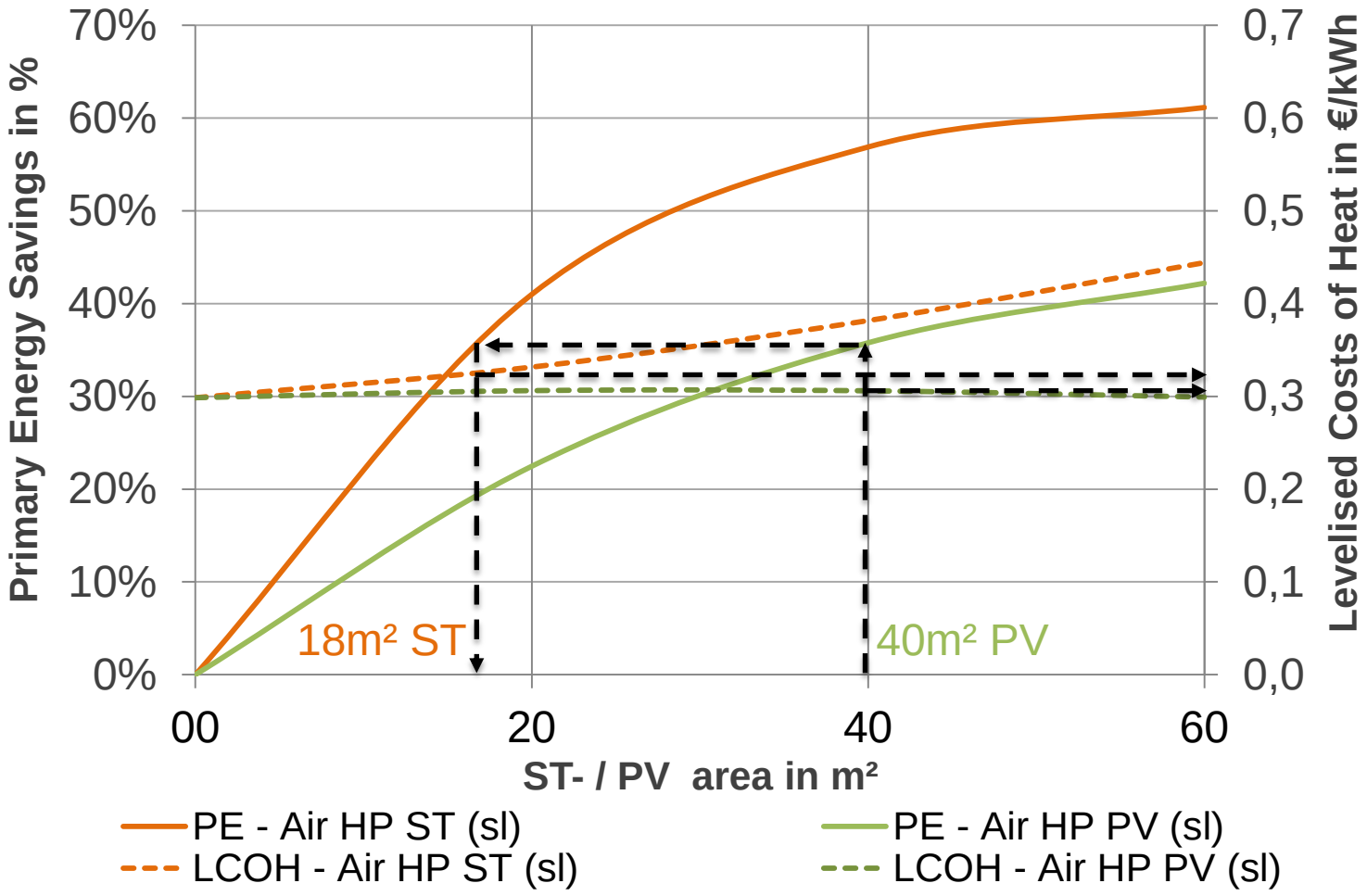
Simulation Results
SFH (LEB, 120m²)

Air HP (0.35 m³); Air HP & 40 m² ST, Air HP & 40 m² PV, (1.5 m³)



Economical and ecological analysis SFH (LEB, 120m²)

Air HP, Air HP & ST (sl), Air HP & PV (sl)



Summary

- Thermal behavior of activated components (TABS) were analyzed in detail using transient simulation models (building / system).
- Energy supply concepts and control strategy were developed and optimised for fluctuated solar energies
- Concepts were anlysed based on technical, economical and ecological aspects

- Solar thermal- and photovoltaic systems can load TABS very efficiently
- The direct system concept shows significant advantages compared to the traditional concepts
- High solar fractions, high PE-savings at low to moderate costs can be reached

Final Project Report: Hohe solare Deckungsgrade durch thermisch aktivierte Bauteile im urbanen Umfeld (in German), Austrian Klima- und Energiefond, Project number: 845182

AEE INTEC

IDEA TO ACTION

Thank you
for your Attention