

# Solar energy buildings with energy active facades

IEA SHC Task 66 - Industry Workshop No 3

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# Requirement for Energy-Active Façades

- **High solar fractions**

Suitable areas for solar collectors on roofs are scarce in urban areas

- **Renovation backlog**

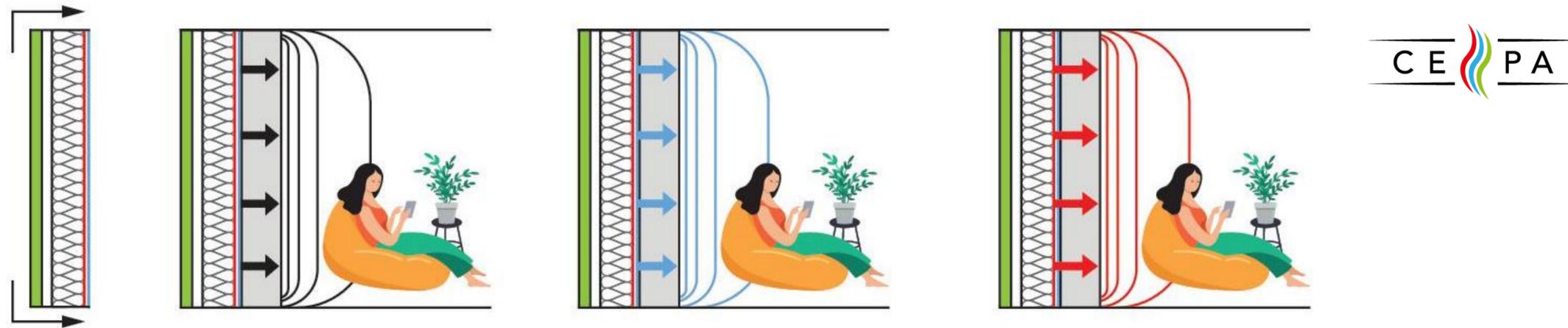
85-95% of the buildings that exist today will still be standing in 2050

- **Energy and emission trends in the building sector which drive flexibility needs**

Energy efficiency, electrification, behavior changes, demand side management

“The objective is to **at least double** the annual energy renovation rate of residential and non-residential buildings by 2030 and to foster deep energy renovations.”

# Energy-Active Façade Concept

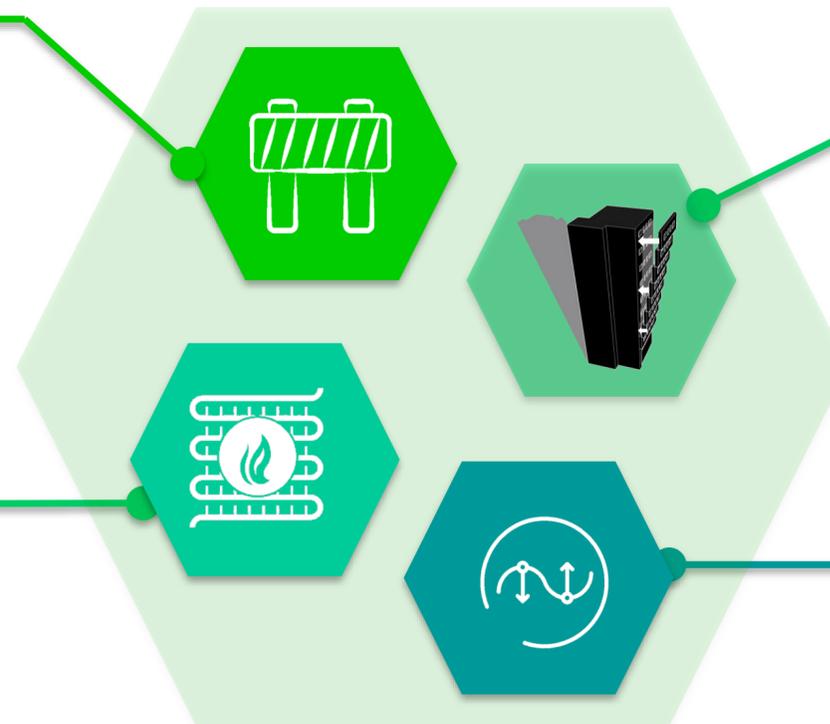


## Overcome barriers

- duration of refurbishment, burden on occupants during refurbishment, avoidance of relocation, elimination of scaffolding, quality assurance, etc.

## Energy active components

- **Thermal activation layer** as part of the façade for heating and cooling



## Renovation concept

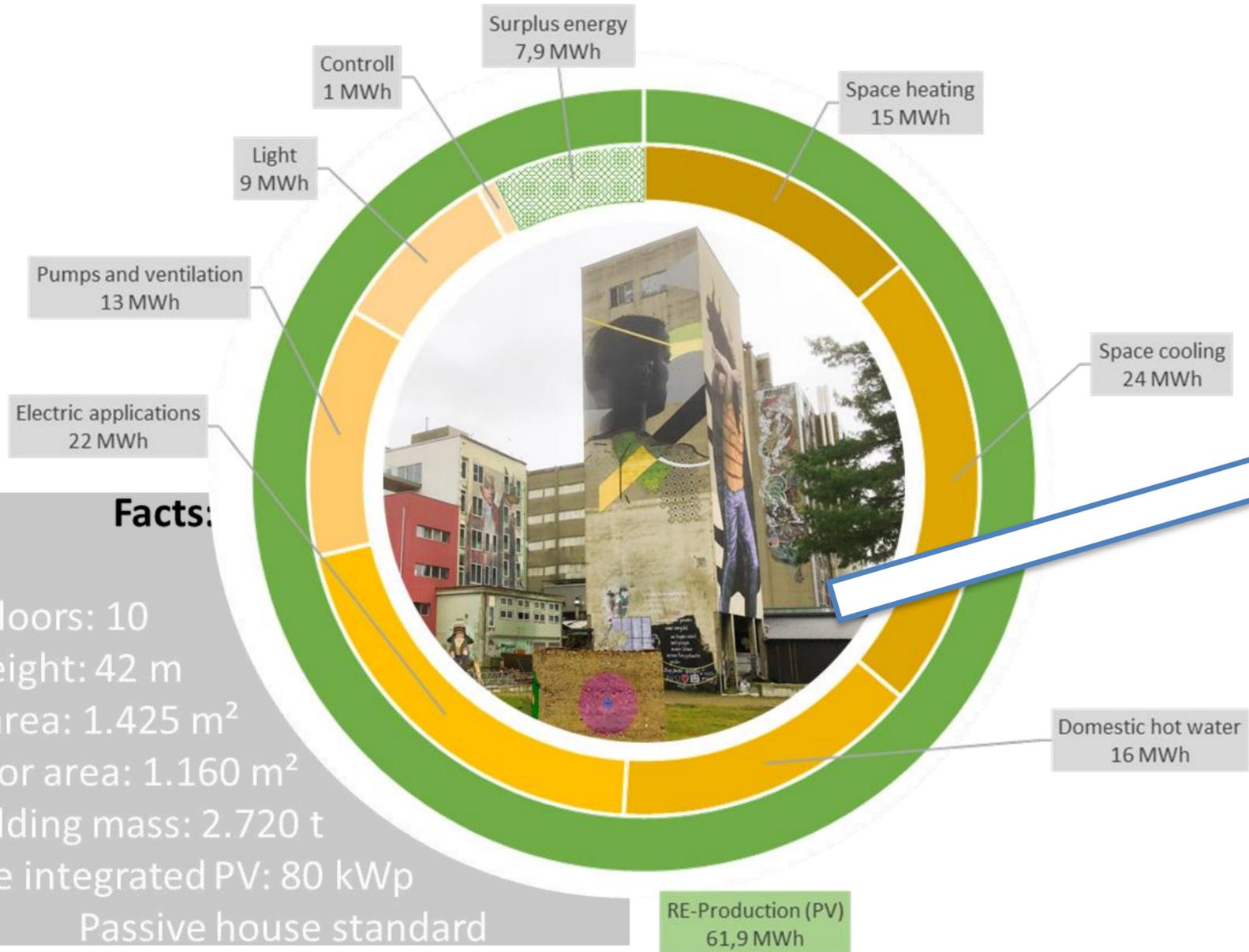
- **Modularity, Prefabrication and Industrialisation are key strategies** in production and resource efficiency in retrofitting of buildings

## Match production and demand

- Using the **existing building structure for heat/cold storage** and as the heating/ cooling dissipation system

# Energy-Active Façade demonstration building

## EXCESS



### Facts:

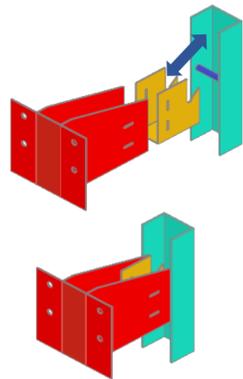
Floors: 10  
 Height: 42 m  
 Façade area: 1.425 m<sup>2</sup>  
 Gross floor area: 1.160 m<sup>2</sup>  
 Activated building mass: 2.720 t  
 Façade integrated PV: 80 kWp  
 Passive house standard



<https://positive-energy-buildings.eu>

# Energy active facade

## EXCESS



### Custom mounting

- Designed to be adjustable
- Quick installation



### Actice layer (stripe) design

- fit very well to uneven surfaces
- allows for more flexibility in dimensions



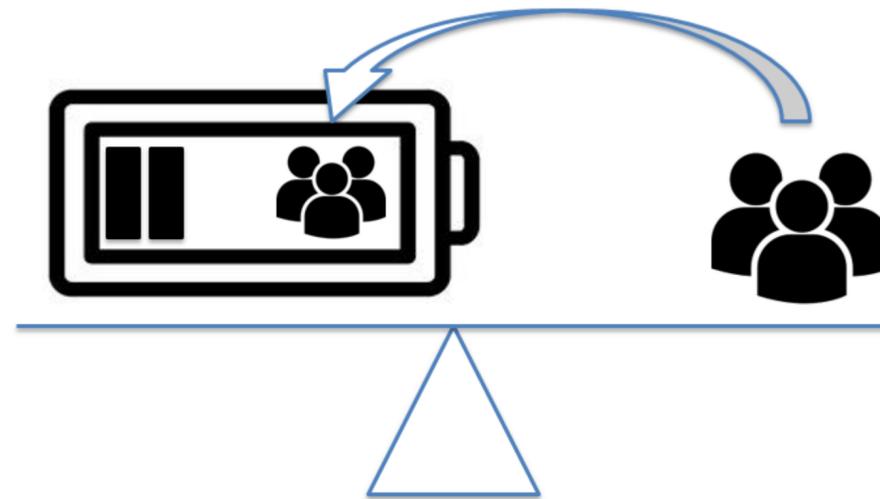
### First facade modules mounted

- Proof of concept for the mounting system

**Next step is to equip a whole storey of the building**

# Active flexibility potential

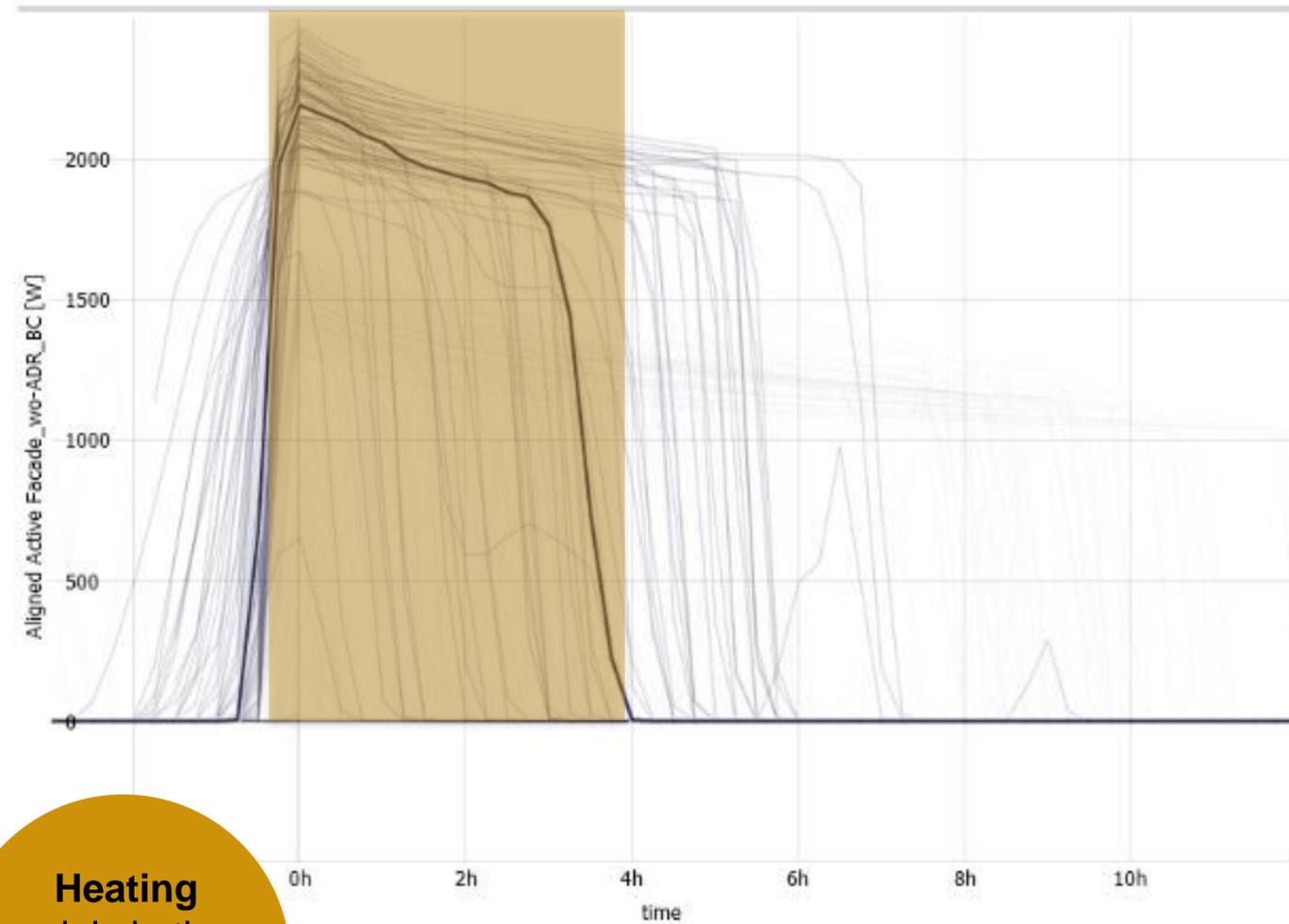
- Energy flexibility in the building context is a trade-off between **storage size** and interference with the **users interests**



- In our concept the users are living in the storage which brings complexity for control systems but also large potential to **raise the solar fraction**

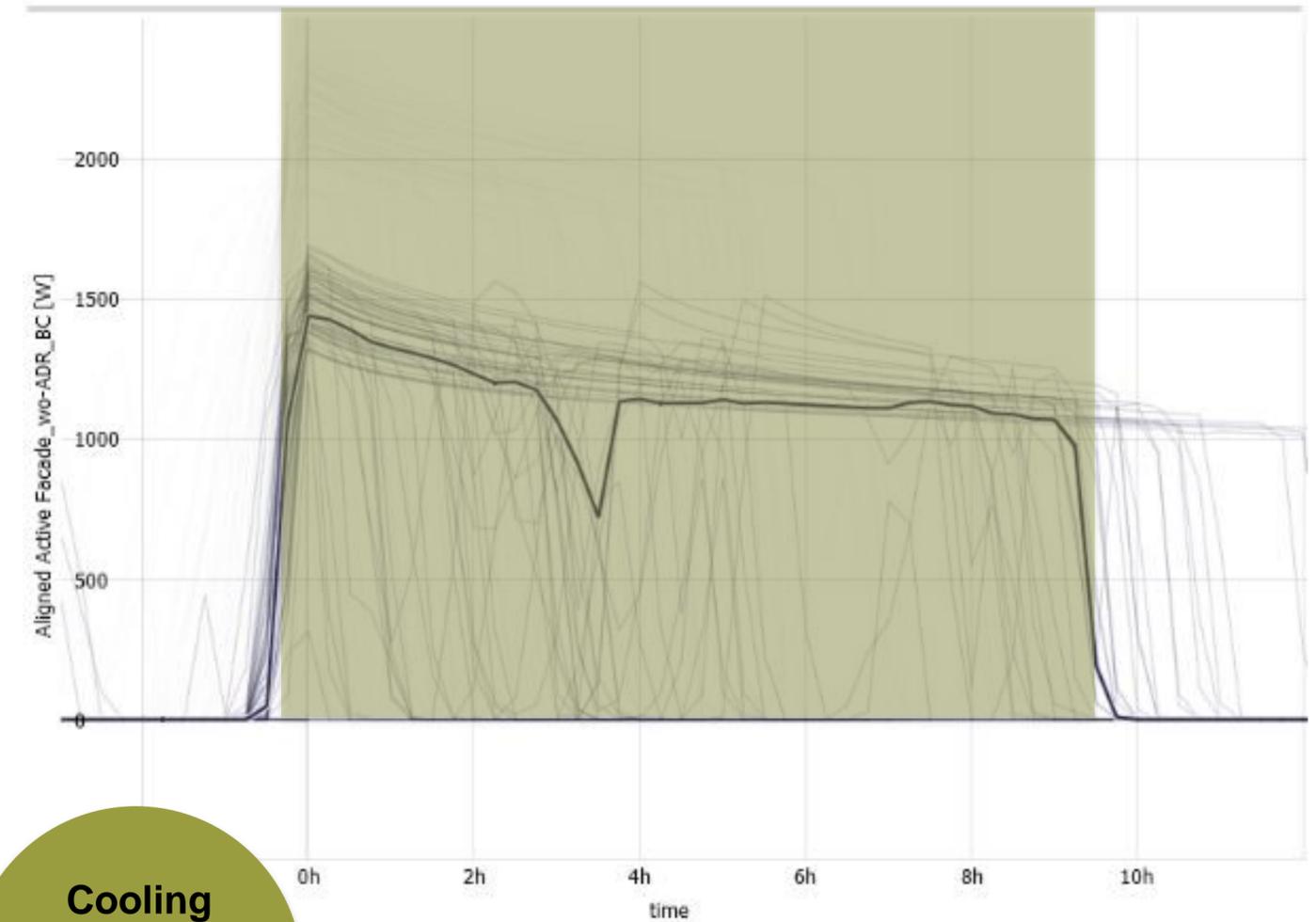
# Typical heating and cooling cycles

Active Facade\_wo-ADR\_BC [W]



**Heating**  
mainly in time  
periods of **3-5**  
hours

Active Facade\_wo-ADR\_BC [W]

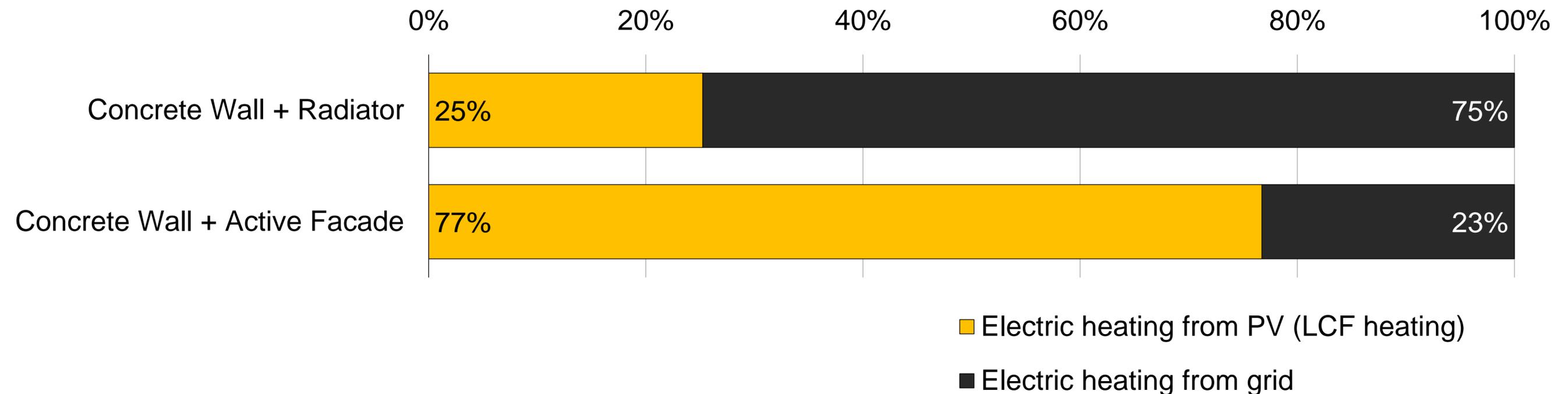


**Cooling**  
mainly in time  
periods of **8-**  
**11** hours

# Structural storage capacity and solar fraction

$$C_{ADR} = \int_0^{t_{ADR}} (\dot{Q}_{h,ADR} - \dot{Q}_{h,ref}) dt$$

The **average** daily value of used structural storage capacity within the heating season is  $0,12 \text{ kWh}_{th}/\text{m}^2_{\text{Wall}}$

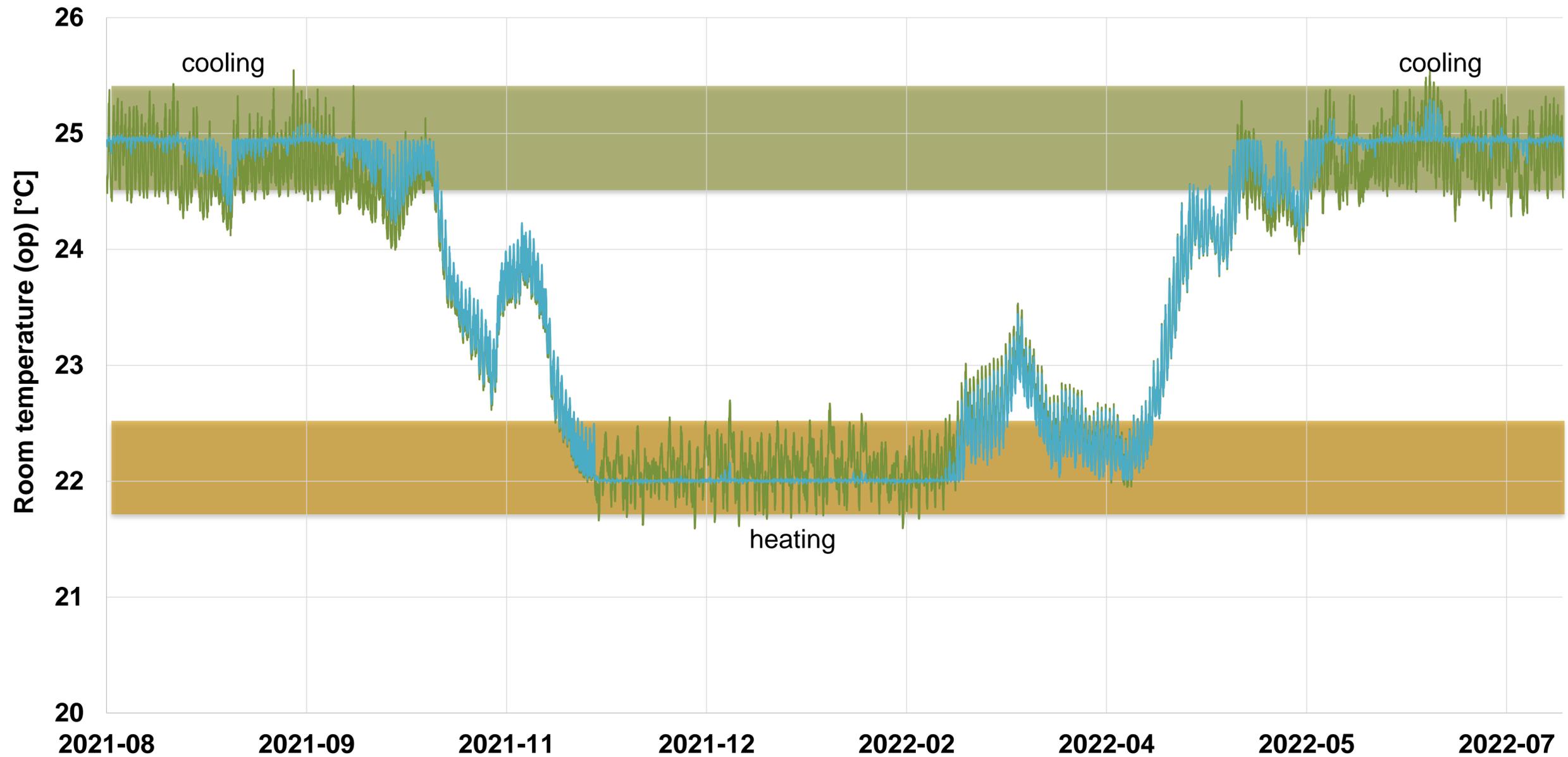
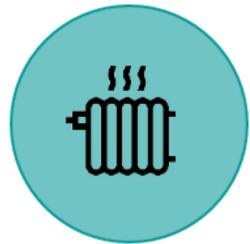


# Thermal comfort

Energy active  
Facade



Radiator



- The active use of thermal storage mass marginally effects thermal comfort

An aerial photograph of a modern building complex. The buildings feature large glass facades and solar panels. A central courtyard with a paved walkway and greenery is visible. The sky is clear and blue. In the top left corner, there is a yellow and blue logo for AEE INTEC. Below the logo, the text 'IDEA TO ACTION' is displayed in a white box.

**AEE INTEC**

**IDEA TO ACTION**

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