



# ***IMPETUS***

*Turning climate commitments into action*

## **Balancing mitigation and adaptation: future energy, comfort, and hygrothermal performance of historic buildings**

A case study

Eleonora Leonardi, Daniel Herrera, Valentina D'Alonzo | 10/12/2024

**eurac**  
research

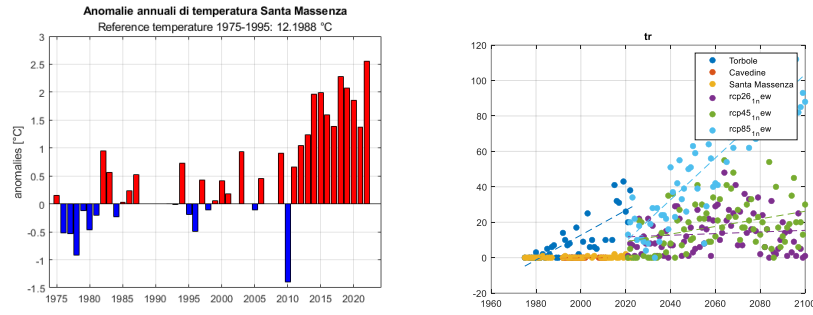
# Project Impetus: general information



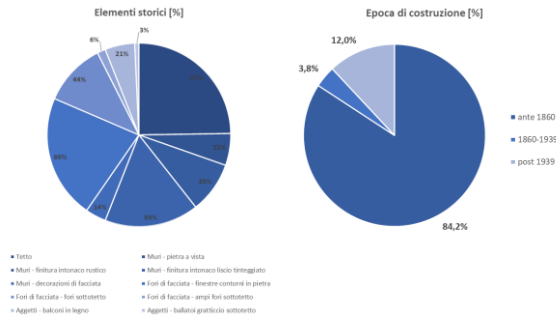
- Horizon 2020
- 9 European countries involved



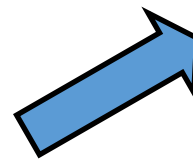
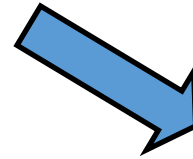
# Methodology



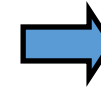
Climate analysis and future climate modelling



Building stock analysis



Hygrothermal and energy building simulation in present and future climates in Wufi Plus



Adaptation strategies for future climate



# Climate change and critical issues for buildings

- Rising temperatures
- Extreme raining events

When planning energy retrofit, only current/past climate is taken in consideration!

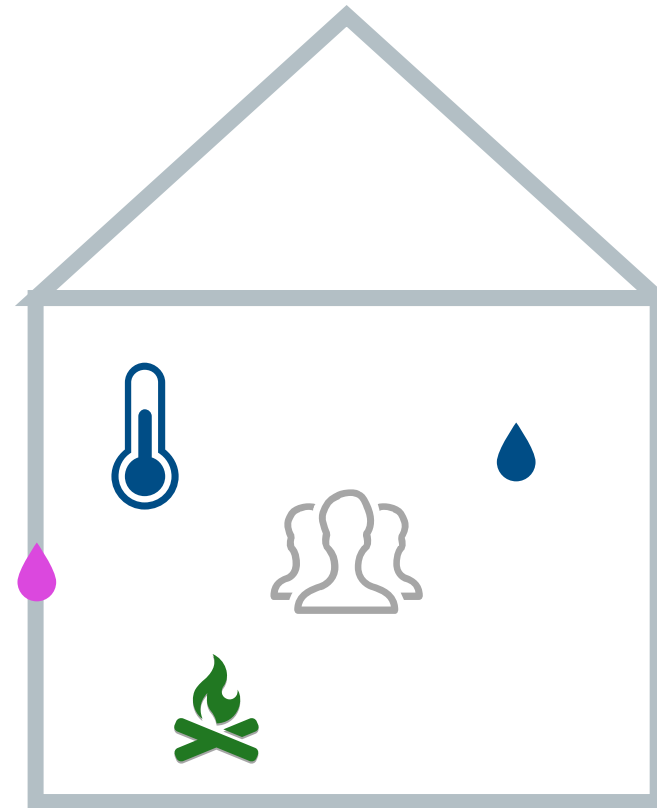
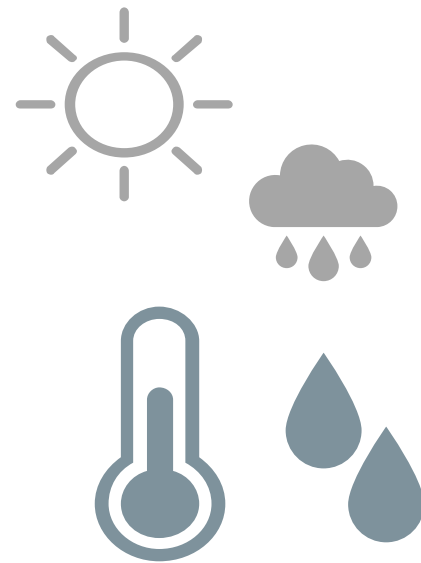
- Building energy performance - energy audit
- Effectiveness of energy intervention - winter



# Dynamic building simulation

## INPUT

- Geometry
- External climate
- Occupation
- Habits
- Heating system


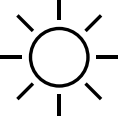



## OUTPUT

- Internal climate
- Energy consumption
- Wall behaviour



# Analysed results

- Comfort:
  - Percentage of hours with temperature  $< 18^{\circ}\text{C}$  
  - Percentage of hours with temperature  $> 25^{\circ}\text{C}$  
- Energy 
  - Heating demand

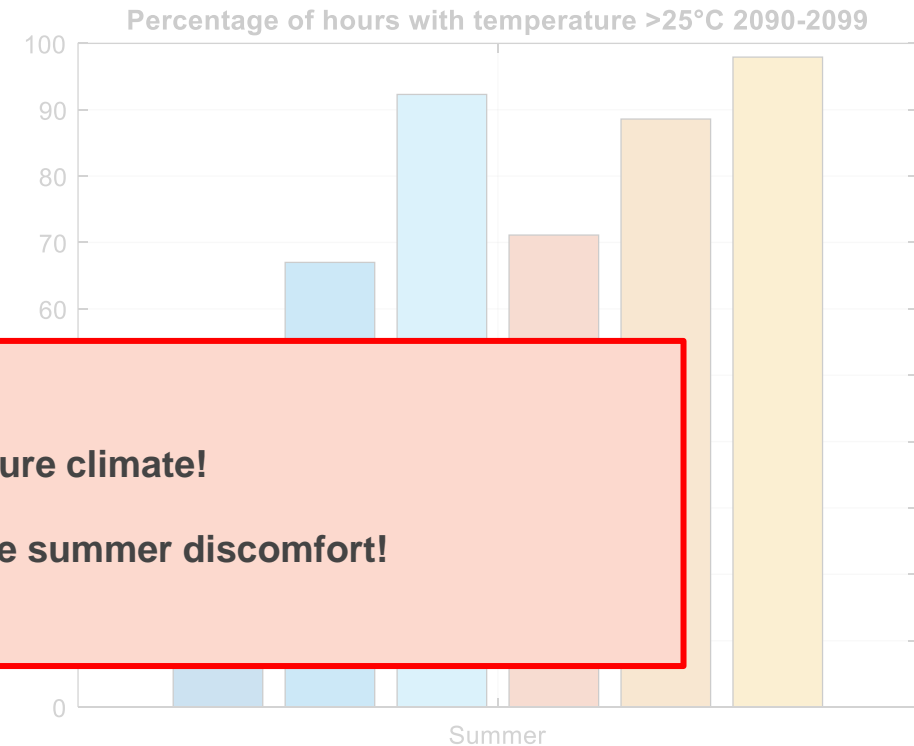
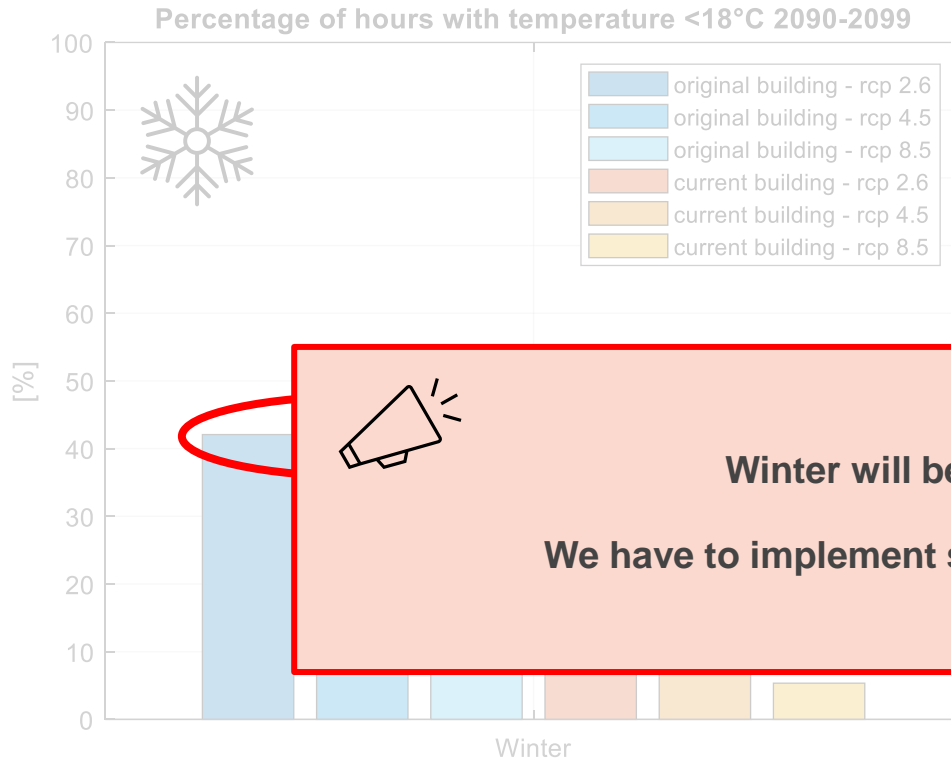


# Simulated buildings and variants

Parameters	Variants	Number of Variants
Geometry and Element's Structures	Original Building Current Building Future Building	3



# Discomfort in future climate



- Winter discomfort

- Summer discomfort

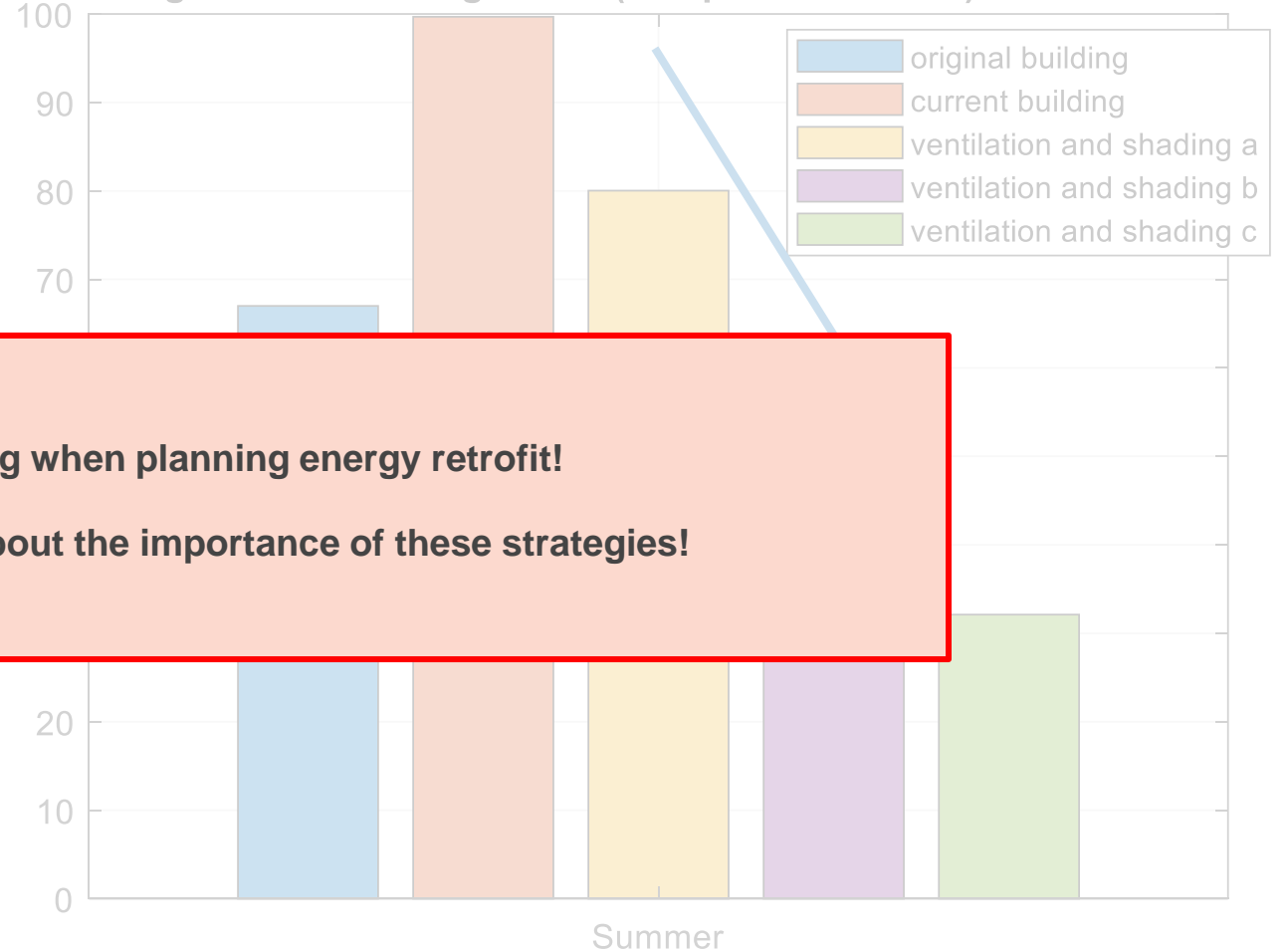




# Ventilation and shading strategies

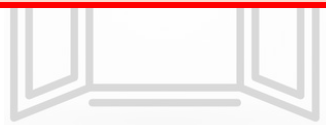
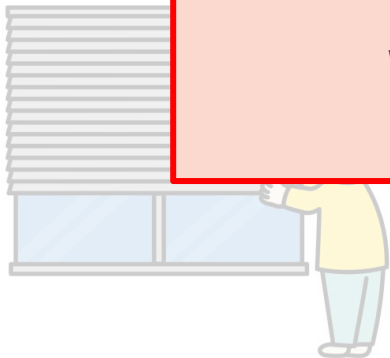
- Summer discomfort
- Window opening during the night and shading during the day

Percentage of overheating hours (Temperature > 25°C) RCP 4.5 far future

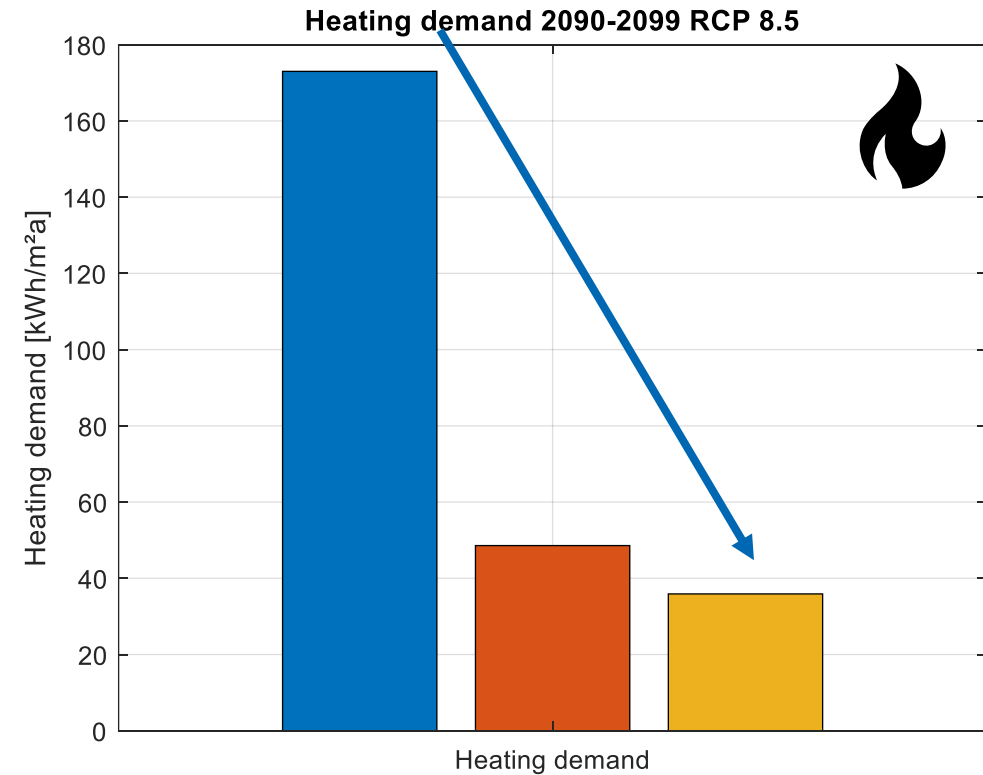
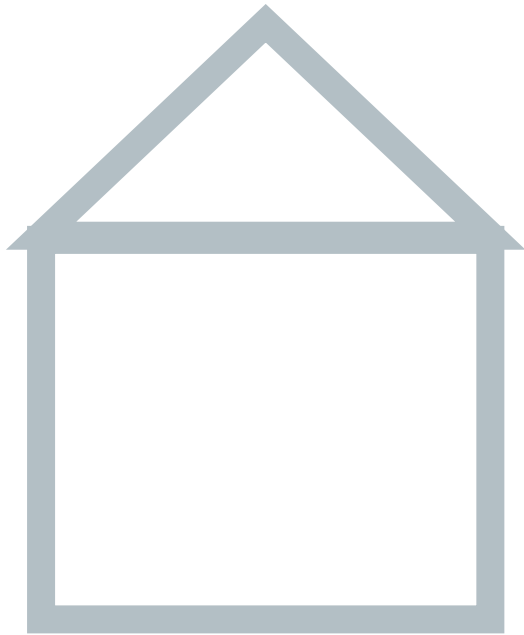


**We have to plan shading when planning energy retrofit!**

**We have to raise awareness about the importance of these strategies!**

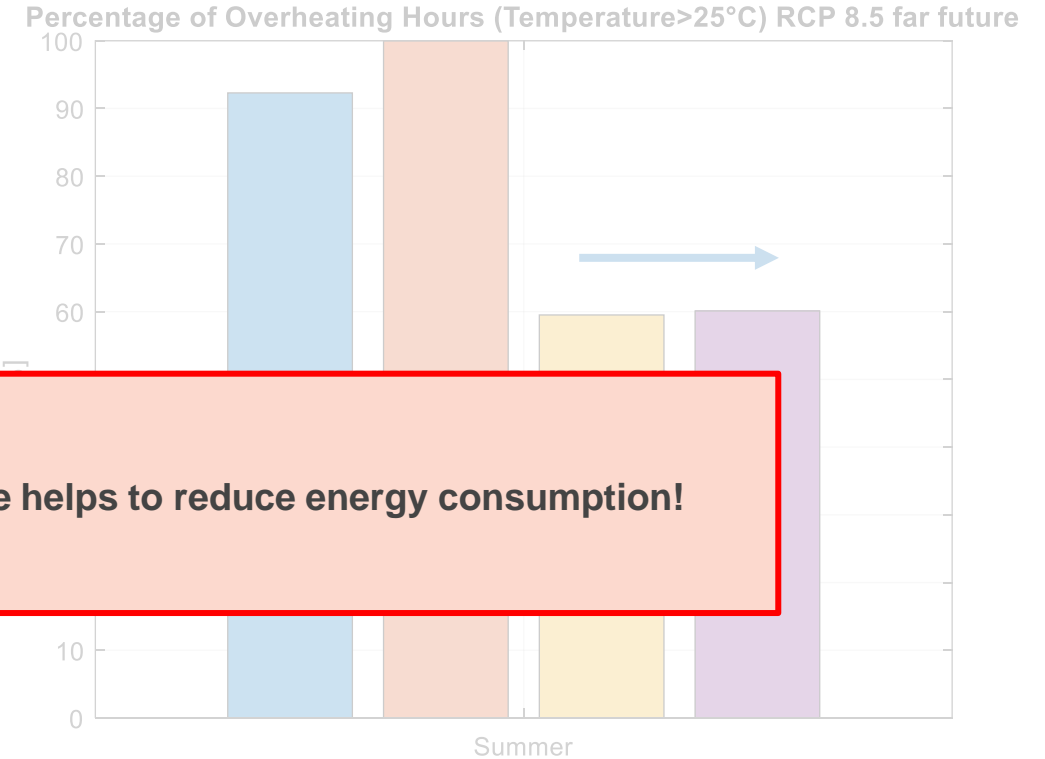
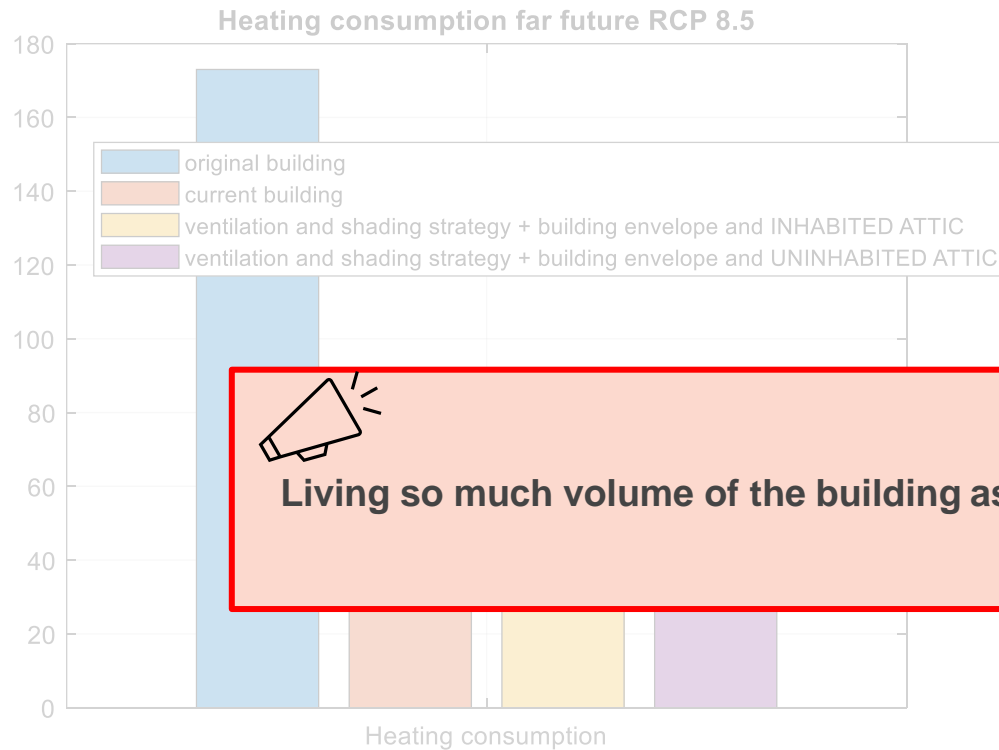


# Building envelope insulation





# Inhabited or uninhabited and ventilated attic?



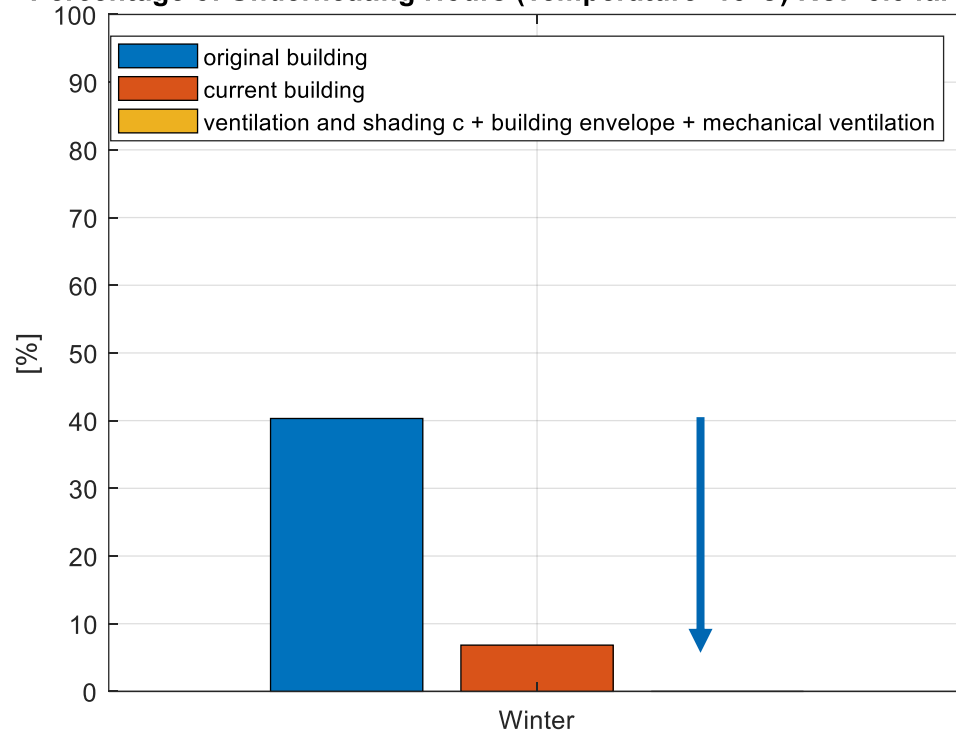
- Heating consumption

- Summer discomfort



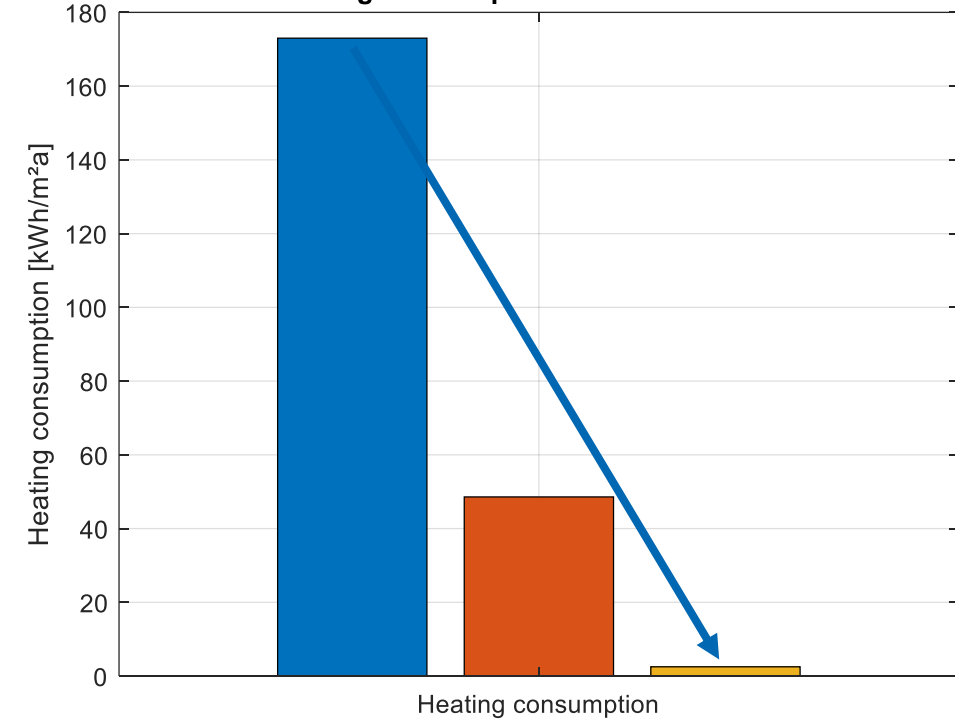
# Building envelope insulation and ventilation with heat recovery

Percentage of Underheating Hours (Temperature < 18°C) RCP 8.5 far future



- Winter discomfort

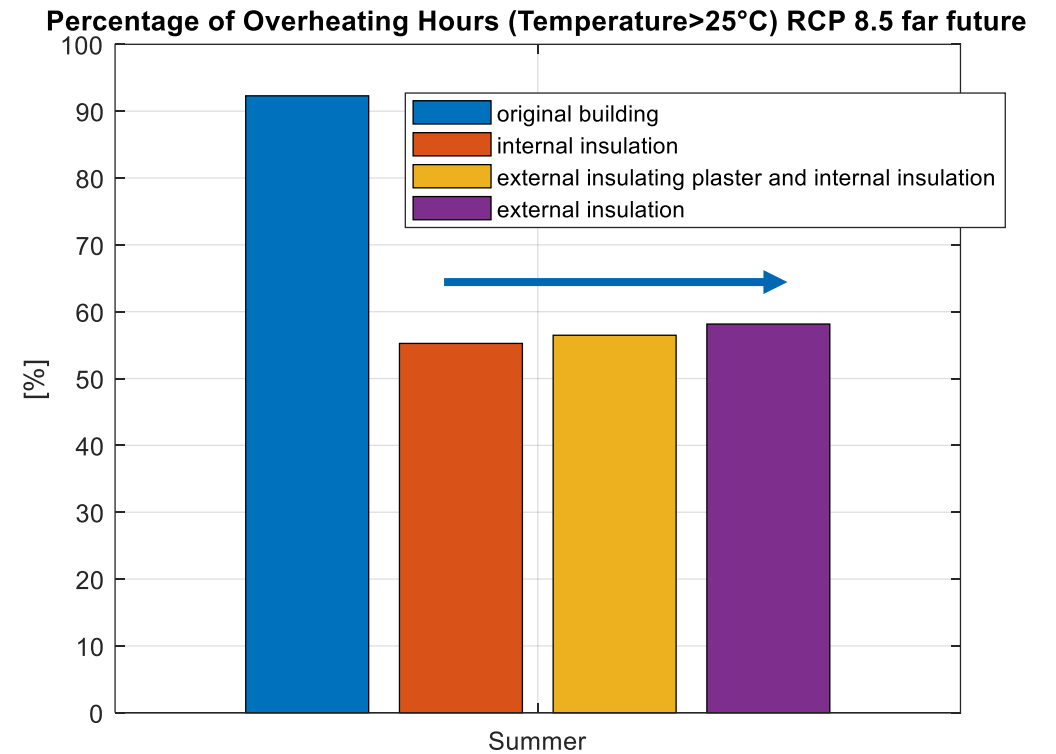
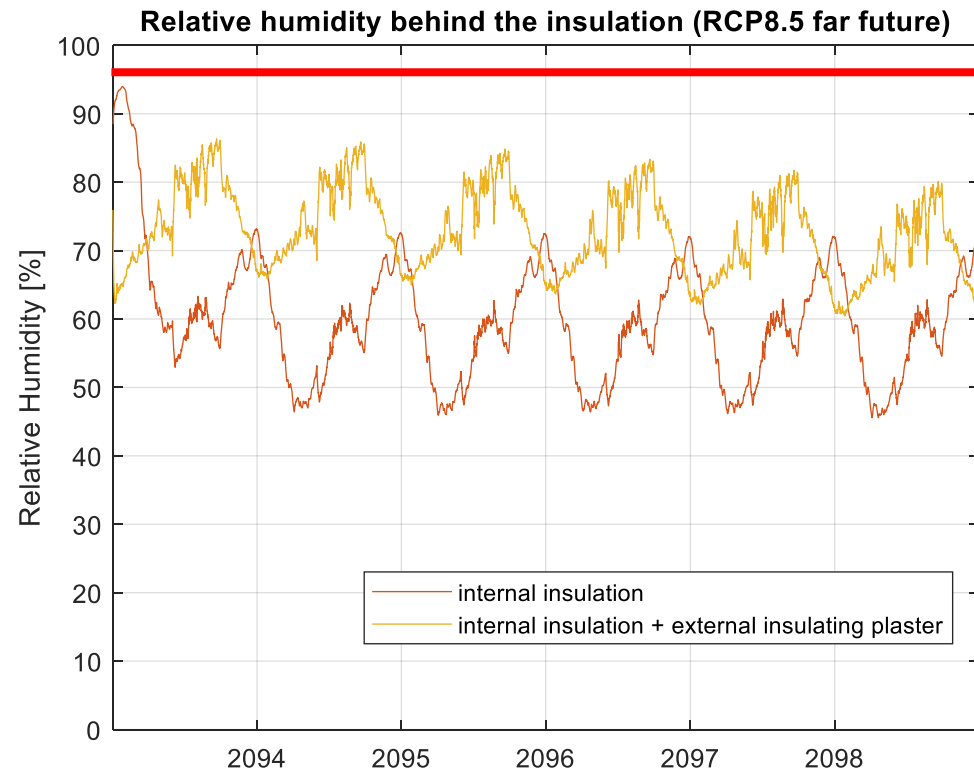
Heating consumption far future RCP 8.5



- Heating consumption



# Internal or external insulation?

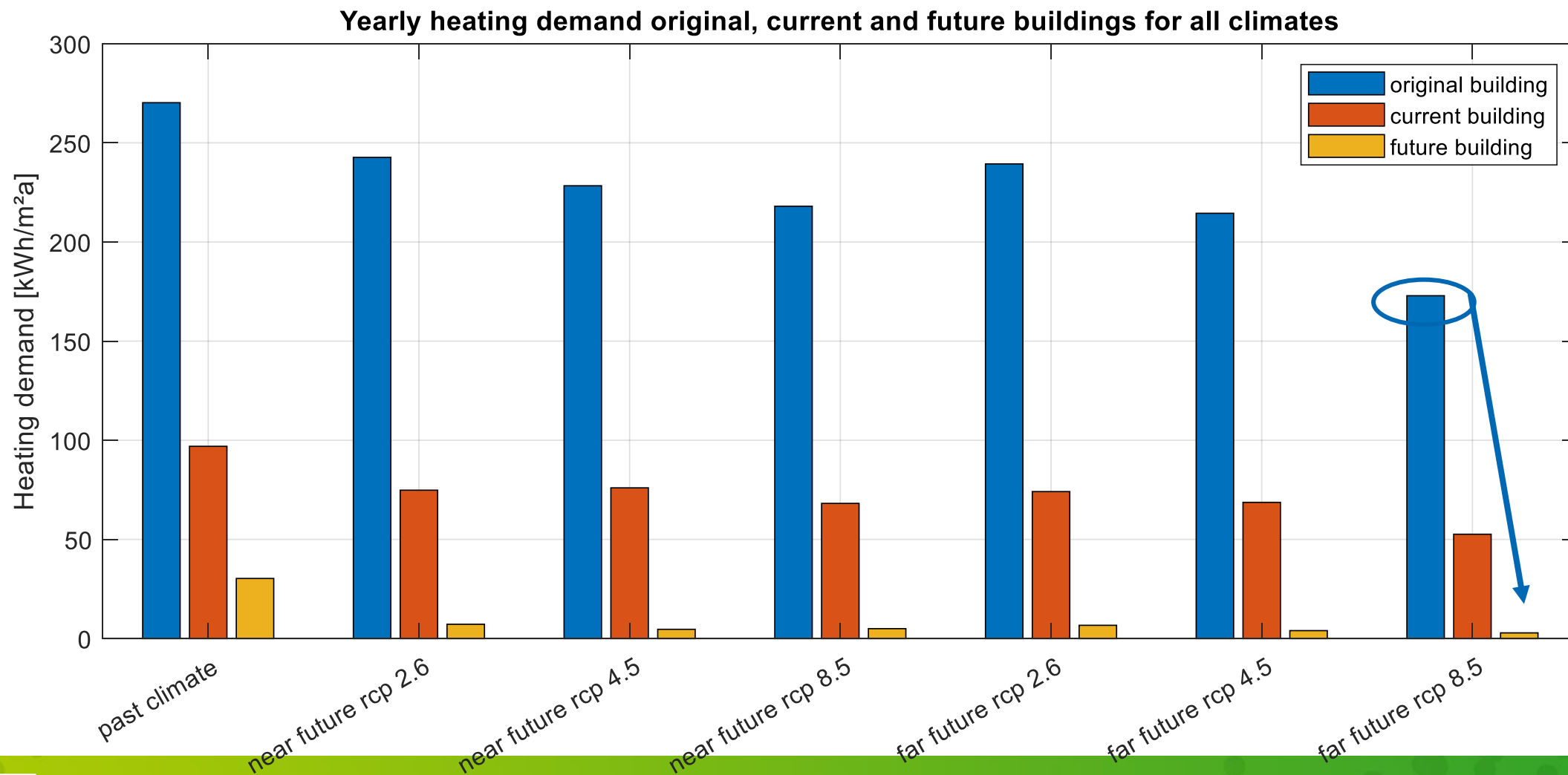


- Hygrothermal analysis

- Summer discomfort



# Yearly heating demand: original, current and future building



# Conclusions

- Renovating historic buildings and adapting them to the future climate is possible!
- Winter will still stay crucial
- Shading and ventilation strategies help for the summer discomfort





# IMPETUS

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## Grazie per l'attenzione!

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