



# Analysing the thermal energy demand of development scenarios of a city district

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## What is the topic?

# Sustainable and resilient thermal energy supply

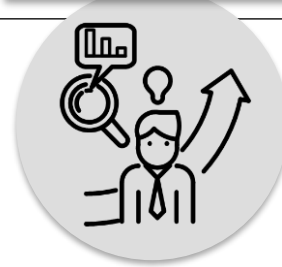
for

## Future-oriented city development

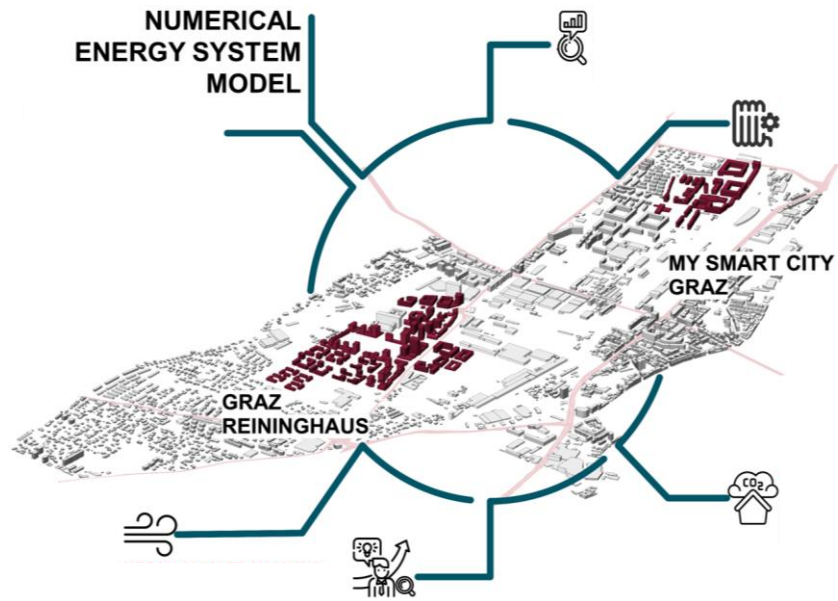
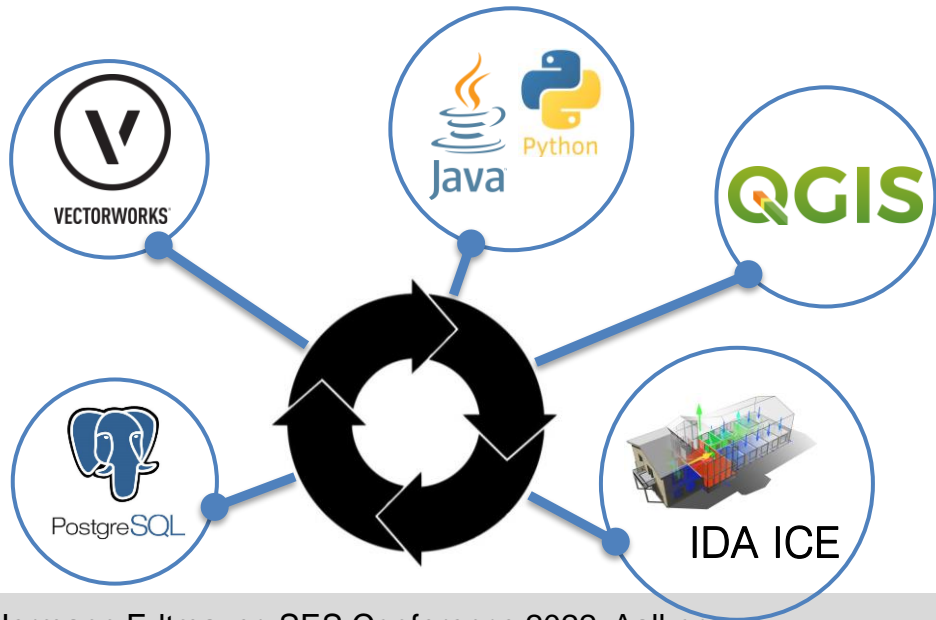
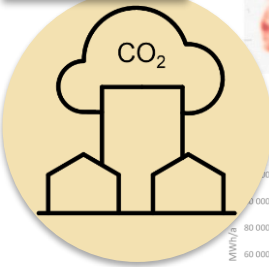
- Urban building energy modelling
- Thermal energy demand analysis
- Efficient use of resources
- Integrative urban planning & urbanistic development

# What is missing?

- **Reliable data** for decision makers
- Information about **status quo** and **future scenarios**
- Possibility to analyse entire **city districts**
- **Digital tools and workflows** to support this analysis



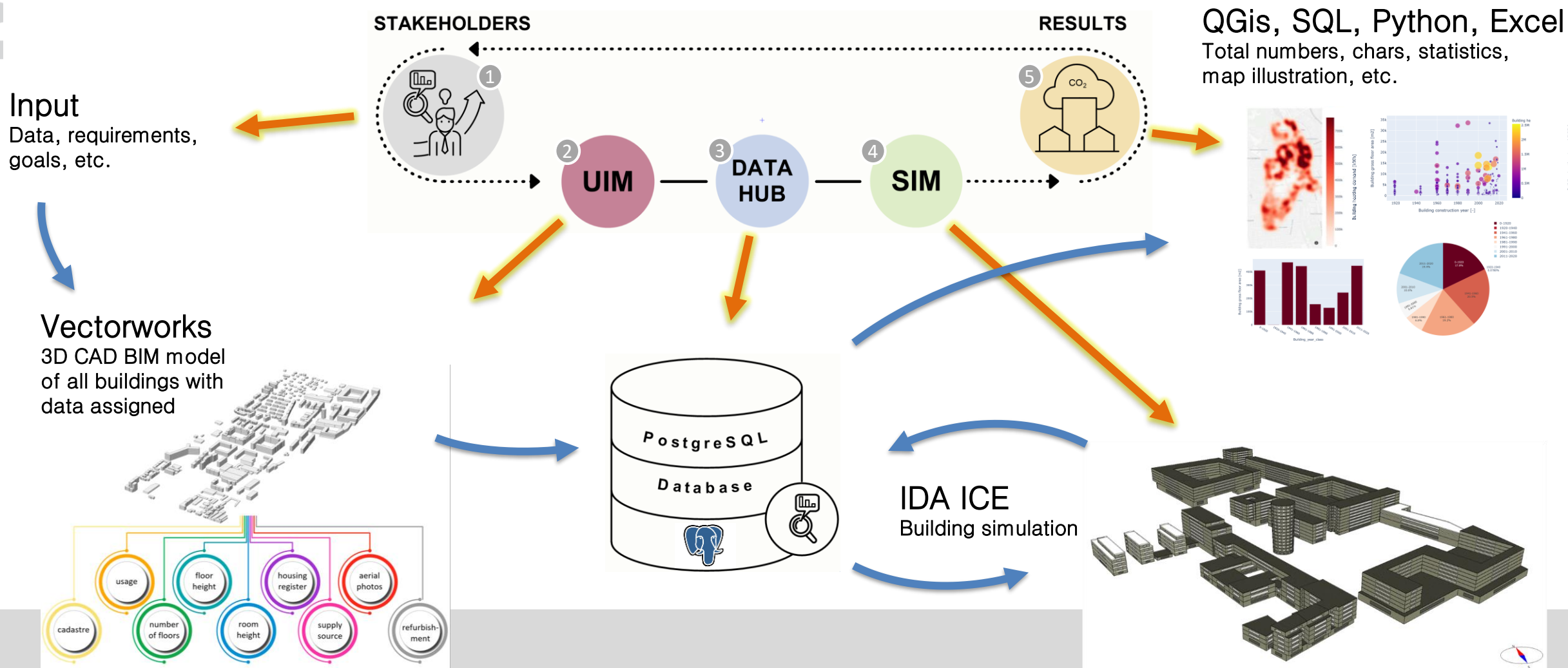
RESULTS



# How do we solve the problem?

- Multi-tool workflow

- 1) Input Stakeholders    2) Urban Information Model    3) Central Data Hub    4) Urban Building Energy Simulation Model    5) Postprocessing



- High-resolution urban building energy model

→ 2000 thermal zones  
310 buildings  
divided in 7 parallel models

→ Resolution

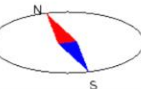
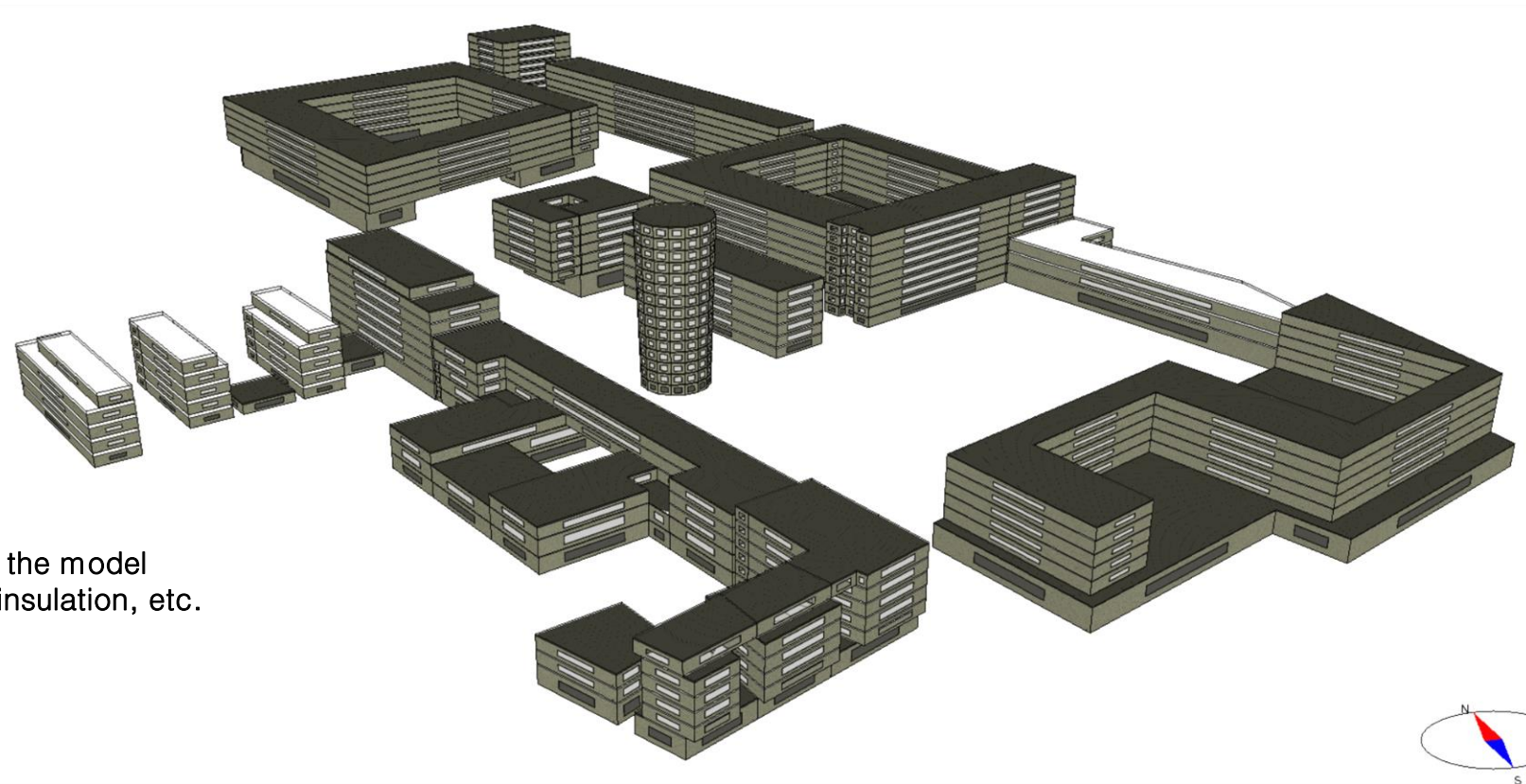
Every storey and usage category modelled in one thermal zone

→ Building data

all information about the buildings included in the model  
wall construction, window area ratio, thermal insulation, etc.

→ Simulation

dynamic building simulation of one year  
hourly mean values as results  
energy demand of: heating, hot water, cooling





- Design of three scenarios
  - Status quo
    - all available data included
  - Scenario 2030
    - current Smart City development completely included
  - Scenario 2050
    - scientific urbanistic approach for virtual future district design
  
- Varied parameters
  - Building usage and gross floor area
  - Climate change impact (IPCC RCP8.5)
  - Building hull quality
  - Human-centred urban design, green spaces, use of resources

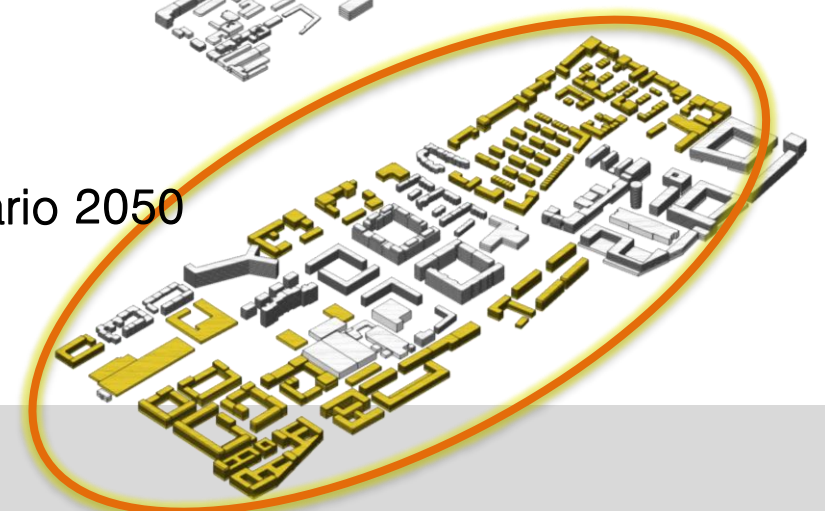
Status quo



Scenario 2030



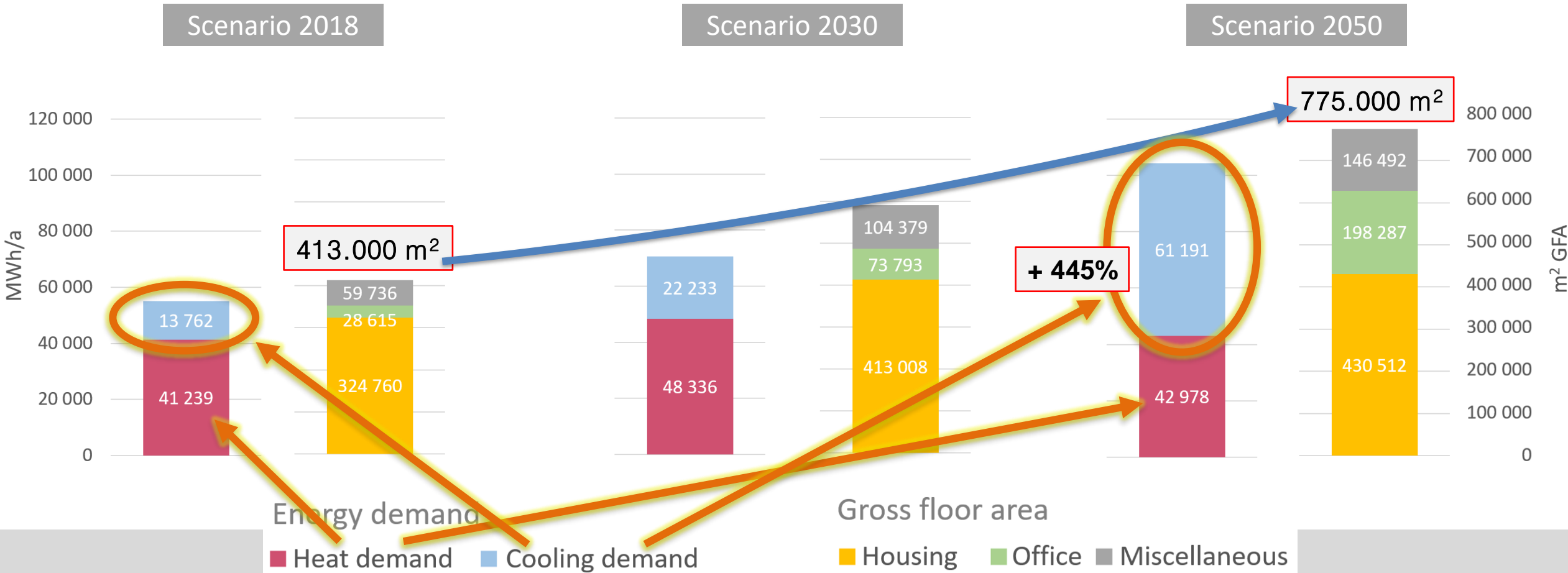
Scenario 2050



# What did we find out?

## Total thermal energy demand

Comparison of the three scenarios - absolute figures of energy demand and gross floor area





# Total heat energy demand

Comparison of the scenarios; heat map and contour plot of the calculated **heat energy demand (heating + domestic hot water)**

Scenario 2018

Scenario 2030

Scenario 2050





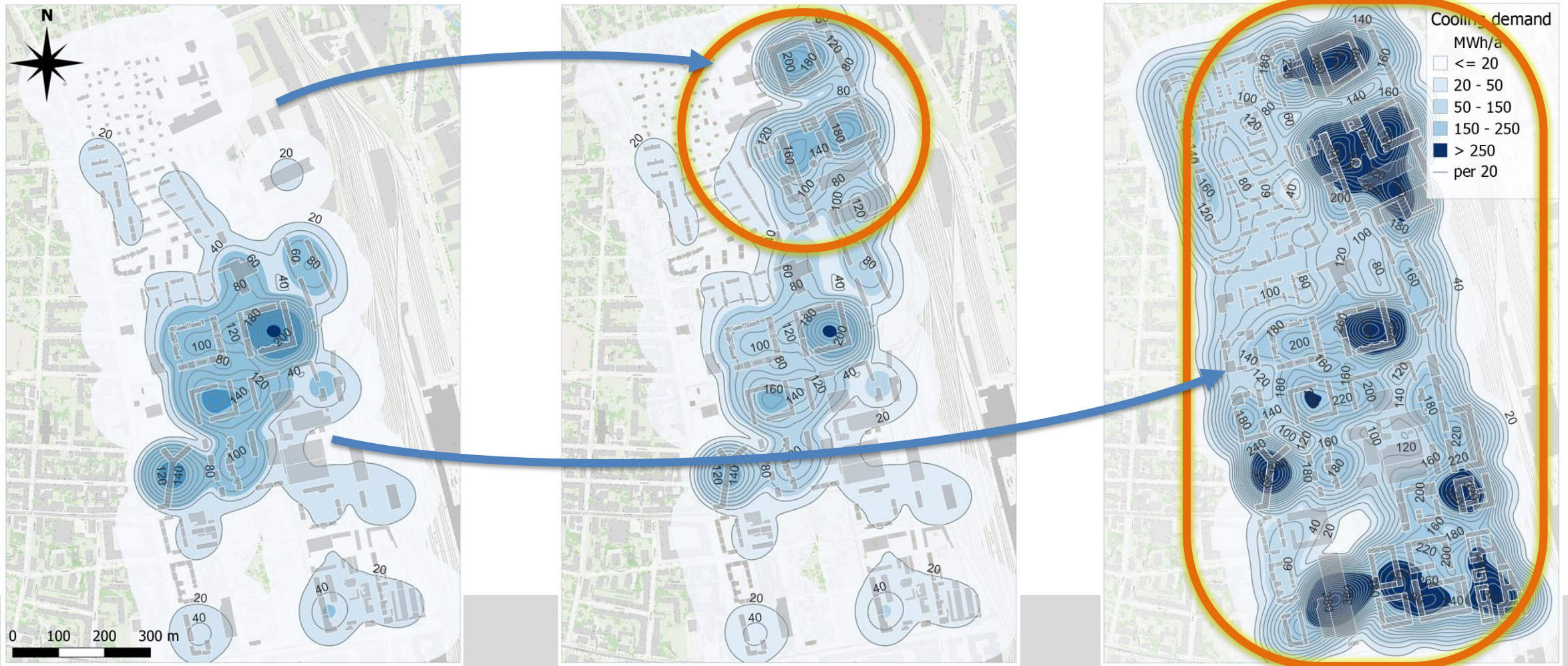
# Total cooling energy demand

Comparison of the scenarios; heat map and contour plot of the calculated **cooling energy demand**

Scenario 2018

Scenario 2030

Scenario 2050





# Thank you for your attention!

## Contact

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## Links

The research project '*ECR-Smart City 2020*'

- [TU Graz](#)

- [Researchgate](#)

## Project partners

- Institute of Urbanism, TU Graz

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