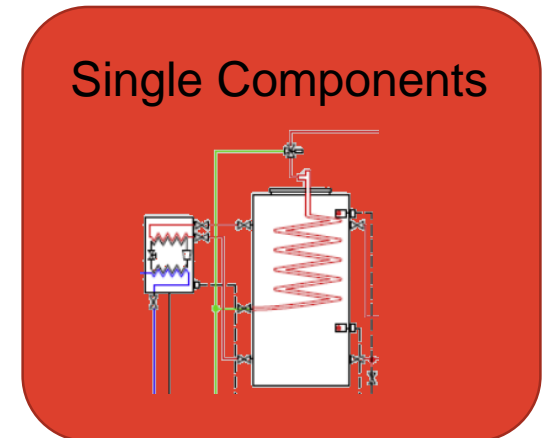
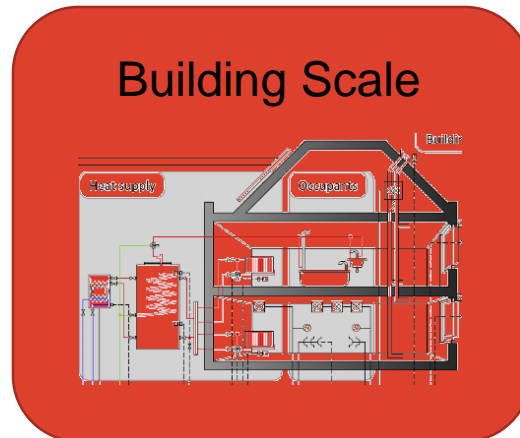
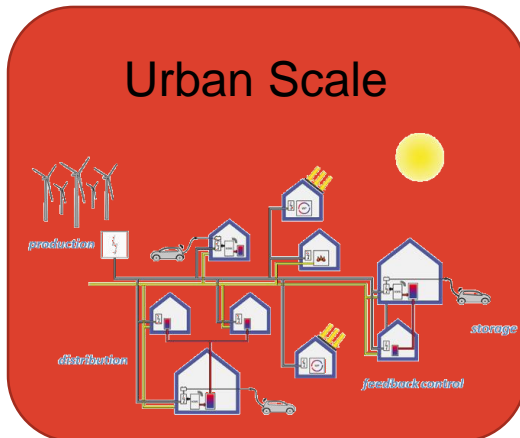




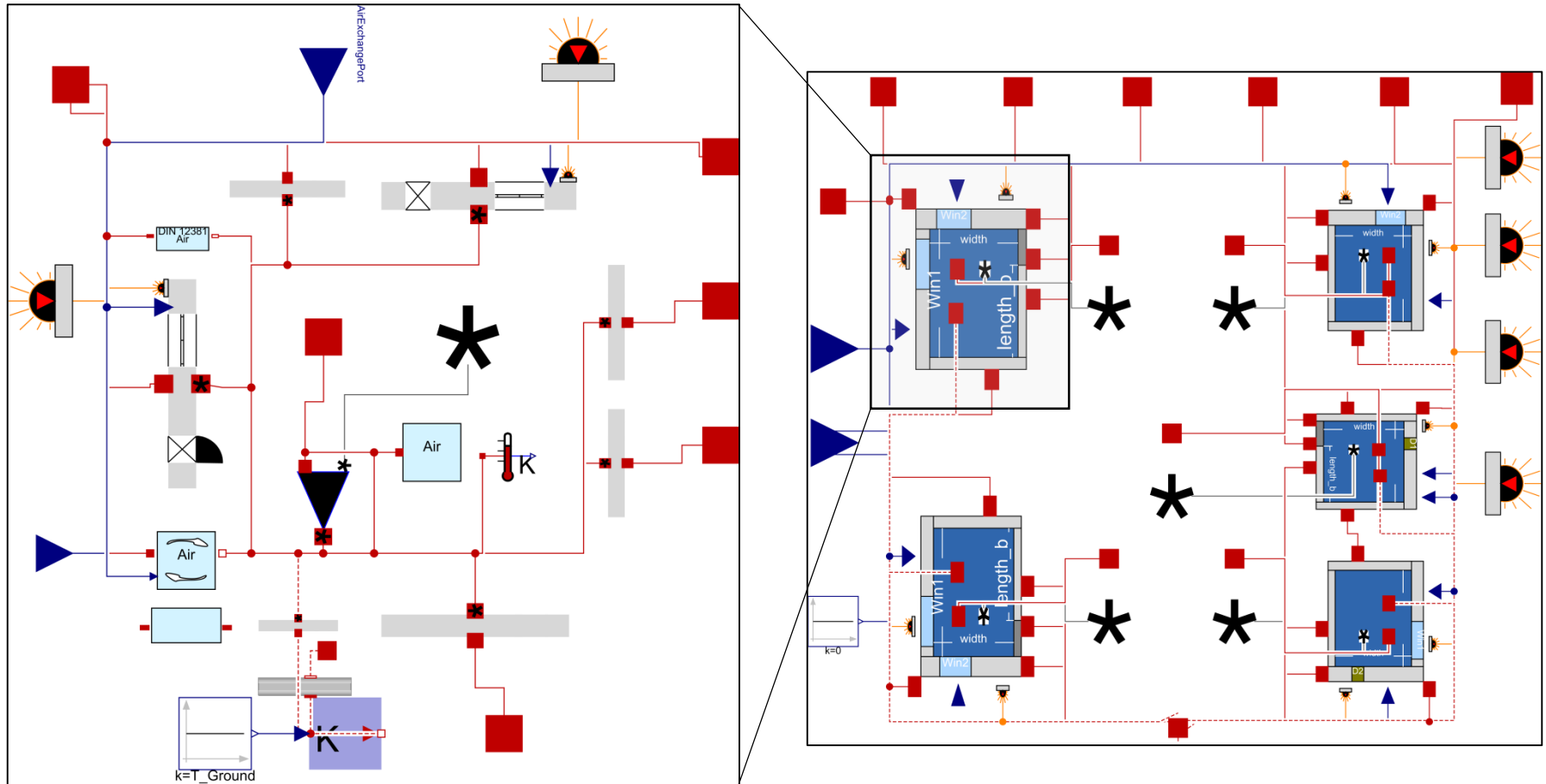
# AixLib – An Open-Source Modelica Library within the IEA-EBC Annex 60 Framework

M. Lauster

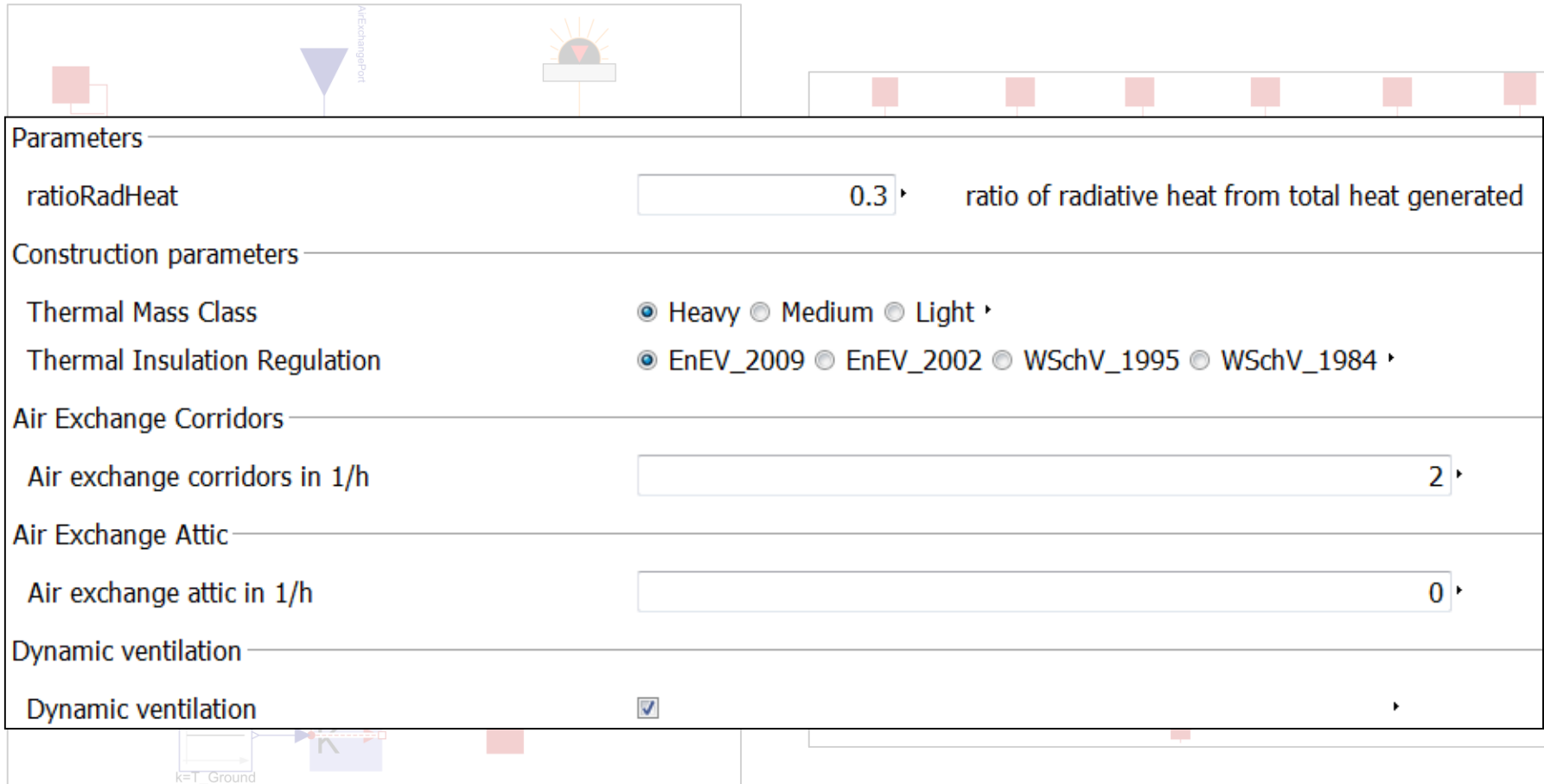
# AixLib: A model library for building performance simulation



# High Order Building Model



# High Order Building Model



The interface features a top header bar with a light blue background, containing three icons: a red square, a blue triangle labeled 'AirExchangePort', and a sun icon. Below this is a main content area with a white background and a light blue border. It is divided into several sections by horizontal lines. The 'Parameters' section contains a text input field for 'ratioRadHeat' with the value '0.3' and a description 'ratio of radiative heat from total heat generated'. The 'Construction parameters' section includes two rows of radio button options: 'Thermal Mass Class' with options 'Heavy', 'Medium', and 'Light'; and 'Thermal Insulation Regulation' with options 'EnEV\_2009', 'EnEV\_2002', 'WSchV\_1995', and 'WSchV\_1984'. The 'Air Exchange Corridors' section has a text input field for 'Air exchange corridors in 1/h' with the value '2'. The 'Air Exchange Attic' section has a text input field for 'Air exchange attic in 1/h' with the value '0'. The 'Dynamic ventilation' section has a checkbox labeled 'Dynamic ventilation' which is checked. At the bottom, there is a footer bar with a light blue background, containing a small icon of a building and the text 'k=T\_Ground'.

Parameters

ratioRadHeat  ratio of radiative heat from total heat generated

Construction parameters

Thermal Mass Class ☒ Heavy ☐ Medium ☐ Light

Thermal Insulation Regulation ☒ EnEV\_2009 ☐ EnEV\_2002 ☐ WSchV\_1995 ☐ WSchV\_1984

Air Exchange Corridors

Air exchange corridors in 1/h

Air Exchange Attic

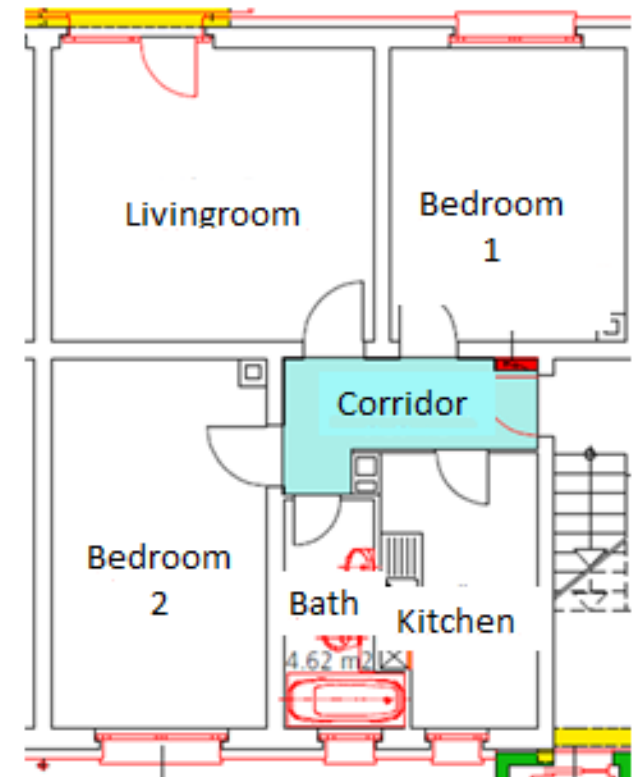
Air exchange attic in 1/h

Dynamic ventilation

Dynamic ventilation ☒

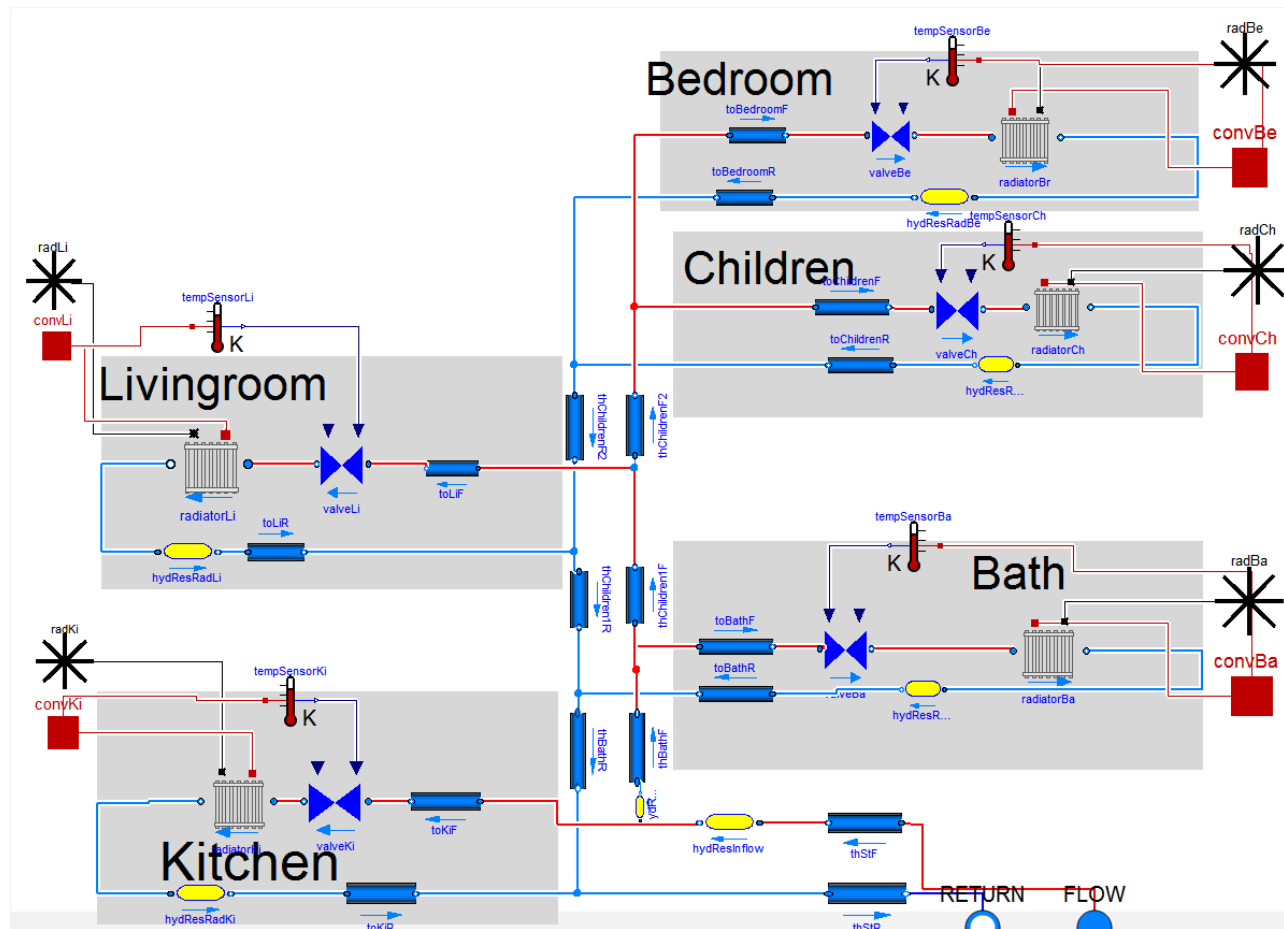
# Use Case: Demand Side Management by Overheating an Apartment

- Heavy building with properties of thermal insulation regulation WSchV1984
- Apartment with 70 m<sup>2</sup> net floor area
- Aim:
  - ≡ Reduce heat demand during peak load hours
  - ≡ Store energy in building mass by overheating



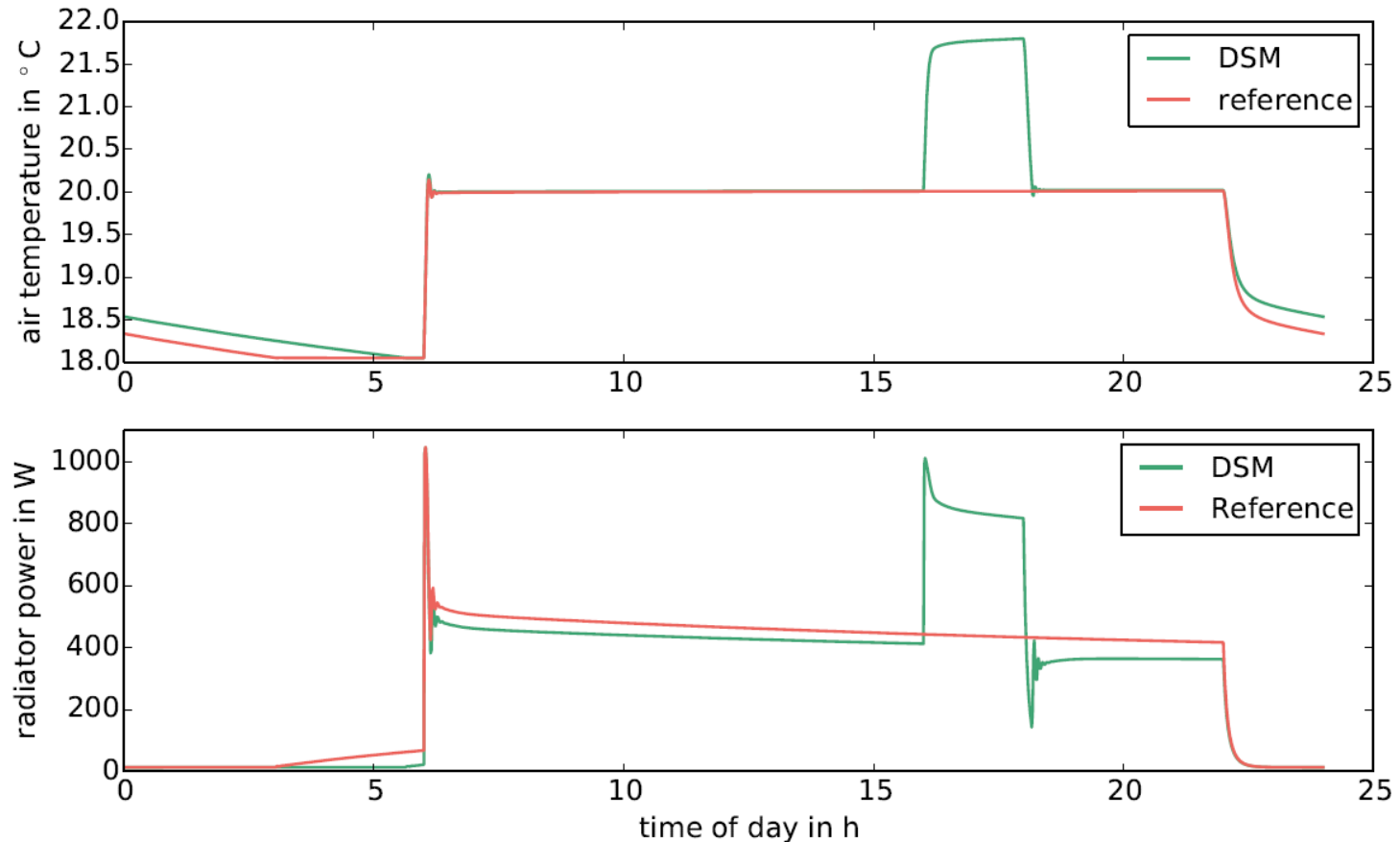
# Use Case: Demand Side Management by Overheating an Apartment

## Combined modeling of building envelope and energy system



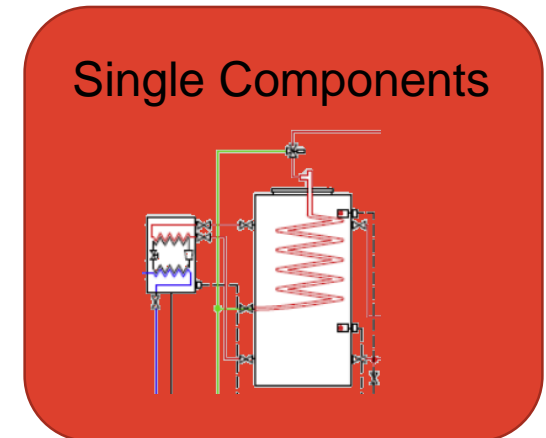
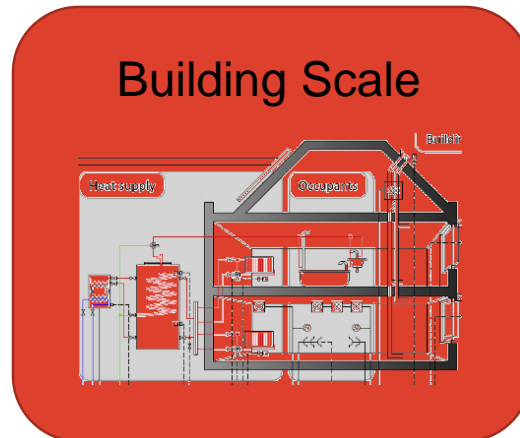
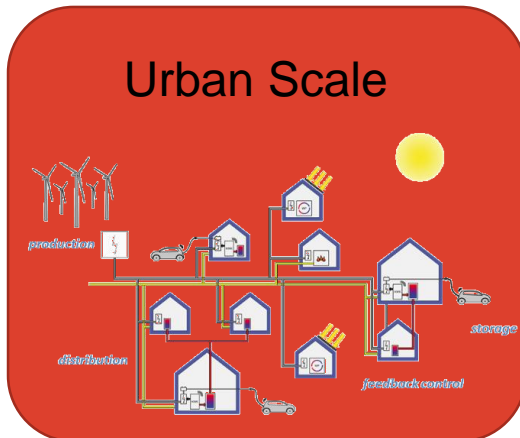
# Use Case: Demand Side Management by Overheating an Apartment

Slight overheating between 16:00 and 18:00 leads to 14 % demand reduction during peak load hours





# AixLib: A model library for building performance simulation

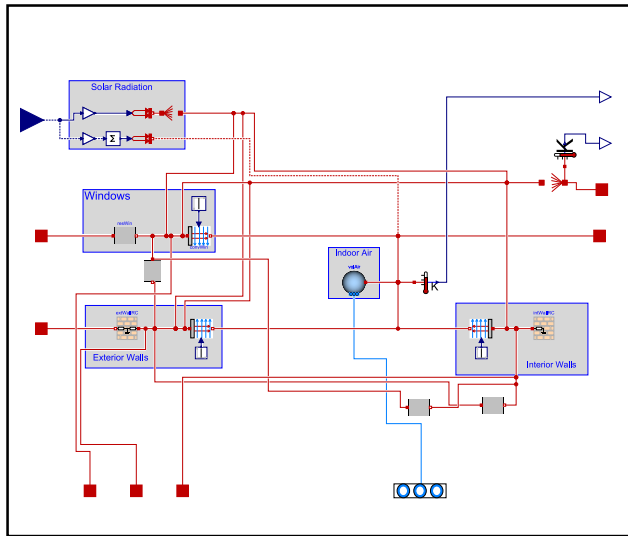




# Reduced Order Model as Core of Multizone Model

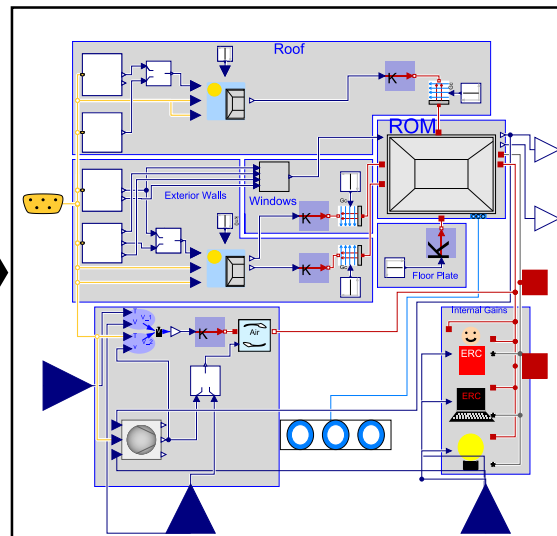
Thermal building model with variable number of layers, walls and zones

## Reduced Order Model



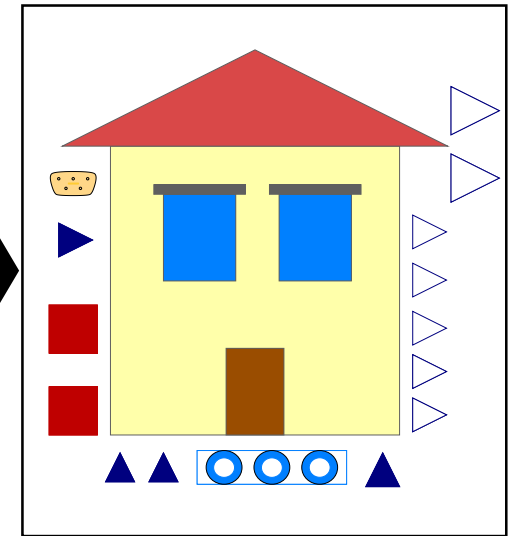
Accounts for building's mass

## Thermal Zone



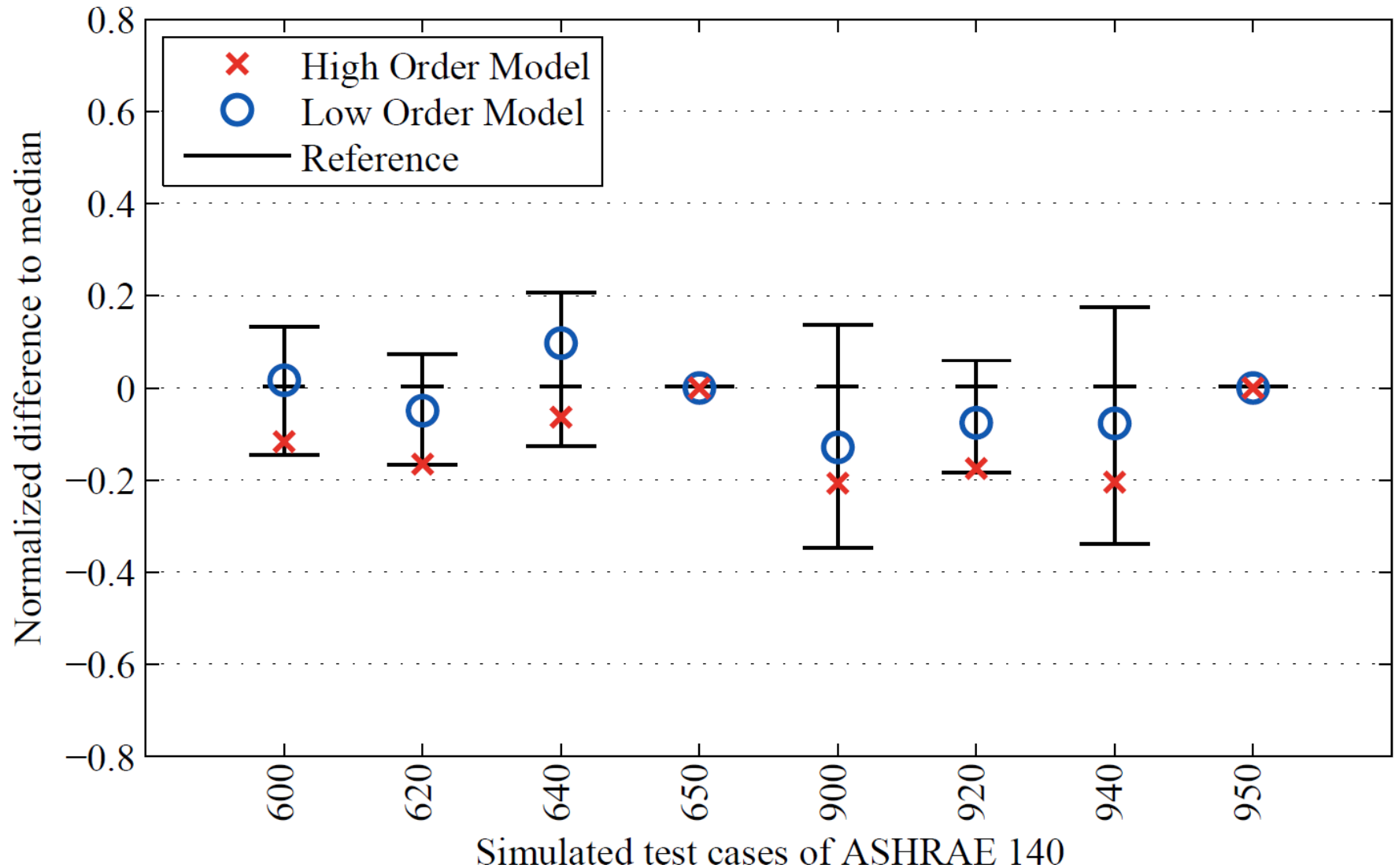
Adds solar radiation and internal gains

## Multizone



Adds a variable number of zones

# Annual Heat Load Validation According to ASHRAE 140

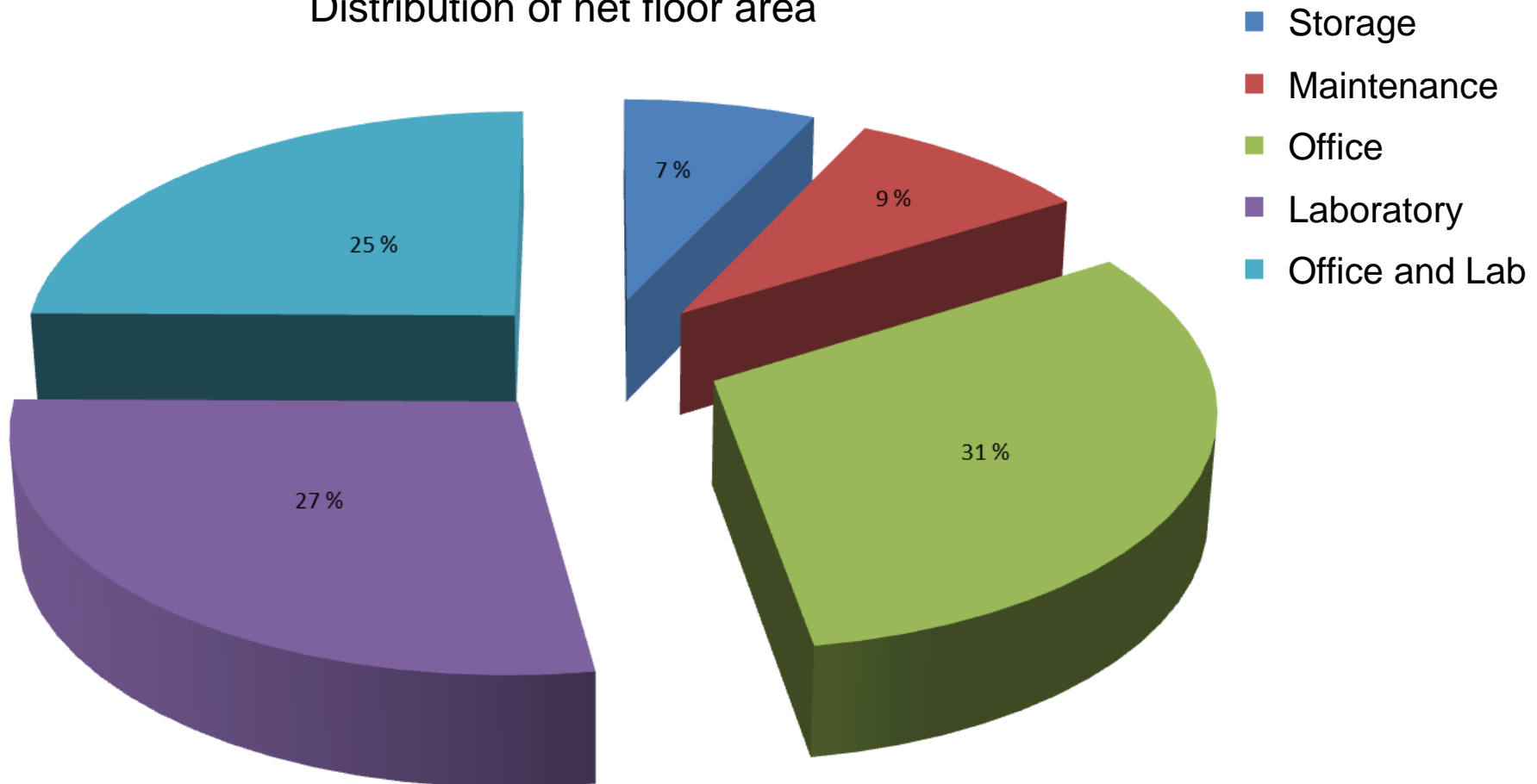


# Use Case: Forschungszentrum Jülich

## Heat Demand Profiles

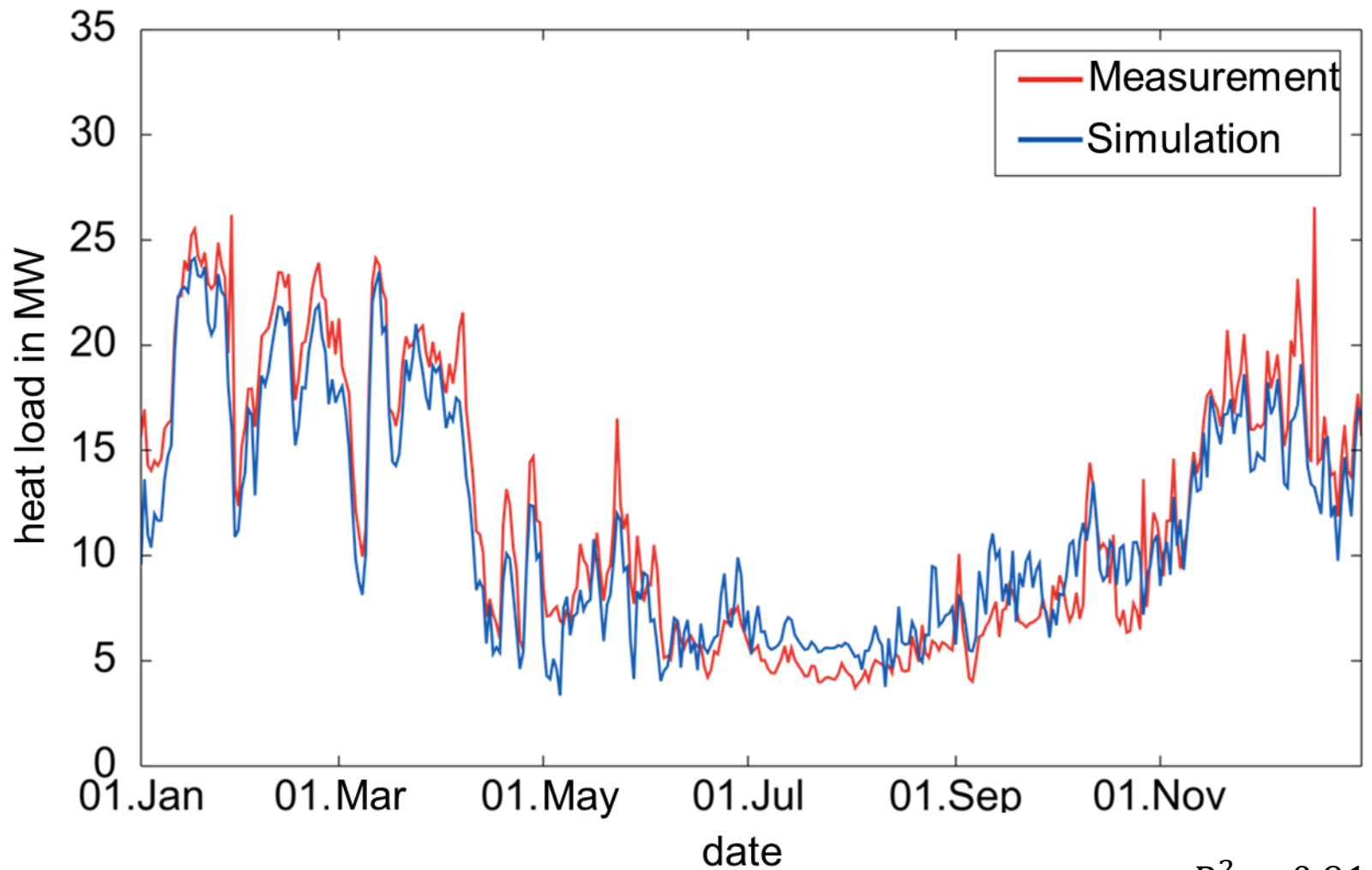
200 buildings of different use, year of construction and net floor area

Distribution of net floor area



# Use Case: Forschungszentrum Jülich

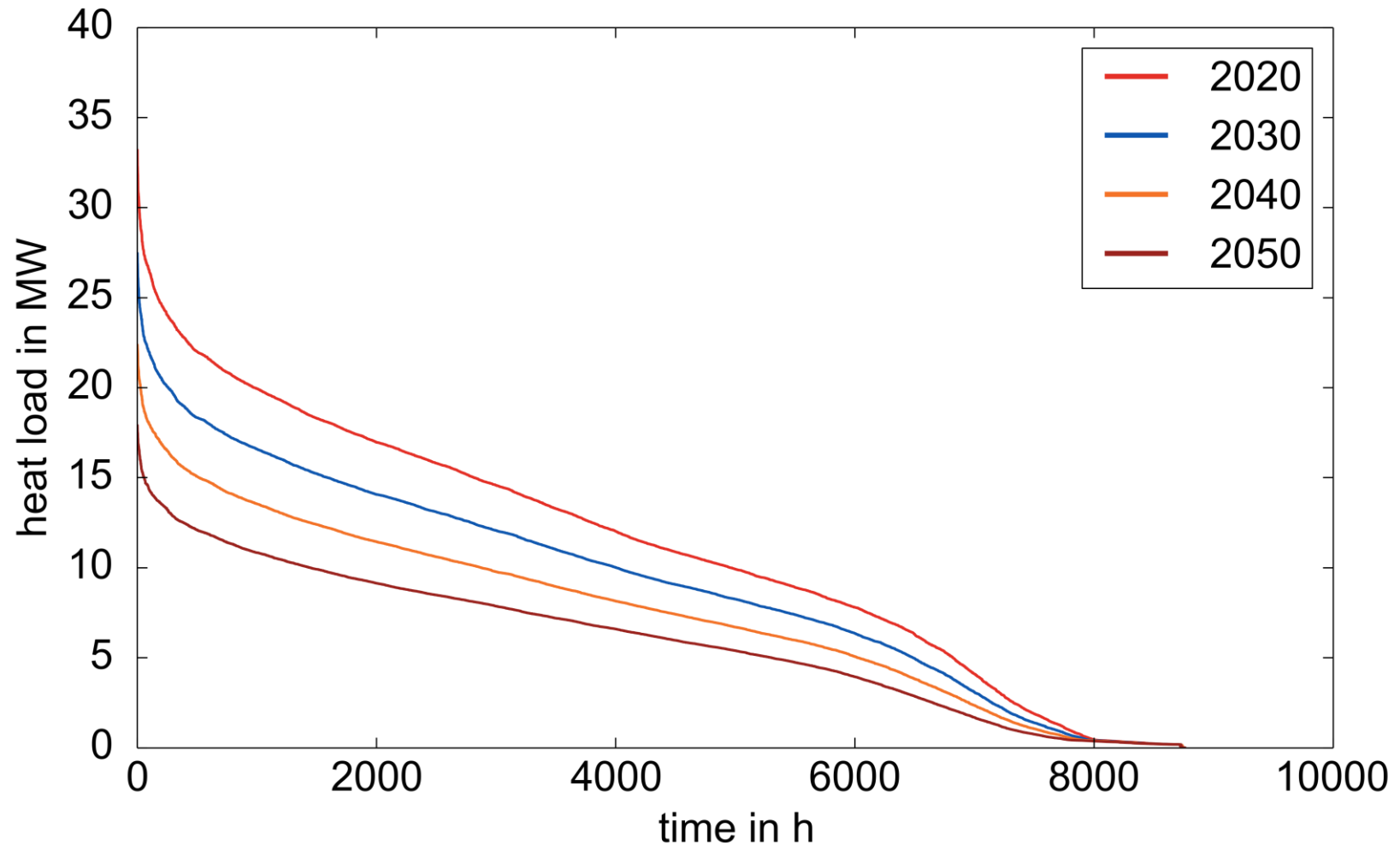
## Comparison of Simulation to Measurement



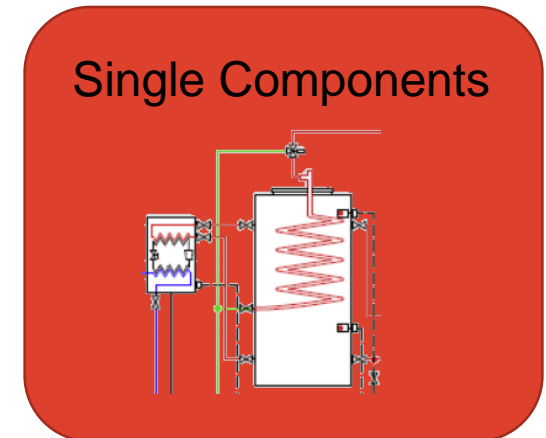
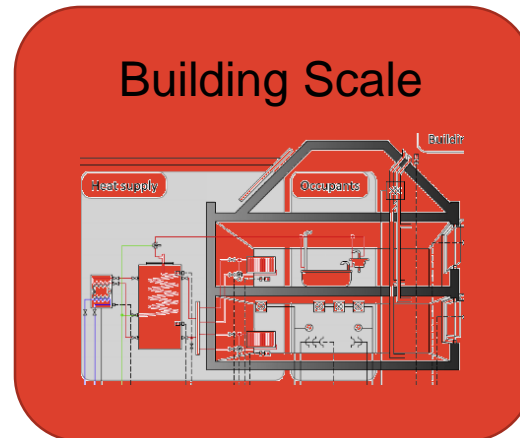
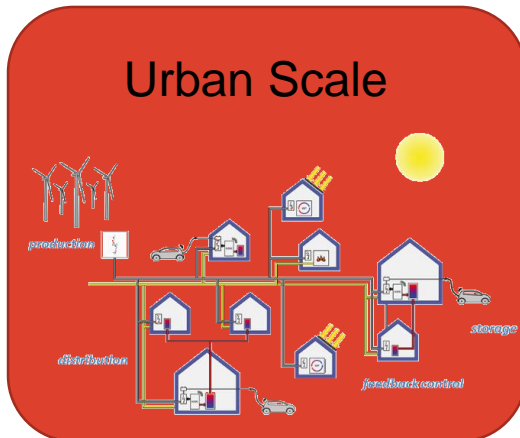
$R^2 = 0.91$

# Use Case: Forschungszentrum Jülich

## Heat Demand Reductions with 1.7 % Retrofit Rate



# AixLib: A model library for building performance simulation



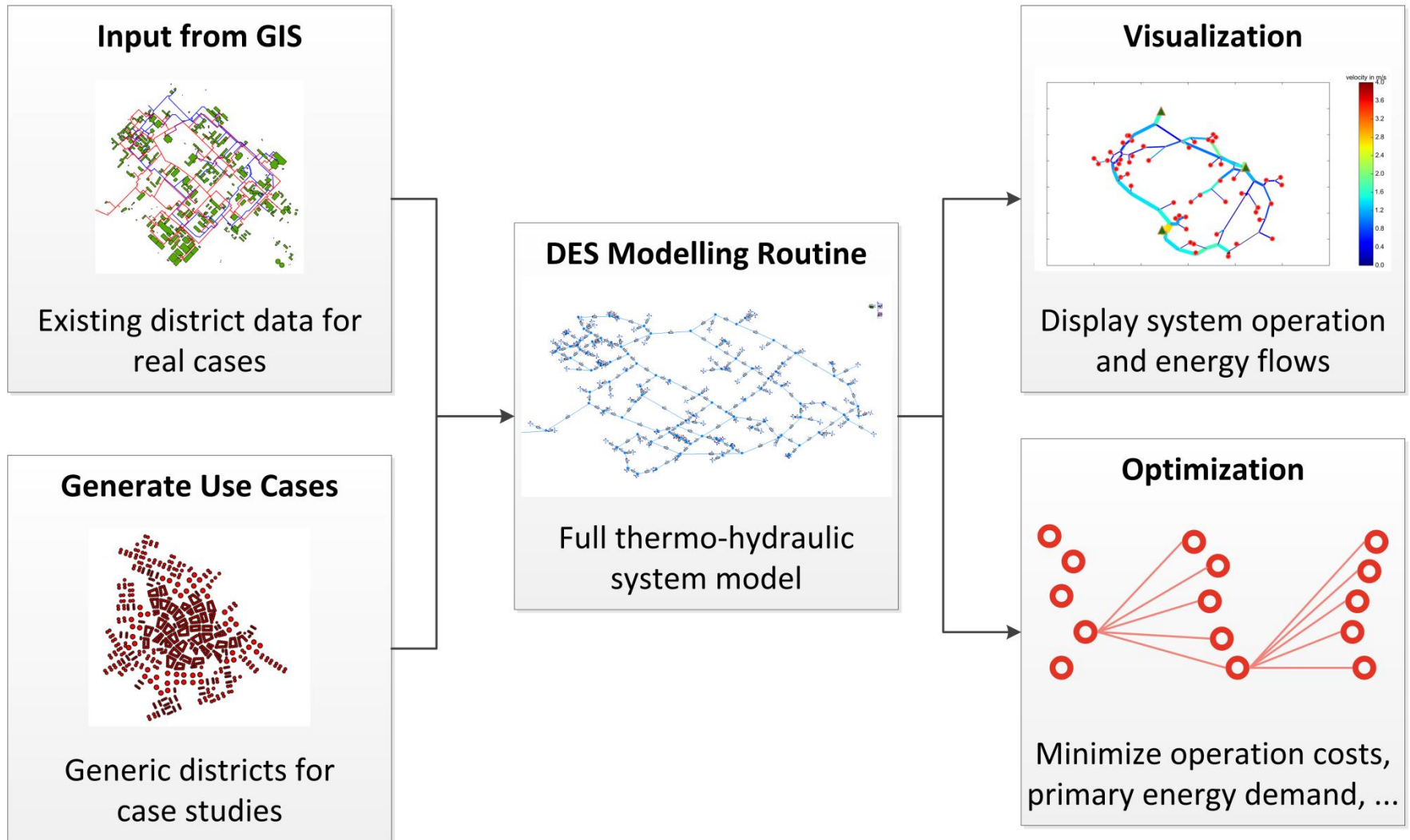
# Use Case: Forschungszentrum Jülich Energy Grid System

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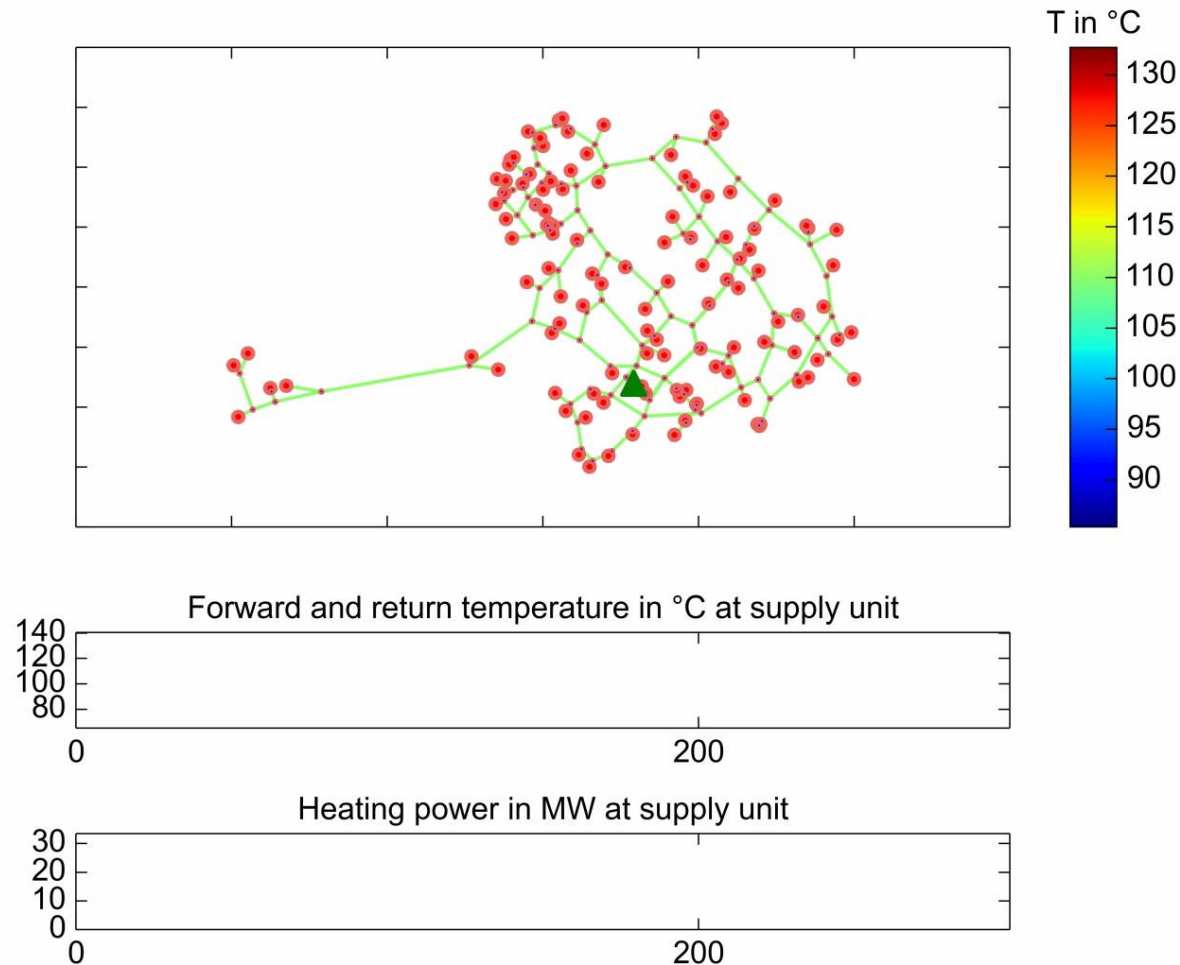




# Automated Model Generation for District Energy Systems



# Visualization of Dynamic Network Simulation



## Recent News

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AixLib V0.4 is expected to be released begin of November `16 including:

- Support of Reduced Order Model core form Annex60 in Multizone model
- HVAC:
  - ≡ Boiler
  - ≡ CHP
  - ≡ HeatPump
  - ≡ Radiator
  - ≡ Storage
  - ≡ PV
- Clean-Up of duplicative models

# AixLib – An open-Source Modelica Library within the IEA-EBC Annex 60 Framework

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[www.github.com/RWTH-EBC/AixLib](https://www.github.com/RWTH-EBC/AixLib)

[www.github.com/RWTH-EBC/TEASER](https://www.github.com/RWTH-EBC/TEASER)

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