IBPSA Project 1

BIM/GIS and Modelica Framework for building and community energy system design and operation

TASK 3: Application and Dissemination
ST 3.1 District Energy DESTEST

Dirk Saelens (presentation)
Ina De Jaeger (chat moderator)

Online expert meeting – Status presentation – 2020.05.06

General objective

- ➔ Development of a DESTEST to
  - develop typical or representative DES cases that can be used for testing different DES simulation environments (intermodel comparison, …)
  - develop a test framework for testing models in a predefined DES environment

Approach

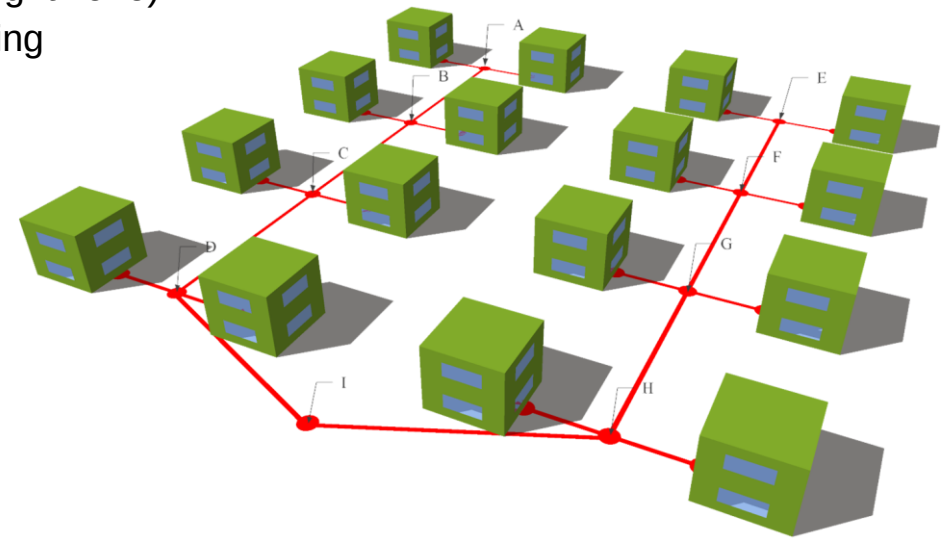
- ➔ Two tracks are working in parallel
  - Focus on building models: Ina De Jaeger (KUL)
  - Focus on network and energy system models: Michael Mans (RWTH)

  Discussion is organized in online coordination meetings and subgroup meetings
  Minutes of these meetings can be found on github

- ➔ Common Exercises
- ➔ Start with description of (very) simple neighborhood of buildings
- ➔ Use this information to design thermal network(s)
- ➔ Gradually increase the complexity

Starting up

- ➔ 1st common exercise
  - 16 identical single-family dwellings
  - Single-family dwelling of 1980
    - Thermal performance based on TABULA project for Belgium
    - Two-zone model (day zone and night zone)
    - Only heat demand for space heating
    - Standard occupant (ISO 13790)
  - Connected by a district heating network



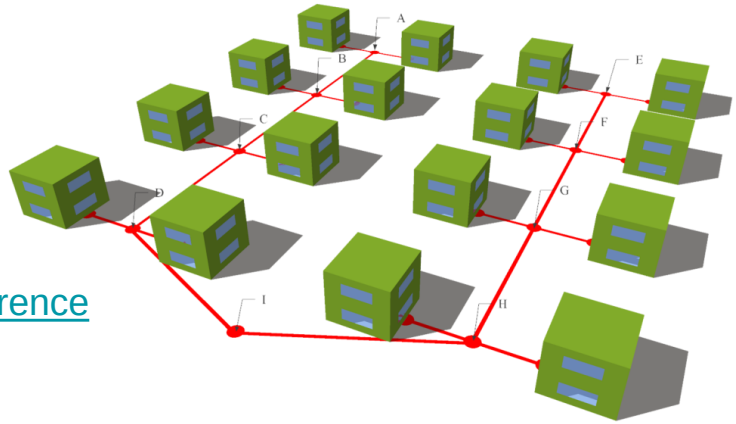
Starting up

➔ 1st common exercise - participants

Modelling environment	Modeler	Affiliation of participant
Modelica IDEAS	Ina De Jaeger	KU Leuven / VITO / EnergyVille
Modelica Buildings	Alessandro Maccarini	Aalborg University
Modelica AixLib	Michael Mans	RWTH Aachen
Modelica BuildingSystems	Haris Shamsi	UCD Dublin
IDA ICE	Øystein Rønneseth, Igor Sartori	Sintef Norway
DIMOSIM	Enora Garreau	CSTB
Trnsys	Lien De Backer	UGent

Past activities documented

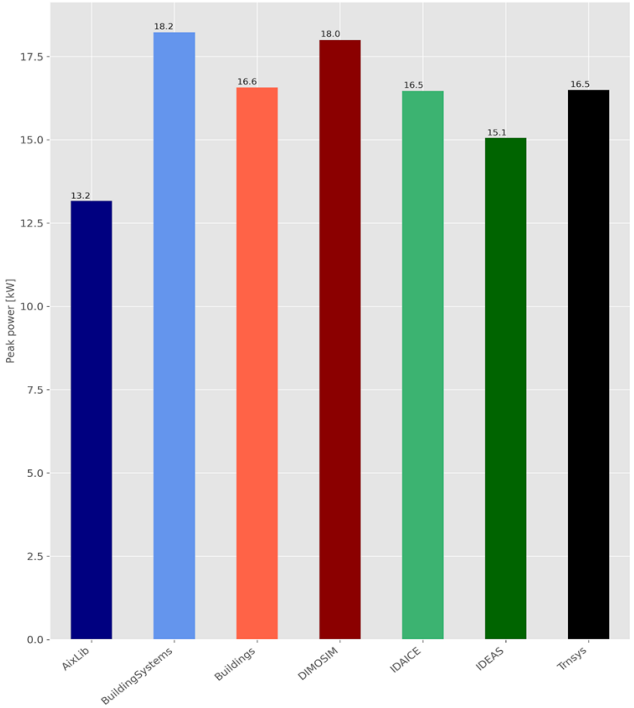
- ➔ 1st common exercise - Resources
  - ◆ Buildings
    - First description can be found here
      - There, you find a README-file that explains the followed workflow and the provided documents as much as possible
      - All of your questions are remarks are collected here
    - Final documentation is available
      - In text format
      - In CityGML format
  - ◆ Network
    - First description can be found here
    - Final documentation is available
      - In text format
  - ◆ Described in a paper presented at the BS2019 conference

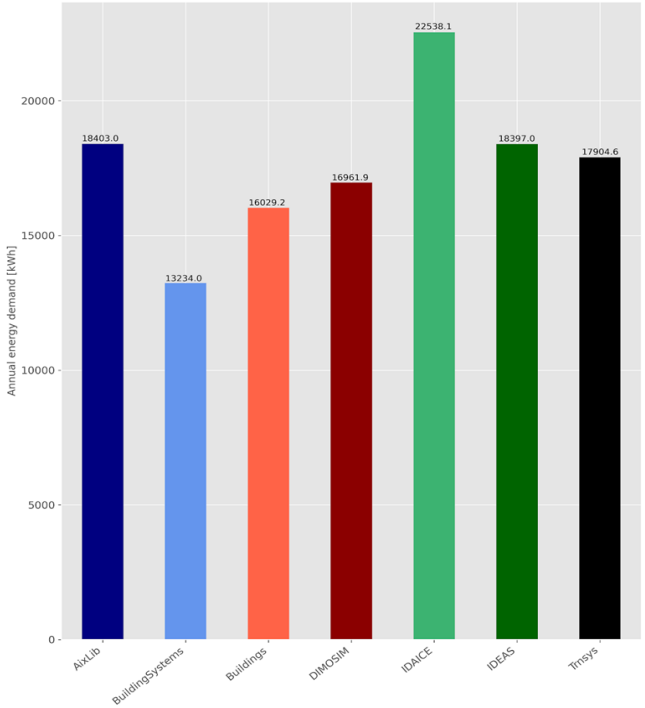


Past activities

➔ 1st common exercise - results

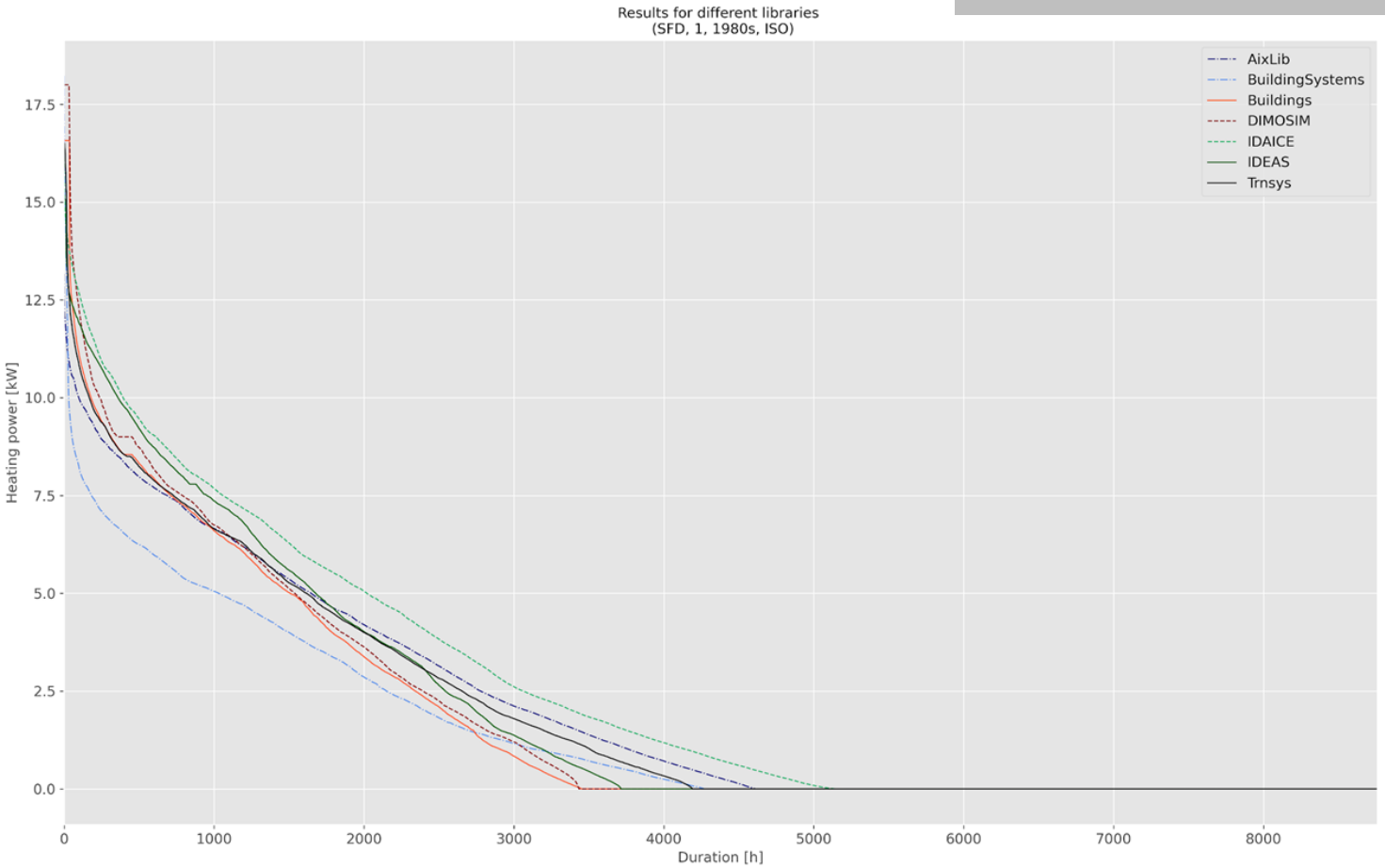
Peak power



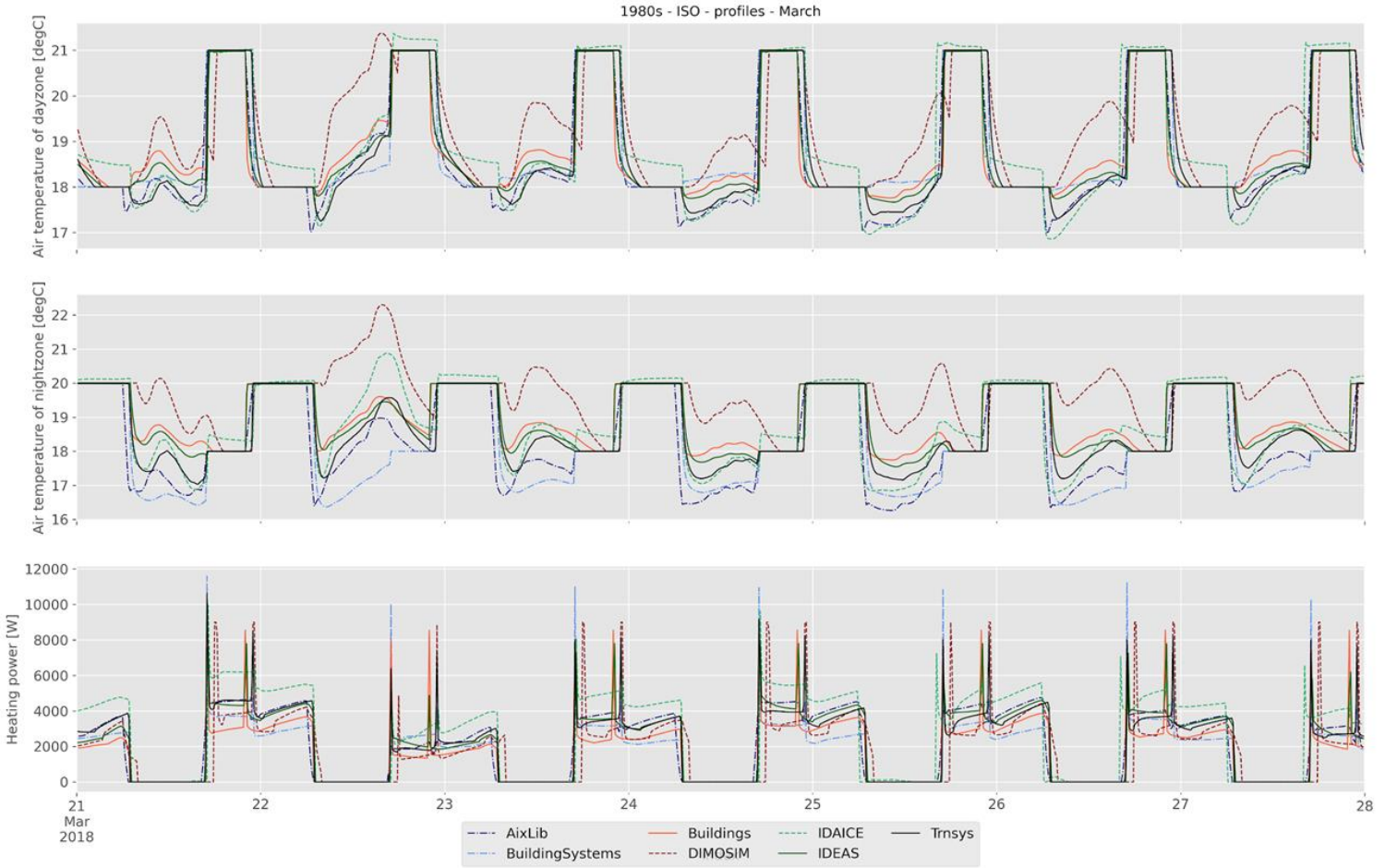


Annual energy demand

Load duration curve



Temperature profiles March



Current activities

- ➔ Gradually defining next common exercises based on the 1st common exercise
  - Single-family dwelling of 1980
    - Standard occupant (ISO 13790)
      → Also included stochastic occupants (16 different profiles) — 2ND COMMON EXERCISE
    - Thermal performance based on TABULA project for Belgium
      → Also included renovations (light and heavy) — 3RD COMMON EXERCISE
    - Two-zone model (day zone and night zone)
    - Only heat demand for space heating
  - Office building — 4TH COMMON EXERCISE
  - Connected by a district heating network
      → Also include different network layouts (8 and 32 buildings) — DHN COMMON EXERCISE

Current activities

- ➔ 2nd common exercise
  - ◆ Single-family dwelling of 1980
    - Thermal performance based on TABULA project for Belgium
    - Two-zone model (day zone and night zone)
    - Only heat demand for space heating
    - Standard occupant (ISO 13790)

      → Also include stochastic occupants (16 different profiles) generated by STROBE
      - ○ Different number of people: 1 – 5
      - ○ Different types of employment
      - ○ Setpoints / night zone heated
  - ◆ Connected by a district heating network

Current activities

- 2nd common exercise - resources
  - Buildings
    - First description can be found here
    - Final documentation is not yet available
  - Network
    - Impact to be investigated

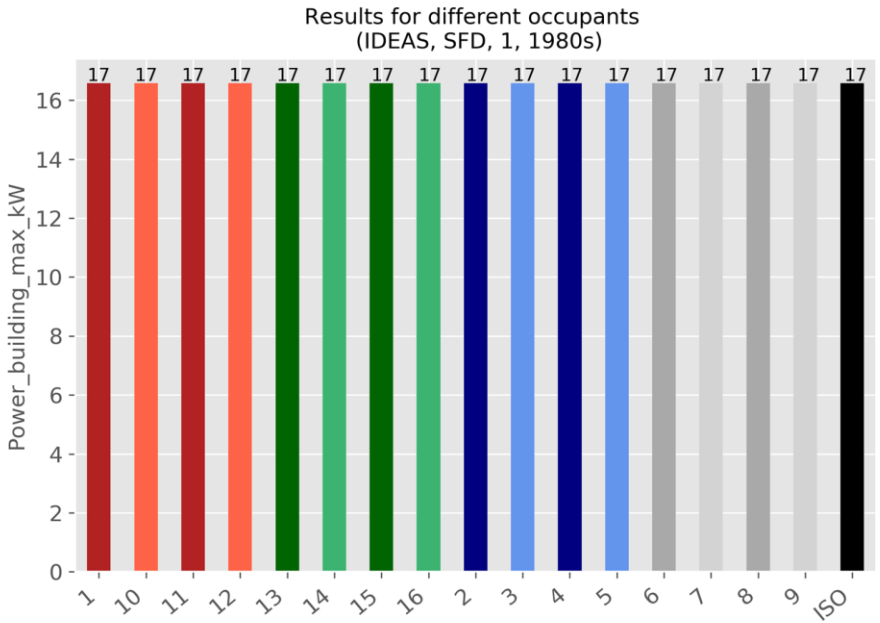
Current activities

➔ 2nd common exercise - results

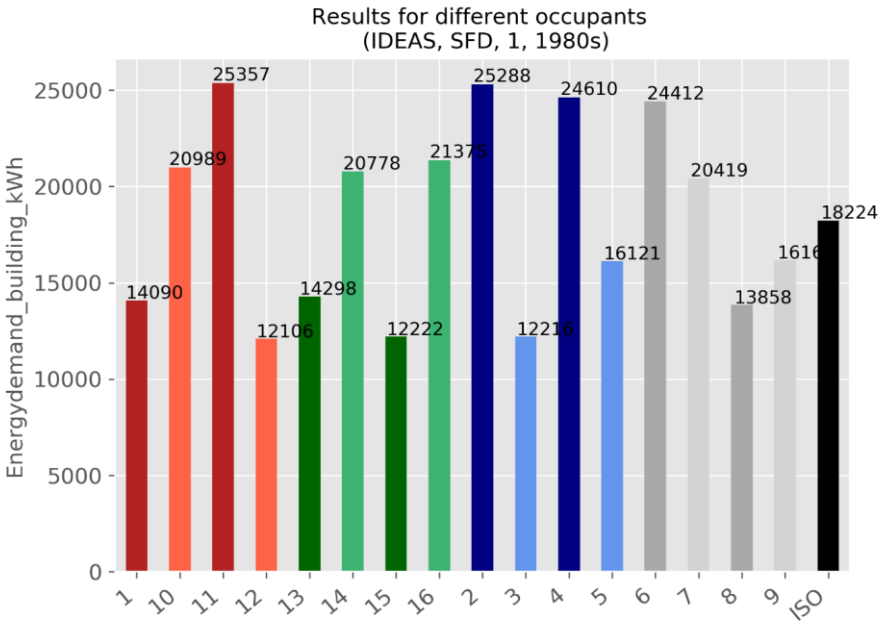
Modelling environment	Modeler	Affiliation of participant
Modelica IDEAS	Ina De Jaeger	KU Leuven / VITO / EnergyVille
Modelica Buildings	Alessandro Maccarini	Aalborg University
DIMOSIM	Enora Garreau	CSTB
Modelica AixLib	Michael Mans, Peter Remmen	RWTH Aachen

Current activities

➔ 2nd common exercise - results



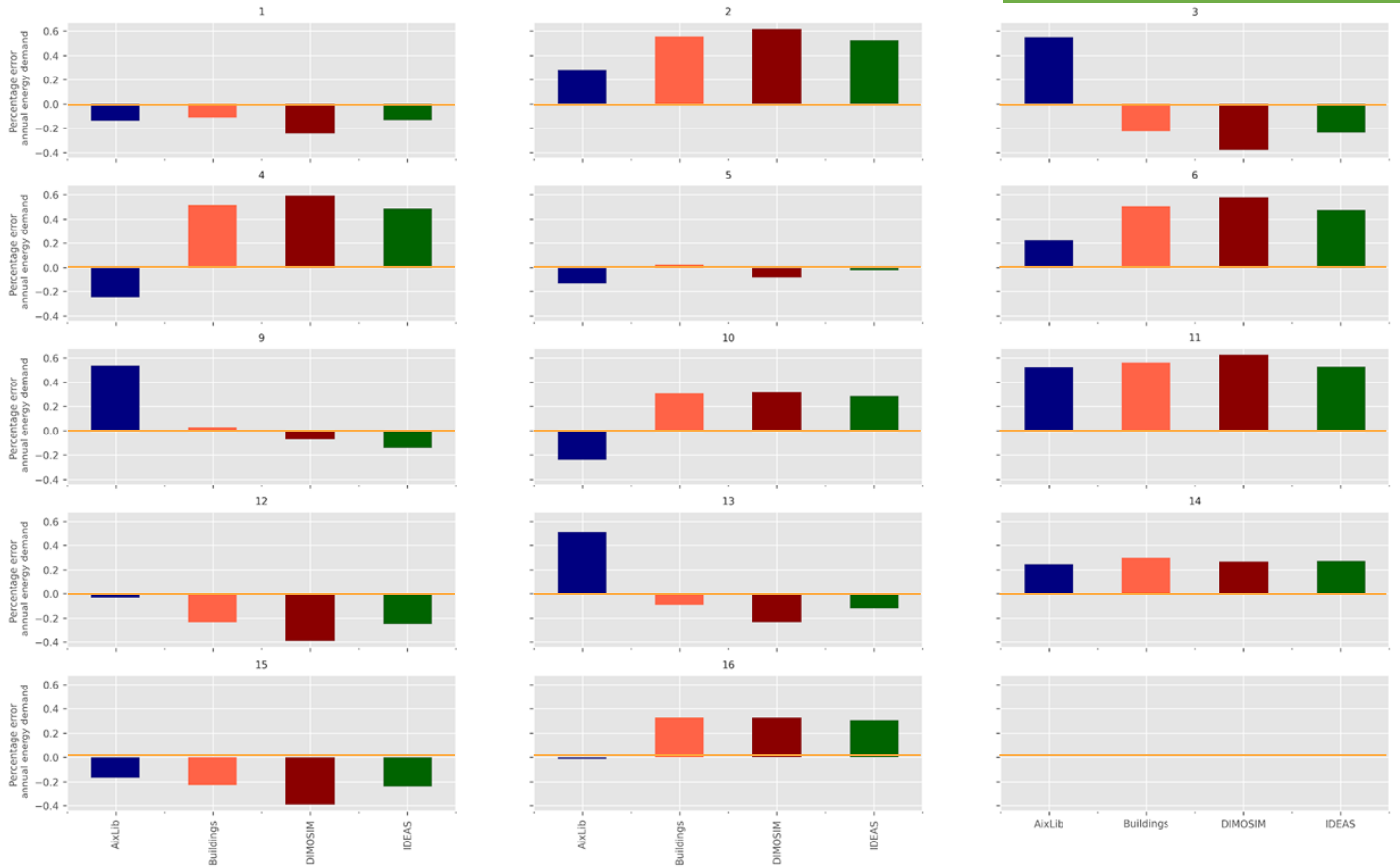
Peak power



Annual energy demand

Impact (1980s relative to ISO)

Relative difference annual heat demand



Current activities

- ➔ 3rd common exercise
  - ◆ Single-family dwelling of 1980
    - Thermal performance based on TABULA project for Belgium
      → Also include renovations (light and heavy)
    - Two-zone model (day zone and night zone)
    - Only heat demand for space heating
    - Standard occupant (ISO 13790)
      → Also include stochastic occupants (16 different profiles)
  - ◆ Connected by a district heating network

Current activities

- ➔ 3rd common exercise - resources
  - ◆ Buildings
    - First description can be found here
      - Models can be found here
    - Final documentation is not yet available
  - ◆ Network
    - Impact to be investigated

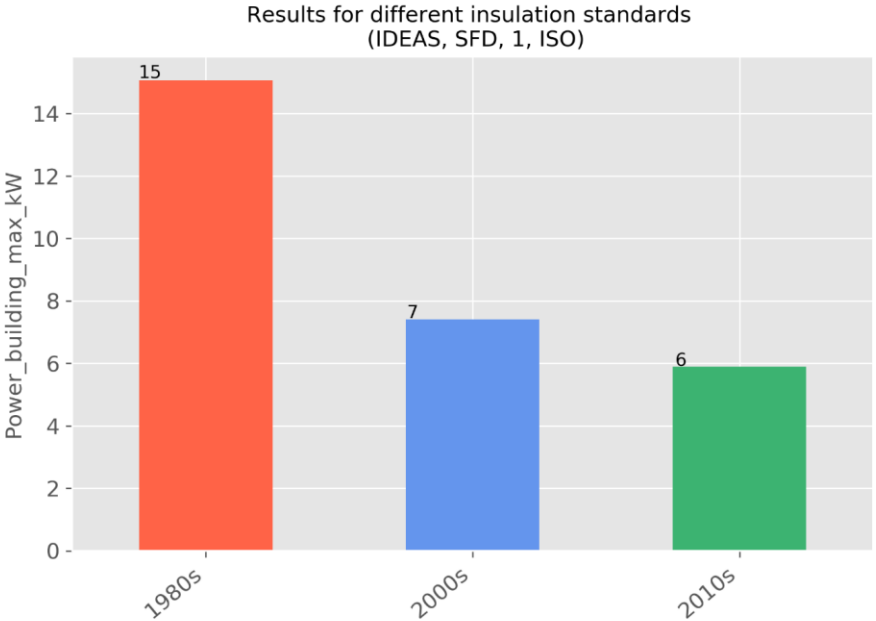
Current activities

➔ 3rd common exercise - results

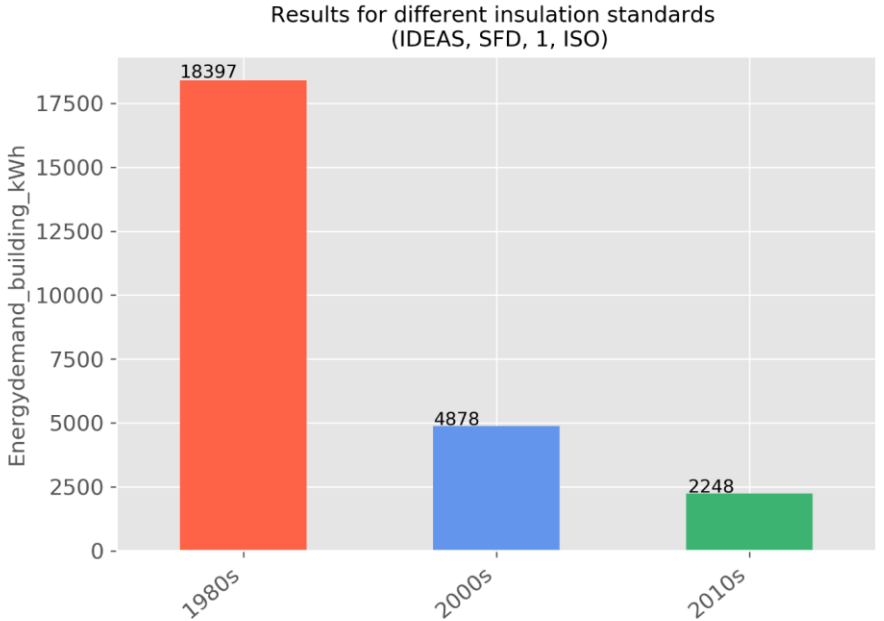
Modelling environment	Modeler	Affiliation of participant
Modelica IDEAS	Ina De Jaeger	KU Leuven / VITO / EnergyVille
Modelica Buildings	Alessandro Maccarini	Aalborg University
DIMOSIM	Enora Garreau	CSTB
Modelica AixLib	Michael Mans, Peter Remmen	RWTH Aachen

3RD COMMON EXERCISE - RESULTS

Results from IDEAS library for all renovations



Peak power

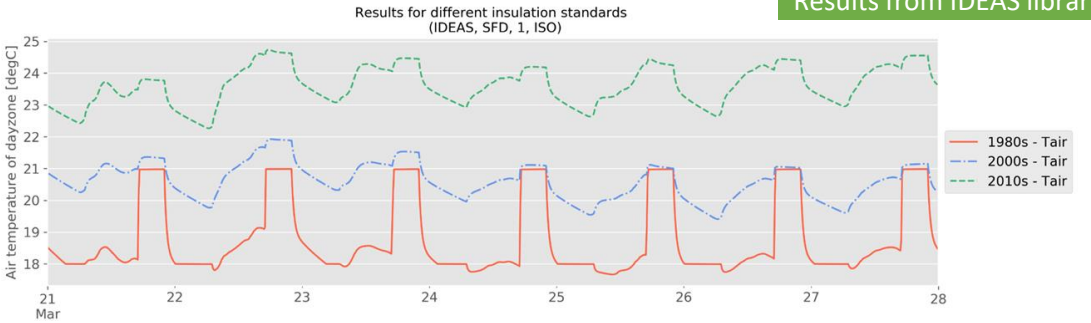


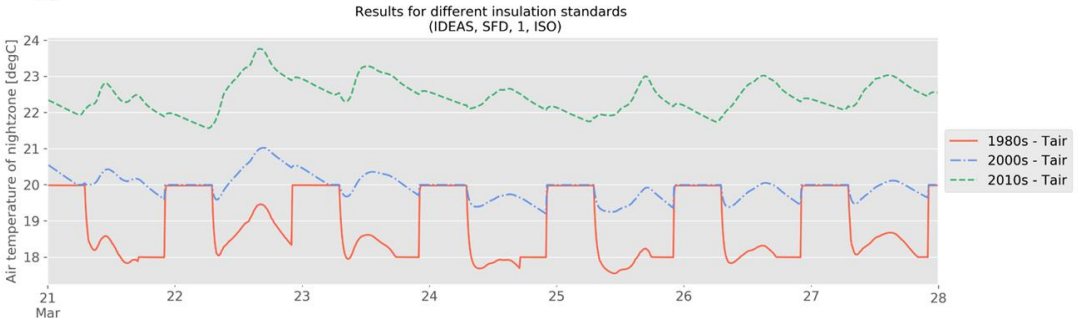
Annual energy demand

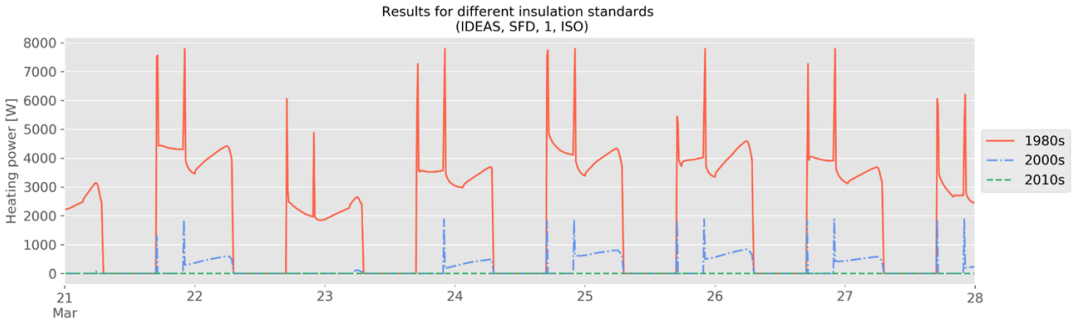
Temperature profiles and heating power (March)

3RD COMMON EXERCISE - RESULTS

Results from IDEAS library for all renovations

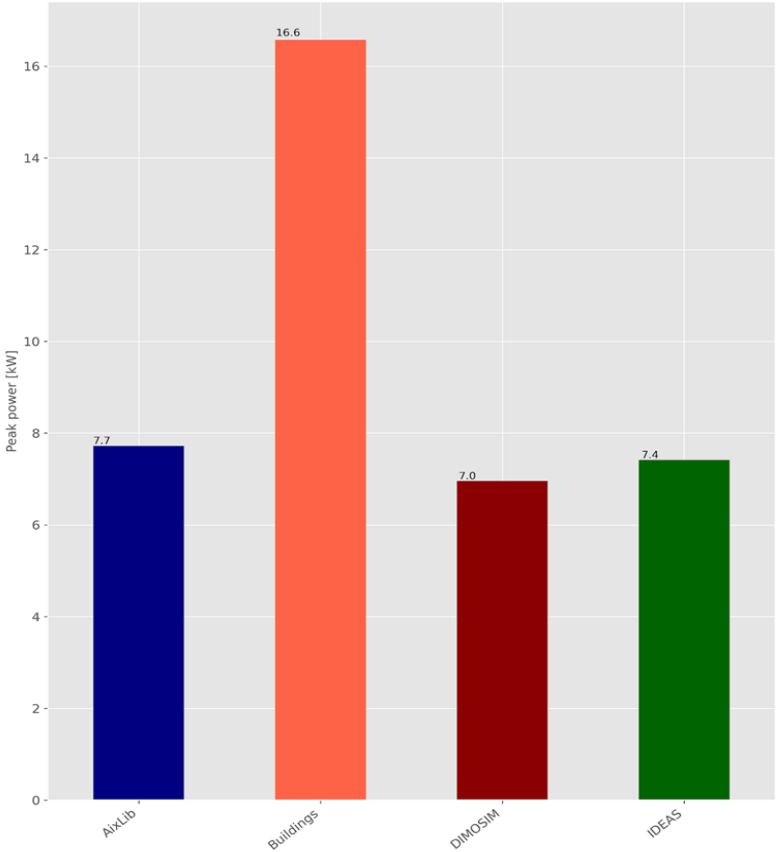




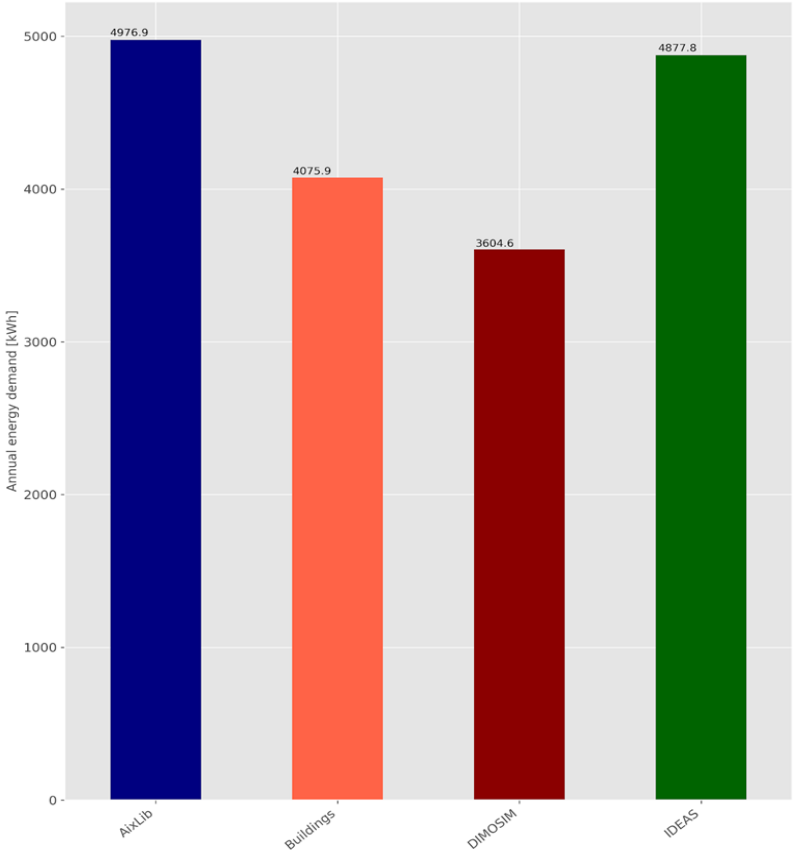


3RD COMMON EXERCISE - RESULTS

Results for 2000s and ISO occupant

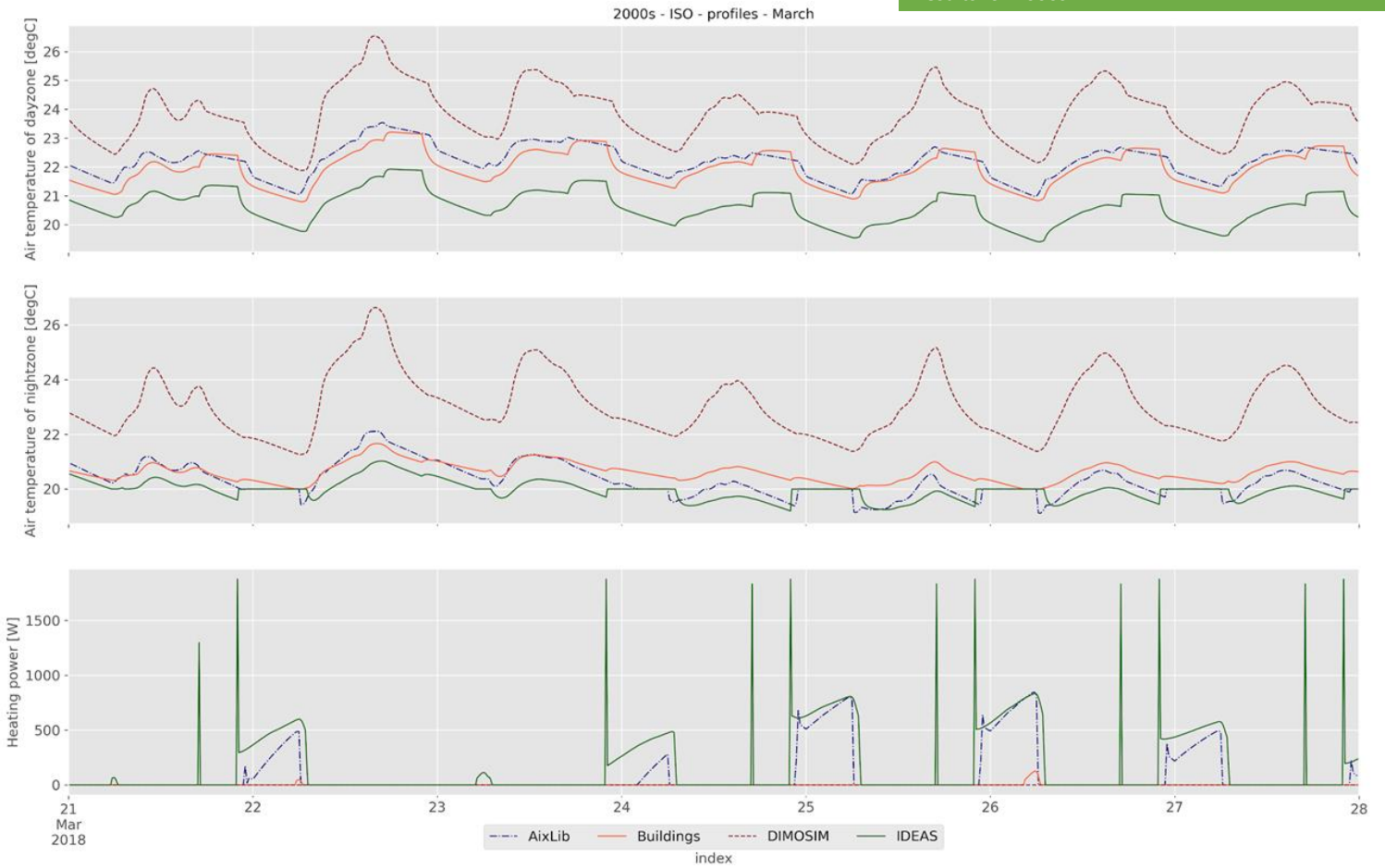


Peak power



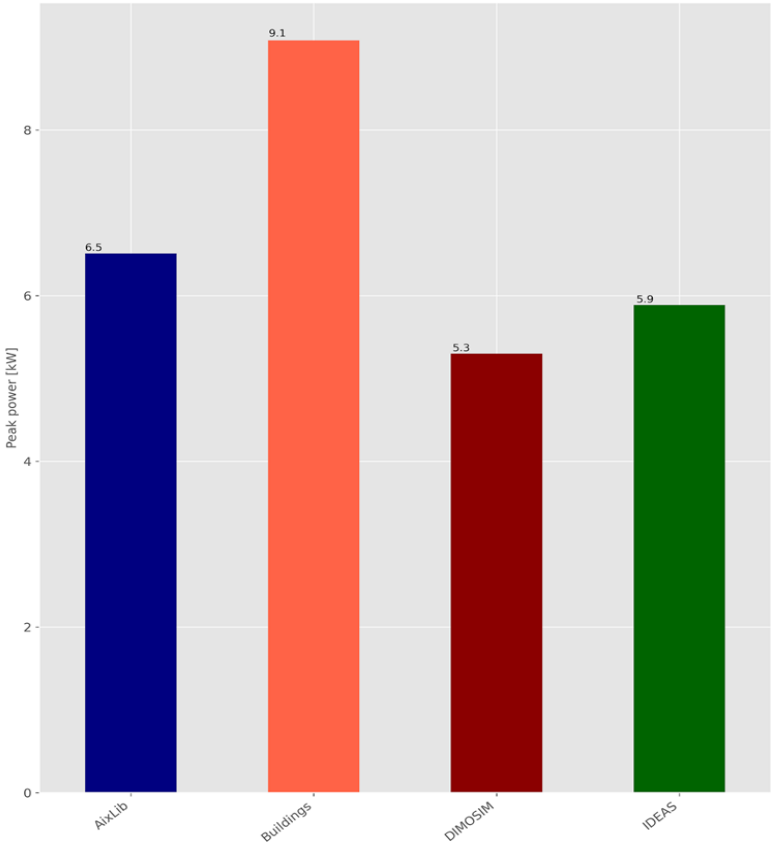
Annual energy demand

Temperature profiles and heating power (March)

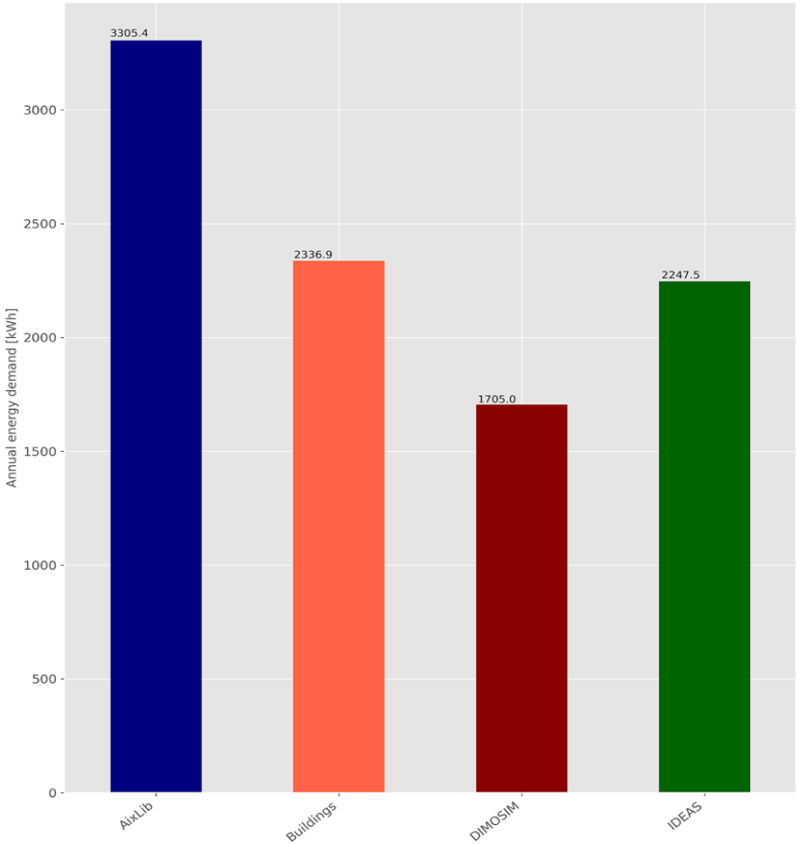


3RD COMMON EXERCISE - RESULTS

Results for 2010s

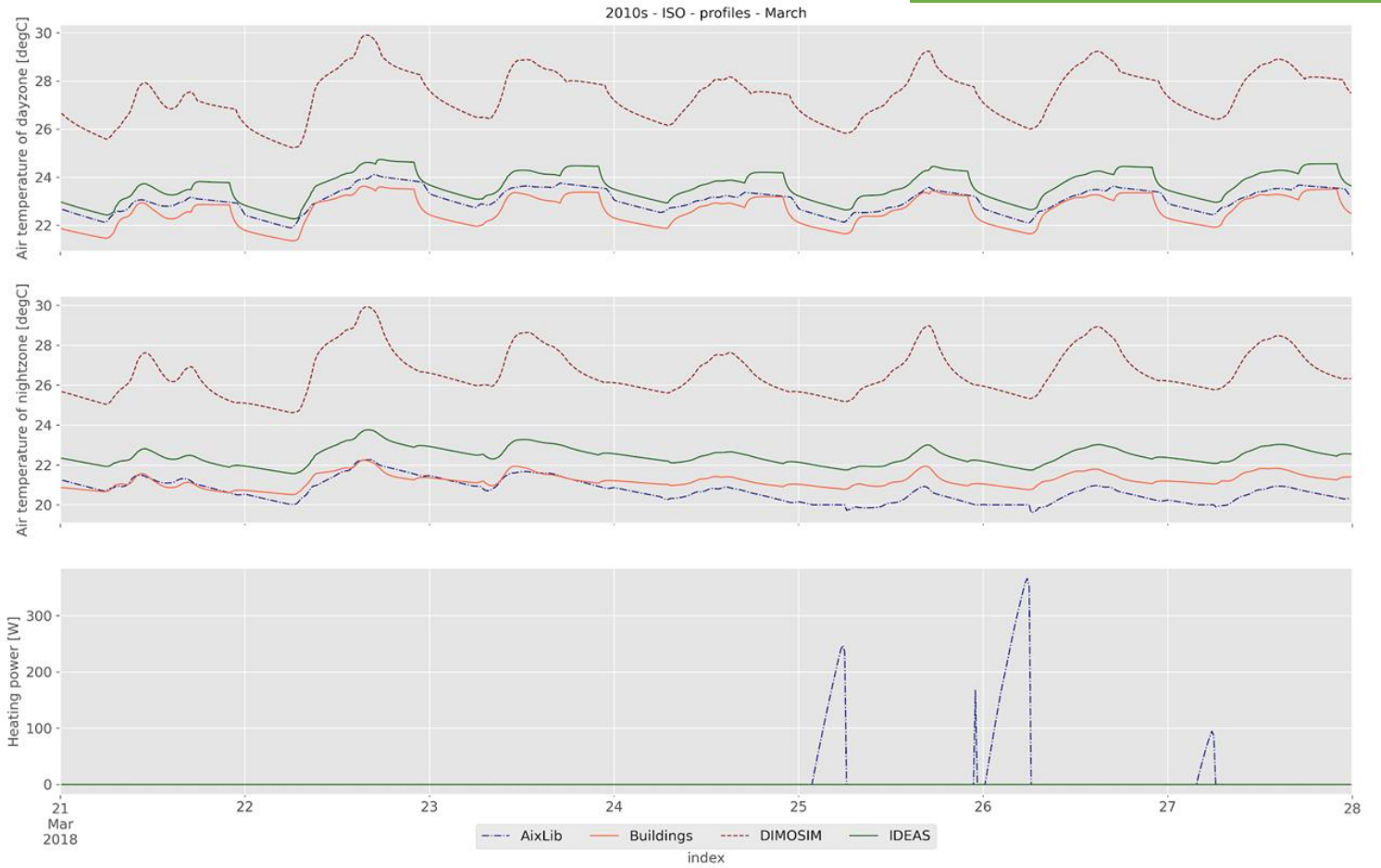


Peak power



Annual energy demand

Temperature profiles and heating power (March)

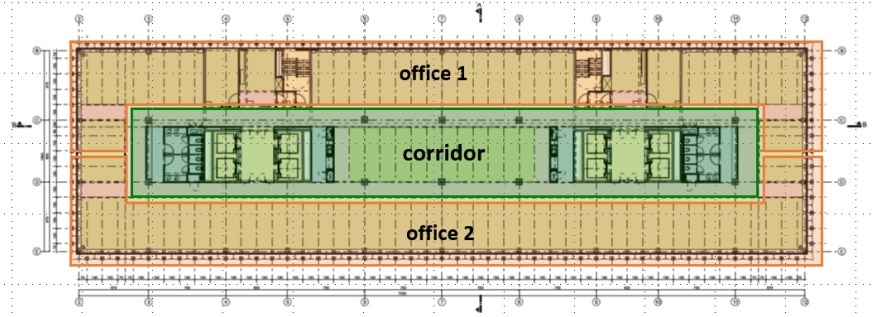


Current activities

- ➔ 4th common exercise
  - Single-family dwelling of 1980
    - Thermal performance based on TABULA project for Belgium
      → Also include renovations (light and heavy)
    - Two-zone model (day zone and night zone)
    - Only heat demand for space heating
    - Standard occupant (ISO 13790)
      → Also include stochastic occupants (16 different profiles)
  - **Office building**
  - Connected by a district heating network

Current activities

- ➔ 4th common exercise - resources
  - ◆ Buildings
    - First description of office building can be found here
      - Models are not yet available
    - Final documentation is not yet available
  - ◆ Network
    - Impact to be investigated

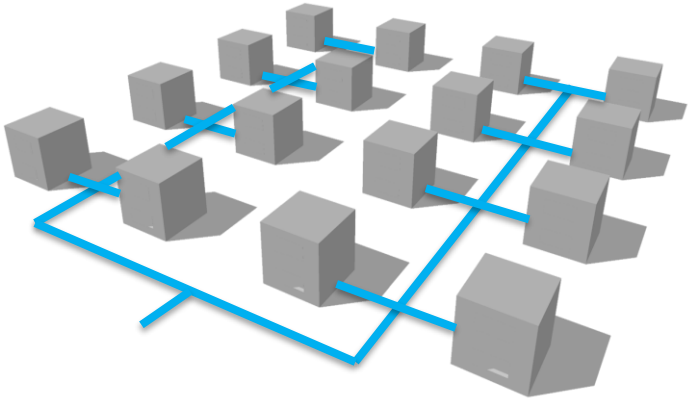


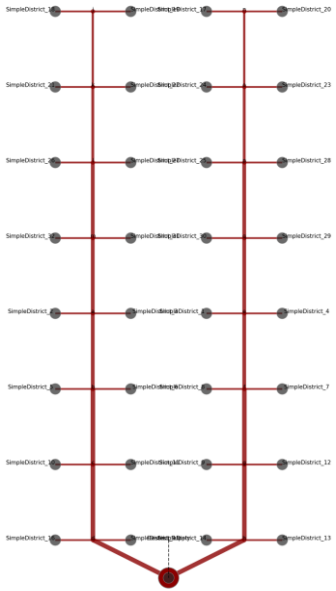
Current activities

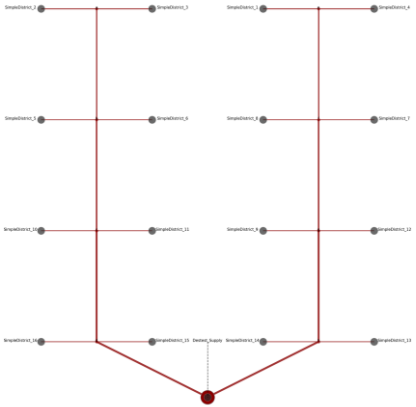
- ➔ DHN common exercise
  - Single-family dwelling of 1980
    - Thermal performance based on TABULA project for Belgium
      → Also include renovations (light and heavy)
    - Two-zone model (day zone and night zone)
    - Only heat demand for space heating
    - Standard occupant (ISO 13790)
      → Also include stochastic occupants (16 different profiles)
  - Office building
  - **Connected by a district heating network**

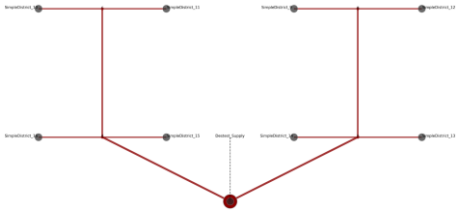
Current activities

- ➔ Preparation of new CE for networks
  - We split up the network layout to have a 8 and a 32 buildings layout in addition









Scale up to …

You want to contribute?

- ➔ Great! What do you want to do?
  - You want to model
    - A single-family dwelling
      - We suggest to start with common exercise (CE) 1, as CE 2 and CE 3 build further on this
    - An office building
      - We suggest to start with CE 4
    - A district heating network
      - We suggest to start with CE 1
  - All required data, you can find in the resources of the CE you want to do
- ➔ Once you are ready, please provide your simulation results in the specified format

Future activities

Discussion in tomorrow's virtual breakout session: 17h00 Brussels time

https://github.com/ibpsa/project1/wiki/2020-05-07-Task-3-Virtual-break-out-session

- ➔ Buildings subgroup
- ➔ Network subgroup
- ➔ Documentation
  - ➔ Update CE descriptions
  - ➔ Making results available for others


International
Building
Performance
Simulation
Association
BS
2021
1-3 SEPT
BRUGES
CALL FOR
ABSTRACTS
Get ready, team up with practice, industry, policy and research to create a real impact with BES
info@bs2021.org
www.bs2021.org
Talent in music as well?
Prepare to be awarded author of the BS2021 Bruges Belfry theme
© Giorgio Galeotti
IBPSA NVL
KU LEUVEN
GHENT UNIVERSITY
daidalos peutz

Patricipate to BS2021: Call for abstracts

- Three kinds of submissions are foreseen:
  - ► Research Papers, on scientific breakthroughs
  - ► Projects and Valorization sheets from successful applications of building simulation,
  - ► Workshops on dedicated topics
- Two possible forms of presentations:
  - ► Interactive presentations, and
  - ► Tradtional presentations

Patricipate to BS2021: Call for abstracts

Submit now through
https://www.conftool.pro/bs2021/

Deadline for submission is July 15th

Abstract submission Guidelines

Please click on the button below to download the guidelines for abstract submission for BS 2021.

ABSTRACT SUBMISSION GUIDELINES