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 (task leader)
Ina De Jaeger (presentation)
Tohid Jafarinejad (chat moderator)

Online expert meeting – status presentation – 2020.10.13

General information

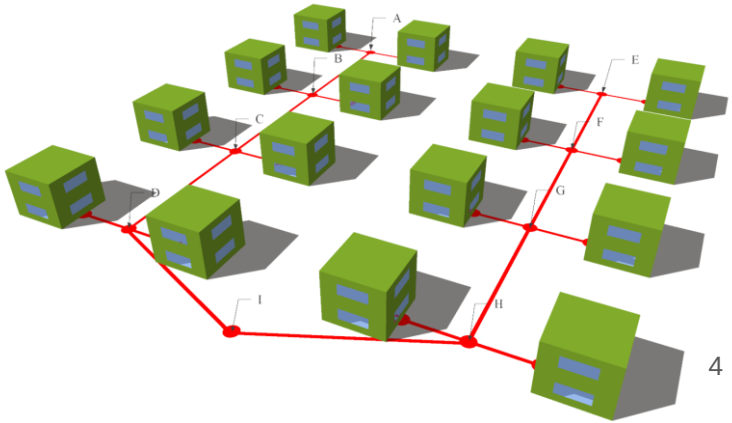
- ➔ General objective: development of a DESTEST to
  - develop typical or representative DES cases that can be used for testing different DES simulation environments (intermodel comparison, …)
  - develop a test framework for testing models in a predefined DES environment

General information

- ➔ 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 are available 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

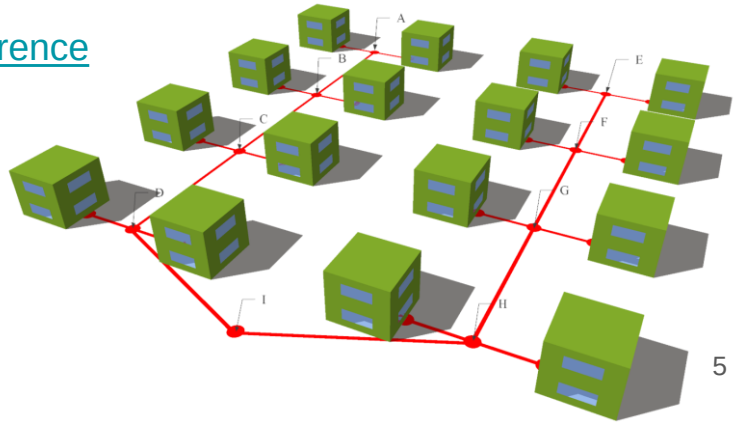
Past activities

- ➔ Buildings 1st common exercise (CE)
  - 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)



Past activities

- ➔ 1st common exercise - resources
  - 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
  - Described in a paper presented at the BS2019 conference

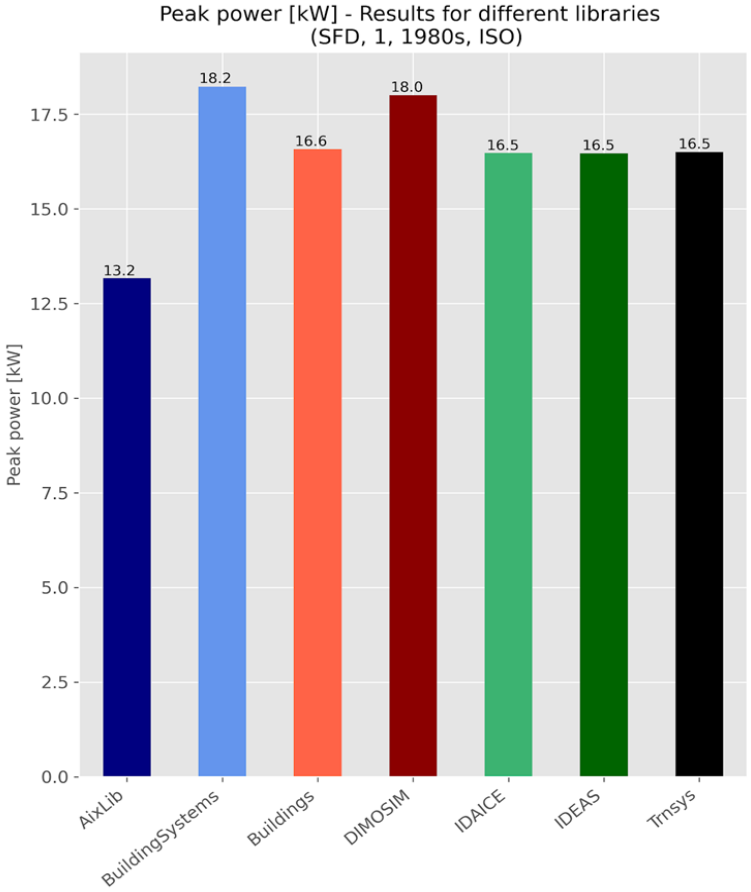


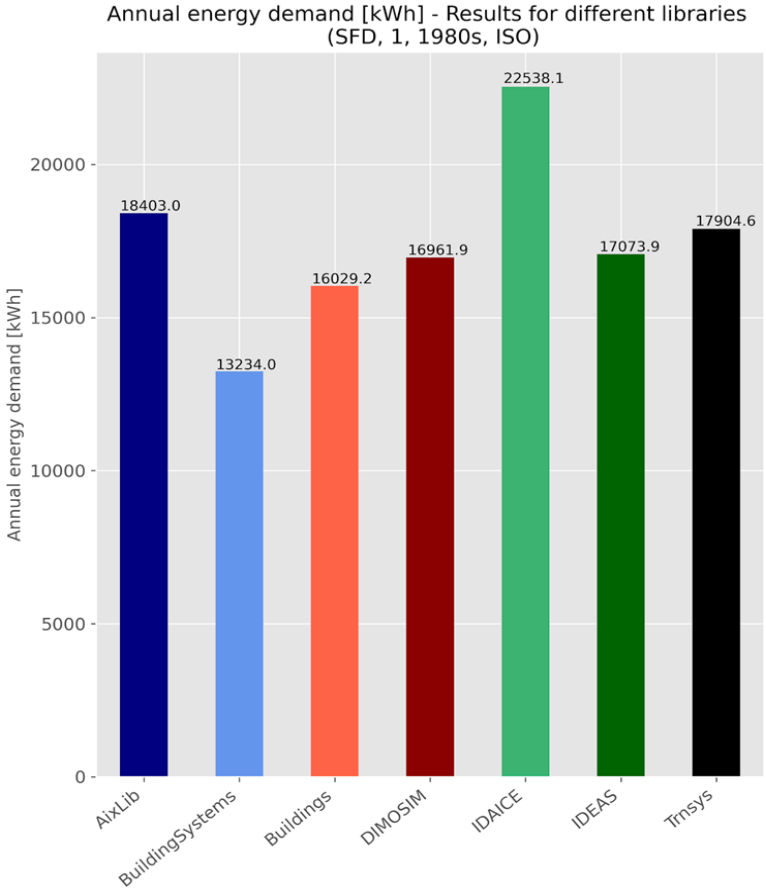
Past activities

➔ 1st common exercise - results

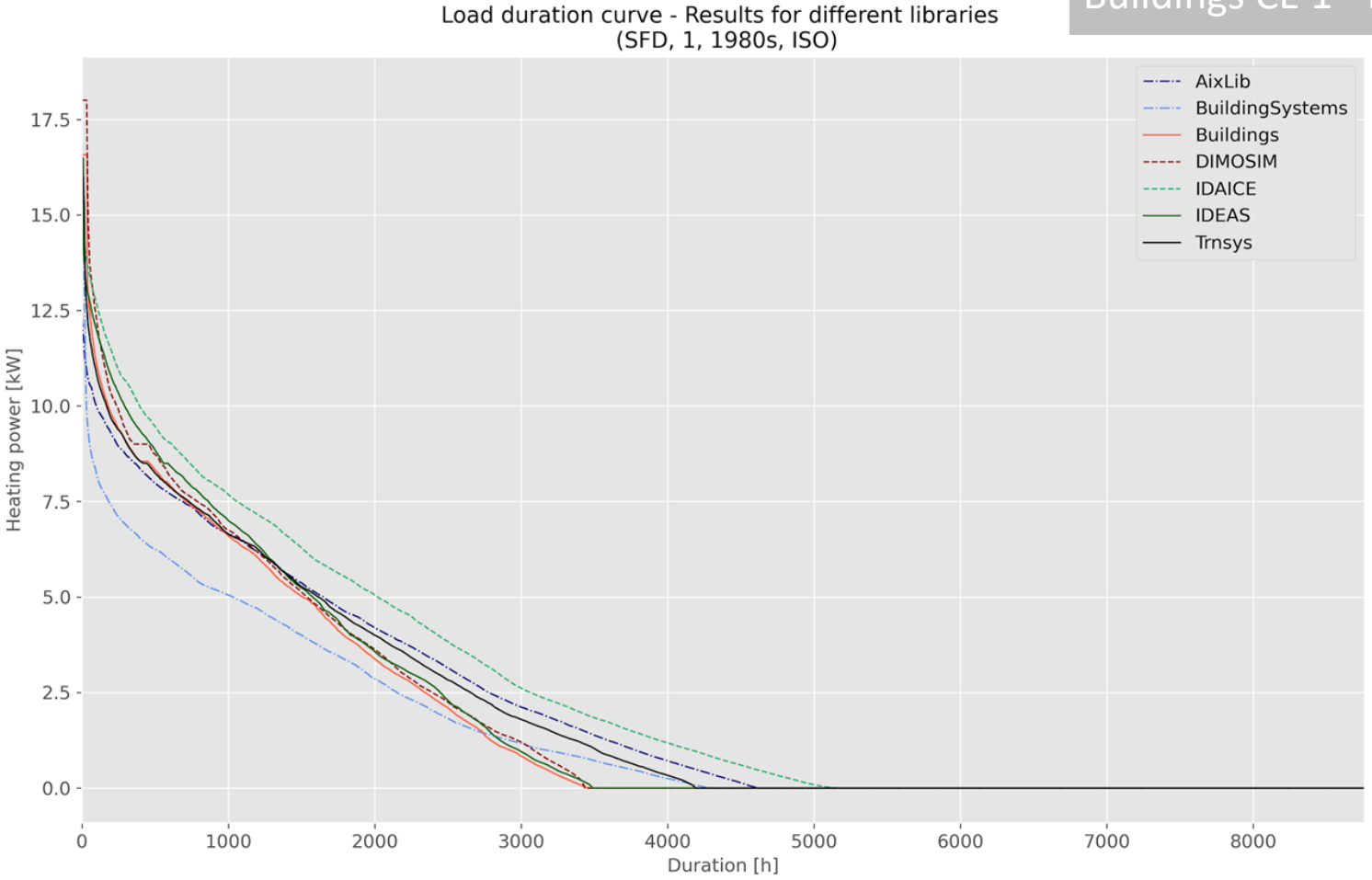
Modelling environment	Modeler	Affiliation of participant
Modelica IDEAS	Ina De Jaeger	KU Leuven / VITO / EnergyVille
Modelica Buildings	Alessandro Maccarini	Aalborg University
Modelica AixLib	Michael Mans	RWTH Aachen
Modelica BuildingSystems	Haris Shamsi	UCD Dublin
IDA ICE	Øystein Rønneseth, Igor Sartori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

Buildings CE 1 - RESULTS

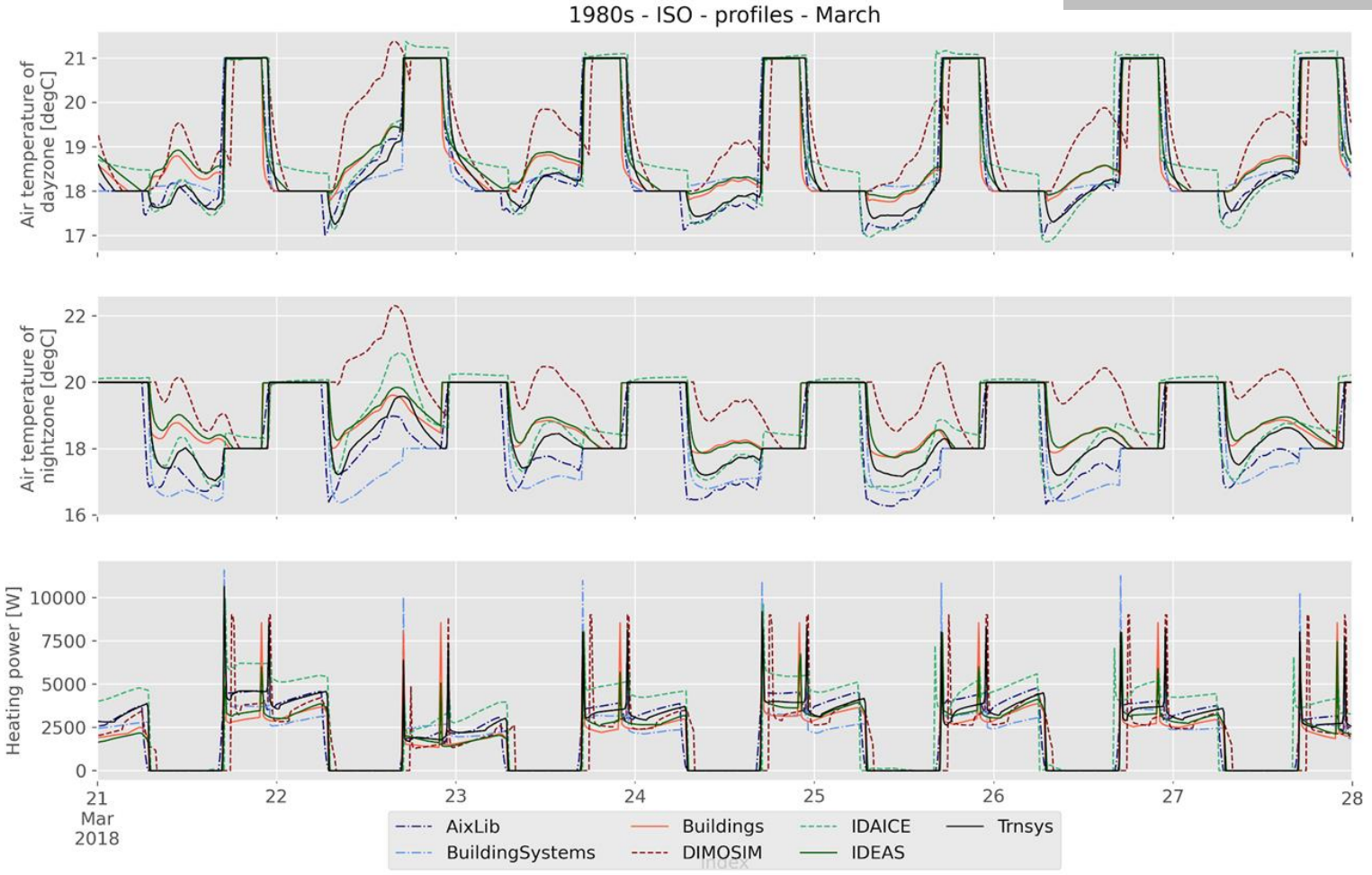




Buildings CE 1 - RESULTS

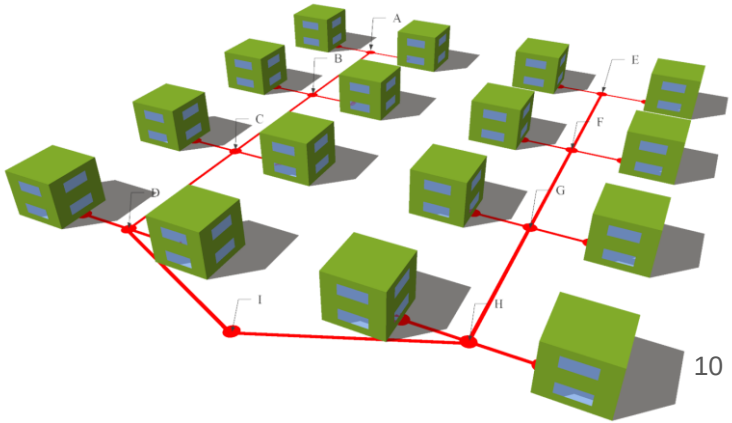


Buildings CE 1 - RESULTS



Past activities

- ➔ Network - 1st common exercise (CE)
  - 16 identical single-family dwellings of 1980s
  - Connected by a district heating network



Past activities

- ➔ Network - 1st common exercise - resources
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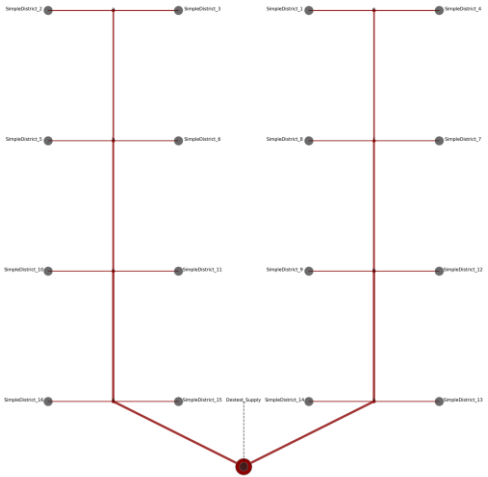
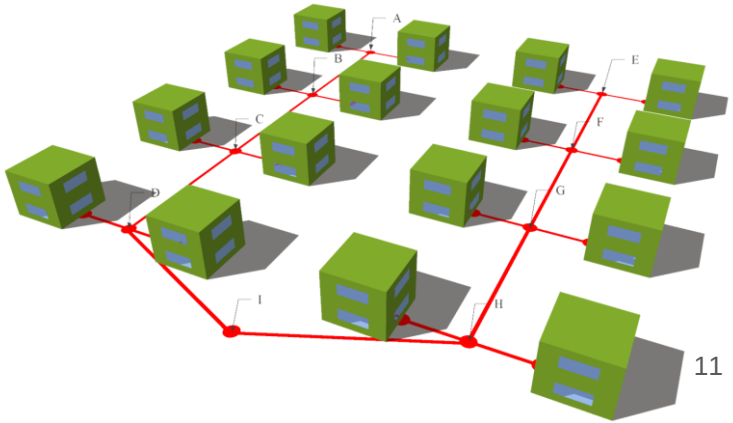




Past activities

➔ Network - 1st common exercise - results

Modelling environment	Modeler	Affiliation of participant
Modelica IDEAS	Bram van der Heijde; Annelies Vandermeulen (?)	KU Leuven
Modelica Buildings	Alessandro Maccarini	Aalborg University
Modelica AixLib	Michael Mans	RWTH Aachen
DIMOSIM	Enora Garreau	CSTB

Current activities

➔ Gradually defining next common exercises based on the 1st 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
    → Also include different network layouts (8 and 32 buildings)

Buildings CE 3

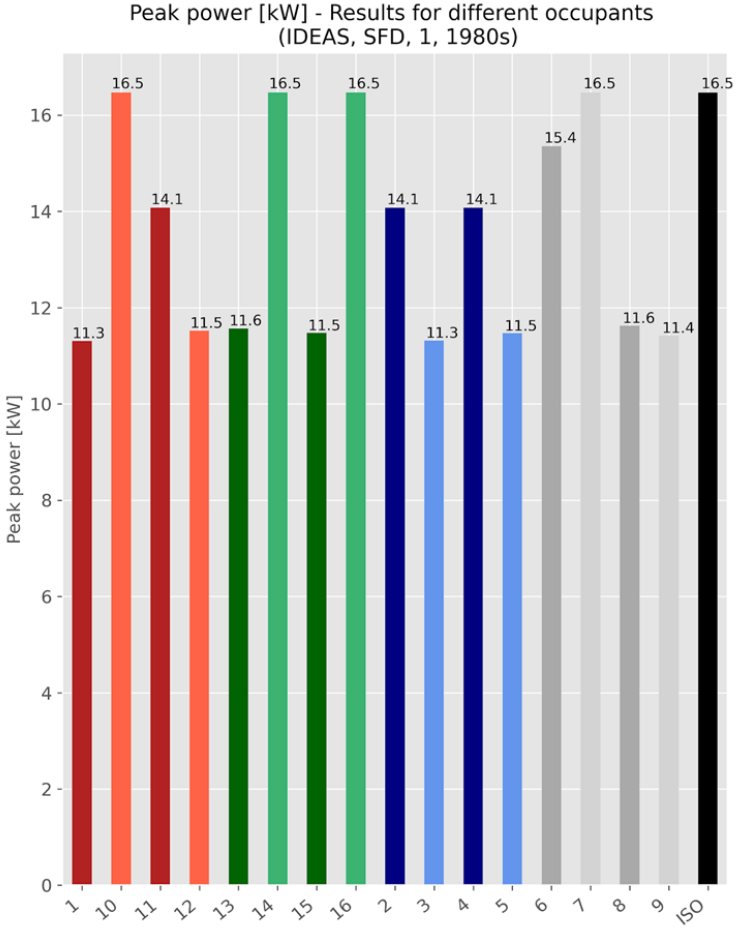
Buildings CE 2

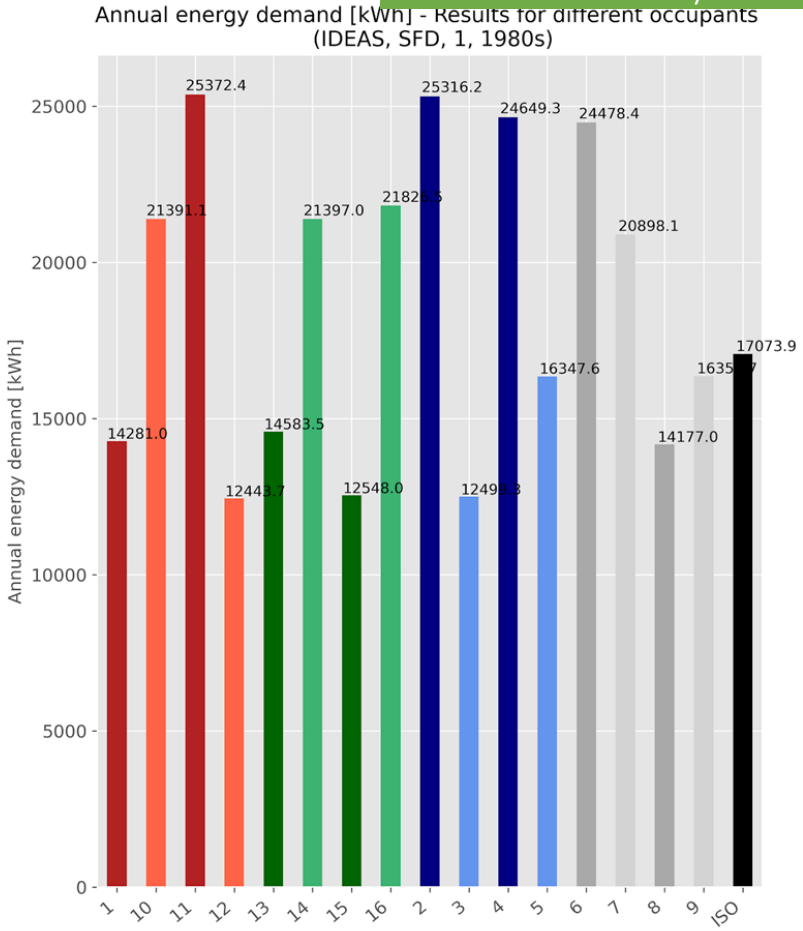
Buildings CE 4

Network CE 2, CE 3

Buildings CE 2 - RESULTS

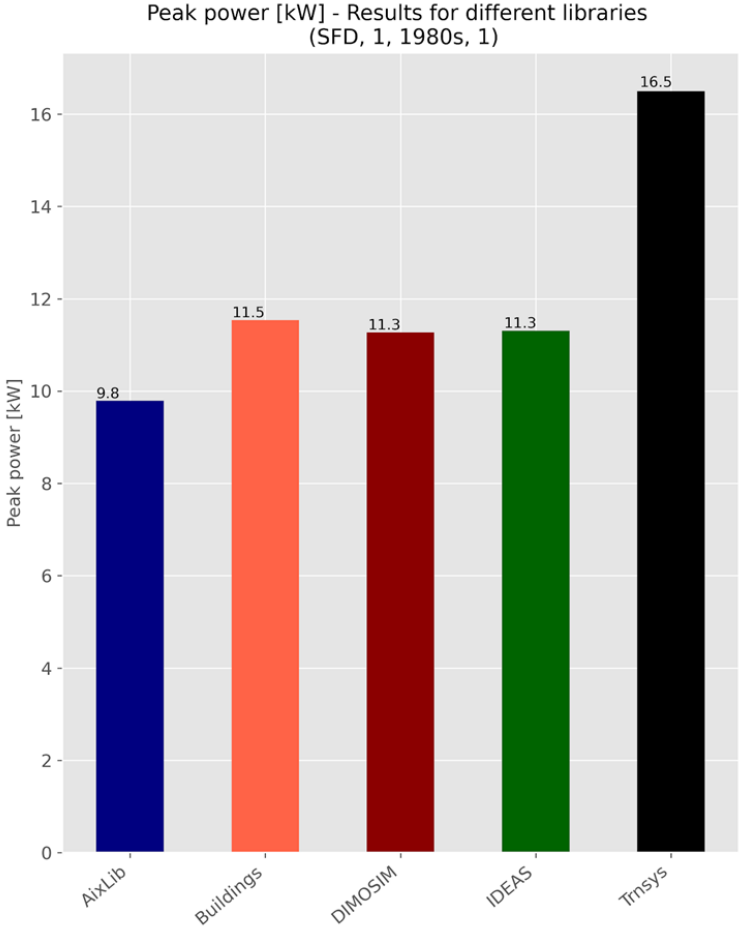
Results from IDEAS library

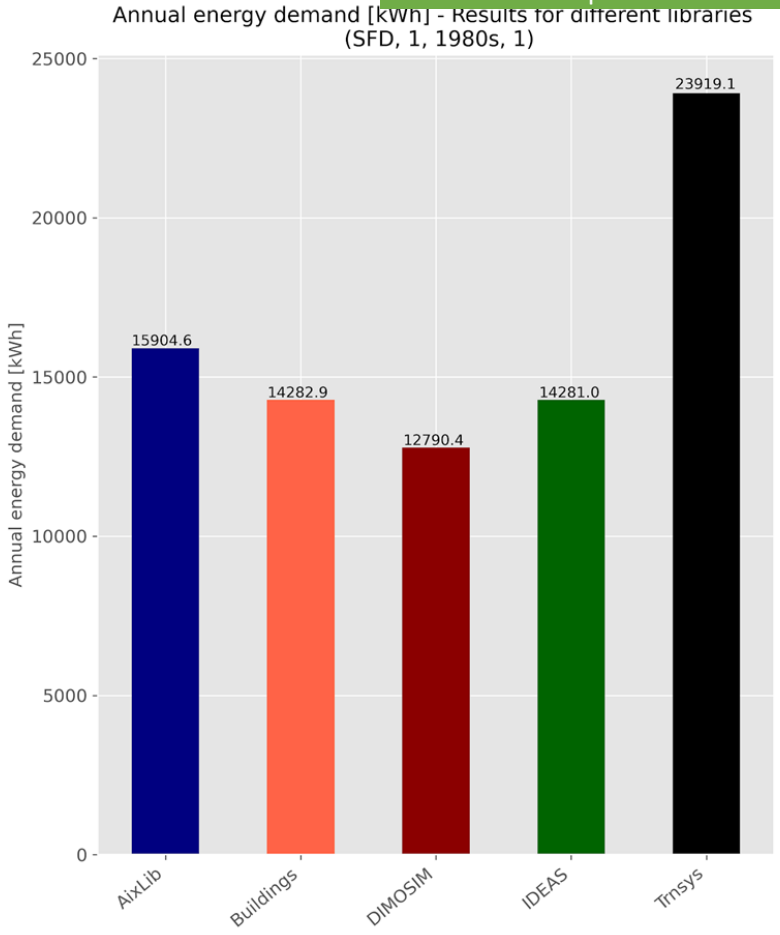




Buildings CE 2 - RESULTS

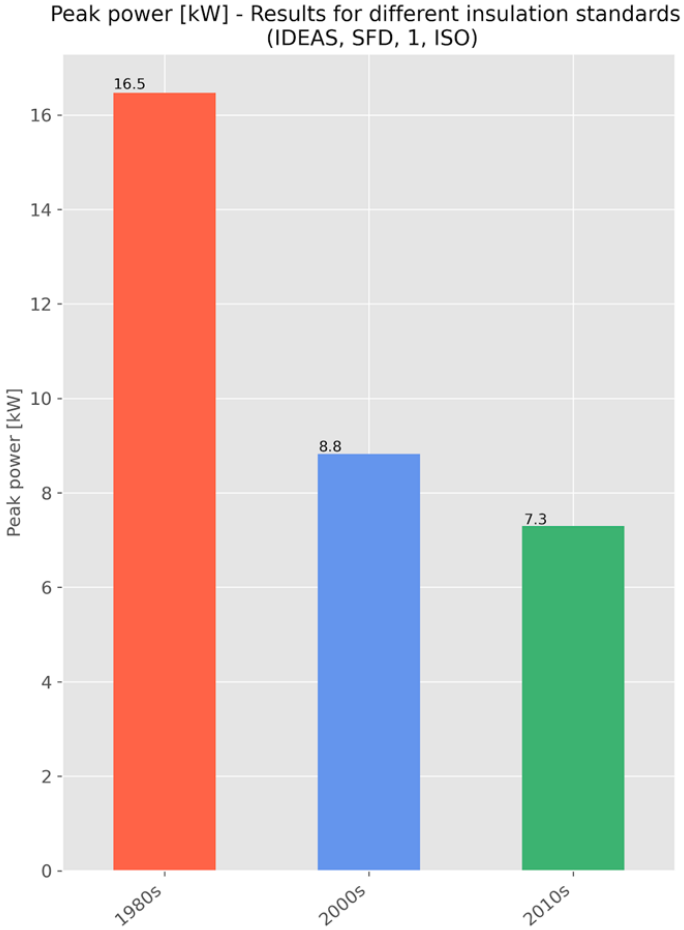
Results for Occupant 1

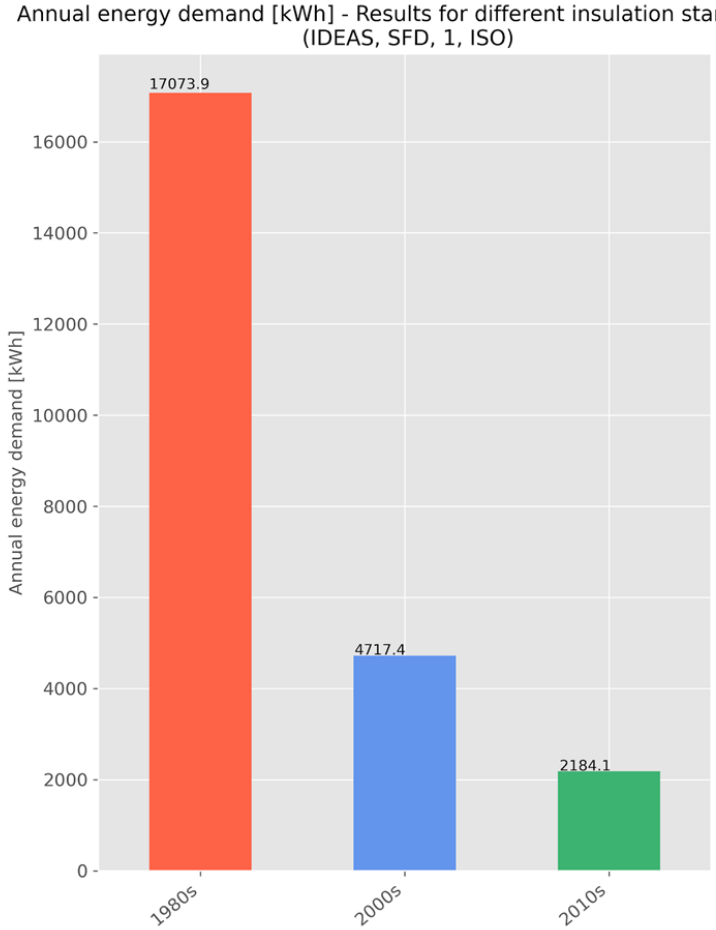




Buildings CE 3 - RESULTS

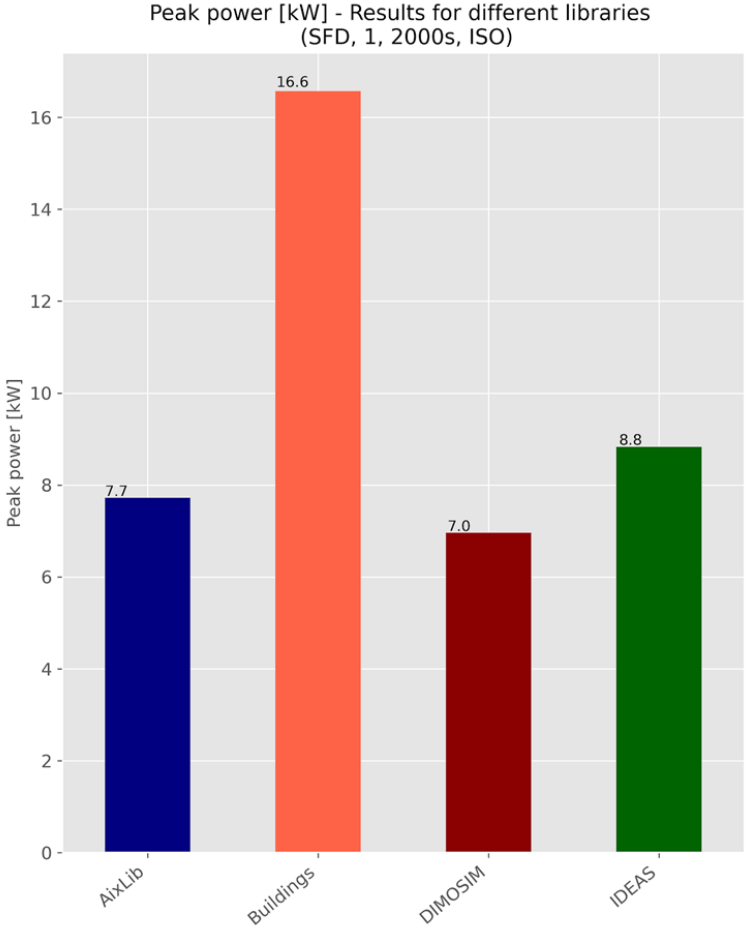
Results for IDEAS library

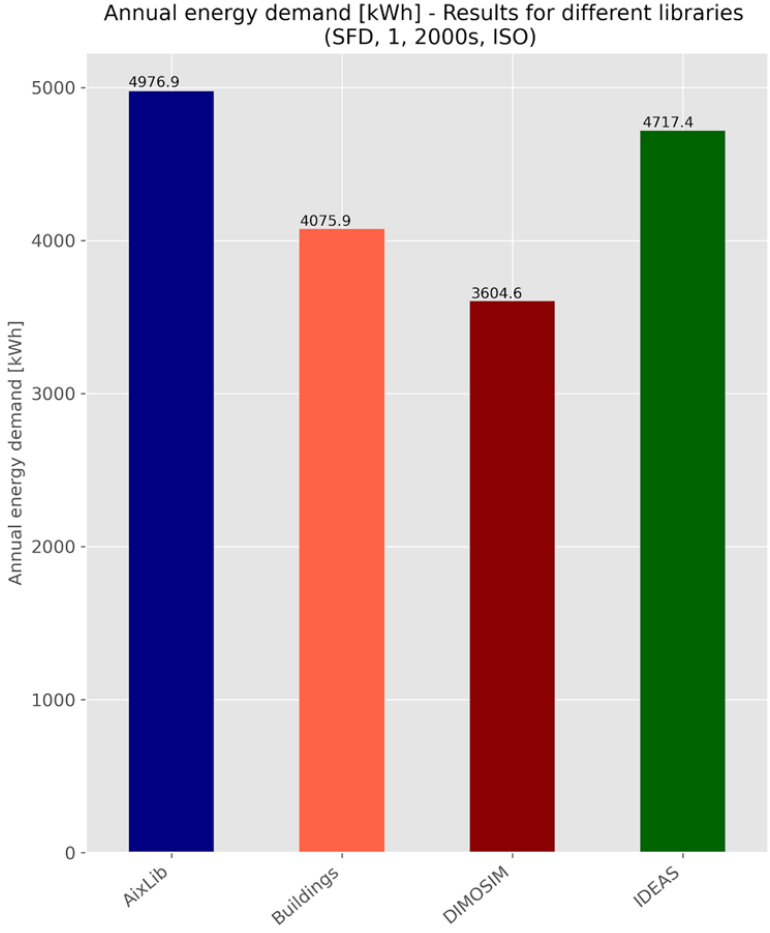




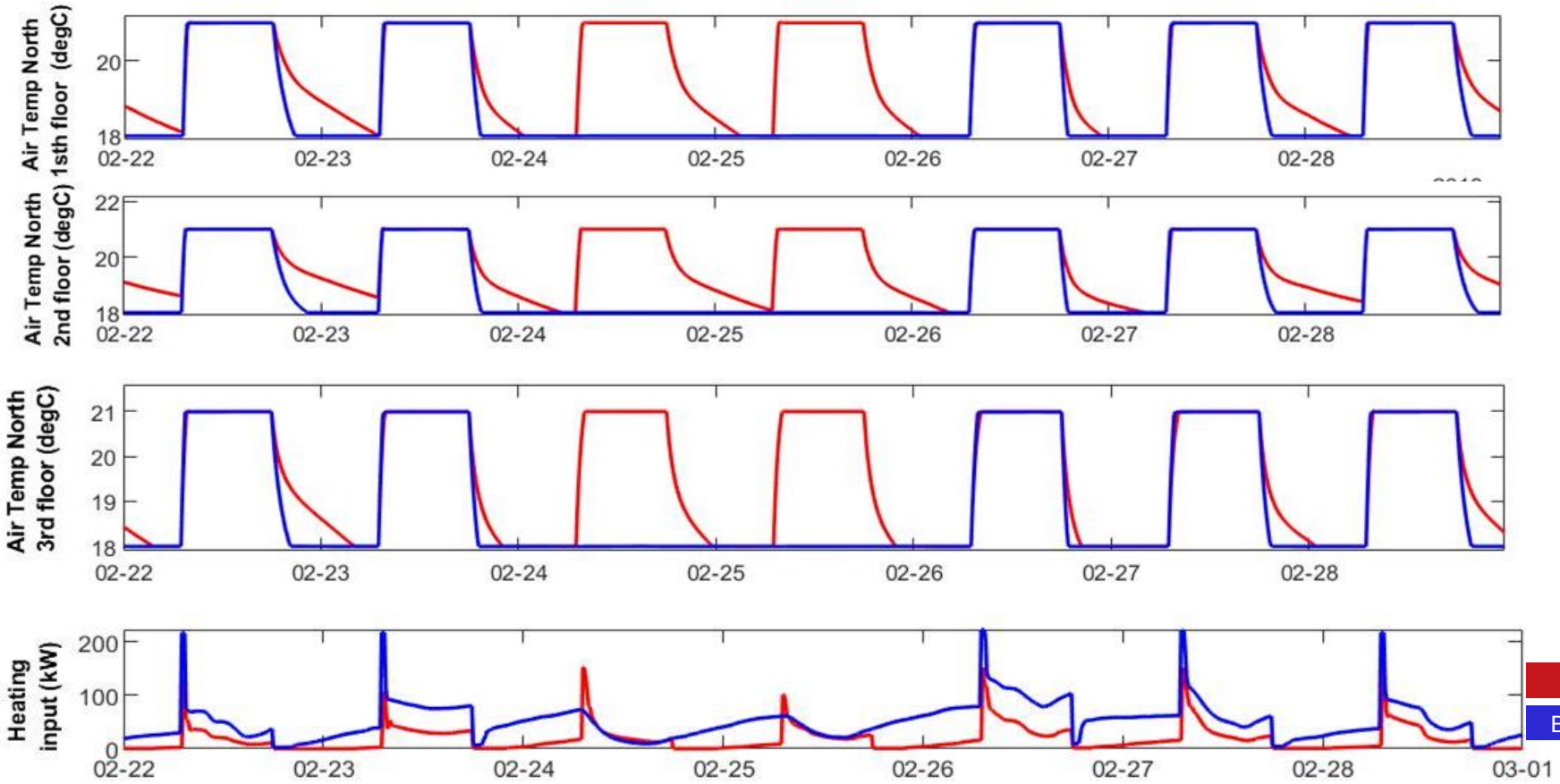
Buildings CE 3 - RESULTS

Results for 2000s and standard occupant





Results of the three floor office Exercise



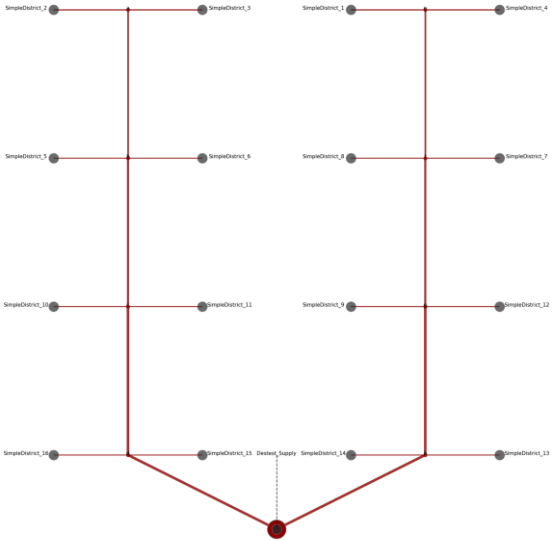
IDEAS
Buildings

Current activities - buildings

- ➔ Solar irradiation issue
- ➔ Office model
  - ➔ Debugging = ongoing

Current activities - network

- ➔ Two new participants:
  - ➔ More data to compare
  - ➔ One more non-Modelica benchmark
  - ➔ Additions and remarks to documentation will be added in a new revision soon
- ➔ Future focus more on low temperature networks:
  - ➔ Influence of ground heat exchange with the use of uninsulated piping



Current activities - comparison of simulation results?

- Development of a Python-based tool for automatic key performance indicator calculation of your simulation results compared to the “average”
- Will be included in the DESTEST repository

Johra, H., Filonenko, K., De Jaeger, I., Maccarini, A., Saelens, D. (2020). Evaluating different metrics for inter-model comparison of building energy simulations. Abstract accepted for BS2021.

Current activities - DESTEST repository

- General
  - Scripts to compare results (Hicham) and make plots (Ina)
- Common exercises
  - Buildings CE1
    - Description
    - Models (including solver specs)
    - Results
    - Comparison of different libraries
    - Supplementary
  - Network CE1
    - Description
    - Models
    - Results
    - Comparison of different libraries
    - Supplementary
  - ...

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
  - See next slide

You want to contribute?

- ➔ Make sure you are subscribed to our WP3 Google Group
  - That way, you do not miss anything
  - Meeting invites and minutes are sent here
- ➔ All information is collected in a Google presentation
  - ➔ More details: on the Project 1 GitHub page + in the e-mails sent in the Google Group

Agenda for WP3 break-out sessions

Session 1 (Day 1)			50 min
Building modelling	Current status	Ina	
	Documentation of Building CE1,2,3	Ina	
	Comparison of simulation results?	Hicham	
Session 2 (Day 1)			55 min
Literally break-out → Participants choose session of interest			
Session 3 (Day 2)			45 min
Network modelling	New subgroup leader	Michael	
	Network Test enhancements by Clemens: documentation, data availability, KPIs	Clemens	
	Ground effects with low temperature network: pipe parameters, ground implementation, pipe interaction?		
Session 4 (Day 2)			45 min
Future plans	Buildings: plans + commitments	Ina	
	Network: plans + commitments	Michael	