IBPSA Project 1

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

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The vision of IBPSA Project 1 is to create open-source software that builds the basis of next generation computing tools for the buildings industry

Allow engineers and scientists to

1) drag and drop preconfigured, modifiable and scalable component models of

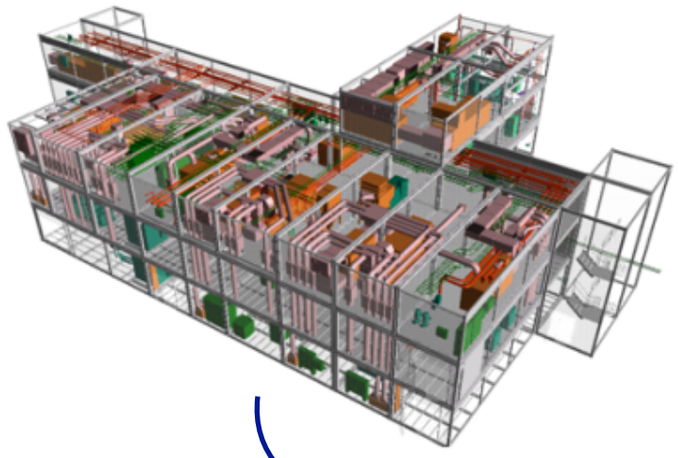
- buildings,
- district heating and cooling,
- HVAC, and
- controls.

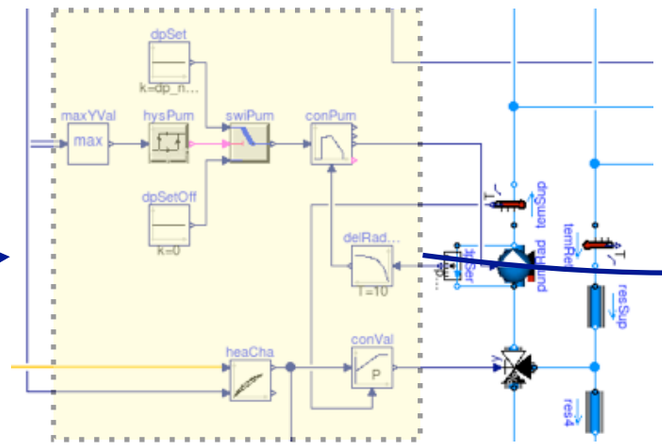
2) optimize the performance of technology options and control strategies in simulation, and

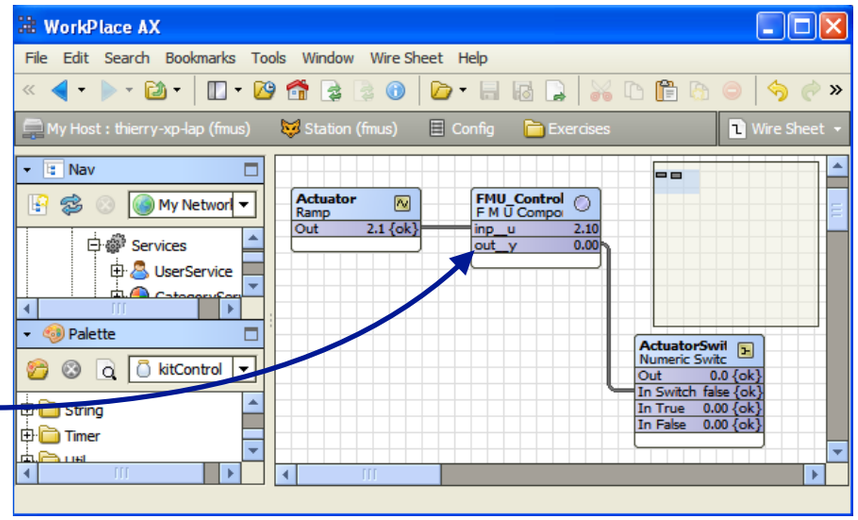
3) export models and control algorithms for

- hardware in the loop testing
- deployment to control systems and embedded hardware, and
- to run as a web service for real time operational support

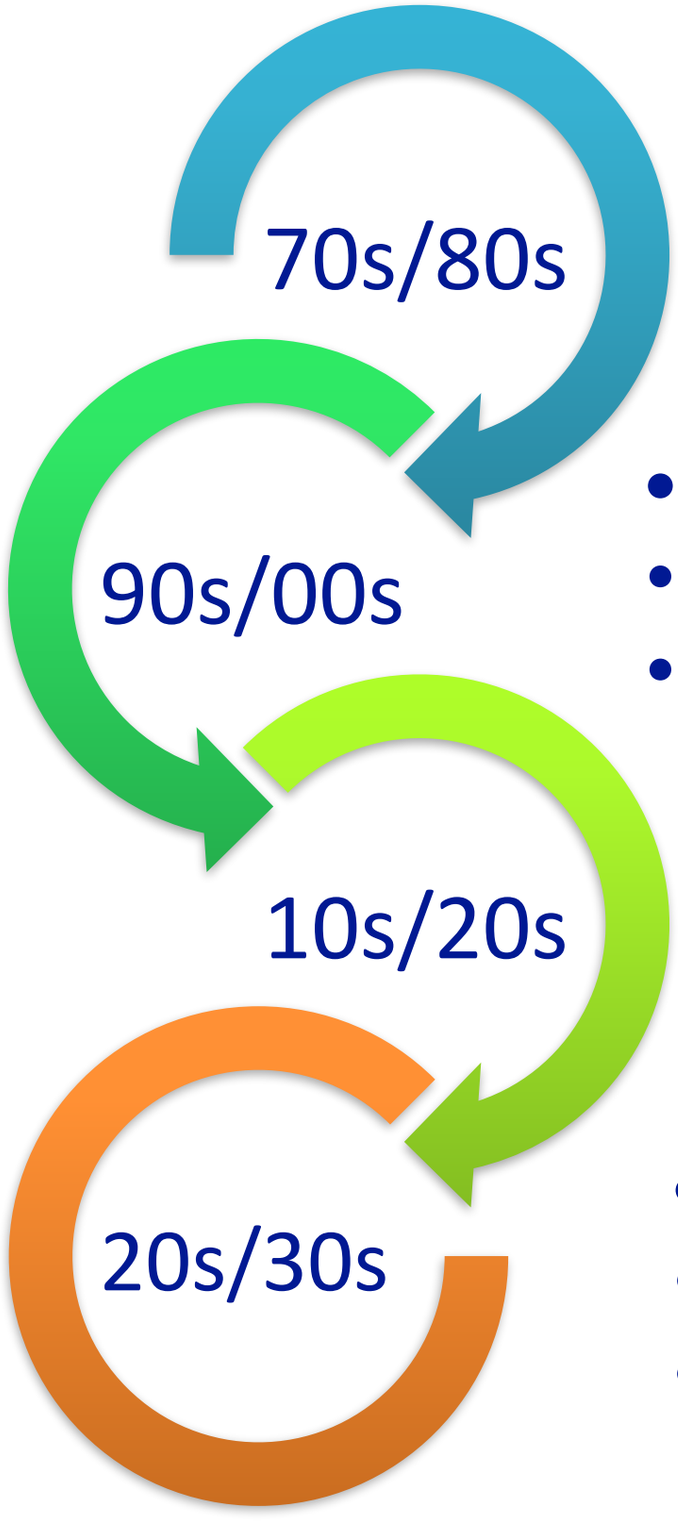
All developed software is free and open source.







We are not the only community that does simulation: Evolution of state of the art in system engineering community



- **Focus on Simulation**
- ODE-based
- Numerical Solvers

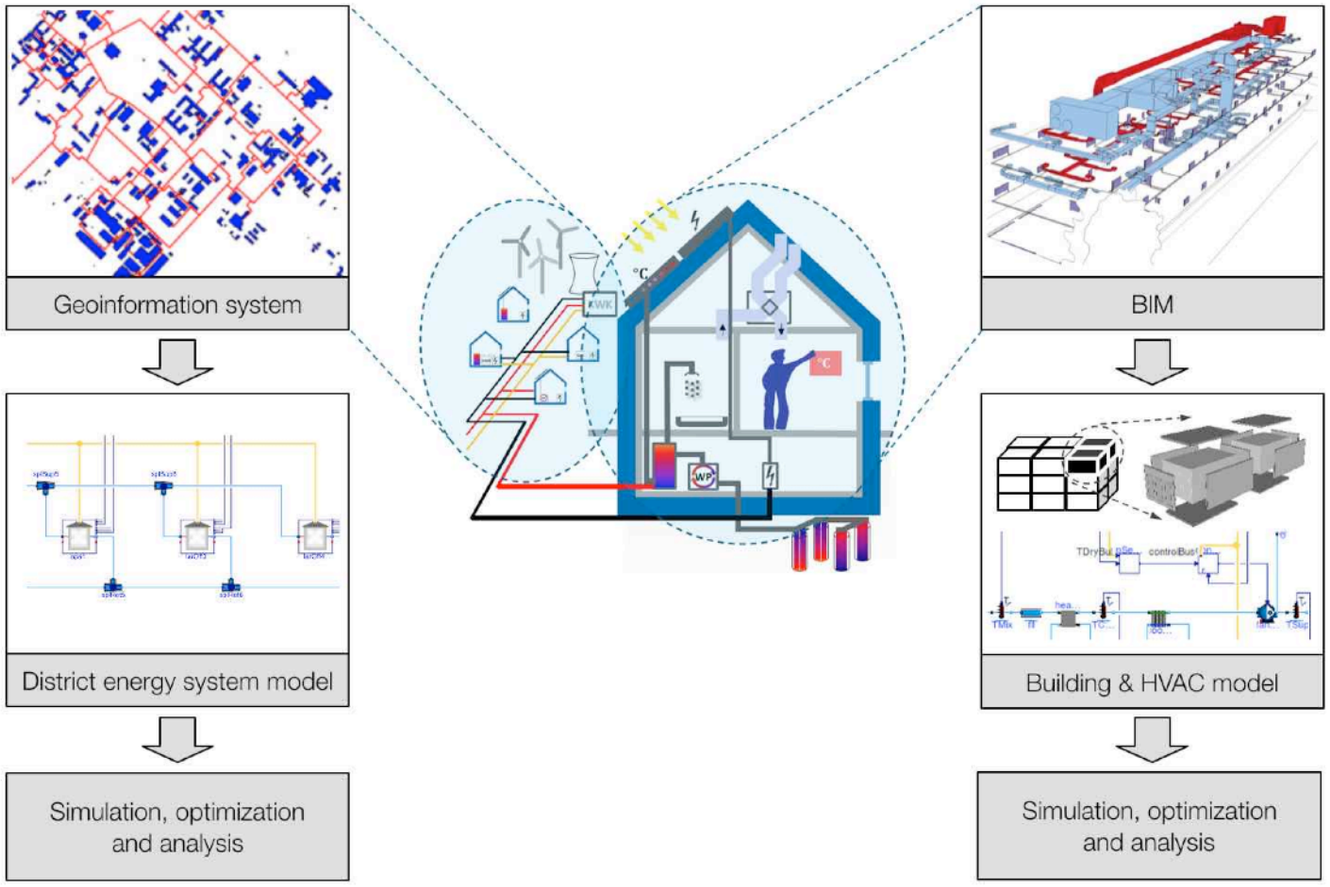
- **Focus on Modeling**
- DAE-based
- Model Compiler Technology

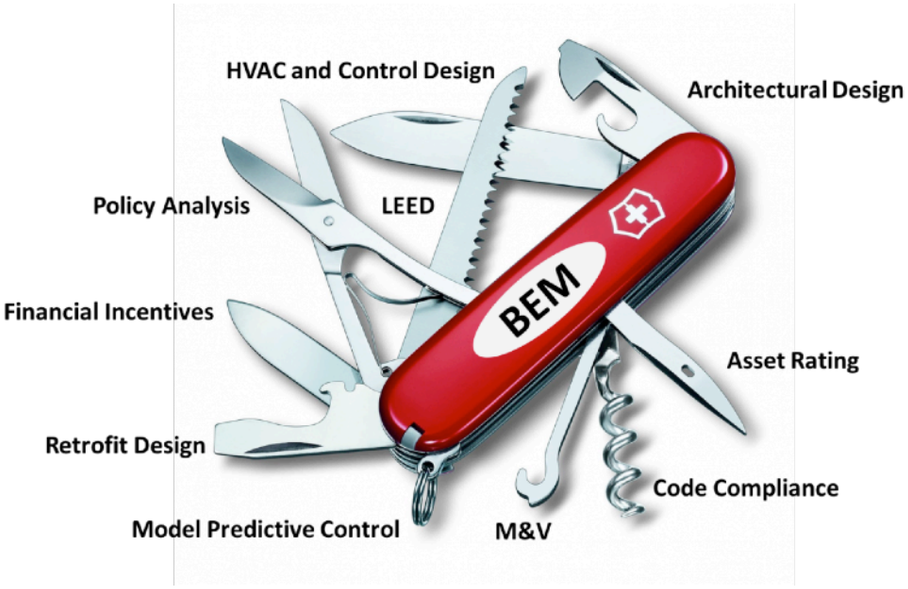
- **Focus on Tool-Integration**
- Based on Interfaces (FMI)
- Model-based System Engineering

- **Focus on Autonomous Modelling**
- Free online modelling
- AI-based modelling

Source:
Dr. Dirk Zimmer
Institute of System Dynamics and Control
DLR German Aerospace Center
dirk.zimmer@dlr.de

What are underlying principles to build a Swiss army knife for such a variety of use cases, domains, and time scales?





modeling tools

abstraction

standards

mathematics

2015: Joe Clarke's vision statement

CrossMark
click for updates

Original Articles

A vision for building performance simulation: a position paper prepared on behalf of the IBPSA Board

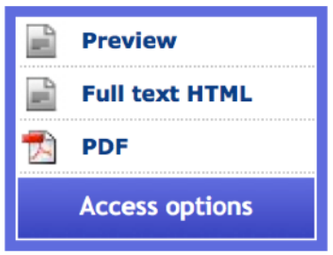
DOI: 10.1080/19401493.2015.1007699

Joe Clarke[a]*

pages 39-43

Publishing models and article dates explained

Published online: 17 Feb 2015



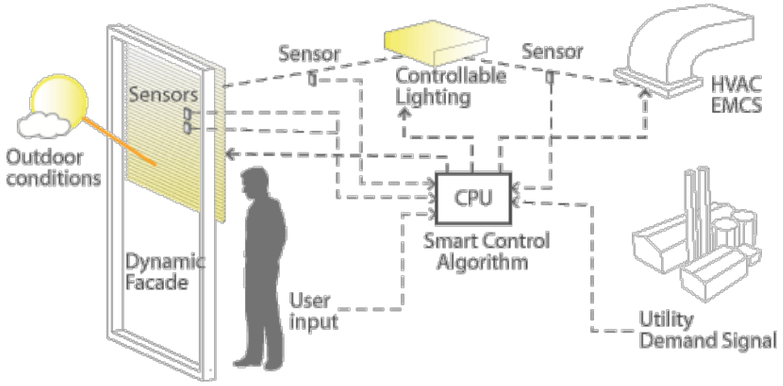
Joe Clarke's vision statement calls for a consolidation of models for HVAC and controls that can be used for testing, as a review framework and as a library (Propositions 1, 3, 4, 5, 6, 7, 9, 11 and 12).

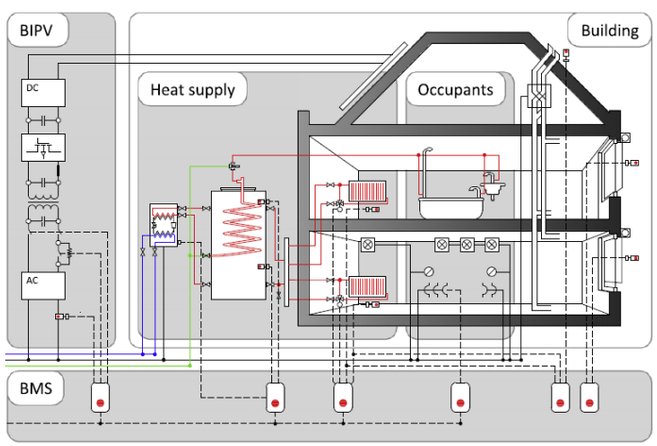
The opportunity is

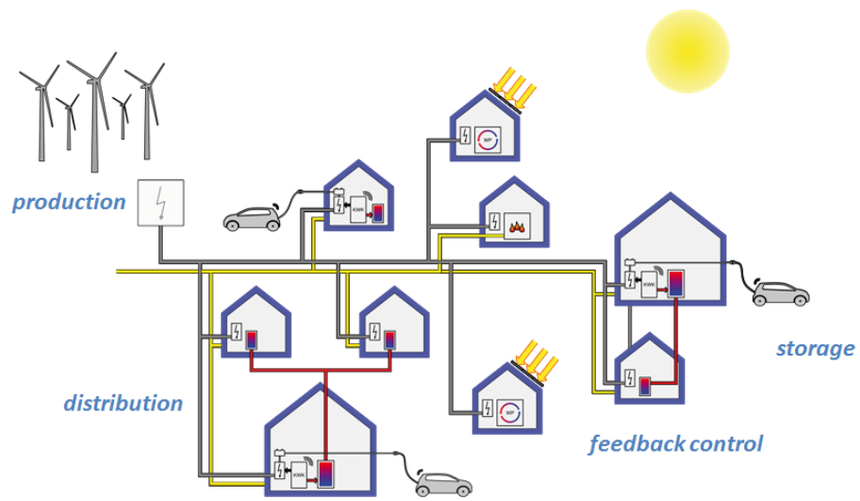
- to standardize the approach for how such component and system models are represented,
- to agree upon the physics for specific use cases, and
- to share resources for development, validation and distribution

IBPSA Project 1 goals

1. to consolidate the development of these technologies, ranging from equipment to system representations of the data (BIM/GIS) and their dynamic behavior (Modelica),
2. to share efforts for, and increase the range of, model validation, and
3. to provide to simulation tool providers stable, well-tested, validated and documented code that they can integrate in their software tools for deployment to design firms, energy service companies, equipment and control manufacturers.
4. to demonstrate through applications capabilities that are enabled through Modelica, and to identify and test through applications research needs and research results.







From controls to buildings and communities

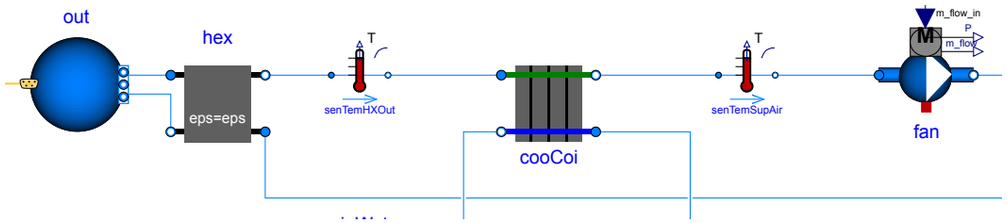
Why do we coordinate this work through IBPSA Project 1?

- Expert panel for discussion of modeling and simulation-related research activities
- Direct access to simulation community
- IBPSA has a history of open dissemination platform and network
- High international visibility
- Coordination of expert meetings with IBPSA conference series

Structure

Task 1: Modelica libraries for building and community energy systems

- WP 1.1: Library for design and operation
- WP 1.2: Model Predictive Control

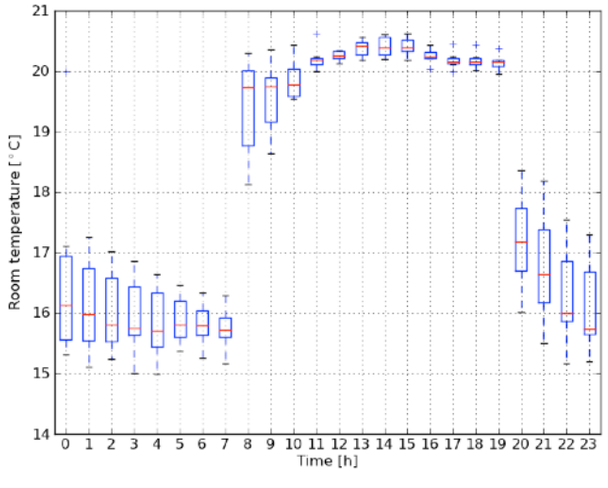


Task 2: Building and City Quarter Models

- WP 2.1: City Quarter Information Modeling
- WP 2.2: Building Information Modeling

Task 3: Application and Dissemination

- WP 3.1: Application & Validation (DESTEST)
- WP 3.2: Dissemination



Levels of participation

Sponsoring participant

- Cash $5k per year. Thanks to
  - Mitsubishi Electric Research Laboratories and
  - ENGIE Lab

Organizational participants

- minimum 0.5 full time employee per year, over the 5 year project
- contribute to 5 to 10 web-based coordination meetings annually
- attend semi-annual expert meeting, generally lasting 2 days

Individual participants

- no predetermined level of commitment, but needs to provide substantial contributions

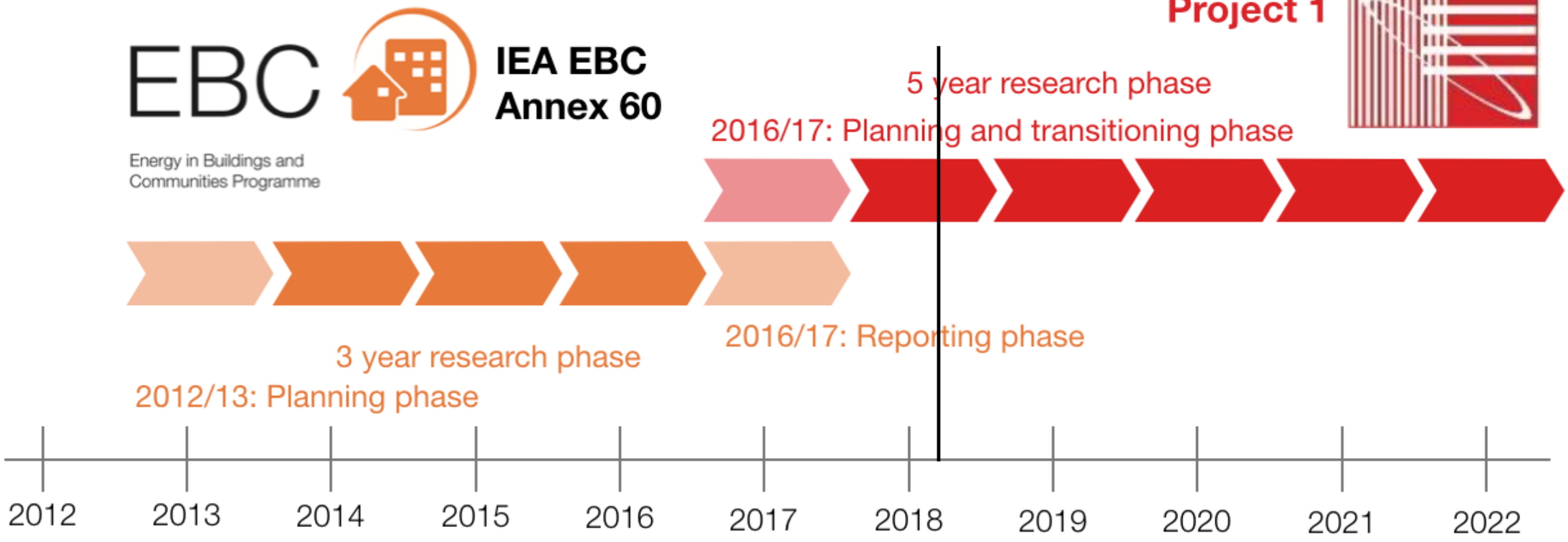
Intellectual property

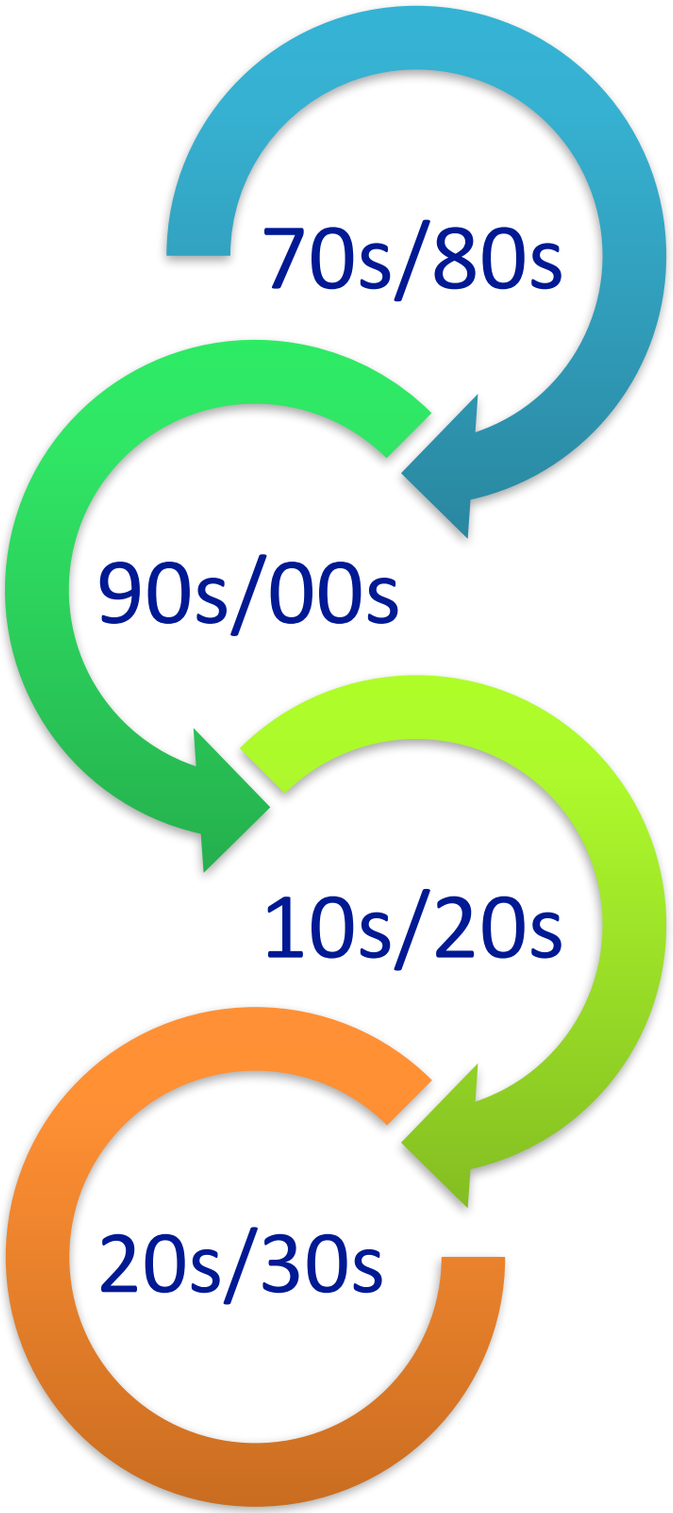
IBPSA is the copyright and license holder.

All workshops, software and documentation will be open accessible to anyone.

Modelica models and other code will use the open-source BSD 3-Clause License.

Timeline


EBC
Energy in Buildings and Communities Programme
IEA EBC Annex 60
IBPSA Project 1
5 year research phase
2016/17: Planning and transitioning phase
3 year research phase
2012/13: Planning phase
2016/17: Reporting phase
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022



Modelica is not just a language

—

it is an enabling technology that allows reasoning about systems and transforming them for different applications

Language shapes the way we think, and determines what we can think about.

Benjamin Lee Whorf, 1897-1941