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EBC
Energy in Buildings and Communities Programme

EBC ANNEX 60
New generation computational tools for building and community energy systems based on the Modelica and Functional Mockup Interface standards

Task 2: Validation and Demonstration
Activity 2: Tools for analyzing district energy systems

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4rd Expert Meeting Berkeley, CA, USA
15-17 September 2014

Annex 60: introduction

New generation computational tools for building and community energy systems based on the Modelica and Functional Mockup Interface standards

Outils de simulation nouvelle génération pour les bâtiments, quartiers et systèmes énergétiques, basés sur Modelica et le standard FMI

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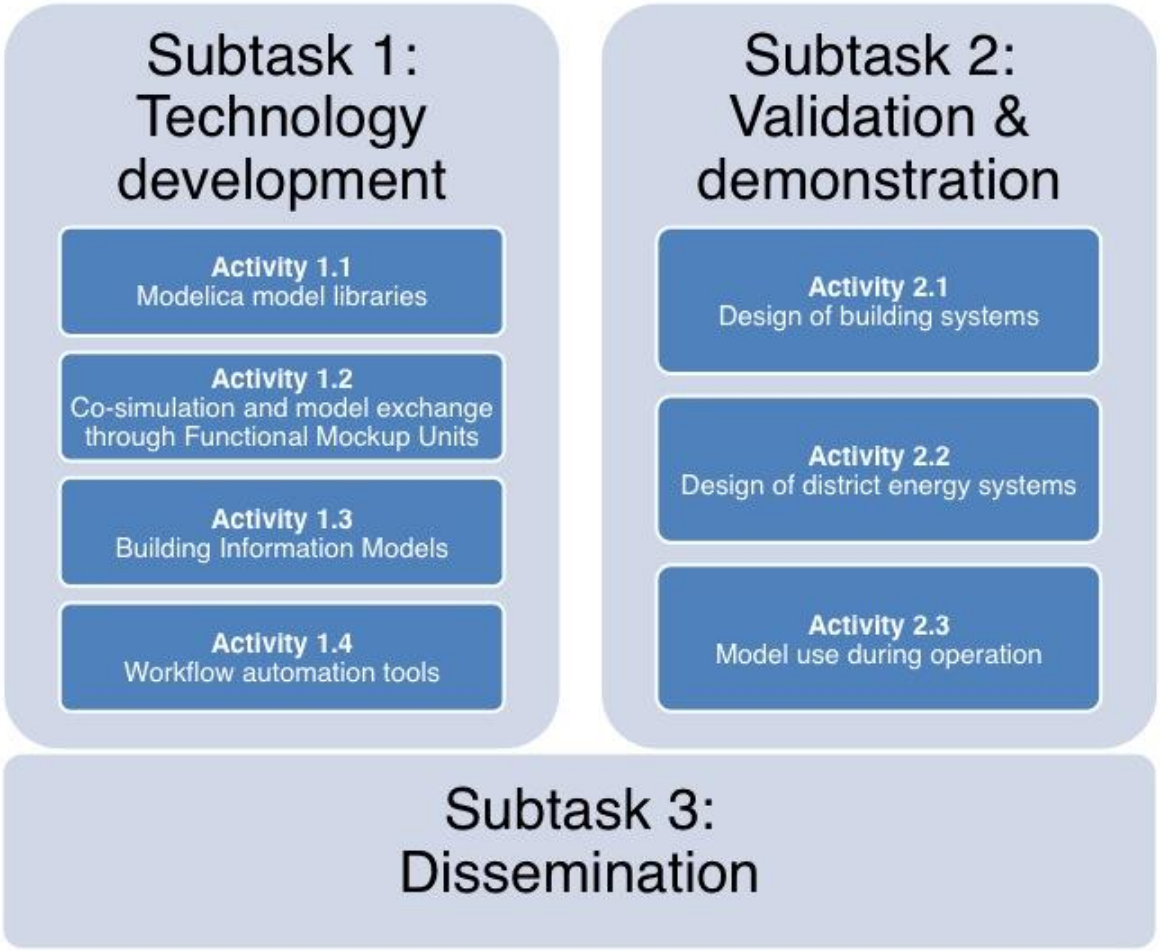
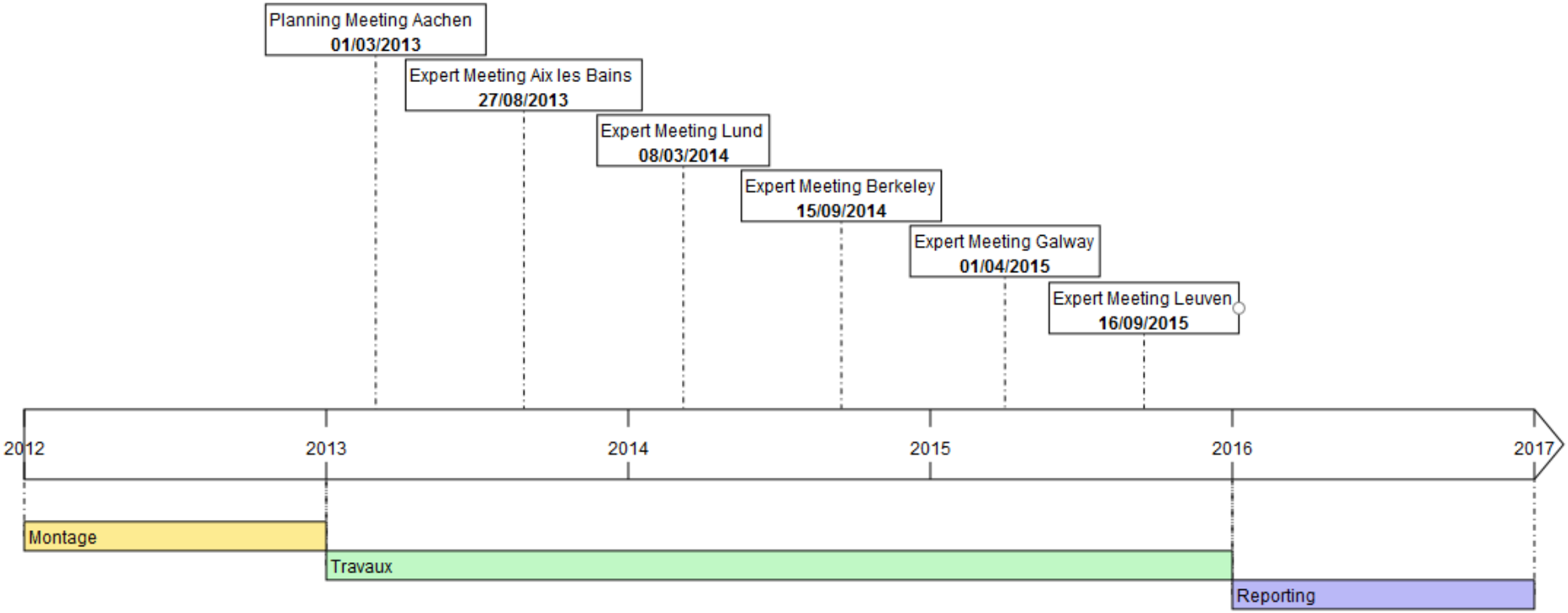
Annex 60: introduction



Annex 60: timeline



Annex 60 : websites

- Public website: http://www.iea-annex60.org/
- Community website: https://bitbucket.org/berkeleylab/iea-annex-60-admin/

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Michael Wetter
(LBNL)

Christoph van Treeck
(RWTH Aachen)

Dirk Saelens
(KU Leuven)

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Activity 2.2: Tools for analyzing district energy systems

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Activity 2.2: participants

- KU Leuven, *Belgium*
- Austrian Institute of Technology, *Austria*
- Eindhoven University of Technology, *The Netherlands*
- RWTH Aachen University, *Germany*
- University of Liege, *Belgium*
- IK4-TEKNIKER, *Spain*
- Université de Grenoble, *France*
- EDF R&D, *France*
- …

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Activity 2.2: Tasks and milestones

1. Literature review

2. Common modelling exercise and results analysis

3. Further developments and analyses of district energy systems

- Free presentations

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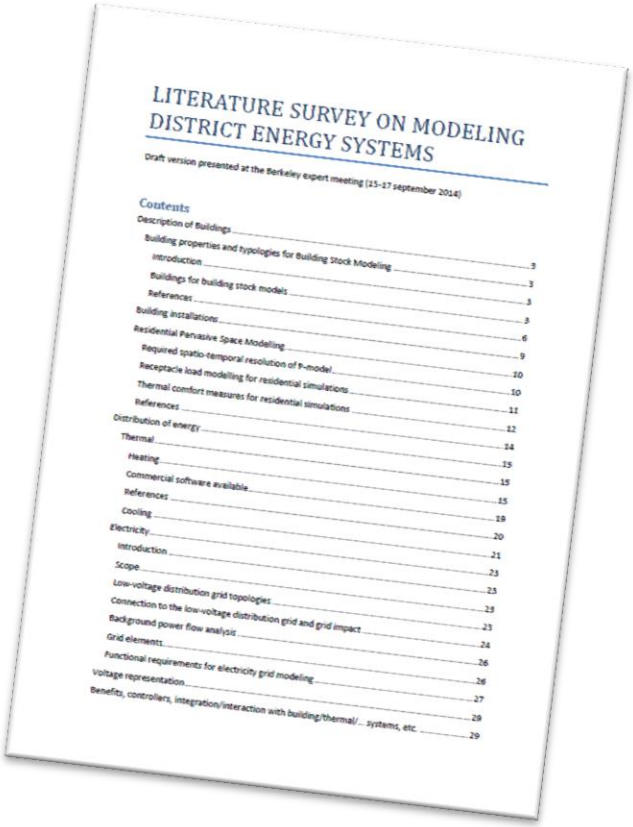
Literature review

1. Description of buildings
2. Distribution of energy
3. Control of districts
4. Storage
5. References

The review process is ongoing!



LITERATURE SURVEY ON MODELING DISTRICT ENERGY SYSTEMS

Draft version presented at the Berkeley expert meeting (15-17 september 2014)

Contents

Literature review

- Description of buildings
  - Building properties and typologies for building stock modelling
  - …
- Distribution of energy
  - District heating systems dynamic modelling approaches
  - District cooling systems
  - Electricity & gas
- Control of districts
  - Energy efficiency mode
  - Demand response mode
  - …
- Storage
- References

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Definition of a common exercise

- Defining a reference “Annex 60 Neighborhood Case” on which different modeling approaches can be tested
- Activity 2.2 identified these main research questions:
  - Interconnection of electrical and thermal grids
  - Control strategies
    - What benefits can it provide for the networks
    - How will the consumer be impacted
    - Language/implementation for controllers (Modelica, Simulink, other…?)
  - Available flexibility can be provided by thermal networks for the electrical networks and vice versa
  - Hydraulic balancing: drive heat correctly to the consumption
  - Change from consumers to prosumers, what is the influence of distributed energy supply?

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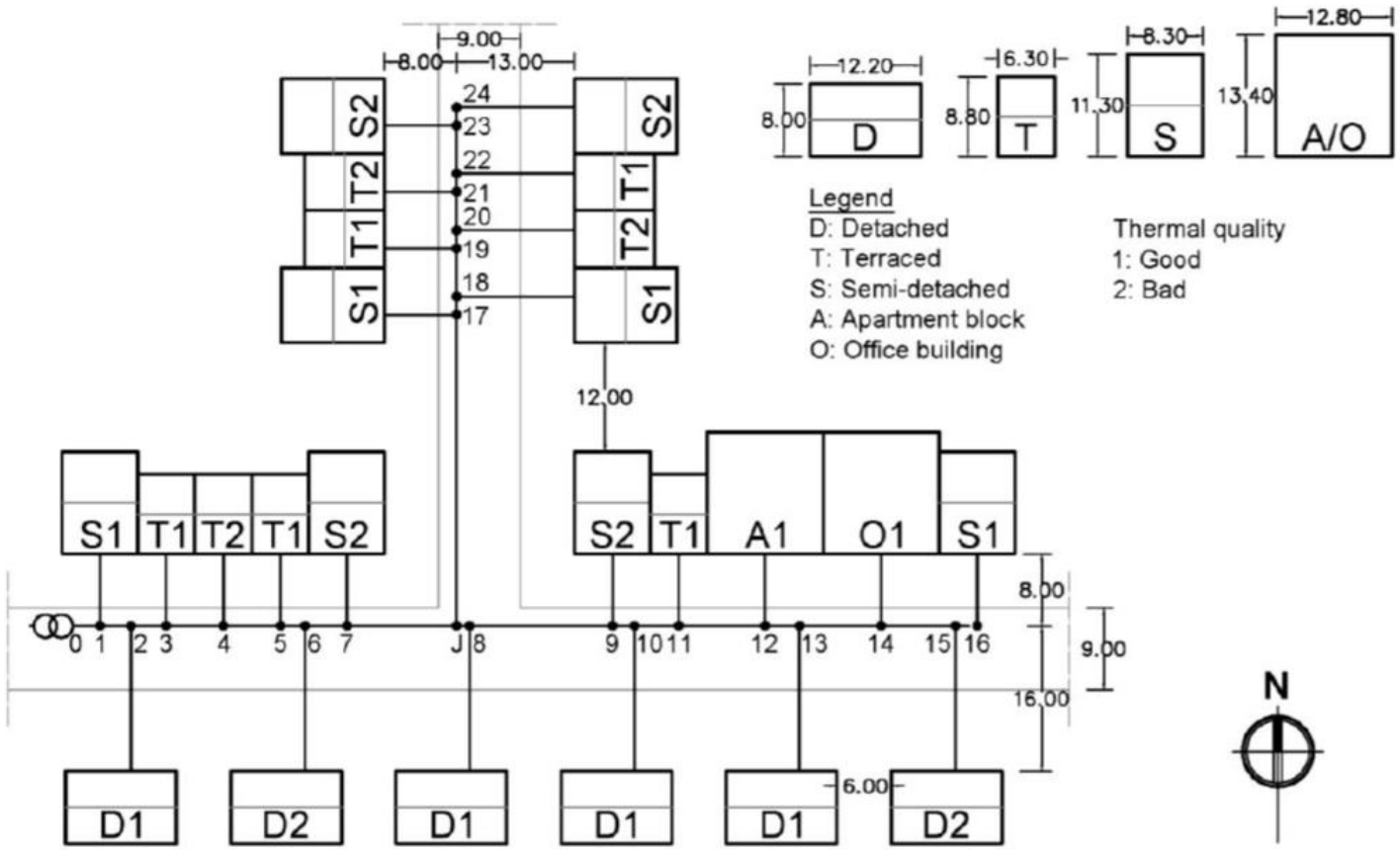
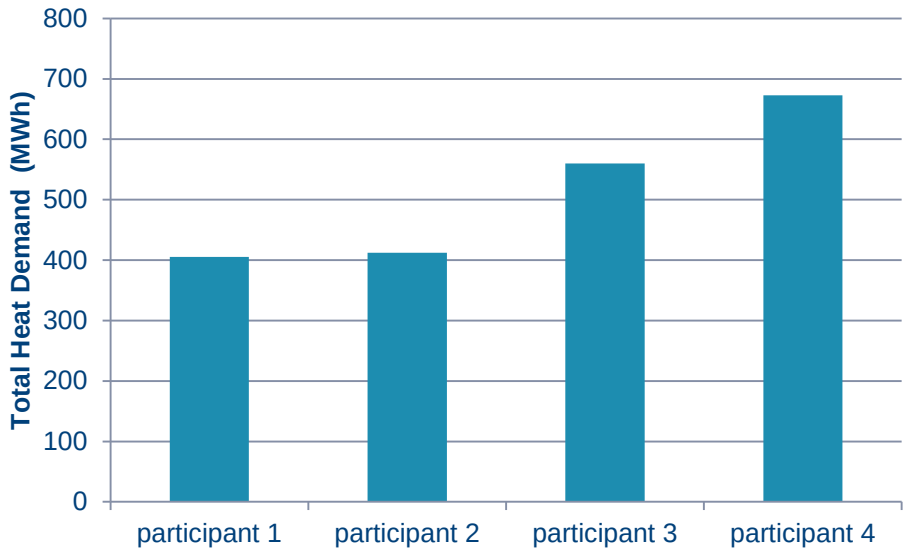
Common exercise

- Step 1: Definition of building stock



Common exercise

- Step 1: Definition of building stock
  - All contributions are in Modelica
  - Different approaches were used: ranging from RC-model to white box models
  - Implementing heating and cooling systems
  - Implementing user behavior and varying set-points



Common exercise

- Step 2: Connecting the buildings
  - Adding thermal network
  - Adding electrical network

- Step 3: Adding control systems

Further developments and analyses

- Aim of Activity 2.2 is to build a working fully coupled neighborhood simulation completely within Modelica
- Further analysis may include:
  - Can/should the district be simulated using FMUs / co-simulation? (Activity 1.2). Advantages / Disadvantages
  - Is it possible to use BIM/GIS for defining the buildings? (Activity 1.3)
  - Which tools for district energy analysis (f.i. parameter analysis on the model) (Activity 1.4)
  - What is the consequence of using reduced order models for buildings?
  - How to replace the neighborhood by reduced order models?
  - How to implement controllers? (Step 3)

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Thank you for your attention

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