Standardization challenges for the energy performance assessment in a BIM context

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Content

1. The set of EPB standards in CEN and ISO
   The internationally standardized methodology for the regulatory assessment of the overall energy performance of buildings

2. BIM standardization activities in CEN and ISO

3. Opportunities and challenges regarding BIM use for the regulatory assessment of the energy performance of buildings
My background

• Experience in development and validation of energy simulation software tools
• Leading expert in development of national (NL) and international (CEN, ISO) energy performance standards
  – In particular: energy needs for heating and cooling and indoor temperatures (e.g. EN ISO 13790:2008, EN ISO 52016-1:2017)
  – Overall energy performance assessment, the integrated approach (set of EPB standards, 2012-2017)
• (Co-)convenor of leading ISO and CEN working groups on energy performance of buildings
• Staff member of EPB Center

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• Service center for information and technical support on the new set of EPB standards
• Founded by ISSO and REHVA
• Director: Jaap Hogeling
Overall energy performance of buildings (EPB)

December 2010

Mandate M480 European Commission to CEN
To develop a consistent set of standards to assess overall EPB

- To support the European Energy Performance of Buildings Directive (EPBD)
- For energy performance certification and to check compliance against minimum EP requirements
- Harmonized procedures, but:
  - with flexibility for national situations
Holistic or systemic approach

Think pyramid!

Boundary conditions

EP

Collect all energy elements

Building energy needs and system energy losses

Component input data

EP aggregation

EP expressions

Common terms, definitions and symbols

Collect all energy elements

Boundary conditions

Building & compon.

Heating. & DHW.

Vent. & cooling

Lighting.

Control & autom.

Overall energy performance

EN

EN Over-arching EPB standard

TC 371

TC 89

TC 228

TC 156

TC 169

TC 247

EN xxx

EN xxx

EN xxx

EN xxx

EN xxx

EN xxx

CEN technical committees

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But: also interest in rest of the world

2009: joint working group in ISO on EPB standards
Collaboration with CEN

ISO organization EPB standards

Joint WG EPB, holistic approach
TC 163-205

Building & components
TC 163

Heating & DHW & cooling & control
TC 205

Lighting.

EN ISO 33 XXX
EN ISO 33 XXX
EN ISO 33 XXX
EN ISO 33 XXX
EN ISO 33 XXX

EN ISO Overarching EPB standard

TC 163
TC 205

ISO

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**Current status**

**Set of EPB standards**

- Published in summer 2017, (almost) the whole set:
  - 17 CEN/ISO EPB standards
  - 35 only CEN EPB standards
  - 39 accompanying technical reports
- Now gradually being implemented at national level
- Already some more “CEN only” standards now being discussed in ISO (to become combined CEN & ISO standards)
- (EN) ISO 52000 family of standards is becoming a strong brand mark
- New EPBD (2018): National procedures to be reported using Annex A template *(explained further on)* of EN ISO 52000-1, 52003-1, 52010-1, 52016-1, 52018-1

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**Set of EPB standards.**

**Strong points**

- Holistic or systemic approach:
- Combined:
  - heating, lighting, cooling, air conditioning, ventilation
  - outdoor climatic
  - local conditions
  - indoor climate requirements
- Taking into account dynamic interactions
- Overall consistency: input-output relations between the standards
- Harmonized but flexible
Set of EPB standards. Harmonized but flexible

- The set of EPB standards:
  - Consistent and transparent package of harmonized procedures
  - Fit for use in the context of building regulations (robust, reproducible, transparent, ...)
- But clearly identified options and national data remain necessary due to differences in
  - climate
  - culture and building tradition
  - building typologies
  - policy
  - legal frameworks (including the type and level of quality control and enforcement)

The “Annex A/Annex B approach”

- Each EPB standard has:
- Choices to be made at national level (regulators!)
- Examples of types of choices:
  - Climatic data
  - Policy factors (e.g. primary energy conversion)
  - Building categories, space categories
  - Set of user conditions per space category
  - Choice between specific detailed or simplified procedures
  - Default values for specific components or products
  - Replacement of specific EPB standards by national procedures (to enable a “step by step” implementation of the whole set)
National choices: unambiguous template (tabulated)

Example (from EN ISO 52016-1):

BIM and energy performance (EP) calculations

- **openBIM** as central technology for the information management
  - ‘universal’ methods to specify exchange data requirements, model specifications and data formats
  - Can combine input from different BIM software tools
  - Flexible: full control over how EP calculated; open for different options
  - Mostly free, some open source

- **BIM benefits:**
  - Information is created only once and changes are consistently managed during the entire life cycle of a built asset
  - No more: loosely connected island-solutions
    - Including need to introduce manually the same information several times in different software packages
    - Leading to inconsistencies and errors

- **Still considerable effort needed:**
BIM standardization:

**Already published**

- **EN ISO 16739:2016** Industry Foundation Classes (IFC 4)
  - Exchange data format
  - Methodology to describe typical workflows (tasks, collaboration)
  - Requirements for information exchange
    (e.g. what needs EPB-specialist from the architect)
  - “Exchange Requirements” (ER): Description of the requirements in human readable text
    (e.g. “For all exterior walls: the geometry, thickness of layers and material properties, for all heated/ventilated spaces: the ... for all HVAC equipment: ...”)
  - “Model View Definitions” (MVD): Specification of ER in machine language, using specific exchange data format (e.g. IFC 4)
    To filter (and check) the information in the IFC4 file sent from architect to EPB-specialist

More information: Prof. Ralf Klein

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BIM standardization:

**Work in progress**

- Less nerdy, more “user friendly” environments are under development
- Ongoing standardization (CEN/TC 442):
  - **EN ISO 19650** (part 1 and 2 expected in November 2018)
    Methodology to set up a construction project using BIM for information management:
    - when and how to specify information requirements
    - how to describe the implementation of the BIM-process
    - when and how to set up the “Common Data Environment” (CDE, the single source of information for all project team members) and when and how to share information
- **Guidelines** (e.g. national and for specific disciplines) how to use and implement EN ISO 19650

More information: Prof. Ralf Klein
BIM standardization: Work in progress

- Several projects dealing with product data:
  - independent of which commercial BIM software
  - incl. rules how to ensure the correctness of the information
  - Aligned with “SMART CE” (CE-marking information in a machine readable form)
- So-called “horizontal role” of CEN/TC 442: to extend the existing collaboration through “liaison officers”
  - Support from CEN/TC 442 for other TCs on how to make standards “BIM proof”
  - New CEN/TC 442 Working Group probably starts Sept. 2018. Also to intensify two way communication with other TCs on BIM implementation in “every day practice” of the different disciplines

Set of EPB standards creates new opportunities for using BIM

- Good starting point: the EPB standards are harmonized, e.g.:
  - Unambiguous input and output data: terms, definitions, symbols, units
  - Modular approach: clear which input data are used in which calculation element(s)
  - Calculation of energy needs and indoor temperatures: not more input data for detailed methods as for simplified methods
  - Technical building systems: simplified methods derived from (so: compatible with) detailed methods
  - Clear distinction between data for products, constructions, conditions, …
  - Innovative technologies: same framework of input/output
- Spaces and zones:
  - The overarching EPB standard (EN ISO 52000-1) has a (mandatory) template to specify categories of buildings and spaces
  - Common zoning rules (thermal zones, systems, daylight, …) in the relevant EPB standards
Levels of detailing BIM versus EPB

<table>
<thead>
<tr>
<th>High level BIM</th>
<th>≈</th>
<th>Detailed EPB calculation procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low level BIM</td>
<td>≠!</td>
<td>Simplified EPB calculation procedures</td>
</tr>
<tr>
<td>Specific BIM details</td>
<td>=?</td>
<td>Precalculation of specific EPB elements (e.g. thermal bridges)</td>
</tr>
</tbody>
</table>

Warning: in EPB calculations:
more detailed ≠ more accurate:

- **Overall EPB assessment**: more detailed = more uncertainties
  *e.g. in input data, conditions, ...*
- but ‘more detailed’ is always useful on **specifically tailored aspects**
  (e.g. overheating in a specific ‘worst case’ room)

Conclusion

- **Use of BIM in present EPB assessment methods**
  - Challenges mostly at BIM side:
    - Continued BIM standardization
    - BIM data fit for energy calculations (materialized objects, spaces, ...; filters)
    - Add EPB relevant data (dimensions, input data, systems, ..., zoning)
  - **Set of EPB standards optimized for BIM**
    - Challenges for EPB standards writers with BIM standards writers
    - Opportunities:
      - Both operating in CEN and ISO committees, aiming at harmonization with flexibility
      - Both interested in linking product data to the overall (EPB and BIM) model
  - **Benefits**
    - All information in a common data environment:
      less effort, less inconsistencies and errors, internationally standardized, transparent, harmonized and flexible
More information on the set of EPB standards:
www.epb.center

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