Compliance and quality of the works in relation to thermal insulation

Summary of the International Workshop on
Performance of Thermal Insulation in Low Energy Buildings and
Advanced Building Renovation Project
15 December 2016 Brussels

Paula Wahlgren
Chalmers University of Technology, Sweden

QUALICheck International Workshop on Performance of Thermal Insulation

<table>
<thead>
<tr>
<th>Time</th>
<th>Session Title</th>
<th>Presenter(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>09:30</td>
<td>Opening by chairperson</td>
<td>Janus Asmussen - Technical University of Denmark</td>
</tr>
<tr>
<td></td>
<td>Overall context for QUALICheck project and for this workshop</td>
<td>Peter Heuer - INES BEB</td>
</tr>
<tr>
<td></td>
<td>Progress and challenges in achieving high performance building envelopes</td>
<td>Arild Johansen - Chalmers University</td>
</tr>
<tr>
<td></td>
<td>The Clean Energy Package</td>
<td>Francesco Berni - RFB</td>
</tr>
<tr>
<td></td>
<td>Coffee break</td>
<td></td>
</tr>
<tr>
<td>11:00</td>
<td>MODULE 2: Building junctions &amp; databases</td>
<td>Hikmat Balad</td>
</tr>
<tr>
<td></td>
<td>Barriers and opportunities for achieving compliance and enforcement: application to transmission aspects</td>
<td>Thijs De Jeter - BBL</td>
</tr>
<tr>
<td></td>
<td>Quality framework for the internal insulation of existing brickwalls in Belgium</td>
<td>Janus Asmussen - Technical University of Denmark</td>
</tr>
<tr>
<td></td>
<td>Thermal bridges calculation rules and accounting in energy calculation in various countries</td>
<td></td>
</tr>
<tr>
<td>11:45</td>
<td>Lunch break</td>
<td></td>
</tr>
<tr>
<td>11:45</td>
<td>MODULE 3: Super insulation materials</td>
<td>Asa Wahlgren, Chalmers University</td>
</tr>
<tr>
<td></td>
<td>Super insulation materials: an overview of international research activities and new products on the market</td>
<td>Roland Gaps - INR</td>
</tr>
<tr>
<td></td>
<td>How to determine the long term performance of vacuum insulation panels</td>
<td>Arild Johansen - Chalmers University</td>
</tr>
<tr>
<td></td>
<td>Retrofitting listed buildings using vacuum insulation panels</td>
<td>Ralf Naber - CITE</td>
</tr>
<tr>
<td>15:00</td>
<td>MODULE 4: Insulation of walls - Quality of the works</td>
<td>Matthias Ehren - Fraunhofer IBP</td>
</tr>
<tr>
<td></td>
<td>Voluntary approach: European technical research and guidelines for the design and installation of high thermal performance roofs</td>
<td>Andrea Costa - RDT Solution Srl</td>
</tr>
<tr>
<td></td>
<td>EU ultr.75/94: Tools for the 21st Century Construction Workforce</td>
<td>Georgi Terehov, president FIEC TCE + Georgi Terehov, deputy CH</td>
</tr>
<tr>
<td></td>
<td>Conclusions</td>
<td>Peter Heuer - INES BEB</td>
</tr>
<tr>
<td>17:00</td>
<td>FLOORING (30 min)</td>
<td></td>
</tr>
</tbody>
</table>
CONCLUSIONS

Environmental challenges require very high building envelope performances

Reduce performance gap by correct calculation of transmission heat loss and good quality of insulation works

On-site testing is important to solve deviations between calculated and real energy performance

BPIE assessment

New
- Smartness indicator
- Provisions to protect vulnerable consumers
- Measures to leverage financing

But the proposal fails to trigger more and deeper renovation activities

Missing
- 2030/2050 EU vision for the buildings
- Requirements for better energy performance of public and commercial buildings
- Any changes to EPC towards personalized renovation advice
S. Smith, P. Wouters- Barriers and opportunities for achieving compliance and enforcement: application to transmission aspects

We have no idea how this is possible (but we are not competent)

The installer has insulated the roof 4 cm whereas 6 cm was foreseen in the declaration at the moment of the building permit. There has to be a sanction...

I have prescribed 6 cm

The technical specifications mentions 6 cm, I made no error

I agreed with the owner to only insulate 4 cm

Which type of sanction? If fine, what level? Who should pay?

Inspector (Civil servant, ...)

Owner

Architect

Rapporteur

Contractor(s)

T. De Mets- Quality framework for internal insulation of existing brickwalls in Belgium

Internal insulation might be the only solution

Cavity-wall-insulation ——— Solid walls

External insulation ——— Worth-preserving façade, strict building lines …

Internal insulation
**T. De Mets - Quality framework for internal insulation of existing brickwalls in Belgium**

Quality framework for internal insulation, from 2017

- Prior inspection
  - no risks manageable risks → internal insulation
    - Executed by a certified contractor or an involved architect
  - risk of damage → no execution
    - Performed by a certified contractor or an involved architect

Subsidy if $R_{nu} \geq 2 \text{ m}^2\text{K/W}$

---

**D. Quenard - Superinsulation materials: an overview of international research activities and new products on the market**

EBC Annex 65 Long Term Performance of Super-Insulating Materials in Building Components and Systems

Preliminary conclusions

**About Products & Systems**
- SIM can be considered as mature products
- Need to move from single product to system solutions

**About Performances**
- Reproducible values for “fresh” products around the world
- Still some deviations for aged panels?

**About Applications**
- Avoid severe conditions without preliminary design & SIM protections
- Interior Insulation is fine
R. Caps- How to determine the long-term performance of vacuum insulation panels

CONCLUSIONS
Conditions for evaluating long term performance of VIPs have been defined by CEN TC88 WG 11 committee.

Accelerated aging of VIPs at climate (50°C, 70%) , most suitable. Change of thermal conductivity is measured during half a year and mean thermal conductivity during service life is then calculated.

Field study: Exterior insulation
- 20% energy use reduction (-31 kWh/m².year)
- Improved hygrothermal performance compared to reference

Laboratory study: Interior insulation
- Important with knowledge of brick and mortar properties
- Moisture content in the wooden beams increased slightly
R. Pasker - How to ensure the quality of ETICS?  
Examples of what EAE members do to ensure durability and reliability of thermal insulation systems.

Conclusions

• Common guidance papers for design and application useful to improve the knowledge about appropriate use of ETICS.
• Certification schemes for both applicators and system components may further support efforts.
• Finally, quality, performance, durability, and reliability of ETICS require a broad quality approach – and joint efforts of industry, designers/architects and applicators.

Efforts finally pay off:

• If applied correctly the life-cycle of an ETICS is regarded to be equal to rendered facades (approved by long-term field-tests; Fraunhofer IBP).
• Only if building owners trust in the long-term performance of External Thermal Insulation Composite Systems they will invest in energy efficient buildings envelopes.

R. Holleron & J. Langmans - Delivering high performance residential pitched roofs in the real world

CONCLUSIONS: A pithed roof is possible if…….

<table>
<thead>
<tr>
<th>Air barrier system</th>
<th>Air barrier system</th>
<th>Density</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;0.0047 m³/m²/h/Pa</td>
<td>20-30 kg/m³</td>
<td>Filled insulation compartment</td>
</tr>
<tr>
<td>Insulation layer</td>
<td></td>
<td></td>
<td>Avoid small air channels</td>
</tr>
<tr>
<td>Wind barrier</td>
<td>Air permeability</td>
<td></td>
<td>&lt;0.05 m³/m²/h/Pa</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
A. Costa- BUILD2SPEC, Tools for the 21st century construction worksite
Self-Inspection, 3D modelling, management and quality-check tool

Conclusions

- The performance GAP is quite relevant and deserves attention in all phases of the BLC
- The B2S project is integrating SOA solutions as well as developing innovative ones to empower on site inspection and quality assurance
- A BIM centered workflow together with geo referencing can be very effective,
- When BIM is not available it can be generated leveraging point clouds (drone and 3D scanning)

Presentations are available here:
http://qualicheck-platform.eu/events/workshops/
The paper reviews several case studies which show that although thermal bridge impacts were addressed in all countries, compliance and verification processes were often missing. How tabulated data correspond to the real values of as-built solutions in construction site is therefore often not known (link to Janek Kuntzala’s presentation http://qualicheck-platform.eu/wp-content/uploads/2017/01/QUALICHeCK-Workshop-Brussels-3.4-Kuntzala.pdf).

However, there are emerging stakeholders such as vacuum insulation panels (VIP) or aerogels represent a small market share as of today; however, they show great potential for innovation market. Many examples in Europe but also in the USA, China, Japan were presented showing how these could be implemented, including in listed buildings with strong aesthetics and architectural constraints, or in expensive districts to save floor area (link to Daniel Quenard’s presentation http://qualicheck-platform.eu/wp-content/uploads/2017/01/QUALICHeCK-Workshop-Brussels-3.3-Quenard.pdf). Significant progress has been made over the past few years to make these materials simpler and easier to handle.

A CEI Technical Committee (TC 68) is working on the characterisation of the long-term performance of vacuum insulation panels, in particular as they are subjected to temperature-moisture stresses (link to Roland Cap’s presentation http://qualicheck-platform.eu/wp-content/uploads/2017/01/QUALICHeCK-Workshop-Brussels-3.2-Caps.pdf). Technical approval frameworks are meant to assess risks, to check the fitness for purpose, and to document specifications for workmanship for a given product or service (link to harmonised standards and European Technical Assessments which are limited to product characteristics to be declared in relation to its essential characteristics as defined in the Construction Product Regulation (CPR/2011). During a round table discussion, panel members shared their thoughts about an international technical consensus to have common references for issues not covered by harmonisation such as workmanship. Note that there already exist several technical requirements for vacuum insulation panels and aerogels that provide reliable data for their properties and durability as well as specifications for their implementation in buildings (link to Daniel Quenard’s presentation http://qualicheck-platform.eu/wp-content/uploads/2017/01/QUALICHeCK-Workshop-Brussels-3.3-Quenard.pdf).

The workshop was the occasion to discuss the perspectives given by information technology to ease the documentation and checks in building construction and commissioning phases account for 10-30% and 15-30% each of the gap between expected and actual energy use in a building. To contain these losses, smart phone applications developed in the Build2Simp project help perform and document quality checks during the construction phase, for instance, user-friendly interfaces to archive georeferenced pictures as evidence. User-friendly interfaces are operational or under development with innovative solutions to reducing lightness, acoustic and indoor air quality, and 3D scanning (link to Andrea Costa’s presentation http://qualicheck-platform.eu/wp-content/uploads/2017/01/QUALICHeCK-Workshop-Brussels-4.2-Costa.pdf). The perspective for such tools, in a context of increasing energy efficiency, is increasing, seems promising.
Conclusions...

- Bringing EPBD article 27 into practice is challenging: “The penalties provided for must be effective, proportionate and dissuasive.”
- There are various possibilities to have an effective compliance and enforcement framework
- The presented approach is one option, each country should check what is the most feasible.

Half of Belgian building stock has non insulated walls

4.5 million dwellings

Not acceptable in the (near) future
CONCLUSIONS

Thermal bridges calculation rules are addressed in the building codes of all studied countries.

Most common solution seems to be some simplified approach where calculations of thermal bridges are not required.

In many cases tabulated or default values in energy calculation software are used.

Compliance and verification processes are often missing. How tabulated or default values correspond to the real values of as built solutions in construction site, is unknown.

In highly insulated buildings a correct thermal bridge accounting is important.