QUALICheck's approach to quality and compliance

Peter Wouters
Manager INIVE EEIG – Coordinator QUALICheck
Structure of the presentation

Why QUALICHeCK?

What kind of activities in QUALICHeCK?

First deliverables of QUALICHeCK

What is in preparation?
Why QUALICHeCK?

What kind of activities in QUALICHeCK?

First deliverables of QUALICHeCK

What is in preparation?
You expect a reliable label

... and you expect a good quality
You expect a reliable label

...and you expect a good quality
...and you expect a good quality
2 objectives of QUALICHeCK

• To set up a series of actions which should result in more attention and practical initiatives for **actual compliance with the claimed energy performance for new and renovated buildings**
  i.e. ‘Boundary conditions which force people to do what they declare’;

• To set up a series of actions, which should result in more attention and practical initiatives for **achieving a better quality of the works**,  
  i.e. ‘Boundary conditions which stimulate and allow the building sector to deliver good quality of the works’.
Why QUALICHeCK?

What kind of activities in QUALICHeCK?

First deliverables of QUALICHeCK

What is in preparation?
QUALICHeCK project (2014-2017)

Solutions

Status of compliance and quality on the ground → Focus of webinar of today

Easy access of compliant EPC input data

Towards more quality of the works

Towards better compliance and effective penalties
4 focus areas in QUALICHeCK

- Transmission characteristics
- Ventilation and airtightness
- Sustainable summer comfort techniques
- Renewables in multi-energy systems
Structure of the presentation

- Why QUALICHeCK?
- What kind of activities in QUALICHeCK?
- First deliverables of QUALICHeCK
- What is in preparation?
WEBINAR: Compliant Energy Performance of Buildings Certificates and better quality of the works — ground status, initiatives and perspectives

Posted on 2015/03/20 by Alexander Deliyannis

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<tr>
<th>Date</th>
<th>Time</th>
<th>Location</th>
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<tr>
<td>Monday 27 April 2015</td>
<td>09:00 – 10:20</td>
<td>London, UK</td>
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<tr>
<td></td>
<td>10:00 – 11:20</td>
<td>Brussels, BE</td>
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<tr>
<td></td>
<td>11:00 – 12:20</td>
<td>Athens, GR</td>
</tr>
</tbody>
</table>
REPORT — Quality of the Works
Posted on 2015/02/28 by Alexander Deliyannis

The trend towards Nearly Zero-Energy Buildings (NZEB) implies the correct execution of classical building works on the one hand, and the proper use of specific workforce skills for implementing advanced technologies on the other. Therefore, to reach NZEB targets in ...
Continue reading →

Posted in Highlights, Reports, Results

REPORT — Compliant and Easily Accessible EPC Input Data
Posted on 2015/02/28 by Alexander Deliyannis

The Energy Performance Certificate (EPC) of a building will only be able to serve its purpose if it is considered trustworthy while minimising the risk of non-compliance of the actual building with the minimum energy performance requirements of the regulations. In doing so, two are the key ...
Continue reading →

Posted in Highlights, Reports, Results

QUALICheck featured at the BauZ! Vienna Congress on Sustainable Building
Posted on 2015/03/31 by Alexander Deliyannis

BauZ! On Friday 13 February 2015, the QUALICheck-dedicated workshop "Quality assurance of energy performance certificates: from calculated energy efficiency to real energy efficiency of buildings", is organised as part of the BauZ! Vienna Congress on Sustainable Building. The Congress takes place from 12 to 14 ...
Continue reading →

REHVA conference 2015 introduces QUALICheck
Posted on 2015/01/31 by Alexander Deliyannis

The REHVA Annual Conference "Advanced HVAC and Natural Gas Technologies" this year takes place in Riga, Latvia on 8-9 May 2015. The conference brings together leading experts from the international heating, ventilation and air conditioning community and serves as a ...
Continue reading →

Posted in Events, Special Sessions

QUALICheck officially introduced to BUILD UP Skills
Posted on 2014/11/21 by Marianna Papadoustra

QUALICheck has been invited to contribute a short introductory presentation at the BUILD UP Skills (www.buildupskills.eu) EU Exchange meeting of the European Commission, on November 12 in Brussels. In the presentation, QUALICheck highlighted the two ways interaction between on the ...
Continue reading →

Posted in Events, Highlights, Special Sessions

1st QUALICheck Conference
Posted on 2014/10/21 by Alexander Deliyannis

Brussels, 30 September 2014 KBC auditorium: Havenlaan 2, 1080 Brussels, Belgium. The 1st international QUALICheck Conference "Towards improved compliance and quality of the works for better performing buildings" was organised on 30 September 2014 at the KBC auditorium in Brussels. The ...
Continue reading →

Posted in Events, Highlights, Special Sessions
Welcome
Environmental concerns, in particular, have over the last decade led to a series of new initiatives in the European Union related to energy efficiency in buildings, with several directives comprising the main driver for action at the level of the Member States. In about 6 years’ time, new buildings will need to be nearly zero-energy (NZE) targets, and, at the same time, building renovation represents a major challenge. Further major steps may not be taken on the longer term and is particularly for the existing building stock to ensure radical progress.

All Member States are currently transposing the various directives (in particular the Energy Performance of Buildings Directive, the Renewable Energy Sources Directive and the Energy Efficiency Directive) into national legislation. Though requiring implementing regulations, this has been the case for the Energy Performance of Buildings Directive, in particular. However, it is important that works related to energy efficiency and renovation are of good quality, in order to ensure that the expected energy performance are achieved and that the works will be sustainable over a long lifetime. In the opposite case, societal and political support might be lacking.

Two of these are the current focus of the QUALICHéCk project, which started in March 2017 and which will run until February 2017. The key messages are the following:

- To set up a series of actions which should result in more attention and real action for reliable information in the Energy Performance Certificates of new and existing buildings i.e. “boundary conditions which force people to do what they decide”;
- To set up a series of actions, which should result in more attention and real action for achieving a better quality of the works, i.e. “boundary conditions which stimulate and allow the building sector to deliver good quality of the works”.

Dissemination of information is a key activity in QUALICHéCk. This newsletter is one of such activities, as is the website. In this issue, you find information on various QUALICHéCk related events and outcomes.

Peter Wouters
QUALICHéCk Coordinator

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QUALICHéCk workshop as part of the Bauen! Conference 2015

Welcome
QUALICHéCk workshop as part of the Bauen! Conference 2015

Welcome to this 2nd newsletter of the QUALICHéCk project, which is now at the end of its first year.

A major QUALICHéCk event is the upcoming 1st workshop in Liéz, on 16 and 17 March 2015, focusing on lessons related to renovation and energy efficiency. The 2nd workshop is scheduled for March 2014 in Antwerp with a focus on sustainable construction technologies. An important point to note is that the QUALICHéCk team is focused on four countries. You can have a sneak preview at the first results of the QUALICHéCk study on compliance with summer thermal comfort requirements in apartment buildings.

In order to achieve more compliance in EPC input data and quality of the works, action is required at national level. Further on, you find information about the national stakeholder conference in Austria. In 2014, a number of similar events are foreseen in other participating countries.

Last but not least, QUALICHéCk will produce a series of fact sheets and organise a series of webinars. The first fact sheet presented in this newsletter is about a French quality management approach to improve building air tightness. The first webinar is scheduled for 27 April 2015. More fact sheets and webinars are planned for 2015.

For more information, please visit www.qualichcek-platform.eu.

Enjoy reading!

Peter Wouters
QUALICHéCk Coordinator

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1st QUALICHéCk Conference
The 1st International QUALICHéCk Conference “Towards improved compliance and quality of the works for better performing buildings” was held on 16th June 2014 in Antwerp.

The conference represented a major opportunity to expand dialogue on the issue for energy efficiency in buildings, with the various QUALICHéCk project teams and one of the stakeholders for discussion. The conference covered among others:

- Lessons learned from major EU initiatives requiring reliability; 
- Energy Performance Certificate input data and quality of works; 
- Experience from industry representatives on the application of the Energy Performance Certificate with a focus on quality of works.

The QUALICHéCk Conference was a success and will be repeated in the future.

Boum! Welcome to the Bauen! Conference 2015

By Susanne Grasser, ÖBB
The Bauen! Conference (www.bauen.at) is an annual event addressing the Austrian construction industry, authorities and administrations, representatives of the real estate sector, as well as architects and engineers involved in building design.

It was the objective of the workshop to introduce the QUALICHéCk project, to present a first batch of good examples from other European countries, to present first results from the Austrian new data collection study carried out by Mr. Staff (Lukas Neid), the event’s keynote speaker and a group of students, from the Consultancy services and quality assurance group of various companies, and to explain the view of the real estate sector (ecolife architects, Wiener Wohnen) and the view of the Building Energy Efficiency Certificate (ÖBB).

The workshop was divided into two parts: the first part focussed on the generalisation of the findings and the second part focussed on the future implications. The workshop was well attended and provided a good platform for discussion. 

(1) It is necessary to have two stages procedure, revealing that the design Energy Performance Certificate (EPC) is used for the review and quality control of the building project. The first stage is the energy efficiency design phase, where the energy performance is calculated and the energy efficiency design phase is validated. The second stage is the commissioning phase, where the energy performance is validated and the energy efficiency design phase is completed.

(2) Default values are important, because the use of default values results in EPCs allowing for comparison of buildings. However, some default values are unrealistic and need revision.

(3) In Austria, it is difficult to assess the impact of the EPC on the real estate market: The residential real estate market is divided into the market for buildings and the market for apartments being rented and the areas being sold. The residential renting market is regulated in detail, making it extremely difficult to assess the impact of the EPC on the rents. The observation of the selling market shows that real estate agents present the

qualifying Energy Performance Certificate (EPC) and the energy efficiency design phase as mandatory. The energy performance of the building is compared with the energy performance of other buildings in the same area. The energy performance of the building is compared with the energy performance of other buildings in the same area. The energy performance of the building is compared with the energy performance of other buildings in the same area. The energy performance of the building is compared with the energy performance of other buildings in the same area. The energy performance of the building is compared with the energy performance of other buildings in the same area. The energy performance of the building is compared with the energy performance of other buildings in the same area. The energy performance of the building is compared with the energy performance of other buildings in the same area. The energy performance of the building is compared with the energy performance of other buildings in the same area.
Status of compliance and quality on the ground

- Easy access of compliant EPC input data
- Towards more quality of the works
- Towards better compliance and effective penalties

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5. CONCLUSIONS

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**QUALICheck**

Towards improved compliance and quality of the works for better performing buildings.

"Status on the Ground"

Overview of existing performance and compliance

Jiheshkani Kani, Tarja Kallio

University of Technology, Lappeenranta

With contributions from:

François Dutart (SETMAT, France), Theo de Jongh, Chrysostomos Athanasiou (MDIA, Greece), Susanne Olesen (EODE, Austria), Céline More, Samuel Coll and Xavier Loncœur (BÉRI, Belgium), Arnold Janssens (UGent, Belgium), José L. Molina (UIE, Spain), Henk Prinsen (URIBAC, Netherlands), Mihai Filip (UCB, Romania), Par Johansson, Olof Wahlgren, Jonas Ouldahottabck (Chalmers, Sweden)

10th April 2015

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To be published very soon
Example:
Quality of ventilation systems in 1.287 new dwellings (France)

Total non-compliance or dysfunctions observed: 1246

- Exhaust airflow: 338
- Air inlet: 300
- Air outlet: 271
- System configuration: 124
- Ventilation unit: 108
- Ductwork and Air transfer: 105

44% of multi-family dwellings don’t comply
68% of single-family dwellings don’t comply
Presentations of new studies...

1. **AUSTRIA**: Introducing an EPC after completion of the building works: reasons behind and preliminary lessons learnt in the Salzburg region  
   Susanne Geissler - ÖGNB

2. **CYPRUS**: Compliance of heat transmission coefficients reported in EPCs in new houses  
   Marina Kyprianou Dracou - The Cyprus Institute

3. **ESTONIA**: Compliance to summer thermal comfort requirements – Control of overheating in new apartment buildings  
   Jarek Kurnitski - Tallinn University of Technology
Status of compliance and quality on the ground

Easy access of compliant EPC input data

Towards more quality of the works

Towards better compliance and effective penalties

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Towards compliant and easily accessible EPC input data
How to get compliant and accessible data for the energy rating calculation of a building?
Overview of some existing approaches

Quality of the works
Documented examples of existing situations regarding quality of works

Compliant and accessible data
BUILDING REGULATIONS CAN FOSTER QUALITY MANAGEMENT: THE FRENCH EXAMPLE ON BUILDINGS AIR tightNESS

The French regulation includes an attempt to relate to systematic building tightness testing to justify a given air tightness level. This route was developed to match professional needs and their methods for implementing building tightness solutions and to ensure specific quality requirements at the end of 2014. In such quality management approaches have been approved representing a production of over 15,000 buildings per year.

- Residential buildings of less than 300m²
- New residential buildings: 0.6
- Existing buildings: 1.0
- Non-residential buildings (no longer applicable as of July 2011)

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Minimum Requirement</th>
<th>Possible Value in Case of 20 Approaches</th>
<th>Default Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-family buildings</td>
<td>0.4 (0.2)</td>
<td>0.6 (0.4, 0.6, 0.8, 1.2)</td>
<td>0.6</td>
</tr>
<tr>
<td>Multi-family buildings</td>
<td>1.2 (0.4)</td>
<td>3.5 (1.2, 0.5, 0.4)</td>
<td>1.8</td>
</tr>
<tr>
<td>Non-residential buildings</td>
<td>3.1, 1.2 (0.5, 0.4) or 0.5, 0.3 (0.4, 0.2)</td>
<td>Depending on building type</td>
<td></td>
</tr>
</tbody>
</table>

The reference test for this criterion is the in-situ air pressure test. The pressure value must be lower than 5 Pascals. In the case of multi-residential buildings, the pressure value must be lower than 3 Pascals. For non-residential buildings, the pressure value must be lower than 1.8 Pascals.

The French regulation includes a significant body of literature showing the respective impacts of air leaks in building envelopes. As well as the benefits of good building tightness with appropriate ventilation, whether natural or mechanical, this explains why the French regulation has been in place since 1978 and applies in all buildings over 300m², with a minimum level of 0.6 m³ of air per square meter per hour at 50 Pascals (1.2 for multi-family buildings).

Objectives and problems addressed

The French regulation was initially developed considering the difficulties building professionals had to achieve good tightness and the hope that cost savings due to advances in non-systematic testing would encourage building professionals to engage in a 20 approach for building tightness. The major problems addressed with this approach include:

- Poor training of designers and installers
- Incomplete and incorrect treatment of envelope leakage sites
- Absence of wall seals on site
- Cost for systematic tightness testing

This scheme is applicable to all new buildings. Because of its limited market potential for non-residential buildings, it will be restricted to residential buildings as of July 2011. The new regulation is based on quality management (2013).

Approach to overcome identified problems

Regulatory background

The 2012 French regulation introduced a reference requirement for the building tightness of all residential buildings, including mandatory justification of the tightness levels contained in Table 1. For non-residential buildings, default values apply depending on the building type, if it is lower than the default value is used in the calculation. If there is no justification, the default value applies as well. In all cases where justification is necessary, the building tightness level must be justified either:

- With an air tightness test for a certified bundle of each building or
- With a certified quality management approach that allows non-systematic testing.
Why QUALICHeCK?

What kind of activities in QUALICHeCK?

First deliverables of QUALICHeCK

What is in preparation?
Procedures to obtain and prove compliant data

There should be clear procedures what must be done

Robust legal procedures in case of non-compliance

There should be clear legal procedures how to decide on non-compliance and related actions

Handling of non-compliance in practice

There should be an effective control and sanctions if non-compliance
Procedures to obtain and prove quality of the works

There should be clear procedures what must be done

Robust legal procedures in case of non-compliance

There should be clear legal procedures how to decide on non-compliance and related actions

Handling of non-compliance in practice

There should be an effective control and sanctions if non-compliance

Source book “About the quality of the works...”
Timeline for both QUALICHeCK sourcebooks...

DRAFT SOURCE BOOK
Analysis of the reasons for good / poor EPC compliance
AND of the reasons for success/problems

Documented set of ‘best practices’ for easy access to compliant EPC input data AND for better compliance and effective penalties
2nd QUALICHeCK conference Brussels
September 4 2015

Themes: focus on
- “2nd recast EPBD” and
- “better compliance/quality of the works”
International QUALICHeCK workshops

Transmission characteristics
- LUND - 16-17 March 2015

Ventilation and airtightness
- ATHENS – 9-10 March 2016

Sustainable summer comfort techniques
- LYON – ~January 2017

Renewables in multi-energy systems
- TALLINN – October 2016
2nd QUALICHeCK workshop ‘Sustainable summer comfort’
March 9-10 2016 Athen (Greece)

2-days workshop

Technologies to be covered:
  • Solar control
  • Thermal mass
  • Ventilative cooling
  • Cool roofs
  • Daylighting
1. **AUSTRIA**: Introducing an EPC after completion of the building works: reasons behind and preliminary lessons learnt in the Salzburg region
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3. **ESTONIA**: Compliance to summer thermal comfort requirements – Control of overheating in new apartment buildings
   Jarek Kurnitski - Tallinn University of Technology
Introducing an EPC after completion of the building works:

Reasons behind and preliminary lessons learnt from the QUALICHeCK case study carried out in the Salzburg region of Austria

Susanne Geissler
ÖGNB – Österreichische Gesellschaft für Nachhaltiges Bauen
(Austrian Sustainable Building Council)
geissler@oegnb.net

27th April 2015
Content of presentation

• Background information on Austrian framework conditions
• Background, objectives and content of the Austrian QUALICHeCK case study carried out in Salzburg region
• Summary of first results
• Outlook
Austria is one of nine EU member states involved in QUALICHéCK and carries out a new study on EPC quality.
Background information on framework conditions in Austria

Austrian regions – Austrian provinces
Case study region: province Salzburg
9 provinces – 9 building codes – 1 guideline

- All provinces are represented in OIB
- OIB develops and issues OIB Guideline 6 and Technical Guideline to comply with EPBD
- Provinces provide input to guideline development and integrate OIB Guideline 6 into their building legislation (fully or with amendments)

OIB Guideline 6 refers to Austrian Standards; thus Austrian Standards become part of the legislation automatically if OIB Guideline 6 is integrated into building legislation.
OIB Guideline 6 (OIB-RL6 2011)

- OIB-RL6 2011 (OIB Guideline 6 on Heat Protection and Energy Saving) and the associated Calculation Guideline have been issued by OIB (Österreichisches Institut für Bautechnik – Austrian Institute of Construction Engineering [www.oib.or.at]).
- This organisation is an association (Non Profit Organisation), and all Austrian provinces are members. It is the objective to harmonize the legislation which is the responsibility of the Austrian provinces, such as the building code. Therefore, all provinces have participated in developing the agreed OIB RL-6 which is the harmonized basis for the building codes at the provinces’ level.
- **The building laws of the Austrian provinces reference OIB-RL6 2011**
- **OIB-RL6 references Austrian Standards, thus becoming part of the legislation.**
  OIB-RL 6 has been revised: first version 2007, revised version 2011, and the next revision is being prepared for publication.
Austrian standards referenced in OIB-RL6 2011 and associated calculation guideline

- ÖNORM B 8110-5: 2011-03-01 Thermal insulation in building construction — Part 5: Model of climate and user profiles
- ÖNORM B 8110-6: 2010-01-01 Thermal insulation in building construction — Part 6: Principles and verification methods — Heating demand and cooling demand
  - Supplement 1: Single family house — Examples for validation of the heating demand
  - Supplement 2: Multi-family house — Examples for validation of the heating demand
  - Supplement 3: Non-residential building — Example for validation of the heating and cooling demand
  - Supplement 4: Single family house and multi-family house — Examples for validation of the calculation of the heating demand of a lowest-energy building, which can be heated by air (passive house)
Austrian standards referenced in OIB-RL6 2011 and associated calculation guideline

- ÖNORM H 5056: 2011-03-01 Energy performance of buildings — Energy use for heating systems
  - Supplement 1: Single-family house — Examples for validation of the calculation of the energy demand
  - Supplement 2: Multi-family house — Examples for validation of the calculation of the energy demand
  - Supplement 3: Non-residential building — Examples for validation of the calculation of the energy demand
  - Supplement 4: Single-family house — Examples for validation using heat pumps

- ÖNORM H 5057: 2011-03-01 Energy performance of buildings — Energy use for ventilation systems of residential and non-residential buildings


- ÖNORM H 5059: 2010-01-01 Energy performance of buildings — Energy use for lighting (National amendment referring to ÖNORM EN 15193)

- ÖNORM B 1800: 2013-08-01 Determination of areas and volumes of buildings and related outdoor areas

Input data: default values used by EPC calculation software
### Point of departure: system boundaries and elements of quality assurance scheme (exemplary)

<table>
<thead>
<tr>
<th>Phases of building life cycle</th>
<th>Design phase</th>
<th>Design EPC (preliminary EPC)</th>
<th>Completion phase</th>
<th>Completion EPC (final EPC reflecting design changes)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Level of quality assurance</strong></td>
<td>Quality of input data</td>
<td>BE, PT: Qualified EPC experts</td>
<td>Quality of the works</td>
<td>UK, DK, IE, etc.: Third party control (certified measurements)</td>
</tr>
<tr>
<td><strong>Method of quality assurance</strong></td>
<td>SE: Evaluation of default values and revision</td>
<td>Individual certification</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>UK: Certified product data</td>
<td>Qualification → BUILD UP Skills</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Legal requirement</strong></td>
<td>Produce EPC and show that energy performance minimum requirement is met</td>
<td></td>
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</tr>
<tr>
<td><strong>Compliance / Control</strong></td>
<td>Individual checks of EPCs</td>
<td></td>
<td>Automatic checks during upload in EPC-database</td>
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<tr>
<td></td>
<td>Automatic checks in calculation program and during upload in EPC-database</td>
<td></td>
<td>Commissioning protocol and verification documents</td>
<td></td>
</tr>
<tr>
<td><strong>Enforcement / Sanction</strong></td>
<td>Building permit</td>
<td></td>
<td>Permit of use</td>
<td></td>
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<tr>
<td></td>
<td>Financial incentives</td>
<td></td>
<td>Financial incentives</td>
<td></td>
</tr>
</tbody>
</table>
Two types of EPC in Salzburg region: design EPC (preliminary) and completion EPC (final)

Preliminary EPC
(Design EPC; limited validity, e.g. 2 years)
Based on design documents

Final EPC (Completion EPC, validity according to EPBD)
Based on final building documents and random site visits

Reasons for checking EPC quality and updating preliminary EPC:

Due to lack of quality of input data: EPC could be C or B
Building design/EPC calculation

Deviation from plan (design changes): Different products with worse energy efficiency performance than planned
Material/component procurement

Due to lack of quality of the works: Mistakes during construction (leakages, wrong installations, etc.)
Building construction

New buildings and major renovations

27.04.15
Objectives and scope of Austrian QUALICHeCK study

**Objectives**

- To analyse the range of deviation of EPC energy performance indicators depending on the quality of input data and the type of EPC (design EPC and final EPC, in Salzburg region required for financial incentive)
- To analyse the cause of deviation and develop recommendations how to improve
- To develop recommendations for the administration of Salzburg region how this can be linked with compliance and enforcement, e.g. by improving automatic checks in the EPC-database combined with random building checks on-site

**Scope**

- 26 multi-unit new residential buildings in rural and urban areas in the province Salzburg, well documented with EPC issued after 2009 (design EPC and completion EPC), approximately 30,000 m²
- Focus of analysis on 4 scientific / technical areas:
  - Transmission characteristics
  - Ventilation and airtightness
  - Sustainable summer comfort technologies
  - Renewables in multi-energy systems

27.04.15
Salzburg region case study: procedure

• **Data collection**: design EPC, completion EPC, specific building information, e.g. site foreman's plan

• **Recalculation of completion EPC** based on collected building information: plans / blueprints, site foreman's plan with EPC-calculation tool GEQ

• **Analysis**:
  – Comparison of design EPC with completion EPC
  – Comparison of completion EPC with recalculated completion EPC
  – Site visits of selected buildings, inspection and check of crucial parameters

• **Detailed investigation of specific questions and expert interviews** on EPCs and building certification in Austria

• **Development of recommendations** for the administration of Salzburg region how to improve quality and compliance

**Focus on special fields**: geometrical data, materials, solar thermal systems, photovoltaic systems, shading, heat pumps, thermal bridges
Project team QUALICHeCK case study Austria

• ÖGNB (QUALICHeCK project partner)
  – Susanne Geissler and Peter Wallisch

• UAS Technikum Vienna (University of Applied Sciences, subcontract for study)
  – Lukas Maul, Marc Wohlschak (Lecturers/scientists)
  – Students attending the programme „Urban Renewable Energy Technologies“:
    Fabio Denner, Christian Handschuh, Simon Hinterseer, Marina Kreuzinger,
    Jan Schindl, David Stuckey

• Region Salzburg (implementing the EPBD and running the regional EPC-database)
  – Georg Thor and colleagues
  – Franz Mair

• Salzburg Wohnbau (building owner)
  – Bernhard Kaiser

• GEQ - Zehentmayer Software (EPC calculation software company)
  – Josef Zehentmayer
Summary of recalculation of HWB (Heizwärmebedarf – heating energy demand - useful energy – indicator for energy performance of building envelope)

Grey: Original completion EPC
Orange: Recalculated completion EPC
Line: deviation in %
Red: Detailed explanations on the following pages

Building number

27.04.15
Explanations: reasons for deviation

Buildings 3, 4, 5 (recalculated indicator is much worse than original):
• Geometry of windows not correct
• Part of conditioned areas not taken into account
• Only one type of wall construction instead of different types (U-values)
• Deviations in building volume

Building 10 (recalculated indicator is a little bit better than original):
Mistakes balance each other:
• Part of conditioned area not considered (cellar)
• Indoor wall defined as outdoor wall, therefore 27% more outdoor wall (U-values)

Building 14 (recalculated indicator is a little bit worse than original):
• Differences in window area
• No zoning between residential part and commercial part of building
Detailed analysis of thermal bridges, shading, and solar thermal systems

Example: Detailed analysis of thermal bridges in four buildings

- Procedure:
  - Calculation with default values according to standard
  - Detailed calculation based on reference values from ÖNORM EN ISO 14683:2007
  - Finite elements simulation with PSITherm

- Results: Detailed calculation results in better indicator: HWB is improved (8 - 38%)

Example: Detailed analysis of thermal solar systems

Calculation of solar-assisted 2-pipe heating systems with different methods: depending on calculation method and required input data, contribution of solar energy differs widely

Project SolCal to further develop calculation method
Preliminary results of analysis

Analysis regarding input data:

- Conditioned parts of the building (cellar, roof situations, staircase, etc.) not included in the calculation; missing / unclear definition regarding input data
- Simplifications regarding wall constructions (missing elements) result in deviations regarding U-values
- Standard temperature is 20°C; not appropriate
- Perimeter length: different interpretation in the EPC calculation software; unclear definition
- Windows: the input data deviates from the real installation
- Big difference: results from detailed calculation of thermal bridges and shading compared with results from calculation based on default data
- Heating systems: too simple and based on default data; 2 pipe heating systems cannot be dealt with in the EPC calculation software directly due to the respective standard the software refers to; complicated procedure is necessary which needs training

→ Definitions must be improved to be unambiguous, in order to reduce range of interpretation; default data should be revised; a solution how to deal with heating systems is needed

Analysis regarding EPC update:

There are many design changes and therefore the design EPC must be updated (final EPC); however, it must be ensured, that the EPC is actually updated based on the final design documents
Outlook

- Site visits of selected buildings and check of crucial parameters by end of April 2015
- Detailed analysis of specific aspects by September 2015
- Recommendations for the administration how to ensure better quality and compliance, including recommendations for enforcement, by September 2015
Compliance of heat transmission coefficients reported in EPCs in new residential buildings in Cyprus

Matthaios Santamouris
Marina Kyprianou Dracou
April 2015
Framework conditions in Cyprus

Summer comfort is extremely essential in Cyprus as the high temperatures experienced during the summer sometimes reach at around 40 - 43 °C.

Moreover, the diurnal temperature variations that occur from the highs and lows during the day make the need for thermal control of the building necessary.
National requirements for U-values (KPD 432/2013 & KPD 433/2013)

2007: First maximum U-values requirements
RESULT = Insulation of a building mandatory.

2010: Important revision: compliance with max. average U-value
RESULT = Compliance with maximum average U-value,
Min. accepted energy efficiency category B in the EPC

RESULT: New specified maximum U-values:
• $U_{\text{max}}$ external walls/ columns/ beams = 0.72 W/m$^2$K
• $U_{\text{max}}$ external exposed floors/ roofs = 0.63 W/m$^2$K
• $U_{\text{max}}$ floors above spaces without air-conditioning = 2.00 W/m$^2$K
• $U_{\text{max}}$ external openings=3.23 W/m$^2$K
• $U_{\text{max}}$ average=1.30 W/m$^2$K
Non compliance with input data = wrong reporting

Reported U-values may vary from actual U-values due to:

• During EPC calculation applying same U-values for construction elements with different U-values
• During construction use of different products with worse U-values than the ones specified during the EPC calculation
• Mistakes or omissions of building elements during construction leading to a different U-value than the one stated
• Missing / unclear definition regarding input data (eg windows, doors)
• Control framework regarding the calculations (submission to authorities for building permit) but no control framework on site

RESULT

Reported performance better than the Actual performance
Scope & Timing of Cyprus new data collection study

Scope of this QUALICHeCK study:
• About 25-30 Residential buildings (now results for 15)
• Newly built buildings (need for compliance with U-values)
• Well documented buildings
• Location: different areas of Cyprus

Targets for timing:
• Collection of relevant information and on site visits by 15.07.2015
• Analysis by 31.07.2015
• Report will be available by 31.07.2015
Methodology

Information collected and analyses conducted:

• Collection of design documentation
• Collection of as stated in EPC U-Values for the shell and frames and average U-value
• Collection of photographs of examined buildings (construction phase) and communication with architect/tenants to check actual construction of elements and calculate their U-values
• Site visits and inspections to check actual construction
• Collection of documents from suppliers regarding U-Values of specific elements
Objectives of Cyprus new data collection study

Objectives

Study aims to provide answers to the questions:

- How well new requirements regarding maximum U-values and maximum average U-Value have been followed both in design and construction?

- What percentage of the residential buildings from those examined actually comply with those regulations?

- In case of non compliance of maximum U-values and maximum average U-value with the requirements in actual construction, are there specific elements that do not comply?

- In case of non compliance of maximum U-values and maximum average U-value with the requirements in actual construction, is there a pattern of causes for this?
Principles of calculation of U-values

The U value is the inverse sum of the resistances of each building material and surface resistances to the outer and inner faces of the material build up of the element.

Why is a U value the reciprocal of the sum of all the resistances instead of the sum of all conductances? Because - the interaction of the building element to outside environments is measured in terms of surface resistance, so for consistency, the behaviour of the built elements are also expressed in terms of resistances.

\[
U = \frac{1}{R_{SI} + R_{SC} + R_A + R_1 + R_2 + R_4 + R_5}
\]

- \( R_{SI} \): thermal resistance of internal surface
- \( R_{SO} \): thermal resistance of outside surface
- \( R_A \): thermal resistance of unvented air cavities
- \( R_1 \) etc.: thermal resistances of building components

Units - \( W/m^2K \)
### Documentation per case

#### Description of the Construction

<table>
<thead>
<tr>
<th>A/A</th>
<th>Description of the Construction</th>
<th>U-value of the Construction (U [W/m²K])</th>
<th>Area of the Construction (A [m²])</th>
<th>U x A of the Construction (W/k)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Walls</td>
<td>0.46</td>
<td>168.70</td>
<td>77.60</td>
</tr>
<tr>
<td>2</td>
<td>Columns/Beams/Shear Walls</td>
<td>0.643</td>
<td>129.98</td>
<td>83.58</td>
</tr>
<tr>
<td>3</td>
<td>Windows (glass)</td>
<td>1.1</td>
<td>59.70</td>
<td>60.5</td>
</tr>
<tr>
<td>4</td>
<td>Doors (wooden)</td>
<td>2.29</td>
<td>4.45</td>
<td>10.19</td>
</tr>
<tr>
<td>5</td>
<td>Doors (aluminium)</td>
<td>3.25</td>
<td>1.98</td>
<td>6.44</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>364.81</strong></td>
<td><strong>238.31</strong></td>
<td><strong>228.31</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Average U-value Um</strong></td>
<td></td>
<td></td>
<td><strong>0.653</strong></td>
</tr>
</tbody>
</table>

#### Notes

The decree requirement for U ≤ 1.30 is fulfilled.
Statements made by qualified building energy assessors (QE) who declined to provide any information regarding either all or some of their EPCs

STATEMENTS MADE BY QE

1. “I know that some of the buildings have not been constructed as specified, and the reason is that there was not a supervising engineer on site during construction.”

2. “Alterations were made during construction but some of the EPCs were not revised due to time/budget reasons.”

3. “When information was asked by the engineers of the project regarding the building elements, they said to proceed with the same calculations regarding those elements as the ones usually made in other projects.”
Deviations between calculated in EPC U-values and in actual U-values

CAUSES

- No reliable input database
- External element not taken into account
- In EPC application of same U-values for construction...
- New calculation method for U-value of ground floor
- Decree requirement not fulfilled
- Calculation mistakes
- Changes during construction with no revision of EPC
- Material omitted in calculations
- No problem found

NUMBER OF PROJECTS OUT OF 15 EXAMINED
Objectives of Cyprus new data collection study

<table>
<thead>
<tr>
<th>The questions:</th>
<th>Preliminary answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>How well new requirements regarding maximum U-values and maximum average U-Value have been followed both in design and construction?</td>
<td>Only in specific construction elements, in 7 out of 15 examined residential buildings, they have not been integrated</td>
</tr>
<tr>
<td>What percentage of the residential buildings from those examined comply with those regulations?</td>
<td>63% of the examined building fully comply</td>
</tr>
<tr>
<td>In case of non compliance of maximum U-values and maximum average U-value with the requirements in actual construction, are there specific elements that do not comply?</td>
<td>Exposed floor slabs, external openings</td>
</tr>
<tr>
<td>In case of non compliance of maximum U-values and maximum average U-value with the requirements in actual construction, is there a pattern of causes for this?</td>
<td>Lack of knowledge with result construction elements not taken into account, changes during construction, application of same U-values for constr. elements with different U-values for simplification</td>
</tr>
</tbody>
</table>
Conclusions

Requested information that was not provided by QE

Main Reason
Reported in EPC U-values vary from actual U-values

Causes
• Lack of a supervising engineer on site
• Alterations made during construction without the relevant revision of the EPC due to time/budget reasons
• Engineer giving wrong and/or deficient information to QE due to lack of knowledge or appreciation of the value of EPC

Even in the 15 examined residential buildings where information was provided by QE, which are the best cases, there are deviations between reported and actual U-values, which sometimes are not so important, e.g. during calculation a construction element like the coat cement being omitted, but which sometimes are very important, e.g. no reliable input data, construction element like a whole exposed slab or single glazed windows being omitted, and changes during construction without the relevant EPC revision.
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Compliance to Summer Thermal Comfort in Apartment Buildings

27.04.2015

Jarek Kurnitski
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Adjunct Professor, Aalto University
jarek.kurnitski@ttu.ee
Overview of the study

- **Objectives:**
  - Determine compliance with summer thermal comfort in new apartment buildings according to Estonian regulation no 68, based on temperature simulations;
  - Assess the overheating problem with field measurements.

- **Methods:**
  - Indoor air temperature simulations with IDA-ICE software
  - Compliance assessment of studied apartment buildings with requirement ≤150°C h
  - Indoor air temperature measurements in dwellings
Introduction – the requirement

Estonian regulation no 68 „Minimum requirements for energy efficiency“

Requirements for summertime indoor temperature

In residential buildings, the requirement for summertime indoor temperature is regarded as complied with, if during the period from 1. June to 31. August, indoor temperature does not exceed the limit temperature of +27°C by more than 150 degree hours (°Ch).

- In residential buildings window airing is taken into account.
- Compliance is proved by performing a simulation calculation based on standard room types.
- Passive cooling solutions should be preferred over active cooling systems.

<table>
<thead>
<tr>
<th>Building category</th>
<th>Outdoor air flow rate l/(s m²)</th>
<th>Heating set-point (°C)</th>
<th>Cooling set-point (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multi-apartment buildings</td>
<td>0.5</td>
<td>21</td>
<td>27</td>
</tr>
</tbody>
</table>

Methods of proving compliance

- The summertime indoor temperature is checked in types of room in which the heat gain is the highest.
- In residential buildings, the summertime indoor temperature calculation is performed with respect to at least one living room and one bedroom.
Introduction – calculation procedure

- Temperature simulation is one part of EPC calculation

- Specific form of summertime temperatures to be filled – together with input and output data forms of EPC, which all are part of building permit application

- There are requirements for simulation tools set, but nothing special for developed tools, i.e. all validated commercial simulation tools can be used

- Calculation rules are set as well, for instance for buoyancy driven window airing:
  "In the case of residential buildings, only the opening of windows to the airing position and the air change driven by the difference between outdoor and indoor temperature are taken into account (the windows are closed when the temperature falls to the heating set-point).

- There are no sanctions (yet) in Estonian practice. If the requirement is not met, the problem needs to be fixed

- Regarding overheating, occupants have made reclamation to developer, who has installed shading or cooling to fix the problem
Introduction – standard use

Estonian regulation no 63 „Methodology for calculating the energy performance of buildings“

- STANDARD USE OF THE BUILDING
  - Occupied hours and heat gain

„The verification of compliance of residential buildings with the summertime indoor temperature requirement is performed using the detailed energy calculation usage profiles of buildings.“

„The total internal heat gain from one occupant is taken to amount to 125 W (sensible heat 85 W)

<table>
<thead>
<tr>
<th>Building’s purpose of use</th>
<th>Lighting W/m²</th>
<th>Appliances W/m²</th>
<th>Occupants W/m²</th>
<th>Occupants m²/person</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multi-apartment building</td>
<td>8</td>
<td>3</td>
<td>3</td>
<td>28.3</td>
</tr>
</tbody>
</table>
Introduction – TRY

- Outdoor climate

“Regardless of the building’s location, the energy calculation and the verification of compliance with the summertime indoor temperature requirement are performed on the basis of the data of the Estonian Test Reference Year (TRY). The test reference year represents the typical outdoor climate of three decades (1970–2000)....”

- TRY contains hourly-average data of outdoor temperature, relative humidity, wind speeds and solar radiation.
Methods

- Indoor climate and energy simulation tool IDA-ICE
- Simulation of selected dwellings with highest risk of overheating
Methods

- 25 apartment buildings
  - Randomly selected newly built modern apartment buildings
  - 158 dwellings simulated
  - 16 dwellings measured, period 1. June to 31. August 2014

- Description of the studied buildings
  - Most of the buildings were designed with precast or monolithic concrete structures with more than four floors above ground
  - The thermal transmittances of the buildings envelope were between 0.15 and 0.25 W/(m²•K) for external walls, 0.09 ÷ 0.17 for roofs and 0.60 ÷ 1.65 W/(m²•K) for windows.
  - The SHGC-s of the windows for different buildings varied from 0.40 to 0.71
## Methods

- **Window modelling**

<table>
<thead>
<tr>
<th>Tōōp</th>
<th>KOGUS</th>
<th>AVA MYYDUD</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>4</td>
<td><img src="window1.png" alt="Window 1 Diagram" /></td>
</tr>
<tr>
<td>A2</td>
<td>7</td>
<td><img src="window2.png" alt="Window 2 Diagram" /></td>
</tr>
<tr>
<td>A3</td>
<td>1</td>
<td><img src="window3.png" alt="Window 3 Diagram" /></td>
</tr>
<tr>
<td>A4</td>
<td>6</td>
<td><img src="window4.png" alt="Window 4 Diagram" /></td>
</tr>
<tr>
<td>A5</td>
<td>2</td>
<td><img src="window5.png" alt="Window 5 Diagram" /></td>
</tr>
<tr>
<td>A6</td>
<td>4</td>
<td><img src="window6.png" alt="Window 6 Diagram" /></td>
</tr>
</tbody>
</table>

### Detailed window construction

- **Name**: [Detailed window construction](detailed_window_construction.png)
- **Layers**:
  - **Outside (ambient or adjacent zone)**
    - Sept: 16.0 mm Air (10%) / Argon (90%) Mix (WIN7)
    - Panel: PLANILUX 4mm.SGG (WIN7)
    - Sept: 16.0 mm Air (10%) / Argon (90%) Mix (WIN7)
    - Panel: PLT ULTRA N 4mm.SGG (WIN7)

- **Glazing properties at reference conditions**
  - Solar heat gain coefficient: 0.55
  - Solar transmittance: 0.413
  - Visible transmittance: 0.719
  - Glazing U-value: 0.894 W/(m²K)
Methods

- Window modelling

Openable window airing area ~10%

Non-openable
Method

- **Temperature excess in degree-hours (°Ch)**

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Temp, °C</th>
<th>Excess, °Ch</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. July</td>
<td>10:00</td>
<td>26.4</td>
<td>0.0</td>
</tr>
<tr>
<td>5. July</td>
<td>11:00</td>
<td>26.8</td>
<td>0.0</td>
</tr>
<tr>
<td>5. July</td>
<td>12:00</td>
<td>27.3</td>
<td>0.3</td>
</tr>
<tr>
<td>5. July</td>
<td>13:00</td>
<td>27.4</td>
<td>0.4</td>
</tr>
<tr>
<td>5. July</td>
<td>14:00</td>
<td>27.5</td>
<td>0.5</td>
</tr>
<tr>
<td>5. July</td>
<td>15:00</td>
<td>27.8</td>
<td>0.8</td>
</tr>
<tr>
<td>5. July</td>
<td>16:00</td>
<td>28.6</td>
<td>1.6</td>
</tr>
<tr>
<td>5. July</td>
<td>17:00</td>
<td>27.5</td>
<td>0.5</td>
</tr>
<tr>
<td>5. July</td>
<td>18:00</td>
<td>27.0</td>
<td>0.0</td>
</tr>
<tr>
<td>5. July</td>
<td>19:00</td>
<td>26.8</td>
<td>0.0</td>
</tr>
</tbody>
</table>

**Requirement:** $685.0 \leq 150°Ch$
Summer of TRY vs 2014

Outdoor temperature (°C)

Time (%)

Date (dd.mm)

Temperature excess 157°C

Temperature excess 0.5°C

Cooling set point 27°C

2014

TRY

Temperature excess 157°C

Temperature excess 0.5°C

Cooling set point 27°C

2014

TRY

Outdoor temperature (°C)

Date (dd.mm)
Measurements

- Temperature measurements in dwellings
  - Logger saving interval: 1h, hourly-average
Measurement results

Indoor temperature (°C)

Date (dd.mm.yy)

- Single dwelling
- Average

27°C
Measurement results

![Bar chart showing degree-hours over +27°C (Ch) for different dwellings. The chart displays the following values: 35, 209, 305, 328, 354, 385, 389, 425, 526, 644, 657, 738, 777, 808, 901, 925, 1053, 2110. The y-axis represents degree-hours and the x-axis represents different dwellings.]
Simulation results

- Overall building results:
  17 out of 25 (68%) did not comply with the regulation
Conclusions

- Measured and simulated results cannot be directly compared because of different weather data
- Compliance assessment needs to be done by temperature simulations
- Measurement results confirm that high temperatures over +27 °C did exist also in reality in majority of buildings for a remarkable portion of the measuring period, indicating high risk of overheating
- Many occupants had complaints, but this data was not systematically collected
- **17 out of 25 (68%) of the studied apartment buildings did not comply** with the summer thermal comfort requirements being a main conclusion of this study
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