QUALICHeCK's approach to quality and compliance

Peter Wouters

Manager INIVE EEIG – Coordinator QUALICHeCK

Co-funded by the Intelligent Energy Europe Programme of the European Union

Structure of the presentation

- Why QUALICHeCK?
- What kind of activities in QUALICHeCK?
- First deliverables of QUALICHeCK
- What is in preparation?

QUALICHeCK
Towards better quality and compliance

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

QUALICHeCK
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You expect a reliable label

… **and you expect a good quality**

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… **and you expect a good quality**

QUALICHeCK
Towards better quality and compliance

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)

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

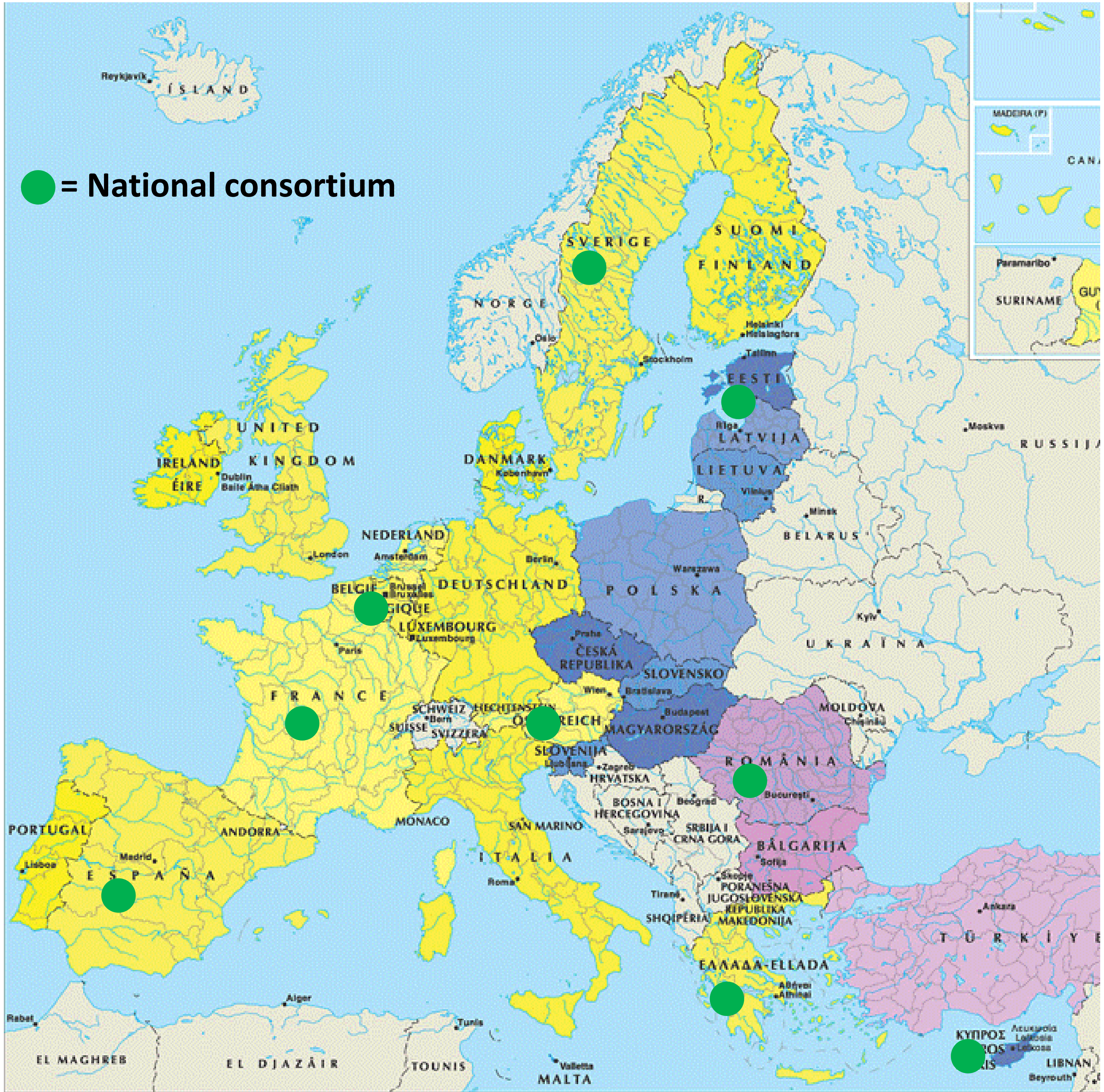
Solutions

QUALICHeCK
Towards better quality and compliance

4 focus areas in QUALICHeCK

- Transmission characteristics
- Ventilation and airtightness
- Sustainable summer comfort techniques
- Renewables in multi-energy systems

QUALICHeCK
Towards better quality and compliance



QUALICheck
Towards better quality and compliance

Structure of the presentation

- Why QUALICHeCK?
- What kind of activities in QUALICHeCK?
- **First deliverables of QUALICHeCK**
- What is in preparation?

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www.qualicheck-platform.eu

Quick Access

- Introduction
- Situation on the Ground
- Compliant and Easily Accessible EPC Input Data
- Quality of the Works
- Compliance and Effective Penalties

Newsletter

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

	09:00 – 10:20 London, UK
Monday 27 April 2015	**10:00 – 11:20 Brussels, BE**
	11:00 – 12:20 Athens, GR

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 2015/01/31 by Alexander Deliyannis

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 Papaglastra

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

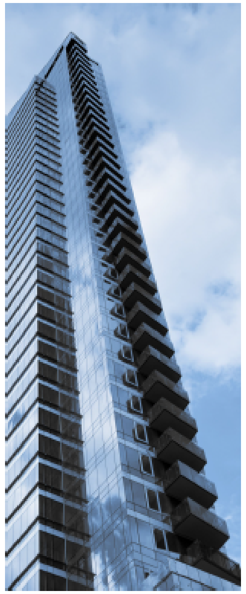
1st QUALICHeCK Conference

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 →

QUALICHeCK NEWS

Towards better quality and compliance issue #1 : 2014/10



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 from now, all new buildings should meet the nearly zero-energy (NZEB) targets and, at the same time, building renovation represents a major challenge. Further steps have to be taken on the longer term and in particular 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 imposing stimulating requirements is important, the claimed energy performance can be different from the reality. Moreover, it is important that works related to energy efficiency and renewables are of good quality, in order to ensure that the expected energy performances are achieved and that the works will be sustainable over a long lifetime. In the opposite case, societal and political support might be lost.

These 2 concerns are in the centre of the QUALICHeCK project, which started in March 2014 and which will run until February 2017. The key objectives 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 declare";

> 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 QUALICHeCK. This newsletter is one of such activities, as is the website. In this issue, you find information on various QUALICHeCK related events and outcomes.

I wish you a pleasant reading.

Peter Wouters

QUALICHeCK Coordinator

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1st QUALICHeCK Conference

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 event represented a major physical opportunity to expand dialogue on compliance and quality issues for energy efficiency in buildings, with the initial QUALICHeCK project findings used as one of the starting points for discussion. The Conference covered among others:

• The overall scene regarding compliance and quality of works for energy efficient buildings.

• Lessons learned from major EU initiatives regarding reliability of Energy Performance Certificate input data and quality of works.

• Experience from industry representatives regarding reliable energy performance data and challenges in respect to quality of works.

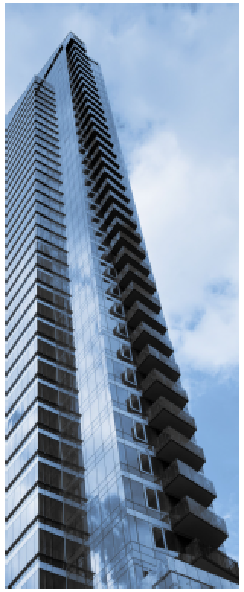
• The QUALICHeCK action and networking perspectives.

More specifically, the following topics were presented and discussed:

Setting the framework: • *Financing energy efficiency - The challenges* (Erik Van Acker, KBC) • *EU energy policy - Status and challenges* (Linn Johnsen, DG ENERGY) • *EU Directives and challenges for the Member*

QUALICHeCK NEWS

Towards better quality and compliance issue #2 : 2015/02



Welcome

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

A major QUALICHeCK event is the upcoming 1st workshop in Lund, on 16 and 17 March 2015, focusing on issues related to ventilation and airtightness. The 2nd workshop is scheduled for March 2016 in Athens with as focus sustainable summer comfort technologies. Also good to know that the 2nd QUALICHeCK conference in Brussels will be on 4 September 2015.

In this newsletter, you find a link to the first 2 reports produced by the consortium members on compliance of EPC input data and quality of the works. The present reports already contain information about existing studies in EU countries. A major outcome in 2015 will be the findings of the new data collection studies being carried out at this moment by the QUALICHeCK team in 9 focus countries. You can already have a sneak preview at the first results of the Estonian study on compliance with summer thermal comfort requirements in apartment buildings.

In order to achieve more compliance in EPC input data and/or quality of the works, action is required at country level. Further on, you find information about the national stakeholders concertation in Austria. In 2016, a series of similar events is foreseen in other participating countries.

Last but not least, QUALICHeCK will produce a series of factsheets and organise a series of webinars. The first factsheet presented in this newsletter is about a French quality management approach to improve building airtightness. The first webinar is scheduled on 27 April 2015. More factsheets and webinars are planned for 2015.

If you would like to be kept informed, please visit *www.qualicheck-platform.eu*.

Enjoy you reading!

Peter Wouters

QUALICHeCK Coordinator

Contents

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BauZ!

QUALICHeCK workshop as part of the BauZ! Conference 2015

by Susanne Geissler, ÖGNB

The Bauz! Conference (www.bauz.at) is an annual event addressing the Austrian construction industry, authorities and administration, 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 QUALICHeCK 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 FH Technikum (Lukas Maul, Marc Wohlschak and a group of students, *www.technikum-wien.at/fh/institute/erneuerbare_energie*), and to explain the view of the real estate sector (Martina Hoffmann, FH Wien der WKW *www.fh-wien.ac.at/immobilienwirtschaft/master-studium*).

The presentations prepared the ground for discussions with about 30 participants, resulting in the following conclusions:

(1) It is necessary to have a two stages procedure, meaning that the design Energy Peformance Certificate (EPC) needed for the building permit must be updated after completion of the building, because design changes and revision of decisions occur which need to be documented.

(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 of buildings and building units being rented and the ones being sold. The residential renting market is regulated in detail, making it extremely difficult to assess the impact of energy efficiency on prices. The observation of the selling market shows that real estate agents present the

Status of compliance
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Towards better quality and compliance

QUALICHeCK

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

"Status on the Ground"

Overview of existi... ...formance ...liance

To be published very soon

..., Jarek Kurnitski, Targo Kalamees
...sity of Technology, Estonia)

With contributions from:

François Durier (CETIAT, France), Theoni Karlessi, Chrysanthi Efthymiou (NKUA, Greece), Susanne Geissler (OEGNB, Austria), Clarisse Mees, Samuel Caillou, Xavier Loncour (BBRI, Belgium), Arnold Janssens (UGent, Belgium), José L. Molina (USE, Spain), Horia Petran (URBAN-INCERC, Romania), Marina Kyprianou Dracou (CYI, Cyprus), Pär Johansson, Paula Wahlgren, Jan-Olof Dahlenbäck (Chalmers, Sweden)

16th April 2015

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3.1.3. Swedish building stock audit - BETSI			X
3.1.4. Thermal bridges` influence on the calculated energy use	X		
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Input data			
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3.2.2. Ventilation performance in new apartment buildings	X		X
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3.2.4. Ventilation airflows in retrofitted apartment buildings		X	X
3.2.5. Ventilation airflows in new apartment buildings		X	
3.2.6. Efficiency of night ventilation technique		X	
3.2.7. Measurements of particulates PM10, PM2.5 and PM1 in Greece		X	
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3.3.4. Quality of ventilation systems		X	
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3.5.3. Quality of solar PV installations		X	
3.5.4. Quality of domestic wood boiler installations		X	
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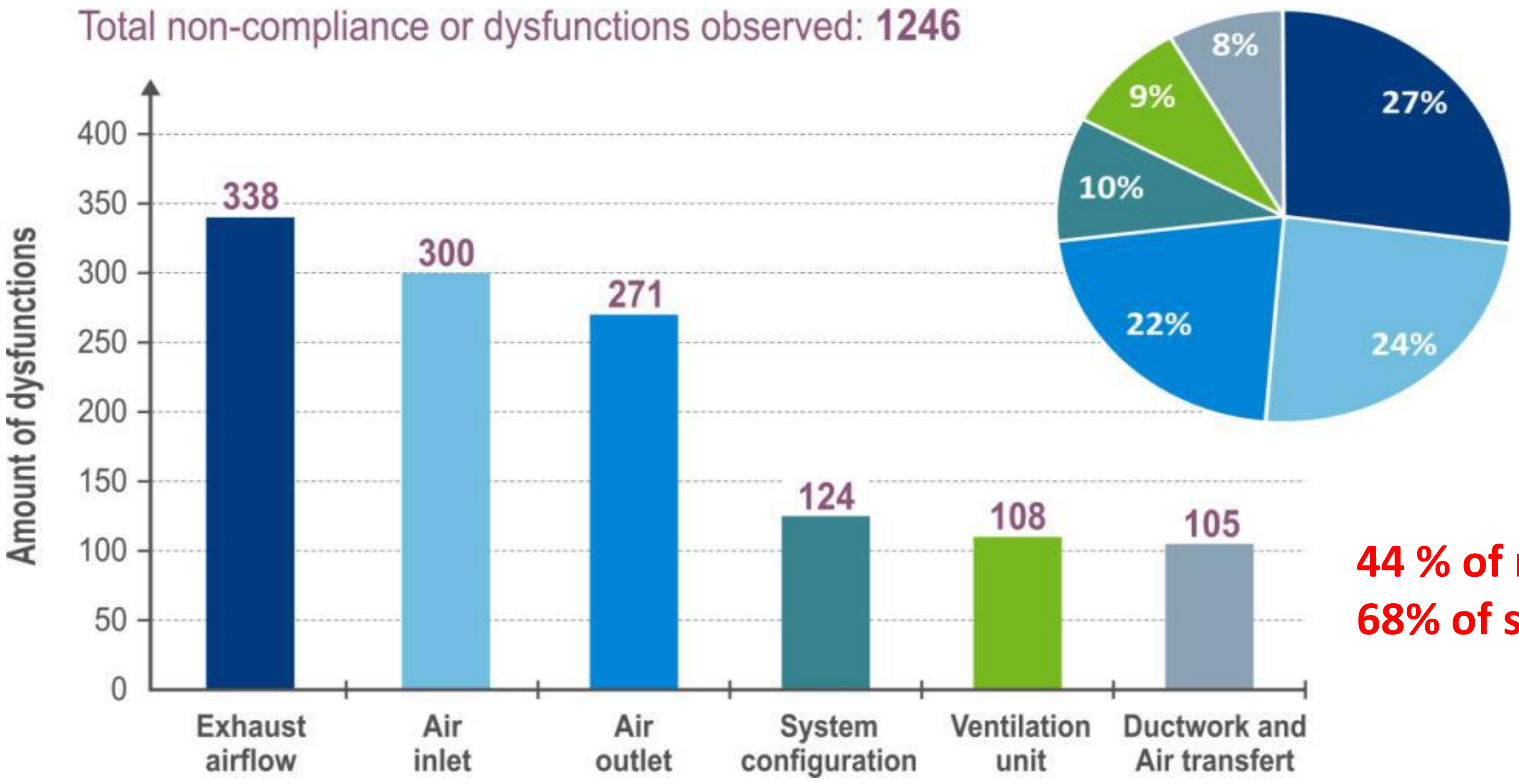
Towards better quality and compliance

Example:
Quality of ventilation systems in 1.287 new dwellings (France)



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

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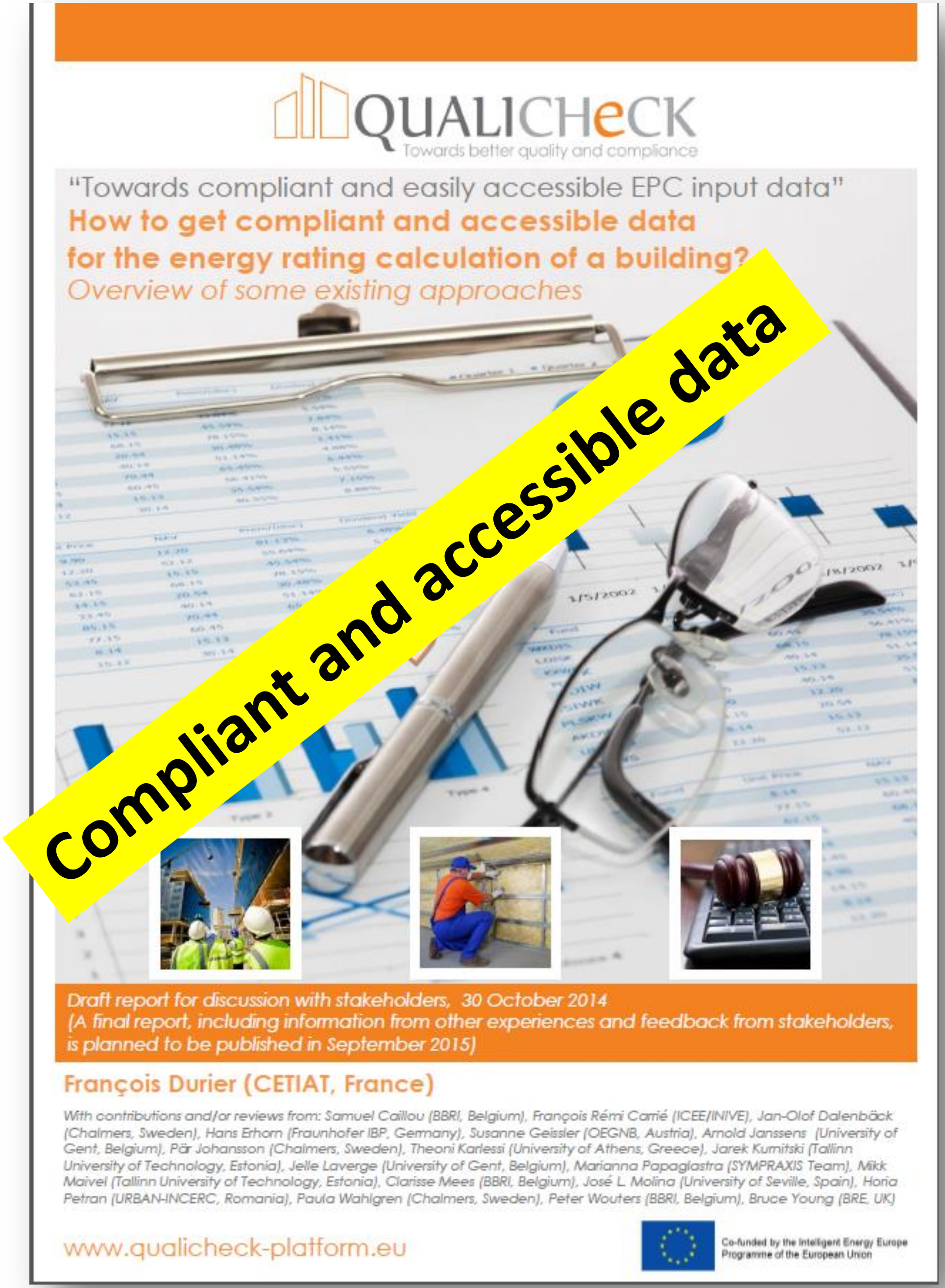
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Towards better quality and compliance
"Towards compliant and easily accessible EPC input data"
How to get compliant and accessible data
for the energy rating calculation of a building?
Overview of some existing approaches
Compliant and accessible data
Draft report for discussion with stakeholders, 30 October 2014
(A final report, including information from other experiences and feedback from stakeholders,
is planned to be published in September 2015)
François Durier (CETIAT, France)
With contributions and/or reviews from: Samuel Caillou (BBRI, Belgium), François Rémi Carrié (ICEE/INIVE), Jan-Olof Dalenbäck (Chalmers, Sweden), Hans Erhorn (Fraunhofer IBP, Germany), Susanne Geissler (OEGNB, Austria), Arnold Janssens (University of Gent, Belgium), Pär Johansson (Chalmers, Sweden), Theoni Karlessi (University of Athens, Greece), Jarek Kurnitski (Tallinn University of Technology, Estonia), Jelle Laverge (University of Gent, Belgium), Marianna Papaglastra (SYMPRAXIS Team), Mikk Maivel (Tallinn University of Technology, Estonia), Clarisse Mees (BBRI, Belgium), José L. Molina (University of Seville, Spain), Horia Petran (URBAN-INCERC, Romania), Paula Wahlgren (Chalmers, Sweden), Peter Wouters (BBRI, Belgium), Bruce Young (BRE, UK)
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"Towards improved quality of the works"
Documented examples of existing situations
regarding quality of works
Quality of the works
DRAFT
Draft report for discussion with stakeholders, 30 October 2014 (A final report, including information from other experiences and feedback from stakeholders, is planned to be published in September 2015)
Heike Erhorn-Kluttig, Hans Erhorn, Sarah Doster
(Fraunhofer Institute for Building Physics, Germany)
With contributions and/or reviews from: Samuel Caillou (BBRI, Belgium), François Rémi Carrié (ICEE/INIVE), Jan-Olof Dalenbäck (Chalmers, Sweden), Eric Dupont (BBRI, Belgium), François Durier (CETIAT, France), Chrysanthi Efthymiou (NKUA, Greece), Susanne Geissler (OEGNB, Austria), Pär Johansson (Chalmers, Sweden), Theoni Karlessi (NKUA, Greece), Marina Kyprianou Dracou (CyI, Cyprus), Mikk Maivel (TUT, Estonia), Marianna Papaglastra (Sympraxis Team, Greece), Horia Petran (URBAN-INCERC, Romania), Paula Wahlgren (Chalmers, Sweden), Peter Wouters (BBRI, Belgium)
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QUALICHeCK fact sheet #01

Towards better quality and compliance

2015.1

QUALICHeCK fact sheet #01

Towards better quality and compliance

2015.1

Authors

François Rémi Carrié (ICEE) and Sandrine Charrier (CEREMA)

Technology	Aspect	Country
Ventilation and airtightness	Quality of the works	France

BUILDING REGULATIONS CAN FOSTER QUALITY MANAGEMENT: THE FRENCH EXAMPLE ON BUILDING AIRTIGHTNESS

The French regulation includes an alternative route to systematic building airtightness testing to justify for a given airtightness level. This route was developed to push professionals to revisit their methods for implementing building airtightness solutions and to include specific quality requirements. At the end of 2014, 81 such quality management approaches have been approved representing a production of about 15.500 buildings per year.

Residential buildings ☑	Non-residential buildings ☑	Specific buildings: ......
New buildings ☑	Existing buildings ☐	

Context

There exists a significant body of literature showing the negative impacts of air leaks in building envelopes as well as the benefits of good building airtightness with appropriate provisions for ventilation, whether natural or mechanical. This explains why the French regulation has taken into account building airtightness since over 30 years, unfortunately with little success until about 2006. That year, a new regulation (RT 2005) came into force, with a benefit of about 7% on the calculated energy use for better airtightness on single-family houses. This regulation also introduced a new scheme (Annex VII of the regulation) to justify for the target airtightness level based on quality management (QM) principles.

Objectives and problems addressed

The QM scheme was initially developed considering the difficulties building professionals had to achieve good airtightness and the hope that cost abatements due to allowance for non-systematic testing could encourage building professionals to engage in a QM approach for building airtightness. The major problems addressed with this approach include:

- ✓ Poor training of designers and workers
- ✓ Recurrent poor treatment of envelope leakage sites
- ✓ Absence of self-checks on site
- ✓ Cost for systematic airtightness 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 2015 (Annex VII, 2014).

Approach to overcome identified problems

Regulatory background

The 2012 French regulation introduced a minimum requirement for the building airtightness of all residential buildings, including mandatory justification of the airtightness levels mentioned in Table 1. For non-residential buildings, default values apply depending on the building types; if a value better than the default value is used in the calculation, mandatory justification applies as well.

In all cases where justification is necessary, the building airtightness level must be justified either:

- ✓ with an airtightness test by a certified tester of each building; or
- ✓ with a certified quality management approach that allows non-systematic testing.

The reference text for this QM approach is in the Ministry order of the energy performance regulation itself (RT 2005 and RT 2012). It allows the applicant not to perform an airtightness test systematically, but requires the organisation to set up a quality management approach for the whole building process that has to be approved by a specific national committee. In its 2012 version (Annex VII of RT 2012), successful applicants can use air permeability at 4 Pa in multiples of 0,1 $m^3/h/m^2$:

- ✓ in the range of 0,3-0,6 m^3/h/m2 (depending on the results they submitted in their application) for single-family buildings (this range corresponds to about 1,6-3,2 m^3/h/m2 at 50 Pa);
- ✓ in the range of 0,3-1,0 $m^3/h/m^2$ (depending on the results they submitted in their application) for multiple-family buildings;
- ✓ greater than 0,3 $m^3/h/m^2$ and smaller than the default value for other types of buildings (no longer applicable as of July 2015).

	Minimum requirement	Possible values in case of QM approach (multiples of 0,1 $m^3/h/m^2$	Default value
Single-family buildings	0,6 (3,2)	0,3-0,6 (1,6-3,2)	
Multi-family buildings	1,0 (5,4)	0,3-1,0 (1,6-5,4)	
Non-residential buildings (no longer applicable as of July 2015)		0,3-1,7 (1,6-9,2) or 0,3-3,0 (1,6-16,2) depending on building type	1,7 (9,2) or 3,0 (16,2) depending on building type

Table 1: Airtightness levels in the 2012 French regulation in m^3/h per m^2 of cold surface area at 4 Pa. Approximate corresponding values at 50 Pa are shown in parenthesis.

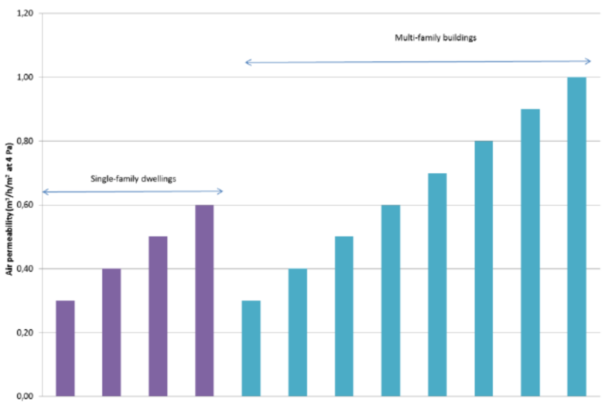

Figure 1: Possible values of maximum air permeability guaranteed by the applicant in single-family dwellings and multi-family buildings.

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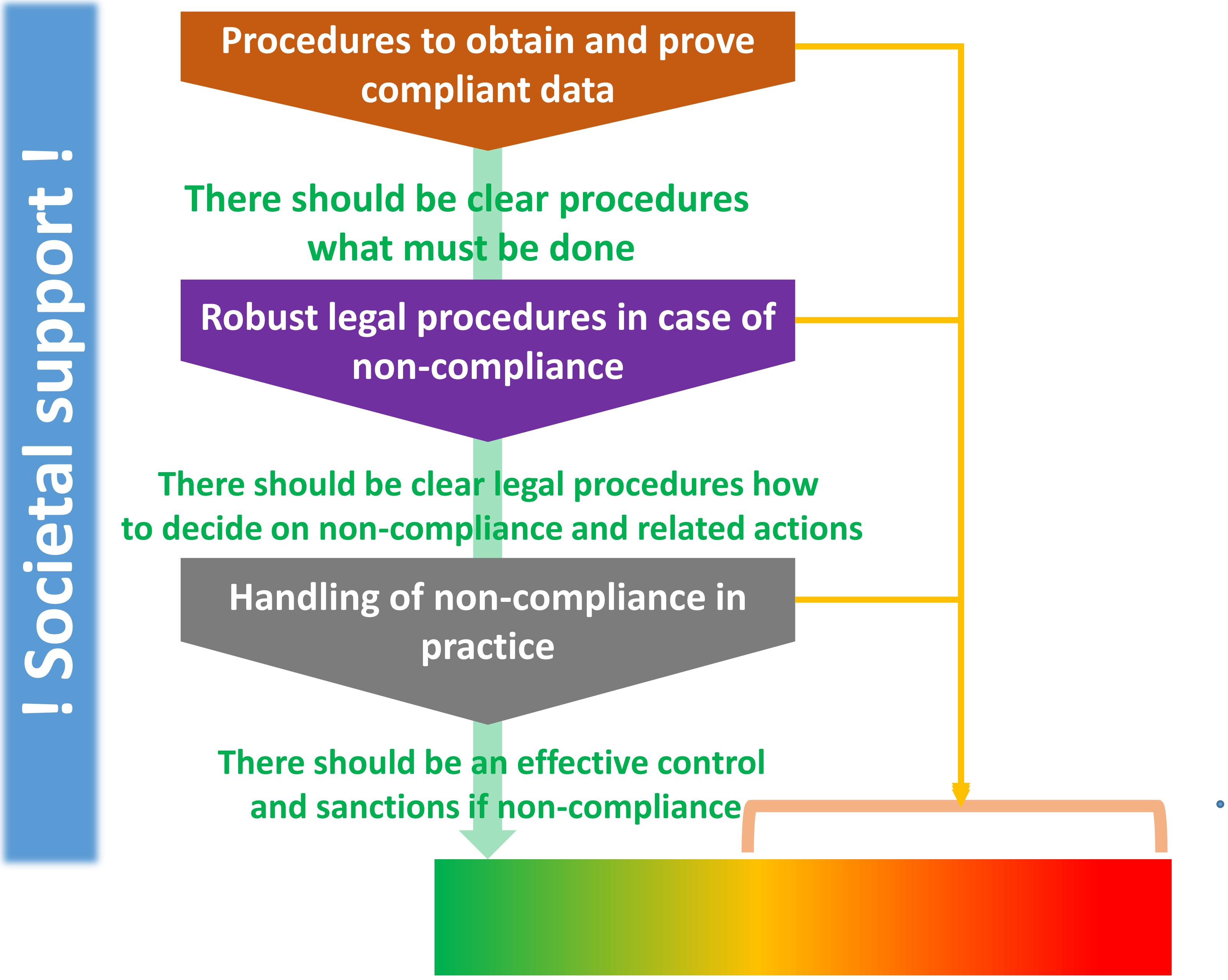
Why QUALICHeCK?

What kind of activities in QUALICHeCK?

First deliverables of QUALICHeCK

What is in preparation?

Source book “Compliance in relation to EPC”



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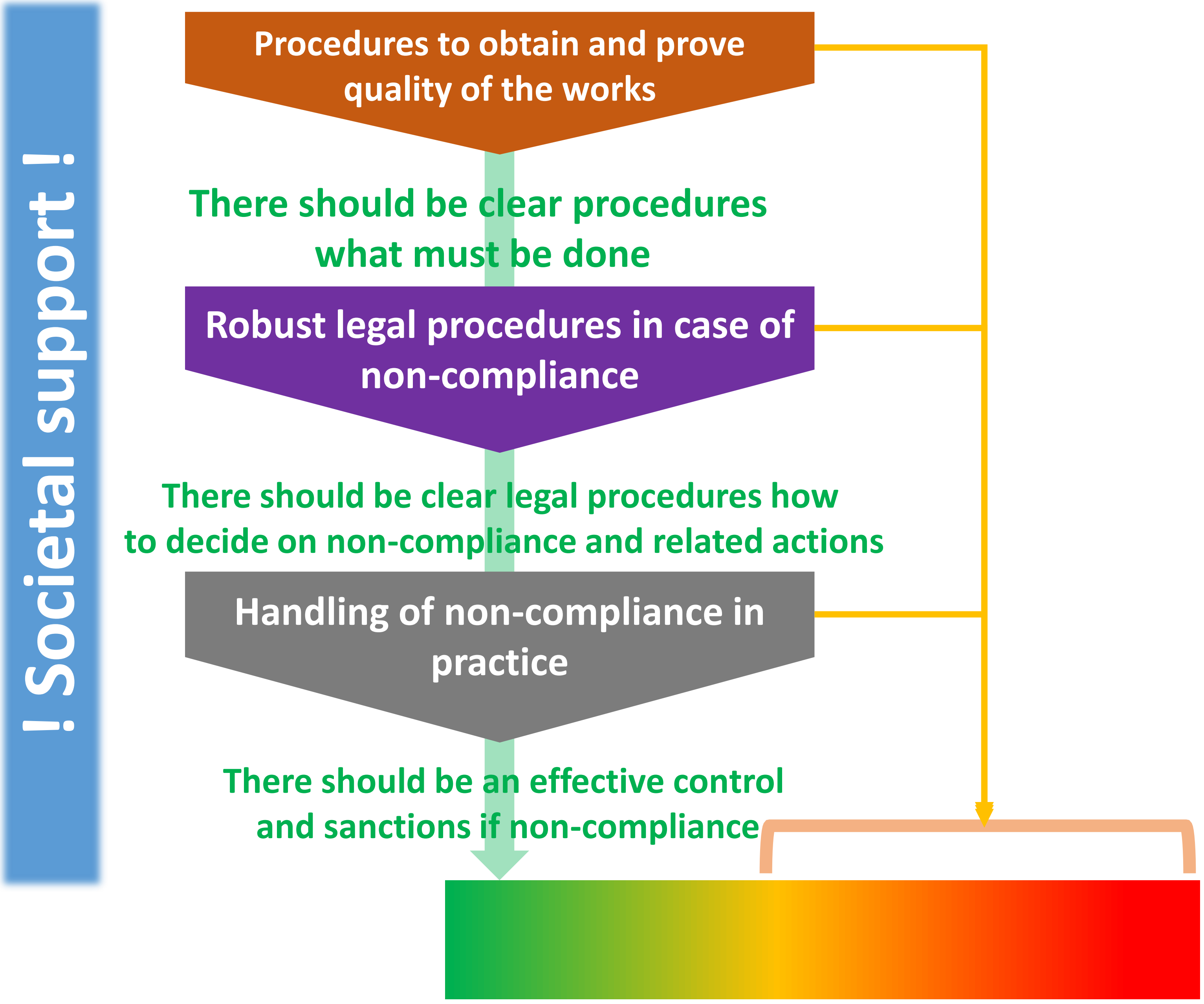
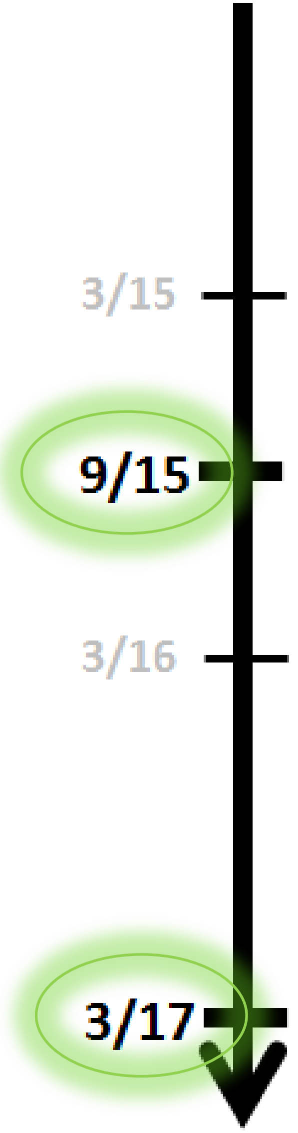
Souce book “About the quality of the works…”



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

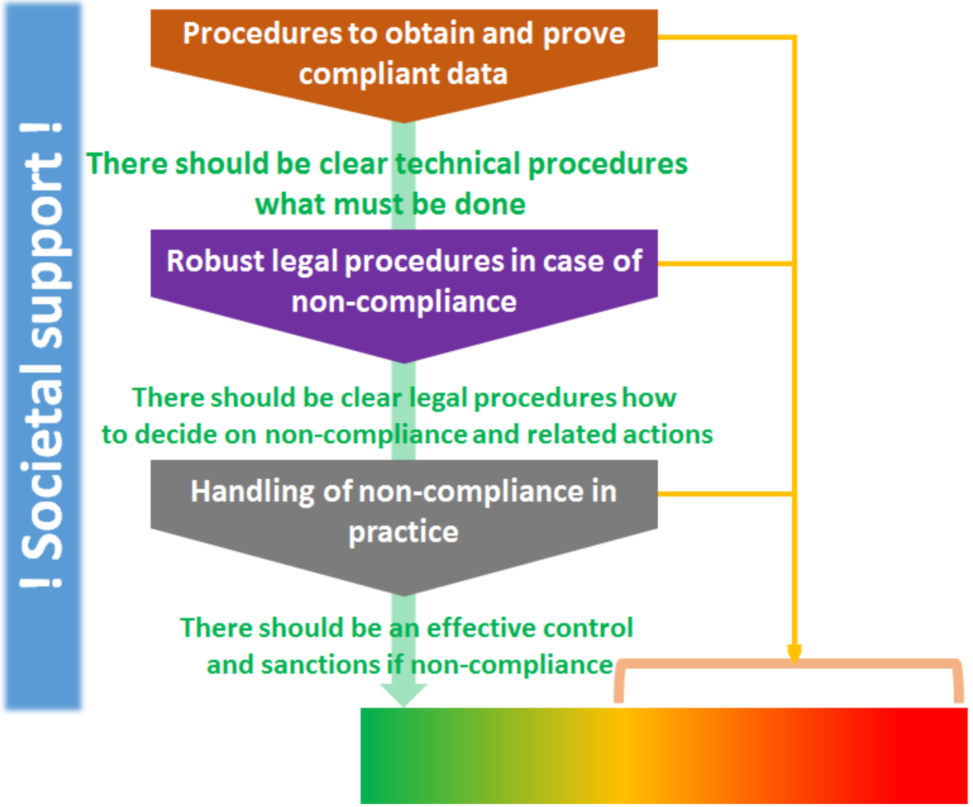
September 4 2015

Themes: focus on

- “**2nd recast EPBD**” and
- “**better compliance/quality of the works**”

September 2015

	1	2	3	✓ 4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				



International QUALICHeCK workshops

- Transmission characteristics — TALLINN – October 2016
- Ventilation and airtightness — LUND - 16-17 March 2015
- Sustainable summer comfort techniques — ATHENS – 9-10 March 2016
- Renewables in multi-energy systems — LYON – ~January 2017

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2nd QUALICHeCK workshop ‘Sustainable summer comfort’

March 9-10 2016 Athens (Greece)

2-days workshop

Technologies to be covered:

- Solar control
- Thermal mass
- Ventilative cooling
- Cool roofs
- Daylighting

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Towards better quality and compliance

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

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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 QUALICHeCK and carries out a new study on EPC quality

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CETIAT

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National and Kapodistrian University of Athens

Tallinn University of Technology

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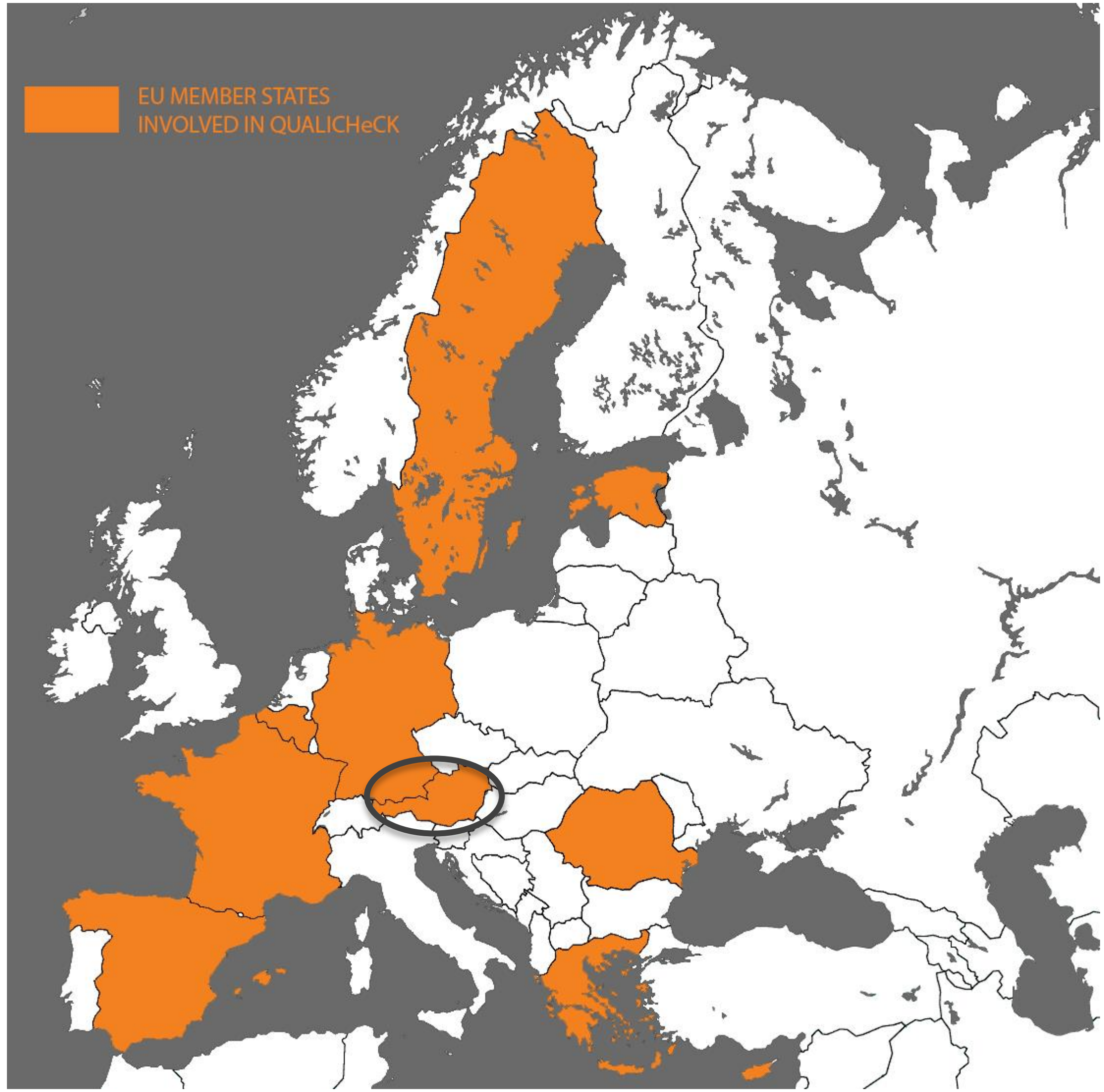


Background information on framework conditions in Austria

Austrian regions – Austrian provinces

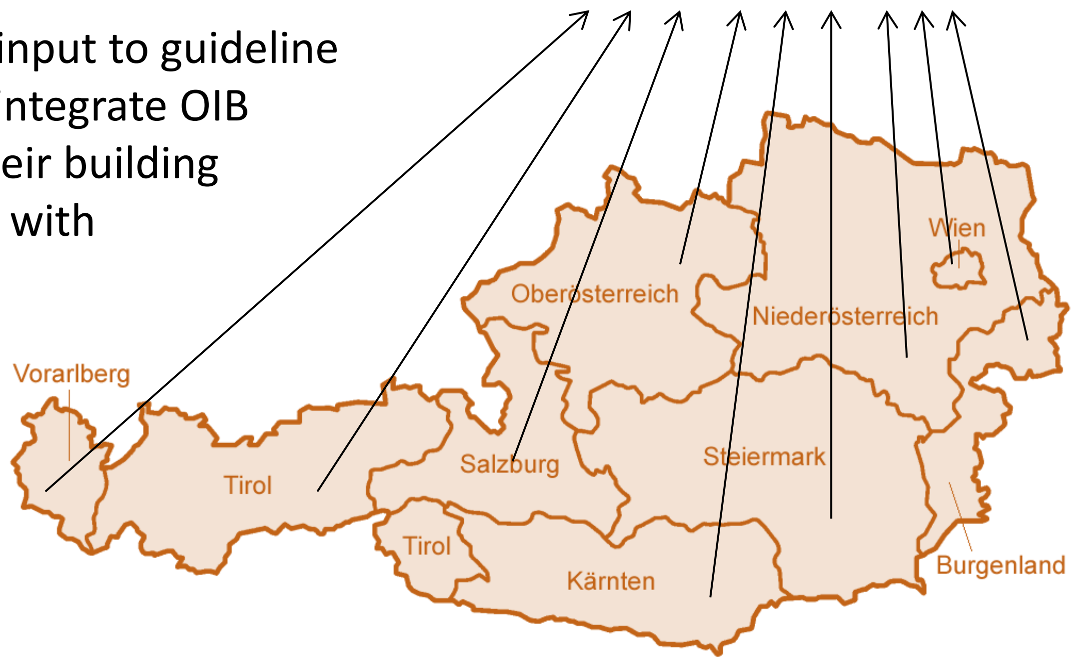
Case study region: province Salzburg

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 AUSTRIAN INSTITUTE OF CONSTRUCTION ENGINEERING

Input to development / revision of OIB Guideline 6



OIB Guideline 6 as basis for revision of building legislation in the provinces

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 Energieeinsparung und Wärmeschutz OIB-330.6-094/11 and associated calculation guideline: Leitfaden Energietechnisches Verhalten von Gebäuden Ausgabe: Oktober 2011 – Revision Dezember 2011 OIB-Zahl OIB-330.6-111/11-010
- **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 8110-2: 2003-07-01 Thermal insulation in building construction – Part 2: Water vapour diffusion and protection against condensation
- ÖNORM B 8110-3: 2012-03-15 Thermal protection in building construction — Part 3: Prevention of summerly overheating
- ÖNORM B 8110-4: 2011-07-15 Thermal insulation in building construction — Economic optimizing of thermal insulation
- **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 oft he 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)

Input data: default values used by EPC calculation software

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 5058: 2011-03-01 Energy performance of buildings — Energy use for cooling systems Supplement 1: Office building — Example for validation
- 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)

Phases of building life cycle	Design phase	Design EPC (preliminary EPC)	Completion phase	Completion EPC (final EPC reflecting design changes)
Level of quality assurance	Quality of input data		Quality of the works	
Method of quality assurance	SE: Evaluation of default values and revision UK: Certified product data	BE, PT: Qualified EPC experts	Individual certification Qualification → BUILD UP Skills	UK, DK, IE, etc.: Third party control (certified measurements)

Legal requirement	**Produce EPC and show that energy performance minimum requirement is met**	
Compliance / Control	Individual checks of EPCs Automatic checks in calculation program and during upload in EPC-database	Automatic checks during upload in EPC-database Commissioning protocol and verification documents Random inspection on site
Enforcement / Sanction	Building permit Financial incentives	Permit of use Financial incentives

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

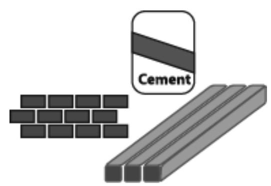
Final EPC (Completion EPC, validity according to EPBD) Based on final building documents and random site visits

Reasons for checking EPC quality and updating preliminary EPC:

Due to lack of quality of input data: EPC could be C or B

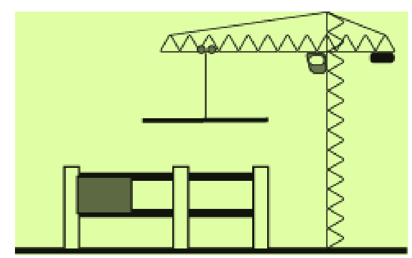
Building design/ EPC calculation

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

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

Salzburg region case study: procedure

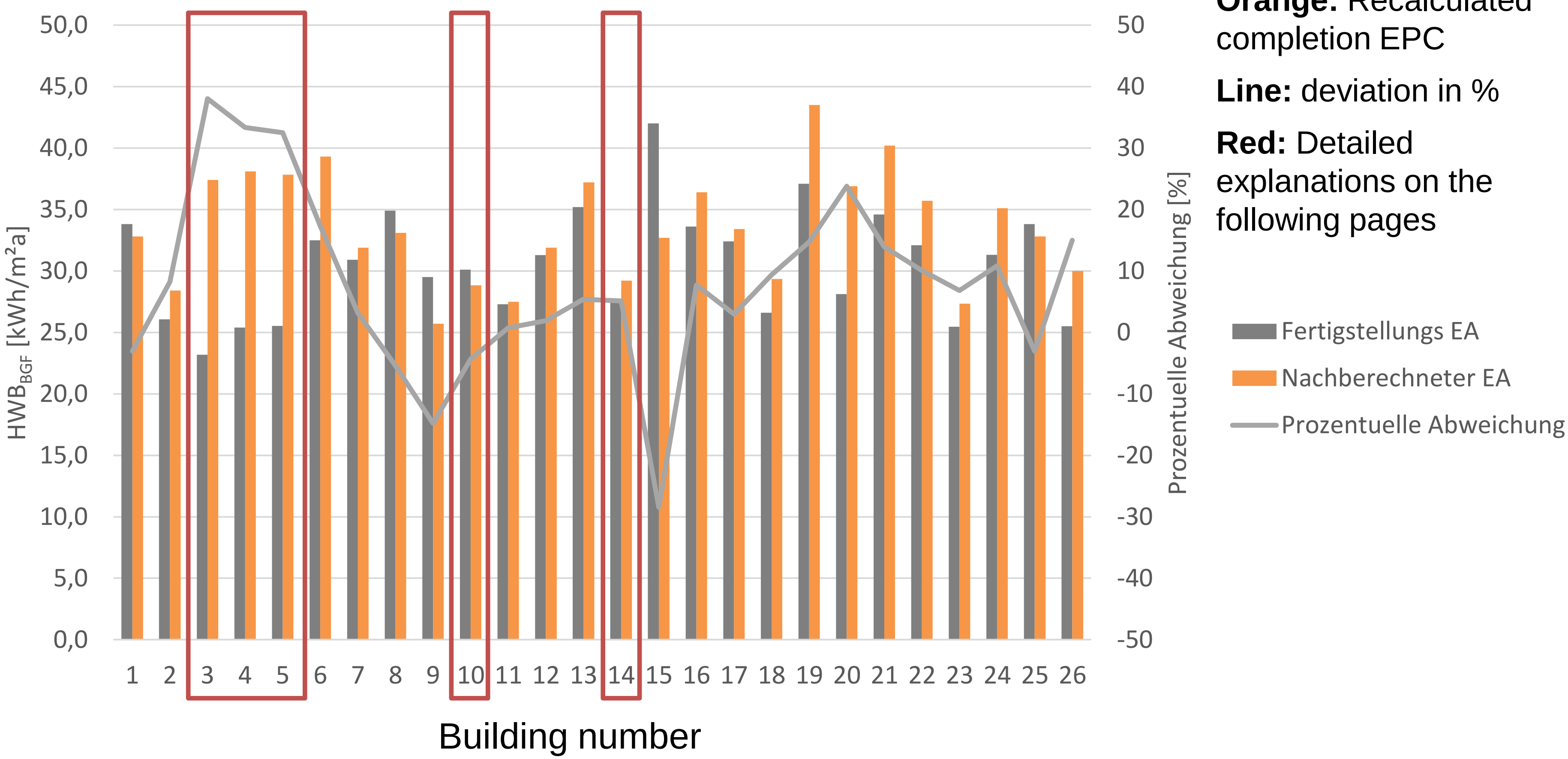
- **Data collection:** design EPC, completion EPC, specific building information, e.g. site foreman's plan
- **Recalculation of completion EPC** based on collected building information: plans / blueprints, site foreman's plan with EPC-calculation tool GEQ
- **Analysis:**
  - Comparison of design EPC 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

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

Software	Hydrauliksystem 2	2
GEQ (method 2)	$Q_{sol,N}$ jährlicher Solarertrag (netto) [kWh/a]	21.682
	Spezifischer Solarertrag (netto) [kWh/m².a]	493
	f_{sol} solare Deckung	30,4%
	Q_{EE} jährlicher Endenergiebedarf in GEQ [kWh/a]	57.484
	Reduktion von Q_{EE} durch die Solarthermie in GEQ [kWh/a]	28,7%
T*SOL (method 1)	$Q_{sol,N}$ jährlicher Solarertrag (netto) [kWh/a]	14.848
	Spezifischer Solarertrag (netto) [kWh/m².a]	337
	f_{sol} solare Deckung	24,0%
	Q_{EE} jährlicher Endenergiebedarf in GEQ [kWh/a]	64.368
	Reduktion von Q_{EE} durch die Solarthermie in GEQ [kWh/a]	20,2%
CombiSol (method 3b)	$Q_{sol,N}$ jährlicher Solarertrag (netto) [kWh/a]	23.603
	Spezifischer Solarertrag (netto) [kWh/m².a]	536
	f_{sol} solare Deckung	33,0%
	Q_{EE} jährlicher Endenergiebedarf in GEQ [kWh/a]	55.434
	Reduktion von Q_{EE} durch die Solarthermie in GEQ [kWh/a]	31,3%

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

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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

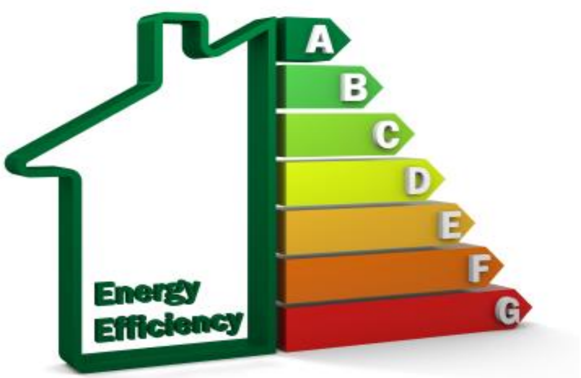
2013: Maximum specified U-values amendment, (KPD 432/2013 & KPD 433/2013).
RESULT: New specified maximum U-values:

- **U_{max} external walls/ columns/ beams = 0,72 W/m^2K**
- **U_{max} external exposed floors/ roofs = 0,63 W/m^2K**
- **U_{max} floors above spaces without air-conditioning = 2,00 W/m^2K**
- **U_{max} external openings=3,23 W/m^2K**
- **U_{max} average=1,30 W/m^2K**

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

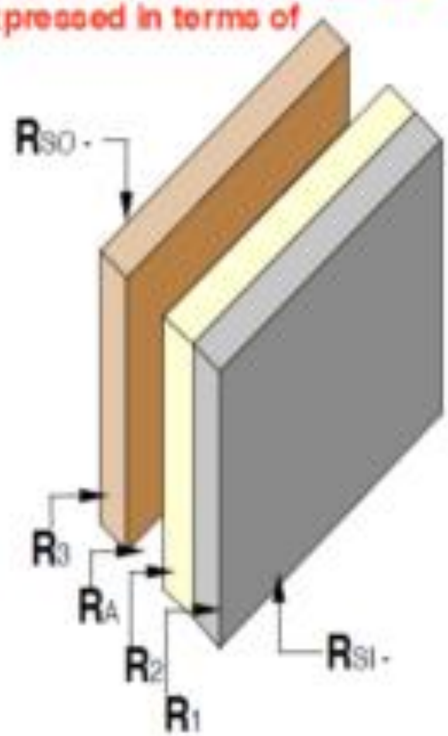
The U value is the inverse sum of the resistances of each building material and surface resistances to the outer and inner faces of the material build up of the element.

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.**

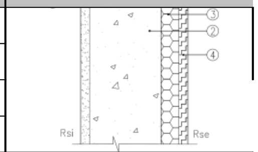
$$U = \frac{1}{R_{SI} + R_{SC} + R_{A} + R_{1} + R_{2} + R_{4} + R_{5}}$$

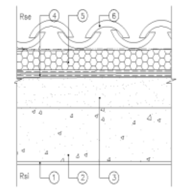
R_{SI} - thermal resistance of **i**nternal surface
R_{SO} - thermal resistance of **o**utside surface
R_{A} - thermal resistance of unvented air cavities
$R_{1\ etc.}$ - thermal resistances of building components

Units - **W/m^{2}K**



Documentation per case

Description of the Construction		External columns / beams / shear walls			
A/A	Material	Width d (m)	Thermal Conductivity λ (W/mK)	Thermal Resistance R (m²K/W)	Typical Detailed Drawing
Starting from inside					
1	Coat (cement)	0.025	1.390	0.018	
2	Reinforced concrete	0.300	2.300	0.130	
3	Expanded polystyrene	0.050	0.041	1.220	
4	Coat (cement)	0.025	1.390	0.018	
Heat flow		Horizontal		U-value U (W/m²K)	
Rsi (m²K/W)		0.130			
Rse (m²K/W)		0.040		**0.643**	
Notes		The decree requirement for U≤0,85 is fulfilled			

Description of the Construction		External inclined roof			
A/A	Material	Width d (m)	Thermal Conductivity λ (W/mK)	Thermal Resistance R (m²K/W)	Typical Detailed Drawing
Starting from outside					
1	Roof tiles	0.020	1.000	0.020	
2	Extruded (exilasmeni) Polystyrene	0.050	0.030	1.667	
3	Asphalt fiber	0.004	0.230	0.017	
4	Screed	0.080	1.350	0.059	
5	Reinforced concrete	0.200	2.500	0.080	
6	Coat (cement)	0.025	1.000	0.025	
Heat flow		Going up		U-value U (W/m²K)	
Rsi (m²K/W)		0.100			
Rse (m²K/W)		0.040		**0.498**	
Notes		The decree requirement for U≤0,75 is fulfilled			

A/A	Description of the Construction	U-value of the Construction Ui[W/m2K]	Area of the Construction Ai[m2]	Ui x Ai of the Construction (W/k)
1	Walls	0.46	168.70	77.60
2	Columns/Beams/ Shear Walls	0.643	129.98	83.58
3	Windows (glass)	1.1	59.70	60.5
4	Doors (wooden)	2.29	4.45	10.19
5	Doors(aluminium)	3.25	1.98	6.44
	Total		364.81	238.31
	Average U-value Um			0.653
	Notes	The decree requirement for U≤1,30 is fulfilled		

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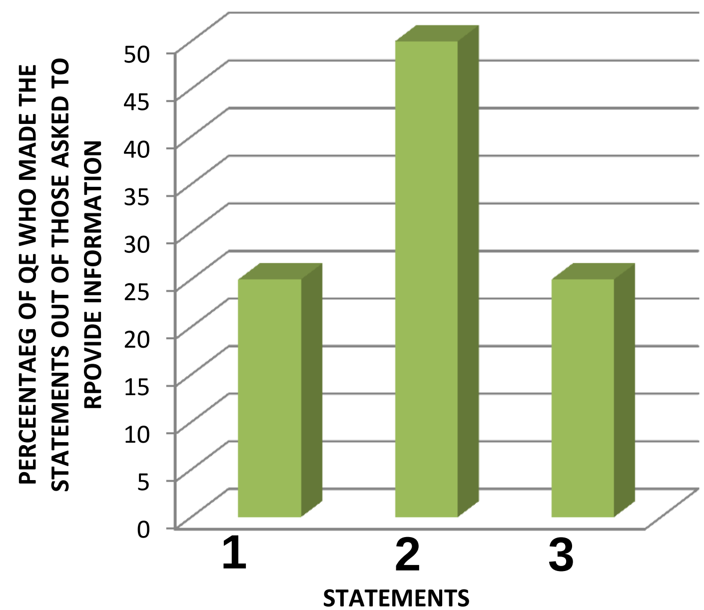
Statements made by qualified building energy assessors (QE) who declined to provide any information regarding either all or some of their EPCs

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."



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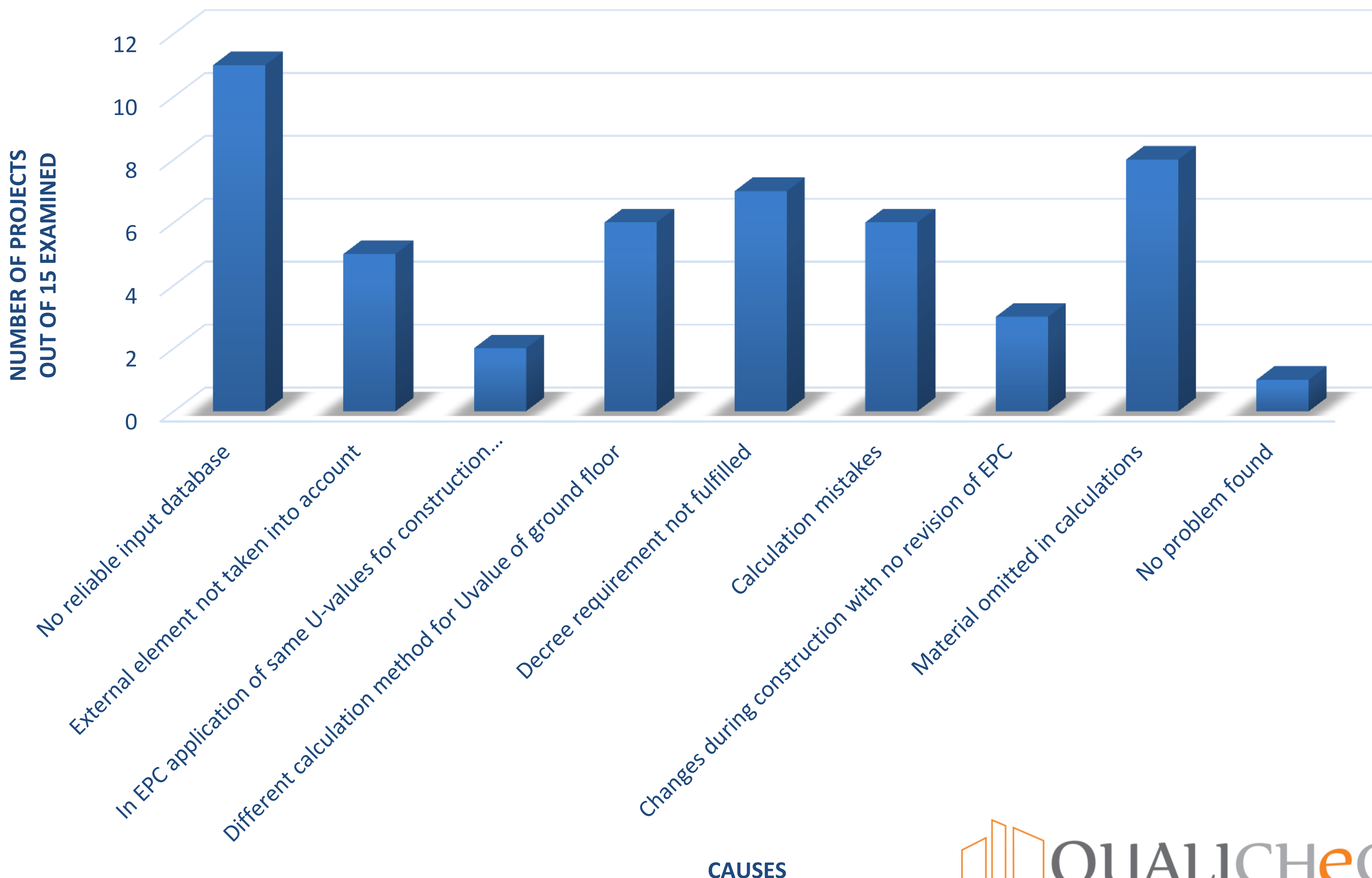
Deviations between calculated in EPC U-values and in actual U-values



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Objectives of Cyprus new data collection study

The questions:	Preliminary answers
How well new requirements regarding maximum U-values and maximum average U-Value have been followed both in design and construction?	Only in specific construction elements, in 7 out of 15 examined residential buildings, they have not been integrated
What percentage of the residential buildings from those examined comply with those regulations?	63% of the examined building fully comply
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?	Exposed floor slabs, external openings
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?	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

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

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Adjunct Professor, Aalto University
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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°Ch
  - 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.*

Building category	Outdoor air flow rate l/(s m^2)	Heating set-point (°C)	Cooling set-point (°C)
Multi-apartment buildings	0.5	21	27

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**

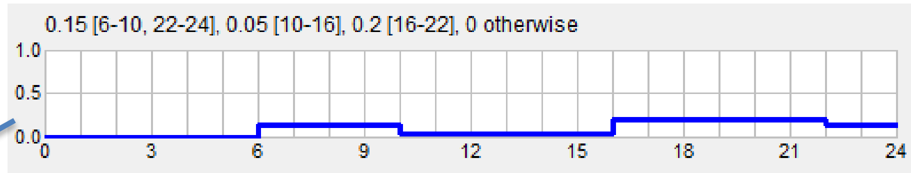
„The verification of compliance of residential buildings with the summertime indoor temperature requirement is performed using the detailed energy calculation usage profiles of buildings."

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

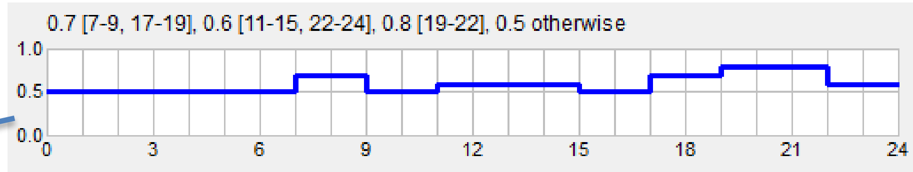
Standard use of buildings and the corresponding maximum values of heat gain per square meter of heated area

Building's purpose of use	Lighting W/m²	Appliances W/m²	Occupants W/m²	Occupants m²/person
Multi-apartment building	8	3	3	28.3

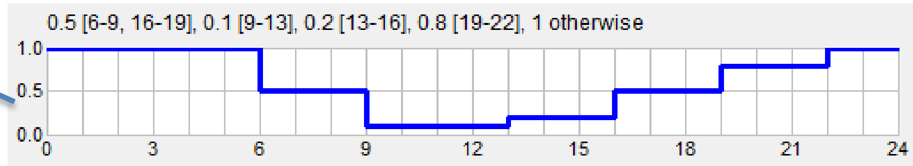
Lighting



Equipment



Occupancy



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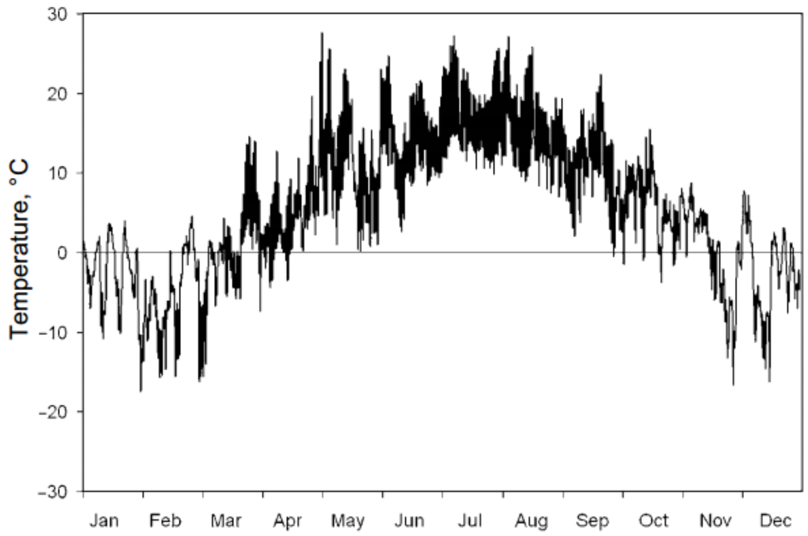
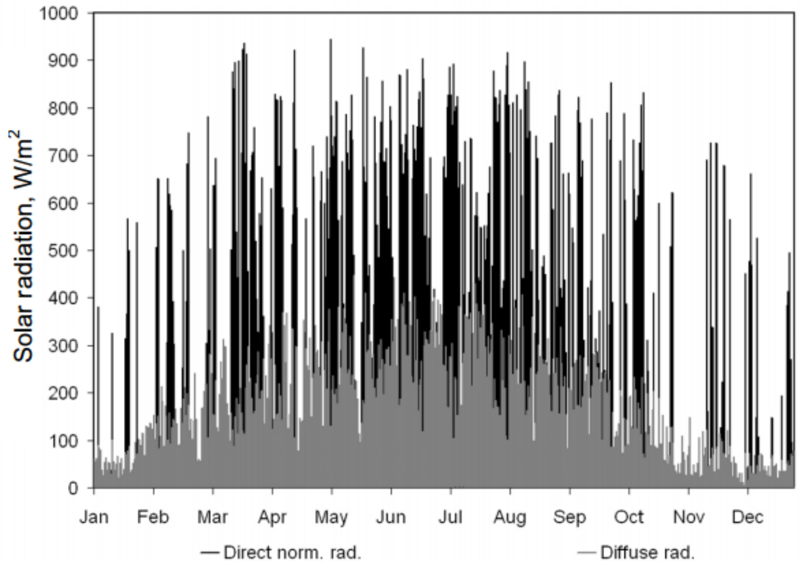
Introduction – TRY

- **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)…."*

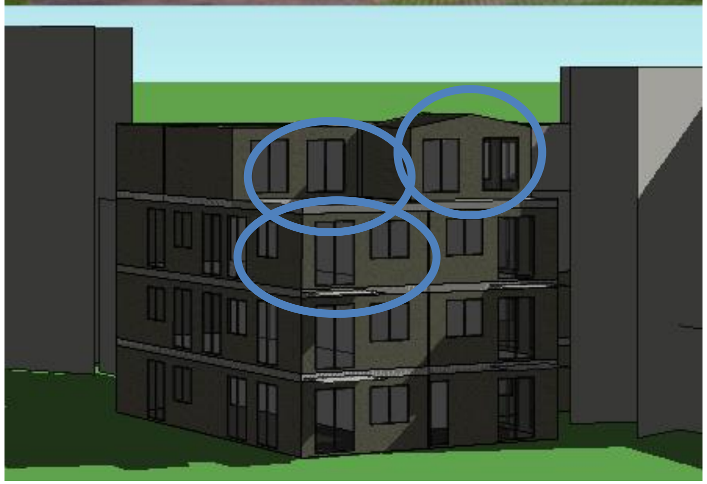
- TRY contains hourly-average data of outdoor temperature, relative humidity, wind speeds and solar radiation.

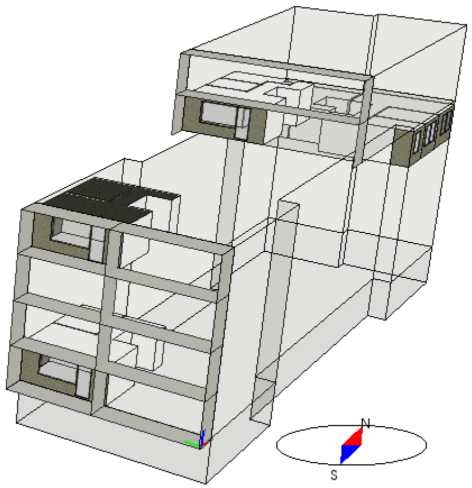




Methods

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



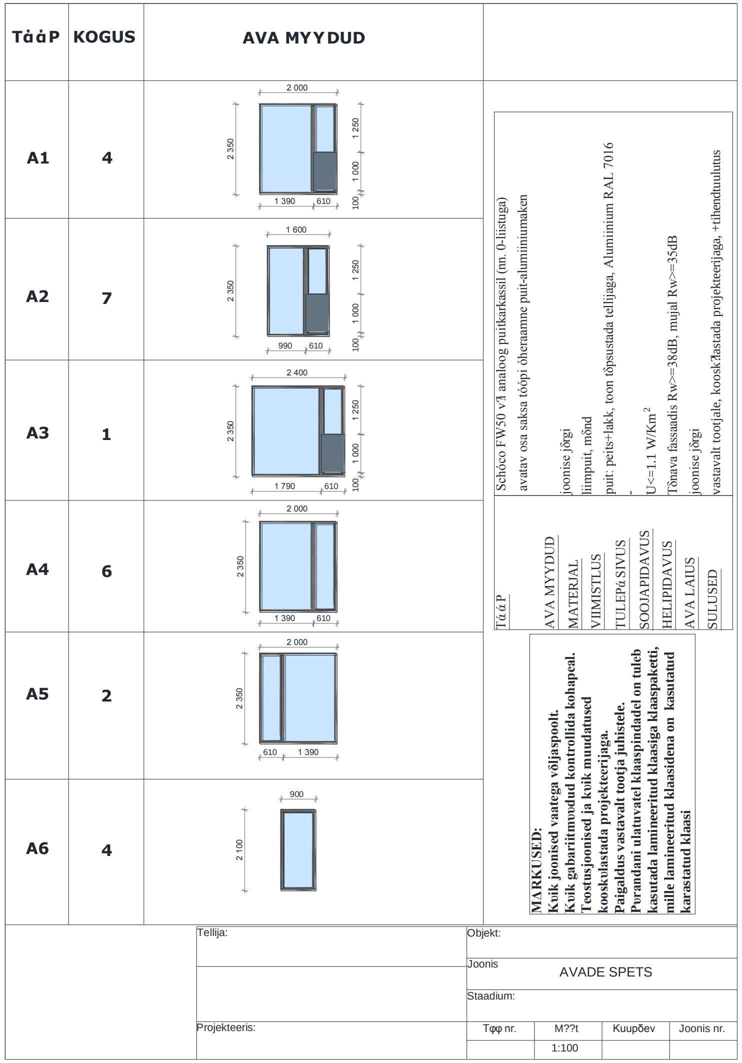


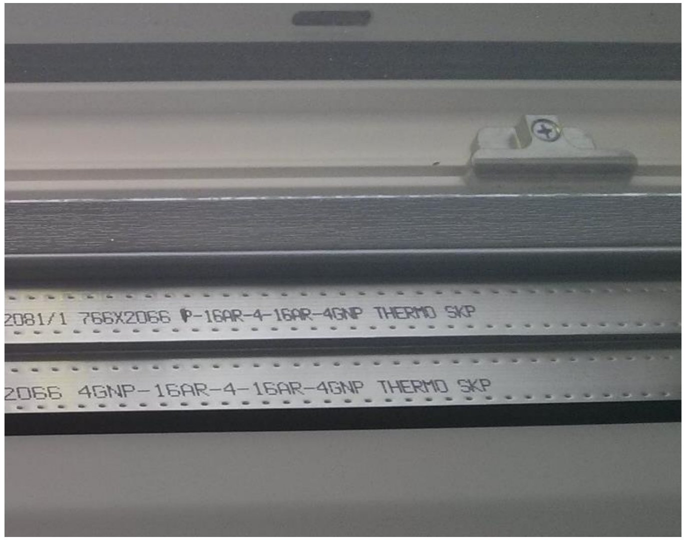
Methods

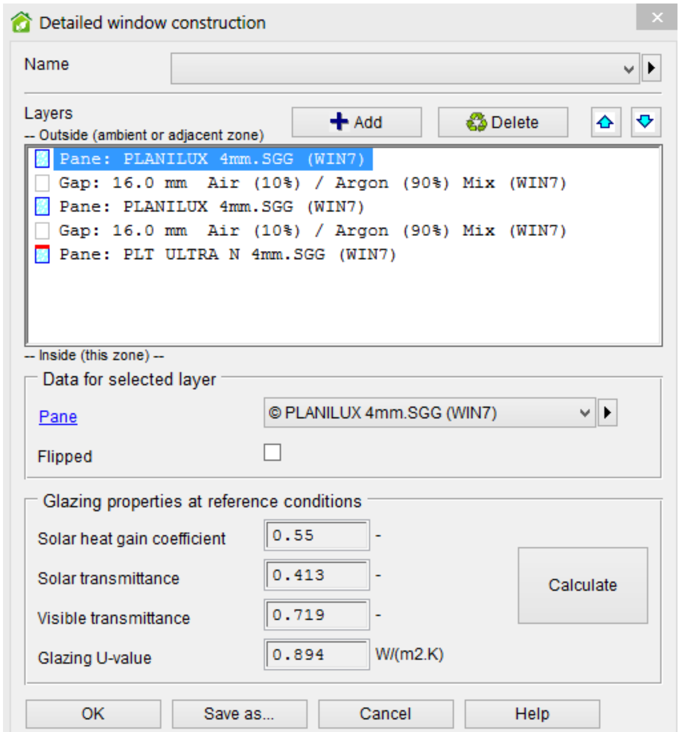
- 25 apartment buildings
  - Randomly selected newly built modern apartment buildings
  - 158 dwellings simulated
  - 16 dwellings measured, period 1. June to 31. August 2014
- Description of the studied buildings
  - Most of the buildings were designed with precast or monolithic concrete structures 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

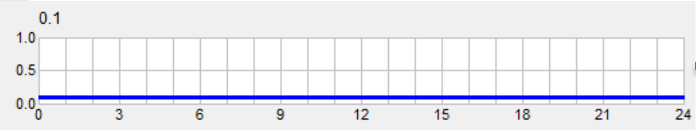


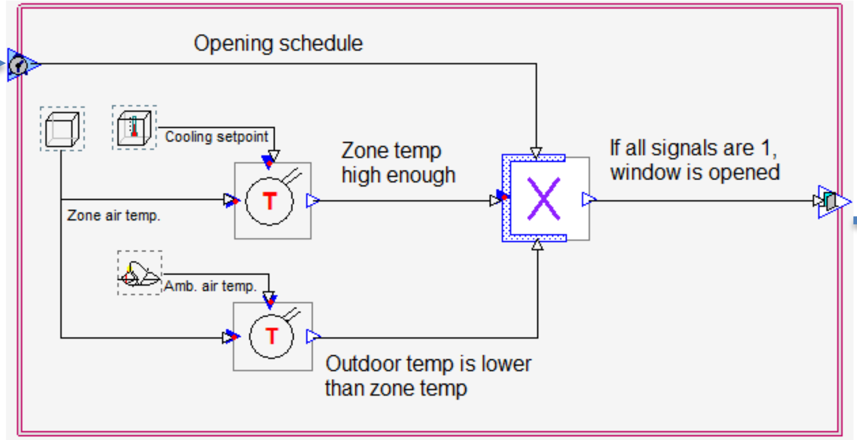


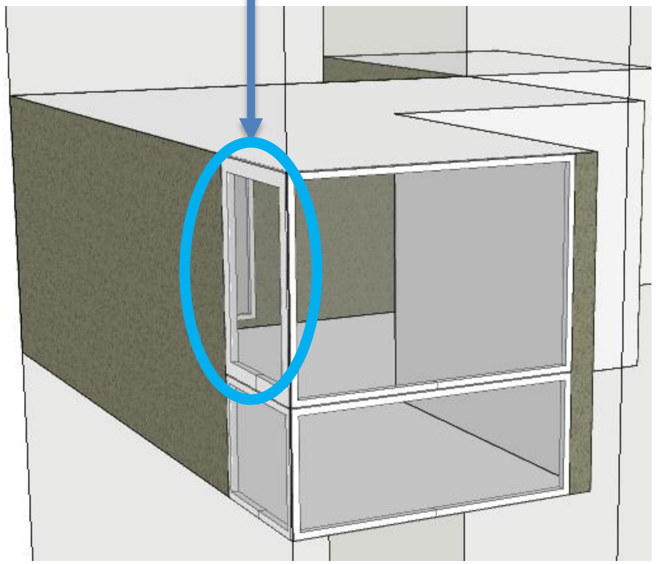


Methods

- Window modelling

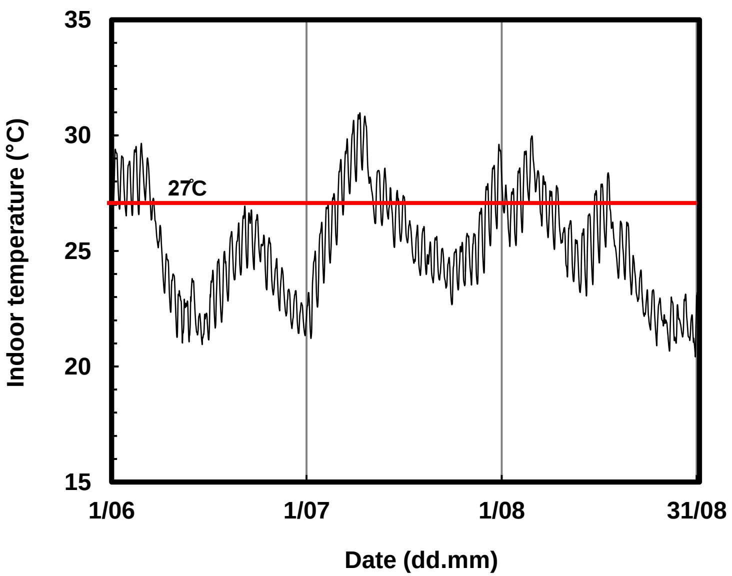


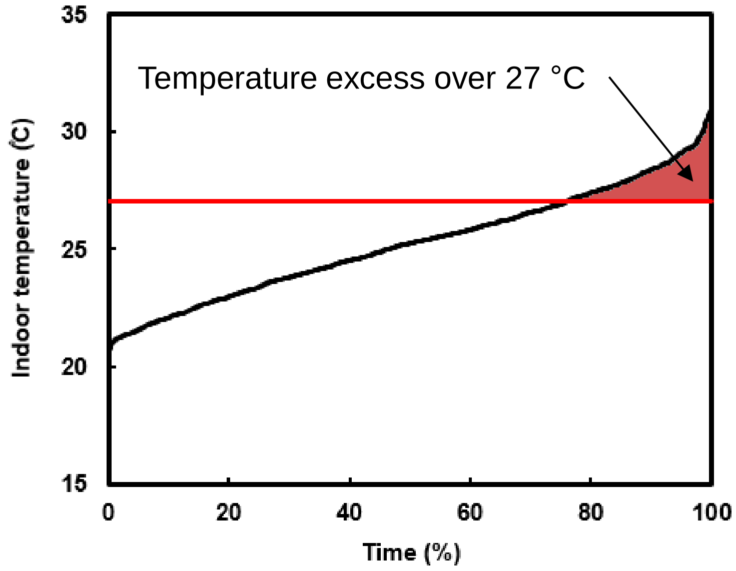




Method

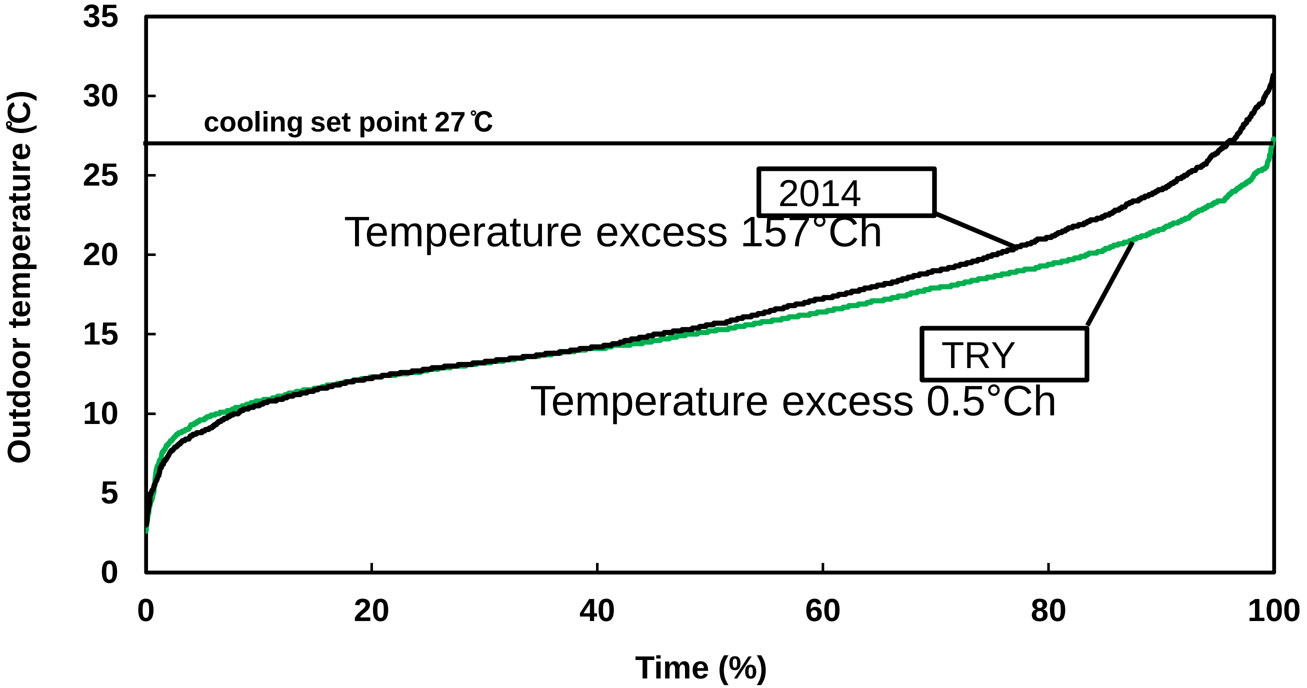
- Temperature excess in degree-hours (°Ch)

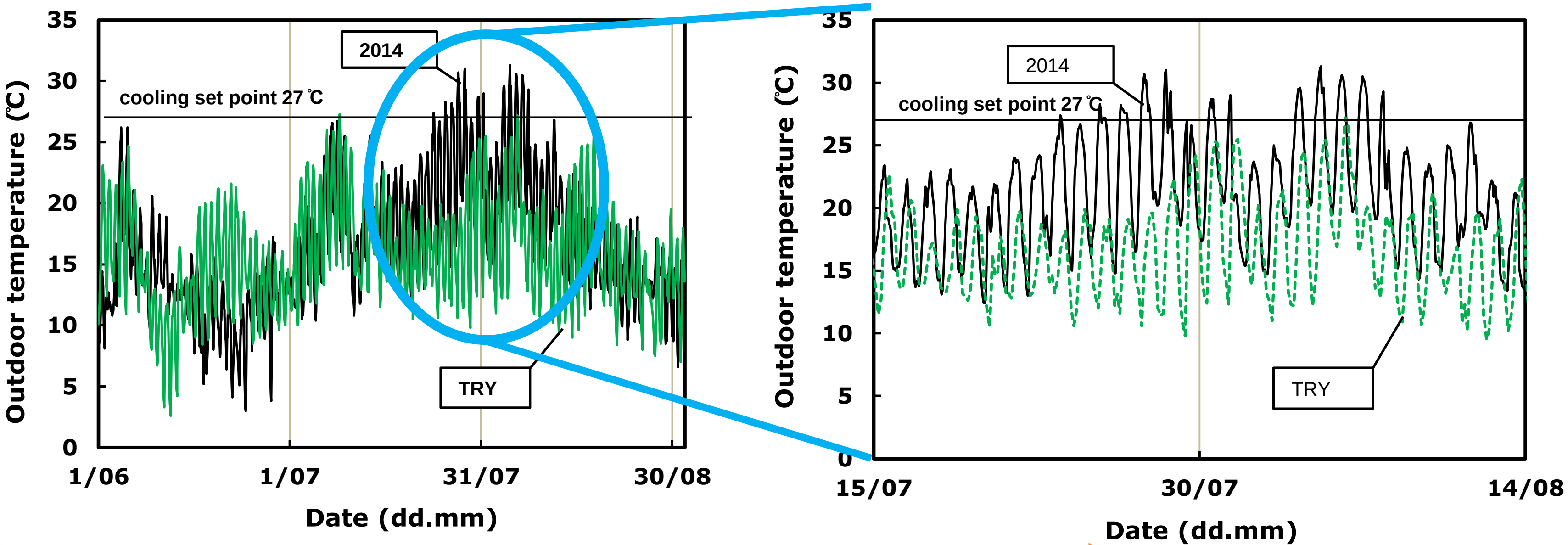




Date	Time	Temp, °C	Excess, °Ch	
...	...	...	...	
5. July	10:00	26.4	0.0	
5. July	11:00	26.8	0.0	
5. July	12:00	27.3	0.3	
5. July	13:00	27.4	0.4	
5. July	14:00	27.6	0.6	4.2°Ch
5. July	15:00	27.8	0.8	
5. July	16:00	28.6	1.6	
5. July	17:00	27.5	0.5	
5. July	18:00	27.0	0.0	
5. July	19:00	26.8	0.0	
...	...	...	...	Requirement
		Σ	685.0	≤ 150°Ch

Summer of TRY vs 2014

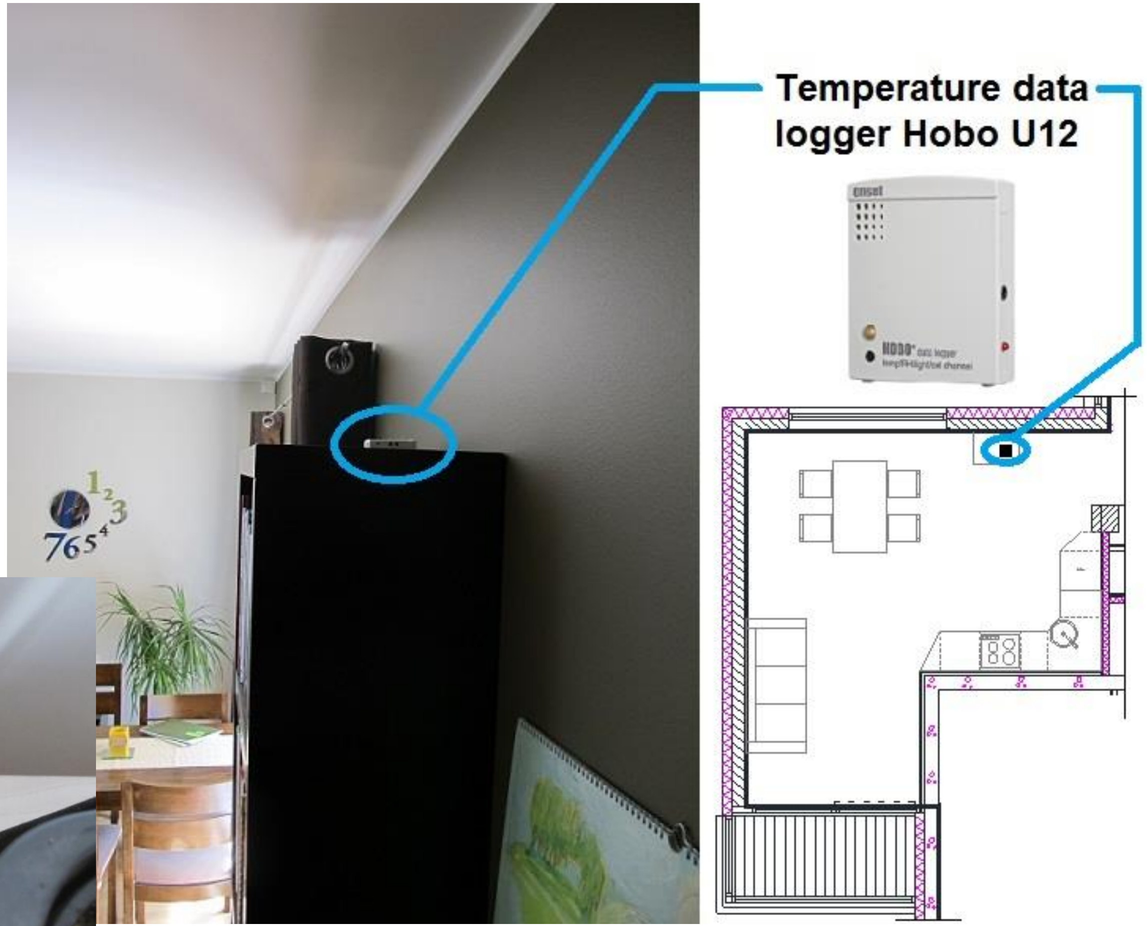


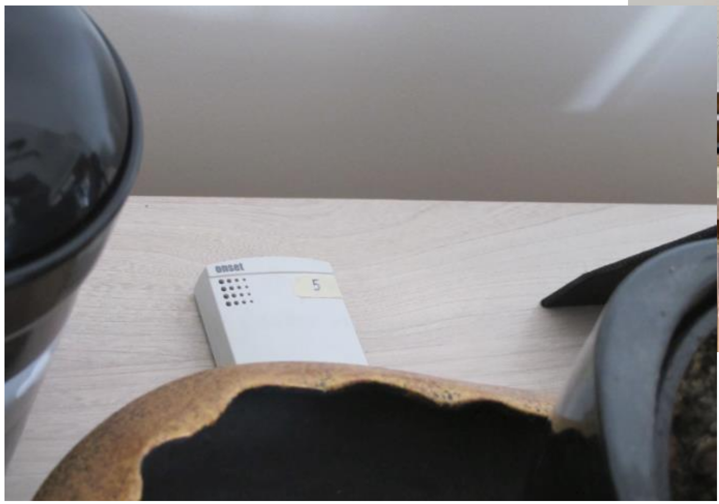


Measurements

- Temperature measurements in dwellings

- Measuring period:
  1. June – 31. August
- Logger saving interval:
  1h, hourly-average





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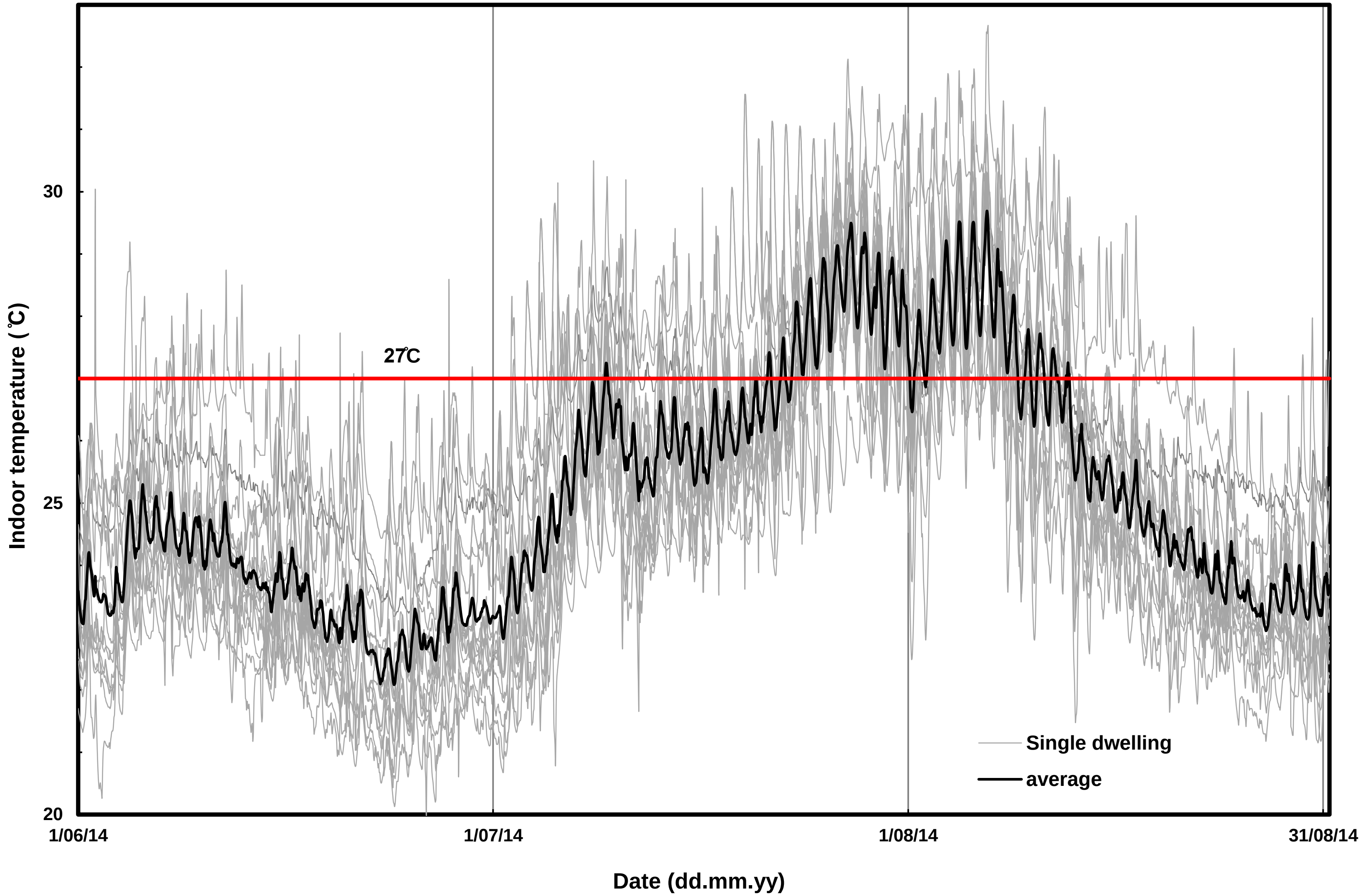
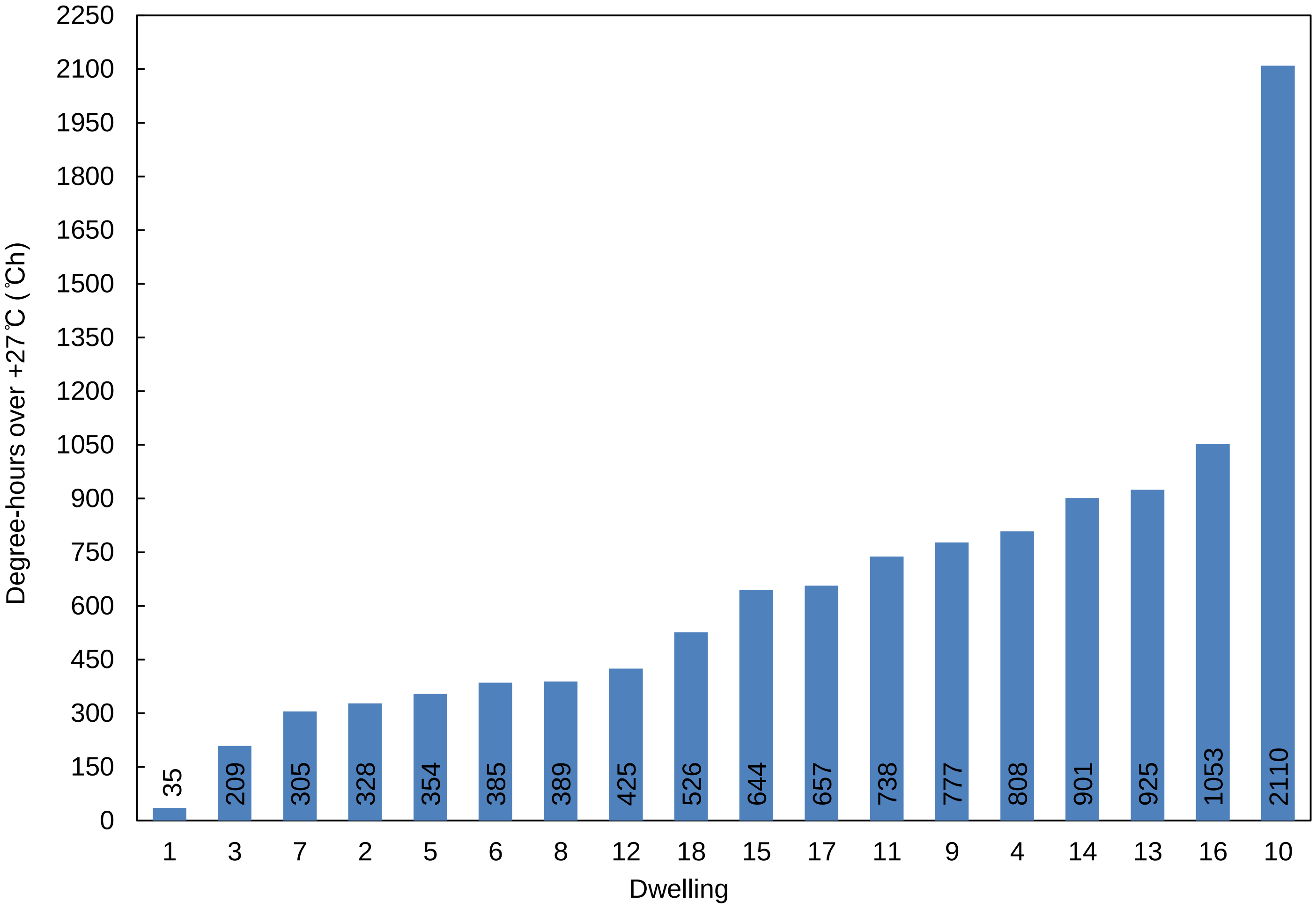
Measurement results



Measurement results



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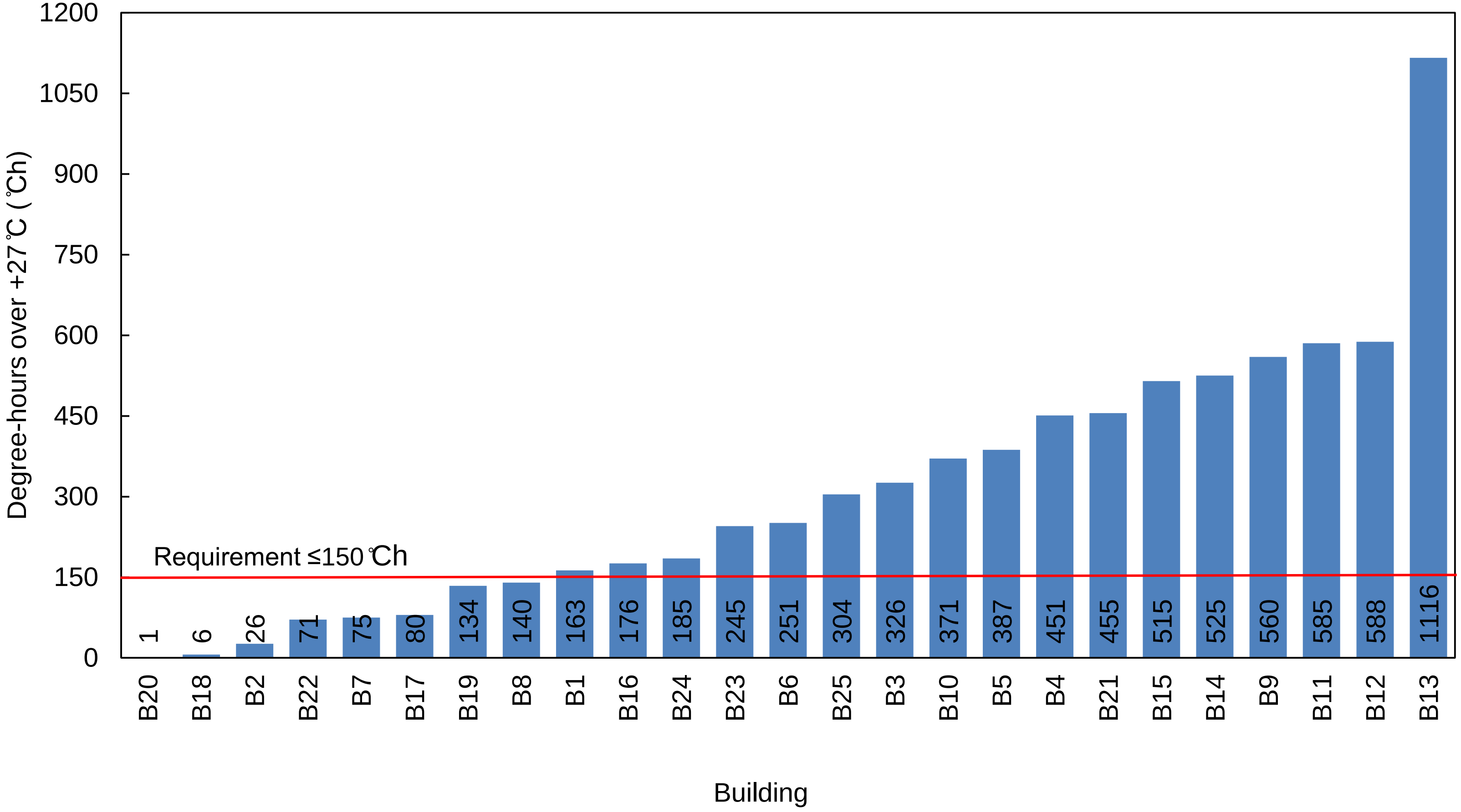
Simulation results

- Overall building results:

17 out of 25 (68%) did not comply with the regulation



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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 ℃ 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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