QUALICHeCK Overview of EPC compliance and quality issues on the ground



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EPBD directive 2002 and its recast 2010 have led to significant efforts in EU Member States to improve the energy performance of buildings. The compliance of energy performance assessments and quality of works are increasingly important aspects needing continuous attention and well developed procedures in order to be able to achieve stringent energy and indoor climate targets in practice.

Keywords: compliance assessment, energy performance minimum requirements, overheating, energy performance certificate, quality of works, compliance framework

To understand the status on the ground QUALICHeCK project conducted a review of 31 previous studies dealing with measured performance, reliability of input data, quality of the works and compliance frameworks. Additionally, 10 field studies were conducted in 9 focus countries. These studies covered all main technology areas:

- Transmission characteristics and air tightness
- Ventilation systems
- Summer thermal comfort solutions
- Renewable systems (heat pumps, thermal solar, PV)

Five of the field studies analysed EP compliance and EPC input data quality by site visits, check of design documentation and new energy and EPC calculation to compare actual and reported energy performance. One study was devoted for summer thermal comfort compliance, including temperature measurements in Estonian apartments, check of design documentation and temperature simulations based on actual solutions checked by site visits. Reliability of EPC issued with different calculation methods was studied in Spain. Last three studies worked with transmission characteristics including quality framework for cavity wall insulation and input data on window thermal performance in Belgium and U-values compliance in Cyprus.

QUALICHeCK responds to the challenges related to compliance of Energy Performance Certificate (EPC) declarations and the quality of the building works. Find out more at http://qualicheck-platform.eu.

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Most of the studies raise questions related to compliance frameworks. Often compliance frameworks stopped to schematic design/building permit and the final design, construction phase and as-built energy performance was not controlled after the building permit was issued. Only 4 out of 9 countries had compliance frameworks extended to final design and construction and commissioning phases, **Table 1**. This means that the rest 5 countries did not have clearly defined control mechanism and related practices how to take into account changes in final design and production information as well as design changes during construction. No common practice was found from commissioning procedures, which were typically not EPBD driven and were not clearly required, but more related to good practice.

Sweden uses different approach from other countries when issuing EPC. EPC in Sweden is based on measured energy use and EPC is to be issued within 2 years after taken in use. The measured energy use is corrected for the reference year, and should also be corrected for normal use, but as no standard methodology is available this is seldom done.

313 newly built houses were studied in Sweden. Of these 100 houses had been taken in use two years prior to this study and only 44 EPCs were available, which means that only 44% of the buildings complied with the requirements of the EPBD. So far no court cases of home owners lacking EPCs and the authority Boverket have not reported and legal actions to force homeowners seem to be difficult if houses are not sold or rented, when EPC is required and well available.

Swedish study compared calculated and measured energy use in studied buildings. In majority of cases the deviations were reasonable, but in some cases the deviation was much higher than the ±10% band shown in **Figure 1**.

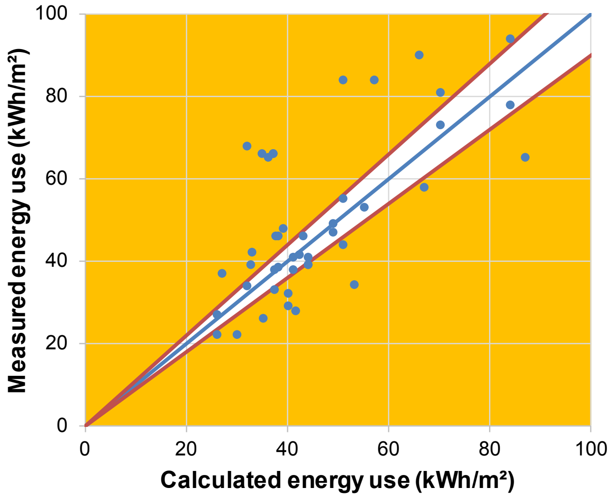

Figure 1. Comparison of measured and calculated energy use in Swedish houses.

Table 1. Overview of time frames for energy assessment requirements for new buildings in 9 countries.

Assessment type[a] →	Calculated (asset)			Measured (operational)
Sub-type[a] →	Design		**As-built**	Actual
Typical time frame →	Building permit		**After completion of the works**	<2 years after completion
Used for EPC → / Country ↓	Yes	No	**Yes**	Yes
AT	•			
BE			•	
CY	•			
EE	•			
ES		•	•	
FR		•[b]	•	
GR				
RO		•[b]	•	
SE		•[b]		•

[a] Defined in EN/ISO 52000-1:2016 [b] Not based on EPC method

Smaller difference than 10% is considered acceptable according to Sveby guide. 29 houses out of 44 (66%) had a larger difference than 10%. The average difference was 25%, max difference has 113% larger measured energy use than calculated. Since the calculations are performed at an early stage and may not have been updated with the latest drawings and information. It was shown that the difference was larger for houses heated by exhaust air heat pump than for houses heated by ground source heat pump.

Estonian study was focused on summer thermal comfort. In Estonia EPBD Annex I requirement: "1. The energy performance of a building shall be determined … and shall reflect the … cooling energy needs (energy needed to avoid overheating) to maintain the envisaged temperature conditions ..." is addressed by a requirement not allowing to exceed +27°C more than 150 Kh (Kelvin hour) in residential buildings and +25°C more than 100 Kh in non-residential buildings from June 1 till Aug 31, to be simulated with standard building use and test reference year. The principle of the temperature simulation based requirement is shown in **Figure 2**.

This relatively new requirement was not yet well established in practice as in many cases no evidence of compliance was provided in the building permit design documentation and simulations conducted for real apartments showed overheating in 68% of studied apartment buildings, **Figure 3**.

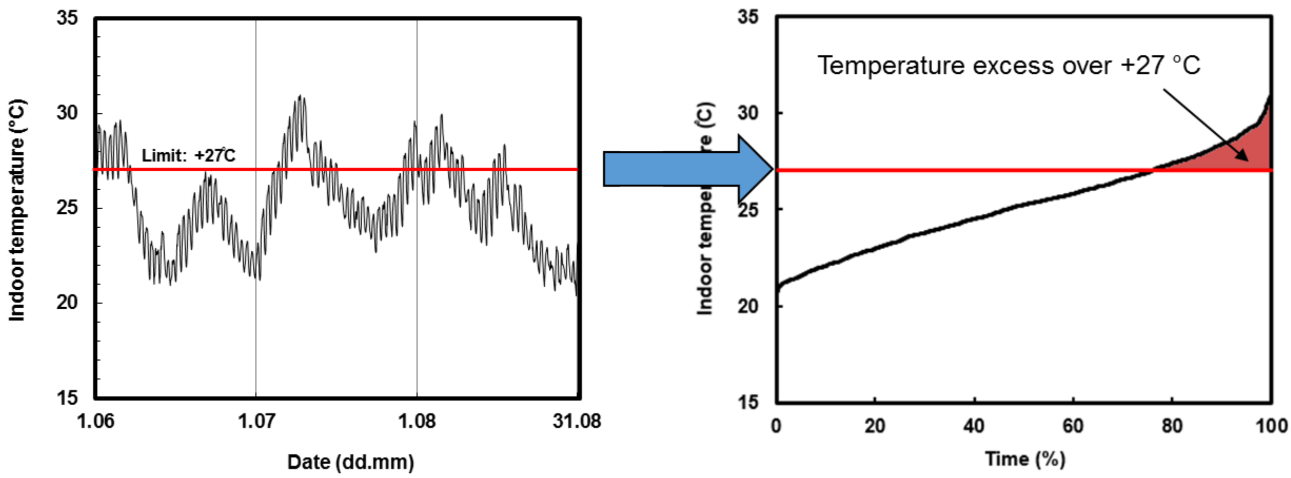

Figure 2. Estonia limits temperature excess over 27 °C to 150 Kh in residential buildings, to be proved by dynamic temperature simulation in critical rooms.

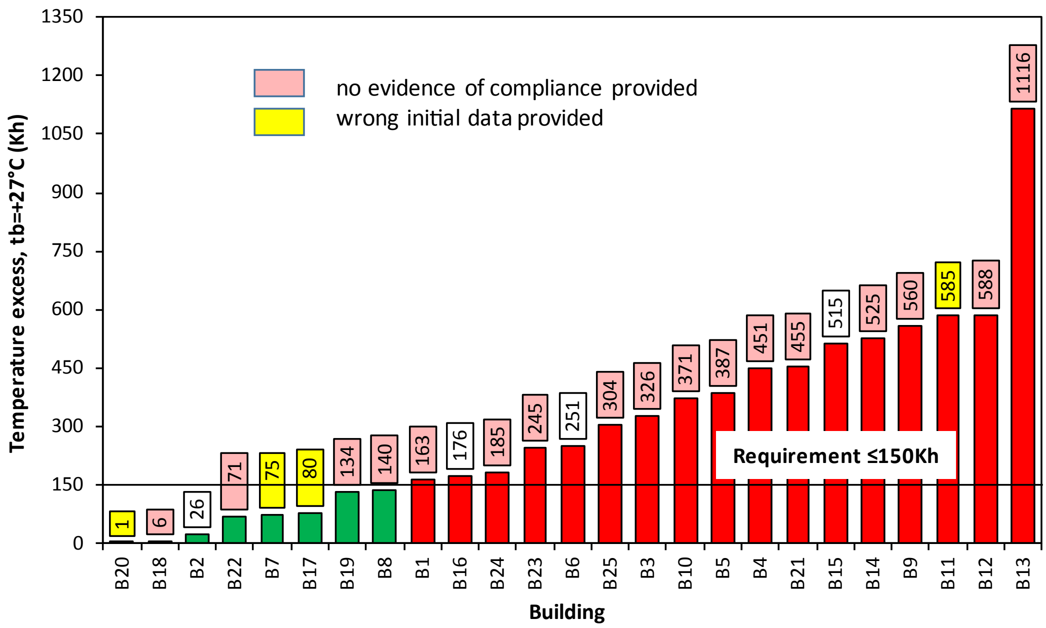

Figure 3. Assessment of overheating index in 25 buildings (based on simulated hourly mean room temperature in degree-hours above 27°C in "worse case" dwellings between 1st of July- 31st of August).

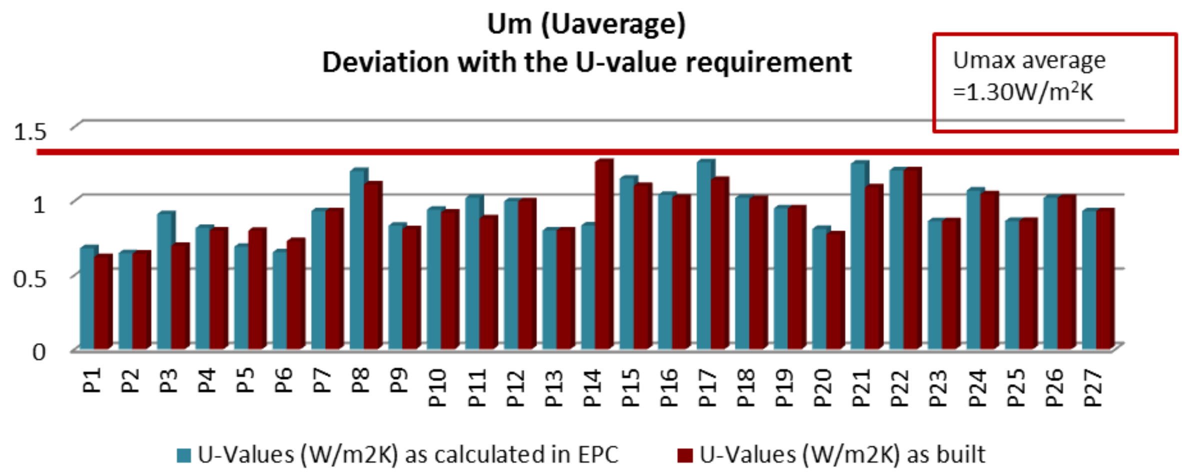

Figure 4. As built U-values comparison to design values in Cyprus.

Estonian study resulted in rule of thumbs how to prevent overheating. In the case of South oriented windows an overhang (by balconies) 0.7 times window height was enough, and for West oriented windows window-to-wall ratio times solar factor no more than 0.2 avoided overheating.

In Cyprus, the compliance with relatively new U-value requirements was studied. Quite modest average U-value requirement of U_{max} = 1.3 was met in all buildings and deviations with design values were reasonable, **Figure 4**.

In Romania EPC-s of 26 residential buildings were recalculated. Compared to existing ones, many deviations were found caused by incorrect calculations, deviations in the assumptions and calculation of input data (net floor area, heated volume, U-values, heat transfer area of building envelope etc.) and by the differences caused by software tools used. As a result, 50 % of the buildings had more than one class higher energy use for space heating and 39 % of the buildings had at least one class higher total energy use, **Figure 5**.

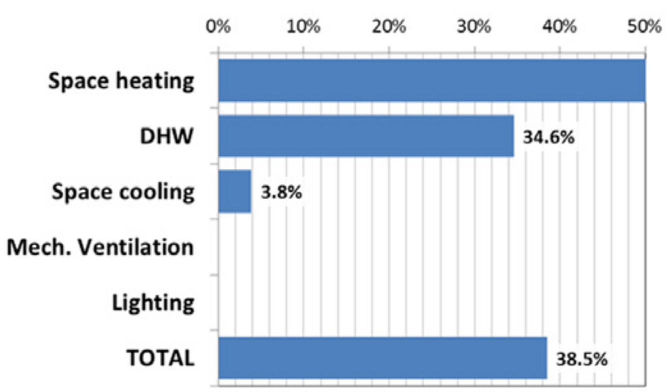

Figure 5. Percentage of EPC-s with more than one class deviation in Romania.

Results reported in this article provide only small insight to QUALICHeCK project results. Outcome of the literature review can be found from the Status on the ground report*. Based on these 31 studies it can be concluded:

- Poor ventilation is seen as a major European problem as ventilation rates and noise typically did not comply with requirements;
- Ductwork air tightness is an issue in Central Europe, but was solved 30 years ago in North Europe;
- Building leakage showed both good and bad examples;
- Studies on transmission characteristics were quite limited and mostly inconclusive;
- Heat pumps, solar thermal and other renewables showed good performance if certified installers type schemes were applied;
- Available data on summer thermal comfort was very limited however the issue was somehow addressed in majority of building codes.

Field studies conducted by QUALICHeCK show:

- In many countries development with 5 years' step can be seen – new requirements and procedures 2007, 2012 etc. have been launched;
- Systemic changes evidently will need time, legislative changes are to be supported with relevant compliance procedures, supervision, commissioning, performance measurements, piloting, model solutions, guidelines, training etc.;
- More ambitious and sophisticated systems (such as Estonian and Swedish examples reported here) more difficult to implement in practice – longer learning curves;
- Compliance frameworks are to be extended in many countries in order to be able to assess as built performance – in about half of studied countries control mechanisms stopped to building permit phase. ■

* http://qualicheck-platform.eu/about/situation-on-the-ground/