Quality of works Existing situations, reasons for problems and first best practice solutions

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Compared to today's practice, the trend towards Nearly Zero-Energy Buildings (NZEB) implies the correct execution of classical building works, e.g., airtightness and the correct execution of building nodes, and the use of advanced technologies requiring specific skills of the workforce such as handling renewable energy sources in combined HVAC systems or advanced ventilation systems. The IEE project QUALICHeCK is here focusing on establishing good technical boundary conditions to ensure adequate quality of the works. In this context it is important to understand that technical requirements are a prerequisite for having a framework that encourages compliance and allows imposing effective penalties related to the quality of the works. The ultimate goal is to stimulate the development of schemes to improve the quality of the works, taking into account the pros and cons of previous experience, with specific attention given to boundary conditions and to allowing effective compliance. The work in QUALICHeCK documents and builds on successful initiatives to overcome critical site implementation issues that undermine the confidence in actual building energy performance.

Matrix on critical situations regarding the work vs. focus areas

As starting point of the work, QUALICHeCK has compiled a matrix with more than 60 critical situations that can arise on the construction site starting with general issues like poor specifications of product performances, time pressure, language barriers, and insufficient knowledge of new technologies and ending with rather specific mistakes that can be made when installing certain technologies, e.g. no accessibility for cleaning the ventilation ducts or wrong control settings. These critical situations have been allocated to the project's technical focus areas transmission, ventilation, sustainable summer comfort technologies, and renewables in multi-energy systems. The matrix has then been filled with experiences and studies from various EU countries and with first best practice solutions.

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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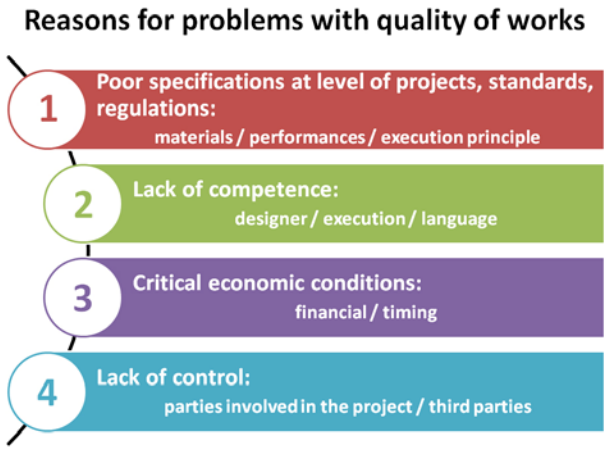
Reasons for problems with quality of works

Based on the matrix there can be a wide range of reasons for poor quality on the construction site from poor specifications at the level of projects, standards or regulations to lack of competence, critical economic conditions and lack of control, see **Figure** below. Poor specifications can concern the material to be used (material characteristics such as thermal conductivity, or the construction details for joints), the definitions of the required performances (air-/water-tightness, wind resistance for PV panels fixtures, acoustical performance of the ventilation system, etc.) or the execution principle (e.g. under which conditions roofing may be installed). Lack of competence can occur at the designer level (see QUALICHeCK work on compliant and easily accessible input data), at the construction workers level and can generally be caused by language barriers. Critical economic conditions may be caused by financial limits and by deadlines too short for the work. Last but not least, lack of control (in combination with the other reasons) may lead to a lower quality of work, but can be overcome by checks from either parties involved in the project (building owner or architect) or by third parties, which can be governmental or come from independent control organisations.



Four main reasons for problems associated with the quality of works.

National experiences and studies

A collection of national experiences and studies of critical situations regarding the quality of works is ongoing, but the first report of the "quality if works" area [1] within QUALICHeCK contains a summary of 17 national reports. They have been analysed with regard to the technological areas covered, their transferability to other countries and the resulting consequences. Examples include results of field tests of heat pumps, solar thermal systems and ventilation systems, the impact of storm on the fixtures of PV systems, surveillance activities on construction sites, studies on reasons for moisture and mould damages, costs of defects in construction, factors affecting the building's airtightness and the general analysis of a country's national status quo regarding the quality of works within BUILD UP Skills [2].

One example for the collected analyses is a study on ventilation systems in classrooms conducted in Austria in 2008 [3]. The researchers performed a technical evaluation of the ventilation systems and found many shortcomings due to mistakes made during planning and installation, including poor specifications of execution performances in the tender, reduced ventilation rates due to noise problems, filter change problems and partly incorrectly installed filters. As a result of the study, a planning guideline proposing 61 detailed quality criteria for classroom ventilation systems was developed. Additionally, the training material for the ventilation installer course was revised.

Good practice examples to solve critical situations

Some first successful national examples that help to guarantee a higher quality of construction and installation works have also been gathered and included in the project report [1]. Fifteen national solutions are presented that can be grouped into education and training of construction workers, qualification schemes and certification of workers or companies, guidelines and checklists, quality assessments by third parties and guarantees for building owners. One example is the voluntary UK quality framework CIGA for the insulation of cavity walls that is a guarantee scheme available since 1995 providing home owners with the comfort of knowing that work carried out by registered contractors complies with the requirements of the UK building regulations. The CIGA guarantee covers defects in materials or workmanship. Another good practice example is presented in the QUALICHeCK fact sheet "the German contractor's declaration" [5]. The German contractor's declaration is a new obligatory scheme that requires contractors to confirm in writing after having completed the works, that the specific minimum energy performance requirements for building envelope components, space heating and hot water generation and distribution systems and newly installed cooling and ventilation systems are met during the realisation of a renovation measure. Infringements lead to fines.

Conclusions and future work

QUALICHeCK has collected and analysed critical situations on the construction site regarding the quality of work, has summarised relevant national experiences and studies and found good practice solutions that help to solve the critical situations. The collections will be extended by further studies and approaches and will be discussed with stakeholder organisations during workshops and bilaterally. This will enable for the experiences an assessment by the stakeholders concerning how they rate the experiences and whether they are aware of similar experiences in other countries, a collection of additional published studies and other knowledge and a discussion about the reasons for the critical points. For the best practice examples the stakeholder feedback shall contain an assessment of the solution examples already included, their view regarding the transferability to other countries or even other critical situations and additional best practice examples.

Thus reviewed and extended, the national and international experiences with critical points at the construction site and approaches to a better quality of work will be presented in the final report. The most interesting experiences and solution approaches will be described in more detail in fact sheets. ■

References

[1] Erhorn-Kluttig, H.; Erhorn, H.; Doster, S.: "Towards improved quality of the works - Documented examples of existing situations regarding quality of works". Report of the IEE QUALICHeCK project available at http://qualicheck-platform.eu.

[2] BUILD UP Skills - An initiative to boost continuing or further education and training of craftsmen and other on-site construction workers and systems installers in the building sector. Intelligent Energy Europe (2011-2013). Further information available at http://www.buildupskills.eu.

[3] Greml, A., Blümel, E., Kapferer, R., et al.:„Evaluierung von mechanischen Klassenzimmerlüftungen in Österreich – Erstellung eines Planungsleitfadens [Evaluation of mechanical classroom ventilation systems in Austria – Development of a planning guideline]". Project report within the programme Haus der Zukunft [Building of Tomorrow]. Kufstein, Austria. 2008. Available at http://www.hausderzukunft.at/hdz_pdf/endbericht_0814_klassenzimmerlueftung.pdf.

[4] Cavity Insulation Guarantee Agency: Further information available on the website https://www.ciga.co.uk.

[5] Erhorn-Kluttig, H.; Erhorn, H.; Doster, S.: "The German contractor's declaration: Supporting compliance with minimum energy performance requirements on the construction site". Fact sheet of the IEE QUALICHeCK project available at http://qualicheck-platform.eu.