

Durable building and ductwork airtightness for healthy energy efficient buildings

This position paper gives a brief overview of reasons behind and issues to be addressed to foster durable building and ductwork airtightness solutions in the member states in the context of the review of the 2010 EPBD¹ to achieve substantial energy savings in the long term without compromising indoor environmental quality.

Context

The regulatory landscape and field practice have evolved very differently between building and ductwork airtightness since the introduction of the first Energy Performance of Buildings Directive (EPBD 2002).

On the one hand, building airtightness has been introduced in most of the energy performance assessment methods in the member states and, in several countries, the airtightness performance of the new building stock has considerably improved. Several aspects explain this trend:

- First, building professionals and scientists have come to a general consensus on the incompatibility of poor airtightness levels with Nearly Zero-Energy targets for most European climates. Evidence that it can severely affect the energy performance is also established for hot and/or humid climates although it is more case specific;
- Second, pilot low-energy programmes have shown that buildings designers and workers could be successfully trained to achieve good building airtightness;
- Third, there is positive feedback from several member states that have gradually put in force control, qualification or certification procedures for builders, designers, testers.

On the other hand, feedback from members of the TightVent Airtightness Associations Committee (<http://tightvent.eu/partners/taac>) strongly suggests that building airtightness improvements are lagging behind in many regions and/or building sectors, although relevant in terms of energy savings and indoor environmental quality. In addition, ductwork airtightness has comparatively received much less attention than building airtightness. Field studies continue to show worrying practice both in terms of design and implementation of ductwork systems. Although the energy and indoor environmental impacts of poor ductwork airtightness have been identified since many years, very few European countries have taken steps to foster airtight ductworks apart from Scandinavian countries that have done so since the 1950s.

¹ Consultation document is available at:

<https://ec.europa.eu/energy/sites/ener/files/documents/EPBD%20Public%20Consultation.pdf>

Addressing simultaneously ventilation performance and building and ductwork airtightness

Article 4 of the EPBD states that "possible negative effects such as inadequate ventilation" shall be avoided; however, several studies strongly suggest that ventilation and more generally indoor environmental issues have been neglected in many member states while implementing energy conservation policies. With regard to building and ductwork airtightness and ventilation, it is a fact that both aspects are bound: on the one hand, poor building and ductwork airtightness can severely affect the performance of ventilation systems; on the other hand, appropriate ventilation provisions are essential in airtight buildings. Therefore, several countries are gradually introducing requirements or recommendations for measurements of ventilation airflows or ductwork airtightness which are slowly raising awareness on this issue. To accelerate the uptake of such measures for new and renovated buildings, they should be encouraged by European legislation and standards and be supported by appropriate compliance and quality control requirements similarly to successful building airtightness approaches (Carrié and Charrier, 2015; Leprince and Carrié, 2014). Such actions would facilitate enforcement and compliance, which is of particular concern for the review of the EPBD (see consultation document, part B).

Long-term performance

The present EPBD gives a weak signal for measures to be taken to maintain the performance of the buildings in time. Therefore, although it seems obvious that new or renovated buildings should keep performing well with time, it is also obvious that the concern for durable performance in building regulations or voluntary programmes is superficial. There is, however, a great opportunity for actual energy savings with durable airtightness methods, products and systems already available on the market, and a severe pitfall to avoid with poor quality products and workmanship. Nevertheless, experience shows that energy performance regulations are such strong market drivers that the uptake of these solutions can only be marginal if not fairly rewarded in the regulations and standards.

Conclusion

TightVent confirms that significant progress can be made to achieve durable building and ductwork airtightness, which could result in substantial energy savings and improved indoor environmental quality. Measures taken to grasp this potential shall address issues such as energy efficient ventilation, comfort, skills development and market uptake in a holistic approach, addressing both new and existing buildings. They should build on the positive experience of several member states, in particular on building airtightness compliance and quality control. Appropriate European legislation and standards are essential to support this effort.

References

Carrié, F.R. and Charrier, S. 2015. Building regulations can foster quality management — the French example on building airtightness. QUALICheck fact sheet # 01, available at <http://qualicheck-platform.eu/wp-content/uploads/2015/02/QUALICheck-Factsheet-01.pdf>

Leprince, V. and Carrié, F.R. 2014. Reasons behind and lessons learnt with the development of airtightness testers schemes in 11 European countries. Proceedings of the AIVC Workshop on Quality of Methods for Measuring Ventilation and Air Infiltration in Buildings, Brussels, Belgium. pp. 103-107.

Annex

This annex gives the TightVent's input to the EPBD review structured by answers to several questions of the questionnaire of the public consultation document available at:

<https://ec.europa.eu/energy/sites/ener/files/documents/EPBD%20Public%20Consultation.pdf>.

A. Overall Assessment

Question 14. Are the objectives of the EPBD delivered efficiently?

The EPBD has triggered significant changes in the regulatory landscape and in the field regarding building airtightness. Several aspects explain this trend:

- First, building professionals and scientists have come to a general consensus on the incompatibility of poor airtightness levels with Nearly Zero-Energy targets for most European climates. Evidence that it can severely affect the energy performance is also established for hot and/or humid climates although it is more case specific;
- Second, pilot low-energy programmes have shown that buildings designers and workers could be successfully trained to achieve good building airtightness;
- Third, there is positive feedback from several member states that have gradually put in force control, qualification or certification procedures for builders, designers, testers (see for instance [1][2][3][4]).

Nevertheless, there remain wide differences in the effectiveness of schemes implemented to foster better airtightness and consideration of indoor air quality issues as required by article 4 of the EPBD. Member states should be encouraged to develop robust frameworks for compliant EPCs and better quality of the works, both for building airtightness and ventilation systems, building on the positive experience mentioned above.

- [1] Carrié, F.R. and Charrier, S. 2015. Building regulations can foster quality management — the French example on building airtightness. QUALICheck fact sheet # 01, available at <http://qualicheck-platform.eu/wp-content/uploads/2015/02/QUALICheck-Factsheet-01.pdf>
- [2] Leprince, V. and Carrié, F.R. 2014. Reasons behind and lessons learnt with the development of airtightness testers schemes in 11 European countries. Proceedings of the AIVC Workshop on Quality of Methods for Measuring Ventilation and Air Infiltration in Buildings, Brussels, Belgium. pp. 103-107.
- [3] Solcher, O. 2012. The FliB certification for craftsmen. Presentation at the 33rd AIVC conference, Copenhagen, Denmark.
- [4] Dichten und Dämmen gehören zusammen, <http://www.flib.de/handwerk.php>

B. Facilitating enforcement and compliance

Question 22. Are there any cost-effective measures for ensuring compliance at local and regional level that could be replicated and used to improve compliance on a larger scale?

Several member states have gradually put in force control, qualification or certification schemes for builders, designers, testers (see for instance [5][6][7][8]). There are no detailed analyses of the cost-effectiveness of these schemes to ensure compliance; however, the large number of testers under these schemes (e.g., 450 in the UK; 500 in Germany; 900 in France; 170 in Belgium), the recent development of similar schemes in other countries (DK, IE, SE), or their extension to ventilation performance (FR, BE) are positive signs.

- [5] Carrié, F.R. and Charrier, S. 2015. Building regulations can foster quality management — the French example on building airtightness. QUALICheck fact sheet # 01, available at <http://qualicheck-platform.eu/wp-content/uploads/2015/02/QUALICheck-Factsheet-01.pdf>
- [6] Leprince, V. and Carrié, F.R. 2014. Reasons behind and lessons learnt with the development of airtightness testers schemes in 11 European countries. Proceedings of the AIVC Workshop on Quality of Methods for Measuring Ventilation and Air Infiltration in Buildings, Brussels, Belgium. pp. 103-107.
- [7] Solcher, O. 2012. The FliB certification for craftsmen. Presentation at the 33rd AIVC conference, Copenhagen, Denmark.
- [8] Dichten und Dämmen gehören zusammen, <http://www.flib.de/handwerk.php>

Question 23. What do you think of the various ways of calculating building energy performance at national/regional level? Please include examples.

Given local specificities (usage, climate, construction methods, etc.), it seems logical that there are wide differences between the EPB calculation methods developed in the MS.

Whereas building airtightness is accounted for in the energy performance calculation methods in most member states, ductwork airtightness is considered in very few countries (to our knowledge, only BE, FR, PT). This is surprising, in particular, when conditioned air is transported in the ductwork as many studies have reported significant energy wastage in such cases.

Question 24. What measures are missing that could simplify the implementation of building regulations to make sure that buildings meet the required high energy performance levels?

See answer to question 22

J. Buildings systems requirements

Question 74. Based on existing experience, do you think in the EPBD requirements is missing for regular inspections of the technical building systems to ensure:

a. that systems' performance is maintained during their lifetime?

b. that owners/occupiers are properly informed about the potential improvements to the efficiency of their systems?

c. that replacement/upgrading of the technical building systems is triggered?

The present EPBD gives a weak signal for measures to be taken to maintain the performance of the buildings in time. Therefore, although it seems obvious that new or renovated buildings should keep performing well with time, it is also obvious that the concern for durable performance in building regulations or voluntary programmes is superficial. There is, however, a great opportunity for actual

energy savings with durable airtightness methods, products and systems already available on the market, and a severe pitfall to avoid with poor quality products and workmanship. Nevertheless, experience shows that energy performance regulations are such strong market drivers that the uptake of these solutions can only be marginal if not fairly rewarded in the regulations and standards.

Regular inspections of ventilation systems (which is not covered in the present directive) could contribute to improving the long-term performance of these systems, both in terms of energy use and indoor air quality. The Swedish experience with the inspection of ventilation systems (OVK) is encouraging, but this experience is inseparable from the voluntary quality system adopted much earlier (in the 1950s) for nearly all new installations with product and workmanship specifications and controls (AMA). TightVent partners believe that, whereas regular ventilation system inspections are likely to be effective to improve the quality of ventilation systems, they have to be accompanied by clear requirements or appropriate incentives and robust compliance frameworks to be cost-effective and to avoid competition distortion.

K. Operational management and maintenance

Question 78. Based on existing experience, does the EPBD promote the best way to close the gap between designed and actual energy performance of buildings?

There are several aspects that question the effectiveness of the EPBD to close the gap between design and actual energy performance:

- Without competent tester schemes, there are concerns regarding the compliance of the input data used in EPCs for building and ductwork airtightness. Assuming the calculation method was perfect, the gap can still be large due to wrong input data.
- Actual energy performance depends on the quality of the works, which is not considered in the present EPBD.
- Default values are often set based on political choices and signals to be given to the market rather than on realistic values that could be attributed to inputs when not carefully assessed. The deviation between default and actual building or ductwork airtightness values can lead to significant differences in energy performance assessments.

There should be provisions in the EPBD to avoid those problems.