EN ISO 52003 and EN ISO 52018: making good use of the EPB assessment outputs

Documents EN ISO 52003-1 & -2 and EN ISO 52018-1 & -2 describe the relation between the indicators to express the various energy performances of buildings (EPB) and the EPB requirements and EPB ratings. These documents provide general insight to private prescribers and public regulators (and all stakeholders involved) on how to make purpose-oriented use of the outputs of the EPB assessment methods.

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These 2 EN ISO standards (i.e. parts 1) [1] [2] and their accompanying technical reports (i.e. parts 2) [3] [4] are of an unusual nature in the set of EPB documents. As a rule, the EPB assessment documents concern inspections/measurements or calculations. The documents at hand concern neither of these aspects, but deal with the productive use of the output (EPB indicators) of the assessment standards for setting requirements, for rating, or for other possible applications. This can be called the "post processing" of the results of the EPB assessment.

The documents EN ISO 52003-1 & -2 deal with the general principles and their application to the overall energy performance. Documents EN ISO 52018-1 & -2 concern their application to various fabric features and to the thermal energy balances for heating, cooling or free floating temperatures (overheating and/or undercooling).

By describing explicitly different aspects related to the development of EPB regulations, all parties involved can gain a better and explicit understanding of the issues at hand, thus facilitating the policy making process. In the case of public regulations, the parties include not only the regulators themselves, but also all stakeholders involved in the policy development, notably diverse organizations representing citizens, designers, supply industry, construction companies, craftsmen, etc.

EN ISO 52003-1 & -2: general principles and overall energy performances

Successively, the following concepts are defined and discussed in the standard and its associated technical report (both replacing EN 15217 and ISO 16343):

- EPB features
- Numerical EPB indicators
- Tailoring for requirements and for ratings
- EPB requirements
- EPB rating
- EPB certificate

Several of these aspects are described in more detail in a previous REHVA article [5] and are not repeated here.

EN ISO 52018-1 & -2: thermal energy balance and fabric features

These documents are new. They list and discuss a variety of possible partial EPB features and indicators for requirements related to the thermal energy balances and to the fabric, notably summer and winter (free floating) thermal comfort, energy needs for heating and cooling, overall envelope thermal insulation, individual element thermal insulation, thermal bridges, window energy performances, envelope air tightness and solar control.

In the standard itself (i.e. in part 1) [2] a very brief possible motivation for each possible requirement is given and different possible EPB indicators are described that can be used for each feature. Annex A provides tables that allow regulators to report in a standardized manner the mix of EPB features and corresponding EPB indicators that have been chosen for the requirements in their jurisdiction. Annex B proposes motivated default requirement mixes for different climates.

The technical report (i.e. part 2) [4] formulates for each EPB feature background considerations with respect to the following aspects (in as far as applicable): a more detailed discussion of possible motivations, possible indicators, comparable economic strictness of the requirements, practical points of attention, testing, new construction and renovation issues, exceptions and other possible aspects.

Part 2 also illustrates in its annex A a practical manner in which fictitious cooling can be integrated in the overall energy performance by means of a conventional probability weighting factor. In this way, an energy efficient overall design can be stimulated that strikes a good balance between summer and winter thermal comfort.

As explained in EN ISO 52003 ([1], [3] and [5]), for some EPB features/indicators the numeric value that corresponds to the technical and economic optimum often varies strongly from 1 construction project to another, depending on function, size, shape, etc. In order to treat all buildings in the same manner (e.g. reflecting the same technical and economic strictness), it is for these indicators thus of crucial importance to use variable value requirements or references that take into account all relevant project-specific features of each individual building. This is called tailoring.

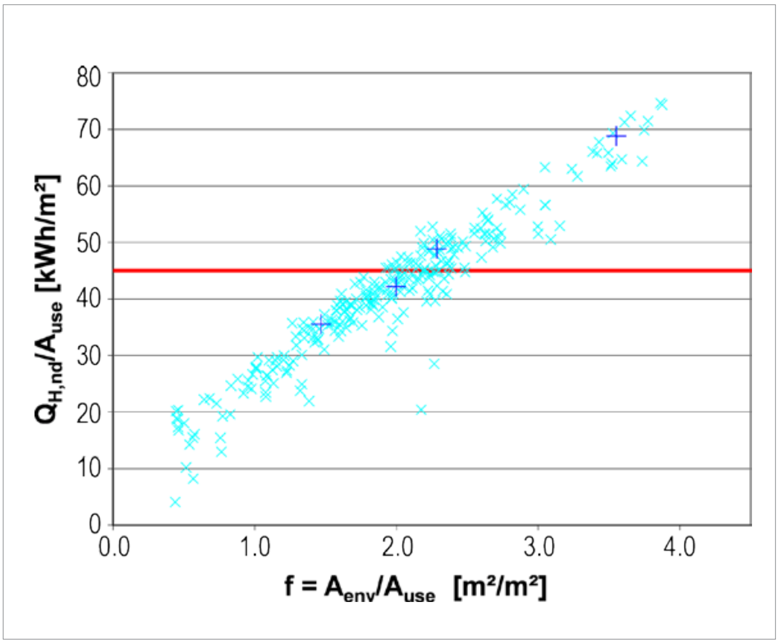

Figure 1. Example of the impact of a fixed (constant value) requirement versus a more appropriate variable value (tailored).

Figure 1 illustrates on the basis of some 200 real dwelling shapes (each individual cross) how for a given set of technical measures (level of overall thermal insulation, degree of airtightness, energy efficiency of the ventilation system, etc.) the numeric value of the specific heating need (i.e. the heating need per useful floor area) can strongly vary from one project to another. The x-axis is the ratio of the envelope area to the useful floor area. This numeric variability of equal technical-economic strictness obviously explains, in combination with other potentially variable factors, the similar variability of the overall energy performance; see Figure 4 in [5].

If the reference value that is used to set a requirement is a fixed value (in casu: requirement expressed as a constant maximum value in kWh/m² disregarding building shape or size: e.g. red horizontal line), then buildings with a relatively large envelope area[1] (compared to the floor area) would need a large technological-economic effort to meet the requirement, while on the other hand buildings with a relatively small envelope area would need only a small technological- economic effort to meet the same requirement. Such mismatch would correspond to a suboptimal use of investments both

[1] I.e. to the right of the graph. For instance small detached dwellings.

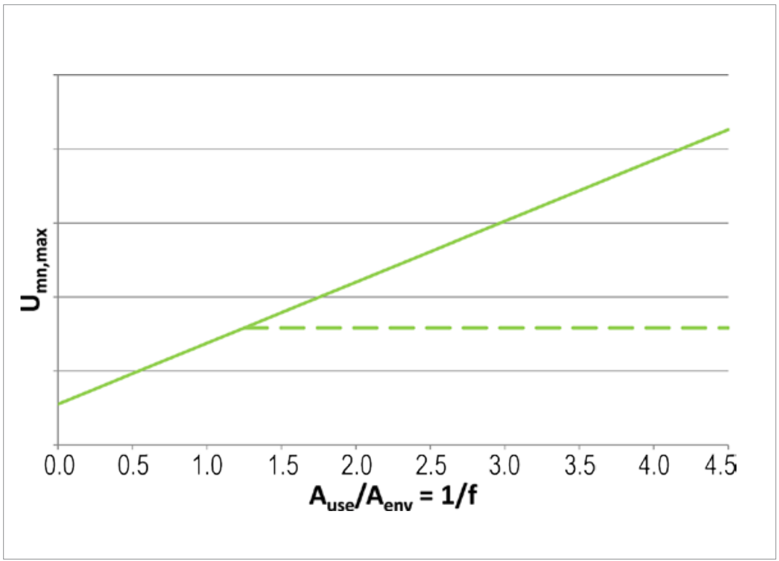

Figure 2. Motivated example of a curve for the maximum mean thermal transmittance as a function of the inverse of the shape factor.

on a societal and on a private level. A more equitable reference for the requirement takes into account this variation and determines project-specific, tailored quantitative requirements.

A more detailed discussion of the graph and further analysis and illustrations of the issue for the specific heating need can be found in annex B of EN ISO 52018-2 [4].

A similar issue arises with a requirement on the mean thermal transmittance of the thermal envelope. It is commonly accepted that the adequate amount of glazing needs to increase with the useful floor area: the broader the building is the more glass is needed for sufficient daylight access and visual outdoor contact. As in practice, the thermal transmittance of transparent elements (windows, etc.) is (due to physical-technical and economic reasons) typically much higher than that of opaque envelope elements, an increasing share of transparent area in the envelope (which reasonably, is thus approximately proportional to the useful floor area) leads to a requirement that increases linearly with the floor to envelope ratio (i.e. the inverse of the shape factor), as illustrated in **Figure 2**. The minimum value of the straight line (for an x-value of 0) corresponds to the (average) thermal transmittance requirement for the opaque elements. The slope of the line depends on the features of the transparent elements: the reasonable fraction as a function of the useful floor area, and their thermal transmittance requirement.

There are however logical limits to the maximal mean thermal transmittance. It should never be larger than value of transparent elements, and in addition, not the entire envelope needs to be glazed: floors are usually opaque, roofs are opaque or only need to be partially transparent, and parts of the facades below the working plane, which do not meaningfully contribute to daylighting anymore, generally do not need transparent elements. In general, the maximum limited is therefore restricted to a constant value above a certain A_{use}/A_{env} value. This is illustrated with the dashed line in **Figure 2**.

Conclusion

Documents EN ISO 52003-1 & -2 and EN ISO 52018-1 & -2 document in a critical manner useful knowledge, distilled from decades-long experiences, that supports politicians/regulators and stakeholders in taking well-informed decisions, optimally tailored to their own jurisdiction. In this manner a well-considered EPB regulation can be developed that matches the sophistication of the EPB assessment methods. ■

References

[1] EN ISO 52003-1, Energy performance of buildings – Indicators, requirements, ratings and certification – Part 1: General aspects and application to the overall energy performance.

[2] EN ISO 52018-1, Energy performance of buildings — Indicators for partial EPB requirements related to thermal energy balance and fabric features — Part 1: Overview of options.

[3] CEN ISO/TR 52003-2, Energy performance of buildings – Indicators, requirements, ratings and certification – Part 2: Explanation and justification of ISO 52003-1.

[4] CEN ISO/TR 52018-2, Energy performance of buildings — Indicators for partial EPB requirements related to thermal energy balance and fabric features — Part 2: Explanation and justification of ISO 52018-1.

[5] Dirk Van Orshoven, Dick van Dijk, EPB standard EN ISO 52003: How to put the EPB assessment outputs to intelligent use, The REHVA European HVAC Journal, Volume: 53, Issue: 3, May 2016.