UTILIZE THE BENEFITS OF DAYLIGHT, SOLAR GAINS, SOLAR PROTECTION, NATURAL VENTILATION AND EVEN MORE

Grasping the benefits of daylight, thermal comfort and indoor air quality

The Clean Energy package, presented at the end of 2016 kicking off the new legislative framework shall deliver the EU's objectives towards the low carbon economy by 2050. After 12 months of intensive political process the first legislative file has been closed and published, namely the Directive (EU) 2018/844 amending the Energy Performance of Buildings Directive (EPBD - named 2018-amended EPBD hereafter).

EuroWindoor welcomes a more holistic approach recognizing the complementary potential of Energy efficiency, healthy indoor comfort and positive impacts on the environment. Of absolute importance is now implementation of the 2018-amended EPBD Directive in to national legislation.

When implementing the 2018-amended EPBD, it is key to[1]:

1. **Increasing the replacement rate of windows as part of the long-term renovation strategy**

2. **Focus on daylight, indoor climate aspects and a dynamic building envelope to ensure that European citizens live and work in healthier buildings**

3. **The energy balance principle shall be defined in the specific heating and cooling climatic conditions to assess the energy performance of windows**

I. Increasing the replacement rate of windows as part of the long-term renovation strategy

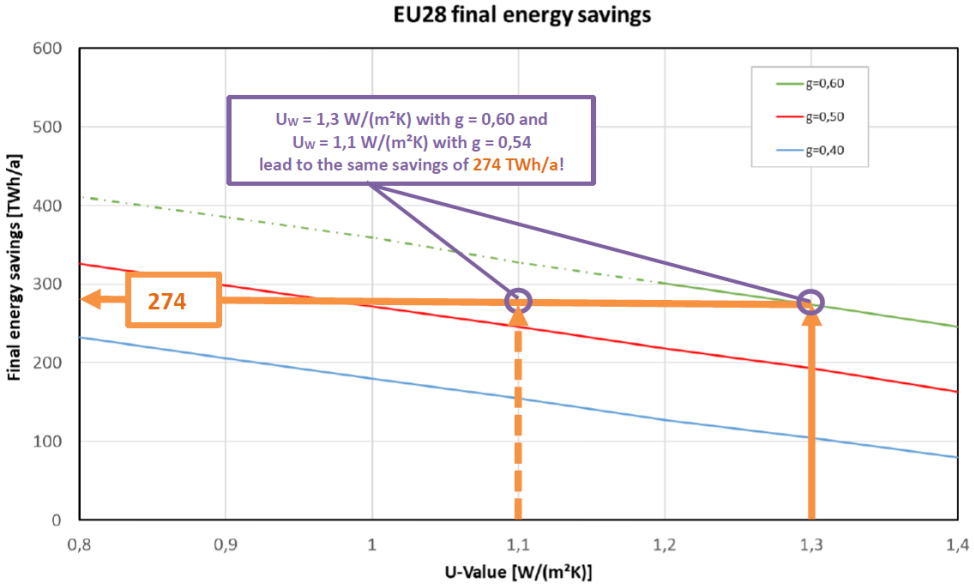
While the Europe's building stock – residential and non-residential is responsible for 40% of EU primary energy consumption and 36% of the CO_2 emissions, and 75% of the building stock remains inefficient. The rate of building renovation is low – below 1.2% per year. The previous EPBD has helped to improve the energy performance of new buildings – but has not helped to significantly improve the building envelope of existing buildings.

The renovation rate needs to grow to 3%/year adding 1 million more jobs. Triggering renovations in Europe is key in obtaining large energy use reductions in our buildings, and the replacement of windows plays a crucial role in achieving this goal.

A new study from Ingenieurbüro Hauser (IBH) on "Pan-European results on energy savings due to window replacement (2018) shows that window replacement policies based on energy balance approach can result in huge energy savings. Below Figure 1 shows that replacing old windows – in this case double glazed windows without coating – with optimized windows for both heat loss and solar gains (e.g. U-value of 1.3 W/m^{2}K and g-value of 0.60) can result in 274 Twh/yearly heating energy savings. Similar findings per country in Europe can be found in the study. It should though be highlighted that the study only includes heating energy savings, and the issue of overheating and energy use for cooling needs to be assessed in the specific condition, and the right window replacement solution varies across climatic conditions.

[1] This position paper is an continuation of the „Benefits of the glazed area" EuroWindoor position paper (2016)

Figure 1: Potential heating energy savings related to window replacement



Source: Ingenieurbüro Prof. Dr. Hauser GmbH (IBH 2018)

Note: The figure shows different energy balance calculations including e.g. building type, climate, and different variants of U_W- and g-values. It only includes energy savings for heating.

Energy savings is one important part of the landscape driving renovation. We know from several consumer surveys and by interacting with customers, that key drivers for renovation are also – and maybe to a higher extent - issues such as increased daylighting, avoiding over-heating, updating design (incl. the visual expression of the building, safety and accessibility in use, protection against noise, burglar resistance etc.) and of course – last but not least – cost considerations.

- ✓ The implementation of 2018-amended EPBD should create incentives for the renovation of the existing building stock in a cost effective way. The cheapest energy is that unused, and buildings should be seen as part of the energy system, and not as isolated islands (in line with the 'Energy Efficiency First' principle).

- ✓ Long-term national renovation strategies and long-term defined cost optimal requirement levels based on an energy balance approach will increase the investment certainty and innovation within the industry.

- ✓ The implementation of the 2018-amended EPBD should reflect what triggers renovation is hardly limited to energy considerations only, but to other triggers like ensuring healthy, comfortable, better and modernized buildings.

Key recitals, articles etc. in the 2018-amended EPBD supporting energy efficient and healthy renovation:

- The Recital 14 (2018/844/EU) and specifically the Article 2a on Long term renovation strategies requests EU Member States to establish long term renovation strategies to support renovation of the national building stock. It shall encompass, amongst other elements, an evidence based estimate of expected energy savings and wider benefits, such as those related to health, safety and air quality.
- Following the above, when setting the general framework for the calculation of the energy performance of buildings, Article 7 (fifth paragraph) and Annex I in point 2 clarifies that all energy needs (space heating and cooling, domestic hot water, ventilation, lightening, etc.) shall be designed in order to optimize health, indoor air quality and comfort.

II. Focus on daylight, indoor climate aspects and a dynamic building envelope to ensure that European citizens live and work in healthier buildings

We spend 90% our time indoors, while studies indicate that more than 30% of all building stock in Europe is poorly ventilated, often humid, lacking daylight and are often the cause for chronical diseases (Fraunhofer, 2016). Therefore, policies must improve indoor comfort conditions.

Increasing energy efficiency in buildings should and can go hand in hand with good daylight conditions and a healthy indoor environment, but only if proper attention is paid to this when setting requirements. So far Member States have implemented daylight and indoor climate comfort requirements very differently, and in most cases to a very little extent. In this respect, the 2018-amended Energy performance of buildings directive (EPBD) offers EU Member States new implementation tools to multiply the benefits and design future renovation schemes with the objective to optimize health, indoor air quality and comfort levels (Annex I). In order to ensure EPBD promotes well performing buildings in respect of daylight and indoor climate more explicit guidance to Member States is needed incorporating EU standards.

Energy efficiency gains during summer and winter can be further achieved by e.g. optimizing the envelope of the building with dynamic products like smart windows and solar protection products – possibly automatized, which takes full account of the needs of the user in the specific heating and cooling context. Sensor driven systems can promote the energy efficiency.

It is essential to promote systems and solutions that result in high level of daylight and quality indoor climate, comfort and low energy consumption in the implementation of the 2018-amended EPBD market by market:

- ✓ Specific and sufficiently accurate calculations of daylight (daylight factor) and indoor climate (thermal comfort, indoor air quality, ventilation) conditions should be part of the performance evaluation in summer- and wintertime to allow accurate predictions of energy use.

- ✓ Evaluation of e.g. daylight, dynamic envelope, overheating and ventilative cooling in building compliance tools in more EU Member States.

- ✓ The implementation of the 2018-amended EPBD should include setting daylight and indoor climate requirements in building codes based on the standards on daylight in buildings (EN 17037), indoor climate and calculation of natural ventilation.

- ✓ Energy Performance Certificates have been instrumental in raising awareness on the energy performance of buildings but EPCs have to evolve to include an evaluation of daylight and indoor climate in order to deliver added value to home owners and tenants.

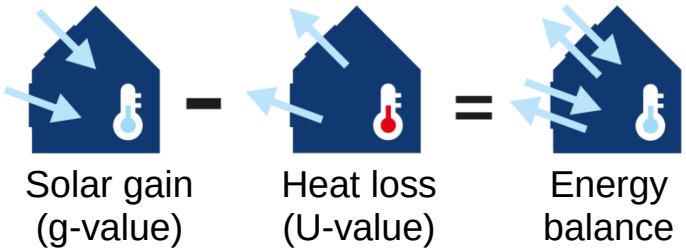
- ✓ Sensor driven energy and indoor climate meters can help ensuring an optimized house in terms of indoor climate and energy efficiency.

Key recitals, articles etc. in the 2018-amended EPBD supporting healthy indoor climate in buildings

- As mentioned above article 7 (fifth paragraph) requests Members States to calculate energy performance of buildings to also optimize health and indoor air quality, and in addition two new recitals (14 and 19 in 2018/844/EU) and a new point 2 in Annex I support this. Annex I in general is still pointing at the need for broader holistic considerations, as comfort and health are 2/8 main parameters in the calculation methodology.
- Recital 30 (2018/844/EU), article 8 and Annex IA introduce the new concept of the smart readiness indicator. Indoor air quality and healthy buildings is included in the framework, i.e. in point 2.b where it is highlighted that the methodology shall response to the needs of its occupants while maintaining healthy indoor climate conditions.

III. The energy balance principle shall be defined in the specific heating and cooling climatic conditions to assess the energy performance of windows

Currently, Member States have regulated windows mainly by U_W-values (heat-loss). However, when the effect of solar gain is left out, the real performance is not reflected and this is not in line with the objectives of sustainable development or giving the right assessment of a window's real contribution to the performance of a building envelope.



Adopting so-called energy balance approach would give a more correct picture of the performance of a building element, and would influence the actual energy performance of buildings. It would also show that windows can be positive contributors to building envelopes as a source of renewable energy.

The IBH 2018 study shows that window replacement can easily save more than 15 % of the whole heating needs of the existing building stock. Furthermore, this significant contribution can more effectively be achieved, if policies are based on energy balance requirements, by combining both minimum solar gains (=minimum solar factor "g-value") and maximum heat losses (=maximum U_W-value) in an overall "energy-balance requirement", see Figure 1 above.

The energy balance approach has been part of the previous EPBD and has been further strengthened in the 2018-amended EPBD. It requires Member States to apply a methodology for calculating the energy performance of buildings and building elements that form part of the building envelope, which is to include e.g. passive solar gains. The energy balance approach has so far only been implemented for renovations and replacements in few Member States (e.g. UK and Denmark).

The 2018-amended EPBD directive in the Article, Recitals and Annex I clarifies main elements on how to strengthen the implementation of the Directive and to stress the importance of complying with an elaborated energy balance approach (not only for new buildings and major renovations but also for elements of the building envelope such as windows).

Due to the different climatic conditions, different levels of energy efficiency occur, which leads to different optimization goals (e.g. in the North heat protection and in the South prevent overheating). Member States are to set the right balance between e.g. the heating and cooling factors in regulation, and to create the best link in the specific climatic context to other relevant regulated performances of buildings or products. However, the same kind of concept can be adopted across borders in Europe.

- ✓ Window replacement policies based on single U_W-value requirements should be replaced by energy-balance requirements to optimise and secure their efficiency

- ✓ Energy-balance equations should be defined at national level to account for local climatic conditions. The concept of a differentiated energy balance approach (U_W, g_W, air permeability and the effect of solar protection) therefore to be defined in the specific heating, cooling and climatic context of Member States.

- ✓ Energy-balance requirements should be based on cost-optimality
- ✓ For cooling dominated climatic conditions, policies should include expectable savings for cooling as they account for a significant part of building consumptions
- ✓ The guidance document on the implementation of the 2018-amended EPBD European to support proper implementation of EPBD should include Energy Balance approach as one of the implementing tools.

Key recitals, articles etc. in the 2018-amended EPBD supporting energy balance approach

- Recital 15 (2018/844/EU), Recital 9 (2010/31/EU) and Annex I in the Common general framework for calculation of energy performance of buildings, requests EU Members States to include passive solar systems and solar protection.
- Along the same lines, Annex I also specifies the EU Member states SHALL (new) include the positive influence of local solar exposure conditions, active solar systems and natural lightening

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About EuroWindoor AISBL – EuroWindoor AISBL was recently founded as an international non-profit Association, in order to represent the interests of the European window, door and facade (curtain walling) sector. Our 17 national associations speak for European window, door and facade manufacturers that are in direct contact with consumers, and thereby having large insights on consumers' demands and expectations. We are at the forefront interacting with dealers, installers and consumers buying windows and doors, and the companies behind the associations cover selling all over Europe.

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