The benefits of windows and glazed areas – providing daylight, solar gains, solar protection, insulation, ventilation and even more

The energy, health and comfort benefits of windows should be further included and implemented in the revised Energy Performance of Buildings Directive

EuroWindoor is a strong supporter of the Energy Performance of Buildings Directive (EPBD). Buildings account for about 40 % of the total energy consumption in Europe and EuroWindoor therefore favours constructive improvements that will strengthen the EPBD's contribution to the EU's energy and climate goals.

In our comprehensive reply to the Commission's consultation on the review of the Energy Performance of Buildings Directive (October 2015) EuroWindoor highlighted how windows are contributing to the overall energy performance of buildings and to the general comfort and well-being of people living and working in these buildings. In order to better harvest these opportunities EuroWindoor considers that the revision of the EPBD is an opportunity to better recognise the crucial role windows play in terms of daylight, indoor climate and energy efficiency.

When revising the EPBD, the following key points should therefore be further included:

1. **Stimulation of the renovation rate of European buildings by acknowledging the importance of non-energy aspects as driving renovation**

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

3. **Assessment of the energy performance of windows based on the energy balance approach to be defined in the specific heating and cooling climatic conditions**

I. Increasing the renovation rate of European buildings to obtain larger energy use reduction

The rate of building renovation is low – below 1.2% per year. The EPBD has helped to improve the energy performance of new buildings – but has not helped to significantly improve the building envelope of existing buildings. 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.

The cheapest and cleanest energy is, no matter what, that unused and we fully support the Commission's Energy Efficiency First agenda. With the current renovation rate it takes around 50 years until windows which have already an outdated energy performance are replaced by new ones in Europe. The examples below show that the replacement of outdated windows with modern energy efficient windows can already result in important energy savings. The examples are based on energy balance calculations where both the solar gain and heat loss are included.

Table 1: Examples of energy savings in replacement situations

Energy savings in replacement situations - *based on central climatic condition and combined performances*						
Replacement situation	Replacing an "old" window (single glazing or "old" double) with a new highly energy efficient **standard** product		Replacing an "old" window (single glazing or "old" double) with a new highly energy efficient **solar control glazing** product		Replacing an "old" window (single glazing or "old" double) with a new highly energy efficient **advanced** product (triple glazing)	
Change in (Uw; g-value)	Uw: 5.8; g-value: 0.85 ⇨ Uw: 1.3; g-value: 0.6	Uw: 2.8; g-value: 0.78 ⇨ Uw: 1.3; g-value: 0.6	Uw: 5.8; g-value: 0.85 ⇨ Uw: 1.3; g-value: 0.35	Uw: 2.8; g-value: 0.78 ⇨ Uw: 1.3; g-value: 0.35	Uw: 5.8; g-value: 0.85 ⇨ Uw: 0.8; g-value: 0.6	Uw: 2.8; g-value: 0.78 ⇨ Uw: 0.8; g-value: 0.6
Change in energy balance	From 333 kWh/m² to 44 kWh/m²	From 130 kWh/m² to 44 kWh/m²	From 333 kWh/m² to 58 kWh/m²	From 130 kWh/m² to 58 kWh/m²	From 333 kWh/m² to 18 kWh/m²	From 130 kWh/m² to 18 kWh/m²
Energy savings in %	**86%**	**66%**	**83%**	**56%**	**95%**	**86%**

Source: Table 9, p. 20, Explanatory Memorandum, European Commission, September 2016 (energy balance results based on combined performances based on central climatic condition)

Furthermore, the sequence of partly renovation needs to be better integrated. If the renovation is done step by step, it needs to be evaluated how the final energy efficiency of the building will look like. Often the conclusion might be to improve the building envelope first, before the technical equipment is changed. If it is done the other way round, finally the technical equipment might be oversized and not efficient anymore. And it is not enough to just replace fossil fuels by renewables, as this will not reduce the energy consumption in the building.

Finally, we know from several consumer surveys and by interacting with customers, that key drivers for renovation are issues like getting more daylight, 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 – but not least – cost considerations.

- ✓ A revised 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.

- ✓ 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.

- ✓ A revised EPBD should reflect what triggers renovation is hardly ever limited to energy considerations only, but to other triggers like ensuring healthy, comfortable, better and modernized buildings.

- ✓ Developing one-stop shops in Member States addressing the main barriers to building renovation, notably access to finance and focus on non-energy triggers for renovation.

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

Windows have the unique property of providing daylight and therefore contribute to human health, productivity and well-being in buildings. People spend up to 90% of their time in buildings but many existing European buildings suffer from poor daylight and indoor climate with adverse effect on health, learning abilities and productivity. A study from Fraunhofer (IBP) 2015, states that around 80 million Europeans live in damp or unhealthy buildings, which has a great impact of the health and well-being. The risk of contracting an infection in an environment contaminated with mould or mildew is almost twice as high as under normal conditions.[1]

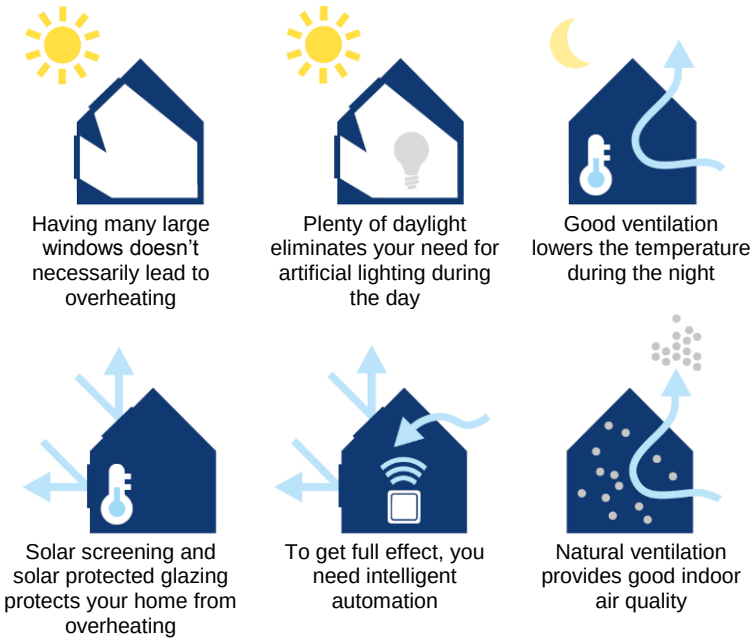
Recent experiences with Nearly-Zero Energy Building (nZEB) buildings have shown that if indoor climate and sufficient strategies against overheating are not taking into account when the building is designed, overheating issues will occur. Overheating is in general becoming an increasing problem in Europe which increases the risks of health issues. Overheating may not

[1] http://www.ibp.fraunhofer.de/en/Press/Press_releases/pm_10-03-2015-literaturstudie-raumklima.html

only occur during summer in a hot or moderate climate but also during shoulder seasons. Solar protection measures as well as ventilative cooling, using rapid ventilation through openable windows, are an effective strategy for limiting and even avoiding overheating.[2]

The articles of the present EPBD weakly reflect the concern for "peak loads" of the energy systems during summer conditions. The most relevant articles focus mostly on the use of renewable energy systems and the energy efficiency of heating and cooling systems. Peak load issues could be better reflected in the articles of the EPBD. This would also be beneficial to technologies such as ventilative cooling systems. Furthermore, e.g. dynamic shading systems, smart windows and solar control glazing play a role in reducing the active cooling needs.

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 – 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.



Increasing energy efficiency in buildings 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. At the moment daylight and indoor climate aspects are not very much highlighted in the EPBD and hence implemented very weakly in most Member States in national building legislations, and it is not very well integrated in the national compliance tools for energy performance evaluation. Member States have implemented daylight and indoor climate comfort requirements very differently, and in most cases to a very little extent[3]. In order to ensure EPBD promotes well performing buildings in respect of daylight and indoor climate more explicit guidance to Member States is needed building on existing and upcoming EU standards.

Against this backdrop, EuroWindoor considers that it is essential to promote systems and solutions that result in high level of daylight and quality indoor climate, comfort and low energy consumption:

- ✓ Specific and sufficiently accurate calculations of daylight (daylight factor) and indoor climate (thermal comfort, indoor air quality, ventilation) conditions should be part of the

[2] IEA, Annex 62 http://venticool.eu/annex-62-about/ (Kolokotroni, M., Heiselberg P., 2015).
[3] BPIE, 2015: IAQ, Thermal comfort and Daylight, http://bpie.eu/publication/indoor-air-quality-thermal-comfort-and-daylight-an-analysis-of-residential-building-regulations-in-8-member-states-2015/)

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.

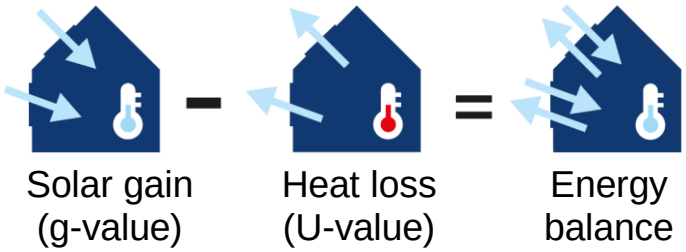
- ✓ A revised EPBD should provide guidance to Member States when setting daylight requirements in building codes based on the upcoming standards on daylight in buildings, indoor climate, and calculation of natural ventilation− and ensure that Member States properly implement them to the benefit of people working and living in buildings.

- ✓ 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.

III. The energy balance is critical to assess the energy performance of windows to be defined in the specific heating and cooling context

Why only regulating one part of a window's function while leaving the contributing part of solar gain out? In addition to their insulation properties, windows provide free solar heat gains to buildings. The modernization of the building envelope, opaque (e.g. insulation) and transparent components (e.g. windows) are usually treated the same way, although they behave very differently. The assessment of the energy performance of windows needs therefore to take into account both solar energy *and* heat loss, and hence windows should not be included when and if Member States are setting requirements to thermal transmittance of the building envelope.



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

The energy balance approach is – in principle – already included in the current 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. However, EuroWindoor observes that this methodology is not strictly applied throughout Europe. The energy balance approach has so far only been implemented for renovations and replacements in few Member States (e.g. UK and Denmark).

Currently, Member States have regulated windows mainly by tightening the U-values, thus pushing towards more layers of glazing. However, when the effect of solar gain is left out, the real performance of a window 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.

The upcoming revision of the EPBD will be an excellent opportunity 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.

- ✓ A revised EPBD should strengthen and provide guidance for Member States to focus on the energy performance of new and existing buildings by incentivizing the inclusion of passive solar gains of windows when setting energy performance requirements to buildings and building components, and by acknowledging the specifics of windows when setting requirements to thermal heat transfer or heat loss of the building envelope.

- ✓ The energy balance is specific to each window and is impacted by climatic conditions and by the building it is installed in. The concept of a differentiated energy balance approach (U_W, g_W, air permeability and the effect of solar protection) to be defined in the specific heating, cooling and climatic context of Member States should be better integrated into the revised EPBD.

- ✓ A guidance document from the European Commission explaining how to interpret the key provision of the revised Directive (e.g. how to include energy balance calculations of windows in national building legislation) would be helpful for Member States.

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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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