Results of a pan-European study on energy savings due to window replacement

Executive Summary

Around 25 % of energy consumption in Europe is directly linked to the households sector, of which heating consumption in existing buildings accounts for approximately 70 % in central European countries (e.g. Germany with total energy consumption of 665 TWh with 462 TWh for room heating (69,5 %)) or even more in northern European countries due to lower average outdoor temperatures in the heating period.

Thorough analysis shows that 57 % of the residential building stock was built before 1980 and a further 22 % was built between 1980 and 2000.

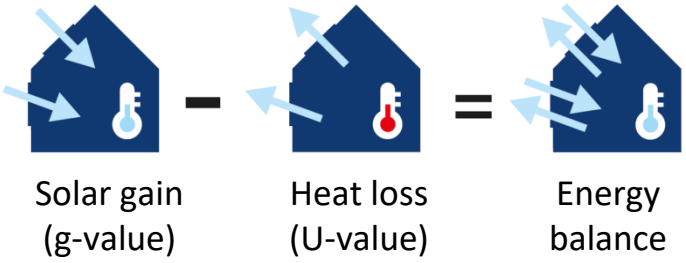
There is great potential for the existing building stock to contribute to energy savings and the reduction of CO_2 emissions, while at the same time improve the indoor climate of the buildings.

It is therefore crucial to define cost-efficient renovation policies that can improve the performance of the existing building stock – both in terms of energy and indoor climate, and window replacement has a significant role to play in this.

The main purpose of this study is to demonstrate how window replacement policies (based on technical assumptions) can support energy savings while maintaining affordable solutions for end-users. This study also describes why the performance of windows should be evaluated not only due to their single thermal insulation performance – as usually addressed by building regulations – but also due to the free solar gains that come through them (energy balance approach).

Based on simulations carried out on representative European residential buildings, this study shows that window replacement significantly contributes to reducing energy consumption in Europe, provided that appropriate measures are taken to secure the performance of replacement windows.

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”.



Energy balance approach

Most European countries today use technical requirements for window replacement based on the single U_W-value, whereas energy-balance requirements can save up to twice as much energy and CO_2.

This study shows that energy-balance requirements could save up to 280 TWh/year and up to 67 Mt CO_2/year across Europe if implemented in renovation policies for windows. Such an approach would also – in addition to securing that energy and CO_2 savings are achieved – stimulate innovation in the building industry, as target wouldn’t be set via a single parameter (U_w-value), but via a combination of parameters.

Energy balance requirements is giving a more accurate picture of a window’s performance to a building. Recommendations for the implementation of energy-balance requirements are provided at the end of the report. The key success criteria of implementing energy-balance requirements and securing the efficiency of window replacement policies are listed below:

- 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, building traditions etc.
- Energy-balance requirements should be based on cost-optimality
- For cooling dominated countries, policies should include expectable savings for cooling as they account for a significant part of building consumptions

Finally, it should be highlighted that saving energy is only one of the drivers for replacing windows, but it is also – and maybe even to a higher extend - driven by e.g. 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.