Window Energy rating: a plea from the fenestration industry

1 Executive Summary

The fenestration industry feels that a clear and dynamic energy rating for windows would help unlock the major energy saving potential of windows by promoting the faster uptake of high performance fenestration solutions.

A concerted effort to replace Europe's outdated residential windows with existing state-of-the-art products requires a simple tool to communicate to the general public about the energy efficiency properties of efficient fenestration products.

The undersigned associations representing all stakeholders of the window industry, glass makers, framing materials, glaziers and solar-shading manufacturers, welcome the European Commission's will to work rapidly towards a window energy rating and subsequent labeling.

- ✓ All of us are ready to work together and with the European Commission to prepare a practical solution meeting the following basic requirement: A window energy rating scheme targeting the residential replacement market, the one where simple communication tools are needed for final consumers to make informed decisions.
- ✓ The 'communicated label' must be clear, understandable & recognisable by consumers.
- ✓ The scheme must be compatible with existing European standards linked to CE marking under the Construction Products Directive (CPD).
- ✓ Product labels must be based on a simplified but credible rating system, which
    - o is supported by scientifically robust evidence,
    - o considers different climates and external conditions
    - o takes energy losses and gains into account
    - o addresses the needs for winter and summer comfort in a building
    - o can be easily managed by the market
    - o allows for technological developments.

Windows are complex products, whose precise performance depends on a variety of factors. Developing a scheme meeting the above needs is already a challenging task in itself. We believe that all efforts should be concentrated on that objective.

The undersigned associations are ready to support and engage with the European Commission to agree and implement swiftly a European window energy rating scheme. On this basis, we are confident that by pulling all existing resources together and engaging in an inclusive and transparent process, we can help the European Commission deliver on its energy label promises.

2 Introduction

The following European associations,

Glass for Europe,

European Aluminium Association (EAA),

EuroWindoor (EPW, FAECF, FEMIB and UEMV) and

European Solar-Shading Organization (ES-SO)

share the will to develop a practical solution serving as a tool for industry to communicate on the relevant energy characteristics of efficient fenestration products.
Therefore a working group has looked at several building codes and the window energy ratings currently used around the World to prepare this position paper. This paper is examining all the evidence and information currently available to help formulate a practical proposal which could benefit the industry, consumers and governments by promoting best performance, speeding up the replacement of outdated windows, boosting the green economy and offering a framework for incentives and green loans helping Member States reach their energy savings and carbon emission reductions targets.

It should be noted that the timing of this review is optimum due to the end of co-existence period for the window and door product standard EN 14351-1 (February 2010) and the European review of the Energy Labelling Directive (92/75/EEC[1]).
With the recast energy labelling directive, it is now clear that energy rating schemes should be developed not only for products which consume energy (the current situation) but also for those which can have an impact on energy e.g. windows.

3 Experiences from existing rating schemes

The European Window Energy Rating SAVE project (EWERS) was completed in 2003 and involved research organisations of 8 European Countries: Germany, Netherlands, Denmark, UK, Italy, Norway, Sweden and Finland.

This provided the basic framework for the development of window energy rating schemes and formulae.

As an outcome of the project, each of the participating countries had the opportunity to develop their own scheme based on the initial research project, like the UK scheme which is currently operated by the British Fenestration Rating Council (BFRC) Ltd.

- Some Countries have successfully introduced and operated a WER scheme, which has promoted the use of more energy efficient product in the market.
- These schemes tend to operate in northern Europe where cooling energy needs and solar control element are not major factors.
- The purpose of a European WER scheme is to promote the use of thermally efficient product in certain climate zones within Europe (to reduce heat loss through the windows) or to reduce the need for artificial cooling systems (due to over heating) in other zones.

[1] Council Directive 92/75/EEC of 22 September 1992 on the indication by labelling and standard product information of the consumption of energy and other resources by household appliances (OJ L 297, 13.10.1992, p. 16) Directive as amended by Regulation (EC) No 1882/2003 of the European Parliament and of the Council (OJ L 284, 31.10.2003, p. 1)

- Solar control is relevant all over Europe
- A WER scheme is to guide the consumer to the best ratings for their property.
- There should be no conflict with thermal performance data i.e. U value, g value and air leakage to the information required by EN 14351-1. This means the U value for the window can be used in a WER scheme and a CE Marking declaration.
- The scheme should be a voluntary scheme.
- There should be no conflict with CE Marking or voluntary quality marks with a WER scheme.

4 New Proposal for European Windows Energy Rating

One single energy rating scheme across Europe is needed taking into account the different requirements set by the local climate conditions and different building designs. However, there is a set of parameters which needs to be adopted which will enable the rating of windows:

- A balance for heating (including solar gain) and cooling (even if there is no artificial air conditioning, for summer and winter seasons
- Limited number of standard climatic conditions to be specified (external temperatures and solar radiation)
- Reference buildings are required to reflect the building design of standard climatic conditions. The window area, inclination towards vertical and orientation should be specified. It might be possible to use reference room according EN 15265.
- Characteristics for energy efficiency should be determined in accordance with European Standards. A list of factors to be eventually considered and relevant standards are detailed in Appendix B of this paper.
- The WER should be perceived as an extension of the CE-labelling with the purpose of giving an end-user friendly interpretation of the energy related properties of the product standard for windows (U_W, g, τ_V, airtigthness) turning these into a rating of a single letter (e.g. A-G).

The energy balance per 1m² of a window should be determined in accordance with the requirements within ISO 18292.

$$Q = Q_{\text{with window}} - Q_{\text{with adiabatic Window (U=0, g=0)}}$$

Balance has to be made between heating and cooling as well as solar gains for different seasons.

By using the above calculations energy rating of windows can be determined using standard climate condition, inclination towards vertical and specified orientation. An example of a possible Energy Rating Scheme is given in Appendix A.

5 Additional energy related window properties and a European rating scheme

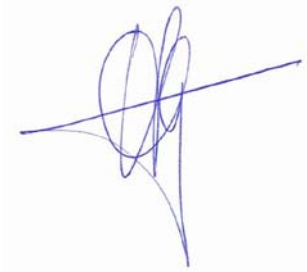
Windows are complex products and many variables affect their very precise performance. For this reason, it must be acknowledged that a label will need to find the right balance between perfect accurate science and practicability.

Nevertheless, for the sake of transparency, it must be noted that in addition to the main parameters affecting significantly the energy performance of a window (detailed in section 4), a number of other parameters exist. For many of these other parameters listed below, there are at the moment no European methods for determination and therefore no values for the whole window available.
In addition, there is no consensus yet between signatories on whether or not these below parameters have a significant impact on energy performance and therefore on whether or not they should and can be considered in a rating scheme.

- Energy gains from non transparent components (e.g. the g-value of the frame) to develop a total solar energy transmittance for the fenestration system
- Frame area ratio F_F
- Aerodynamic free area of a window for calculation of natural ventilation to save cooling energy
- Calculation method for energy saving by the use of natural lightning
- Influence of automatically controlled opening and closing of window
- Shading device (incorporated or not, automatically controlled or not).

The proposed European Windows Energy Rating should be evolutive to allow for re-evaluation to reflect market developments in the different market situations.

Brussels, June 2010



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Appendix A

Example of an Energy Rating Scheme

The energy index can be determined by the following calculation:

Energy balance of the window in the heating season:
Rating = A * g window solar value – B (U value of the window + L air leakage)

Energy balance of the window in the cooling season:
Rating = C * g window solar value – D (U value of the window + L air leakage)

Units are kWh/m²/year

A, B, C and D are constants for particular climate conditions

1. Hot summer, mild winter (reference Athens)
2. Warm summer, mild winter (reference Paris)
3. Warm summer, cold winter (reference Stockholm)

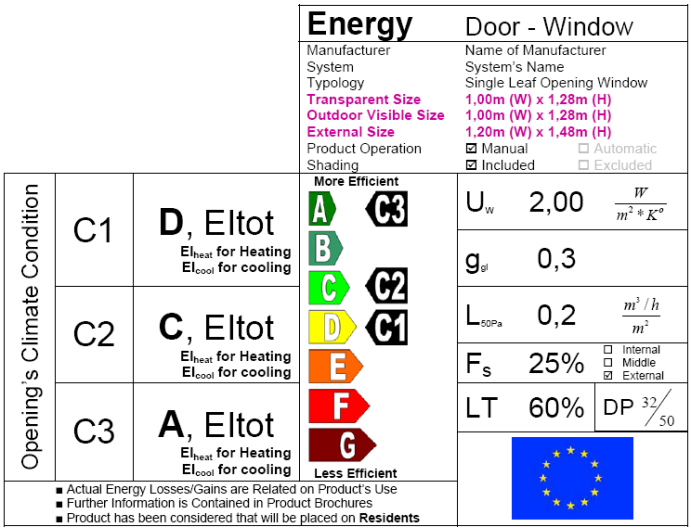
and reference buildings or room

1. Mediterranean House (H1)
2. Central European House (H2)
3. Scandinavian House (H3)

Once set the A, B, C and D values are not recalculated and become fundamental to the rating of windows for the geographical conditions selected.
Each EU member state should clearly state, which climate condition(s) is relevant for its inhabitants.

Calculation of Energy performance of windows

The energy performance measured in kWh/m²/year determines the energy loss and solar gain for a window over a year, this is calculated on a 1m² area.
The energy performance figure can then be used in energy rating label by using defined rating boundary. A window with an energy rating can then have a label produced as shown below:



This example is only meant to illustrate the use of the A-G scale on the basis of three different climatic conditions. It is not a proposal for the lay-out of a finished scheme.

Appendix B

Characteristics for energy efficiency and European standards

1. Thermal transmittance (U value)

EN 14351-1 states the thermal transmittance is determined for the standard sizes referenced within Annex E in accordance with:

- EN ISO 10077-1 table F.1 or F.3 or
- by calculation by using EN ISO 10077-1 or EN ISO 10077-1 and EN ISO 10077-2 or
- by Hot Box method using EN ISO 12567-1 or EN ISO 12567-2

2. Air tightness / air permeability (L value)

This is determined in accordance with EN 1026 and is the average of the two pressure tests (one positive the other negative) and is measured m^3/h.

This shows the air leakage for the window.

3. Solar gains (g value)

This determined in accordance with EN 410.

This shows the amount of solar radiation the glass would gain.

The g_W value is the solar gain for the complete window.

The g value for the combination of a window with additional external solar shading device is derived using the simplified method given in EN 13363-1, EN 13363-2 and ISO 15099.

Other parameters not yet the source of a consensus

4. Light transmittance

Light transmittance measures the amount of natural light in a room and therefore affects well being as well as the use of artificial lighting (which also has an environmental impact). This may be determined in accordance with EN 410.

5. Solar shading for protection against overheating

When properly used, this prevents excessive heat gain in a building which has a detrimental effect on indoor comfort.
Reference could be made to ISO 18292 which does include cooling and solar shading.
Solar shading takes the form of internal and external components like shutters blinds.