Towards an EU energy labelling scheme for windows: insight and learning of the development phase of the first label for an energy-related building product

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Abstract

The 2010 Directive "on the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products" (European Union, 2010) has increased the number of products potentially covered by energy labels. Despite its broad scope – the 2010 Directive applies to "energy-related products which have a significant direct or indirect impact on the consumption of energy" – the EC has mainly focused its work on developing labels for white goods. With its recent initiative on developing an energy labelling scheme for windows, the EC targets a type of product that was not yet covered by the existing labels, i.e. a building product. This work is a clear test for the EC that should provide additional options to tap further into the high potential of energy saving in the building sector and eventually pave the way for eco-design measures for building materials. The paper provides an insight on the most recent evolution of this initiative, and questions the spill-over effect it could generate. It discusses four main barriers that are to be overcome and are inherent to these products: the relation between ecodesign and energy label; the scope of the label in light of the variety of building types and product markets (B2B versus B2C); the decision-making process, which exemplifies the complexity of involving multiple actors; the balance between simplicity and accuracy of information, i.e. a complex multi-situational label, which is intrinsic to the localisation of the building and the resulting variation in the energy balance of the products.

The paper also discusses the possibility of including components (as foreseen under article 2 of the 2010 Directive). With regard to windows, this could be the case of shading whose impact is highly dependent on user's behaviour. To date, the EC contemplates all the options and the paper tries presents the *pro et contra* of these solutions.

The paper presents the provisional results and the lessons to be learned from this first exercise to reflect on the next steps towards a meaningful strategy for the development of the first energy related building products label.

Introduction

The extension of the scope of the Ecodesign Directive 2009/125/EC from all energy using products to all energy-related products (European Union, 2009) allowed building products to be considered for the development of implementing measures. However, at the moment, no implementing measures have been adopted for products falling under this category. The window products will be the first energy-related building product fully studied under the new methodology (MEErP) and, potentially, the first to be covered by implementing measures. The present paper proposes to assess this ongoing work at the present stage of the process (the preparatory study) and the implication it might have for the development of future initiatives targeting products falling under the same category.

The present paper focuses on the assessment of implementing measures for window products. It is mainly based on the ongoing preparatory study (Lot 32) and stakeholders contributions made in its consultative framework. The final version of the preparatory study is expected by May 2015. However, a final draft of the preparatory study – including all tasks – was

already circulated to the stakeholders involved. When referring to the "preparatory study" the present paper refers to the last draft version circulated to the registered stakeholders on the 24 February 2015[1].

The paper is structured as follows: The first section introduces the extension of the Ecodesign Directive (European Union, 2009) to energy-related products and the inclusion of a list of building products in the Ecodesign Work Plan for 2012–2014 (European Commission, 2012); The second section presents the preparatory study's recommendations and briefly analysis the most salient issues (i.e. the scope of the label, the definition of the different climatic zones and reference building, and the inclusion of components); The conclusions present the provisional results and lessons to be learned from this first exercise while reflecting on the next steps towards the development of the first energy labelling for a building product and the implication it might have for future products falling under this category.

Labelling building products – state of play

FROM ENERGY USING PRODUCTS TO ENERGY-RELATED PRODUCTS

Two legislative acts are relevant for the implementing measures: the Ecodesign Directive 2009/125/EC and the energy labelling Directive 2010/30/EC. Both directives are complementary, as they respectively push the market and pull it towards more efficient products[2].

Since its initial version (2005/32/EC), the Ecodesign Directive 2009/125/EC has extended its scope from all energy using products sold in the domestic, commercial and industrial sectors to all energy-related products (European Union, 2009). In practice, since the implementation of the new Directive, the European Commission (EC) has presented a new Ecodesign Working Plan for 2012–2014 (European Commission, 2012) that includes new categories of products that could not be contemplated under the initial version. Window products, which are under consideration in this paper, were considered one of the main priorities, as highlighted by their inclusion in the "priority product groups".

The extension of the scope has also had impacts on the methodology developed for evaluating the products and called for its revision. The challenge was double for the consultants. First, they had to review its effectiveness and update, whenever necessary, the Ecodesign Methodology. Second, they had to extend the Ecodesign Methodology to Energy-related Products and to evaluate whether and to which extent new energy-related products fulfil certain criteria for implementing measures under the 2009 Ecodesign Directive (COWI and VHK for European Commission, 2011). A new methodology for the Ecodesign of Energy related Products (MEErP) was developed and used for the preparatory study under consideration in the present paper. This point will be further developed in the following sections of this paper, as the methodology will have a direct influence on the outcome of the preparatory study for the window products.

LABELLING BUILDING PRODUCTS

The potential of energy savings in the building sector and for building products is well known[3] and acknowledged by the EC in its recent communication on the Energy Union (European Union, 2015). However, the task of developing implementing measures for this category of products remains challenging. In this sense, the methodology developed for the Ecodesign of Energy related Products clearly states in its first part the constraints inherent to this exercise "(…) in many cases, the analysis of what would be the baseline characteristics of the buildings takes as much or even more time and effort than the analysis of the product itself". In addition, as underlined in the same document that:

> The best a MEErP methodology can do, is to supply a common set of building-, climate- and occupancy data that can be used as a basis for any building-related product. The source for these data are the preparatory studies that have already been conducted and on which measures have been or will be based. This data-set cannot be complete and will require additional analysis in each of the preparatory studies for ErP, but at least it provides a framework that will avoid exaggerated or minimalised saving potentials. (COWI and VHK for European Commission, 2011, p. 63)

Although a few energy-related building products were included in the Working Plan 2012–2014 under the Ecodesign Directive (European Commission, 2012), the window product is the first energy-related building product fully studied under the new methodology. The preparatory study, expected by May 2015, will be the first to cover all steps of the MEErP and could play a major role in the assumptions made in future preparatory studies for energy-related building products.

The window products initiative is not the unique EC attempt to develop a building product. Thermal insulation products for building were included in a list of conditional products groups[4] under the Ecodesign Working Plan 2012–2014 (European Commission, 2012). However, the study remained exploratory and the EC decided not to propose implementing measures. Three conclusions can be drawn from the thermal insulation products for building recommendations. First, the window products remain the pilot product for implementing measures (being ecodesign and/or energy labelling). Second, the thermal insulation products for building exploratory study was limited to a few tasks and therefore its impact on future preparatory studies for building products is going to be limited. Finally, it underlines the complexity of developing such measures for energy-related building products with three inherent obstacles: the existing regulation, the variety of performance requirements and the dependence on the installation of the products.

1. The last draft version of the preparatory is available on line on the dedicated Lot 32 webpage http://www.ecodesign-windows.eu/documents.htm.

2. http://www.energylabelevaluation.eu/eu/introduction/.

3. See for instance the International Energy Agency study on "Capturing the Multiple Benefits of Energy Efficiency".

4. The list of conditional product groups includes: positive displacement pumps, fractional hore power motors under 200 W, heating controls, lighting controls/systems, and thermal insulation products for buildings.

Ecodesign Preparatory Study on Window Products (Lot 32)

To date (March 2015), the ecodesign process for window products is in its third step (i.e. Preparatory Study) and its development is comparable to the slowest experienced for energy using products (Siderius, 2013). As highlighted in the previous point, the complexity and novelty of the exercise could explain the lengthy process.

The final version of the preparatory study is expected to be published by May 2015 and could pave the way towards the next phases in the policy process. This section is based on the last draft circulated to the registered stakeholders[5] on 24 February 2015 and comments made by the stakeholders in the consultation process (see annex 1)[6]. It is important to remind here that the preparatory study does not represent the EC proposal and that this paper does not claim to anticipate it. It is aiming at providing insights on the main points discussed while building up the necessary background knowledge for a future initiative on energy-related building products and more specifically on window products.

The elements to be addressed in this section are developed as follows:

- Implementing measure: ecodesign and/or energy labelling?
- Scope of the label in light of the variety of building types and product markets (B2B vs. B2C).
- Defining different climatic zones and reference buildings.
- Including components (shading devices) – *pro et contra.*

For the interest of brevity, this section of the paper refers to the "consultants" when referring to the authors of the Lot 32 preparatory study (i.e. Van Holsteijn en Kemna BV (VHK) in collaboration with ift Rosenheim and the Flemish Institute for Technological Research [VITO]).

IMPLEMENTING MEASURE: ECODESIGN AND/OR ENERGY LABELLING?

In its generic recommendations, the consultants recommend the development of an energy labelling but exclude any ecodesign requirements whether specific on energy performance or resource efficiency, or generic.

Ecodesign requirements

The preparatory study underlines that, under the Energy Performance of Buildings Directive (EPBD), Member States are required to introduce requirements for building elements based on a cost-optimal approach. Firstly, since most Member States (MS) have introduced requirements that will lead to application of windows at their least life cycle cost point, it considers that the envisaged specific energy performance requirements under ecodesign at least life cycle cost target levels would not lead to further savings. Secondly, in relation to the (potential) harmonisation of environmental legislation covering products, the preparatory study concludes that the LCC point is not the same across the three climate conditions considered in the analysis (north, central, south) and that it will be difficult to properly harmonise the market based on a single (non-optimal) target. Thirdly, following the subsidiarity and proportionality principles it is considered that minimum energy performance requirements should be better handled at national level, rather than EU level.

As highlighted in the task 7 "Policy Options & Scenarios" of the preparatory study, these conclusions are in line with the findings of the study on thermal insulations[7]. One important conclusion that can be drawn from these two studies is that while covering energy-related building products, attention should pay to the interrelations and potential overlaps with existing EU legislation. In the case of window products, the EPBD and the Construction Products Regulations (CPR) are limiting the scope of possible ecodesign implementing measures, since they respectively foresee energy performance levels set at the envelope level and enforce information requirements as part of the CE marking.

However, it does not mean that the existing legislative framework is considered optimal by the Lot 32 consultants. For instance, regarding the EPBD implementation, they stress the need for MS to regulate windows based on an integral assessment of the window energy performance instead of one parameter (the thermal transmittance of the window, as it is the case in most Member States). To a certain extent, this argument supports the consultants' recommendation for a window energy label reflecting the overall performance of the product, as it will be developed below.

Energy labelling

The consultants in its preparatory study recommend the development of an energy labelling that should be limited to information relevant for resource consumption in the use phase only, using a A–G scale. In addition to the label, the consultants propose to include a technical fiche[8] to provide more information specific to the actual installation. For instance, the fiche could make it possible to take into account the effect of the window orientation.

Consultants' proposals: three designs for the label

The consultants propose three different designs for the label with a limited number of information. Each of the label proposals provide an assessment of the heating performance (symbolised by snowflakes and moon) and cooling performance (symbolised by a sun) (see Figures 1 and 2). No references are made on other values such as the g[9] or Uw[10] values of the glazing, nor the acoustic or light transmittance properties.

The main variables used in the window energy performance model proposed are: the season (cooling or heating), the cli-

5. Some of the most active contributors to the window products preparatory study were Glass for Europe, Velux, European Aluminium Association, Somfy, European Solar-Shading Organization and the Syndicat national de la construction des fenêtres, façades et activités associées.

6. From a practical point of view, stakeholders were consulted at 5 points (each of them corresponding to a further development in the preparatory study prepared by the consultant): Publication of task 0; Publication of interim tasks (tasks 1 to 4); Three surveys (Member States requirements survey, window costs survey and window energy label survey); Publication of revised tasks 1, 2, 4 and interim tasks 5 and 6; Final draft preparatory study.

7. The conclusion on the thermal insulation products are reproduced in the Lot 32 task 7 "Policy Options & Scenarios", p. 14.

8. The fiche proposal can be found in the Lot 32 Task 7 "Policy Options & Scenarios" pp. 107–110.

9. Solar energy transmittance of the transparent part of the window.

10. Thermal transmittance of the window.

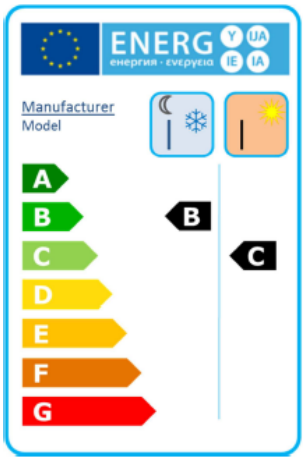

Figure 1. Lot 32 label design proposals I (central zone heating/cooling climate neutral) and III (north zone heating/cooling climate neutral).

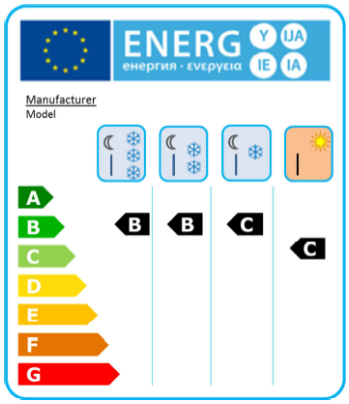

Figure 2. Lot 32 label design proposals II (north, central and south zones for heating/cooling climate neutral).

mate conditions (outdoor temperatures, solar irradiance) and the use or not of shutters. The combination of all these variables and many boundary conditions results in three options. In practice, it should be noted already here that the climate conditions are not fully represented since the cooling performance is not taking into consideration the outdoor temperatures and solar irradiance in its calculations.

The first option presents one climate condition as the 'average' EU climate with one heating performance indicator (based on the central zone) and one cooling performance indicator (independent of climate conditions) (see Figure 1). The second option presents the heating performance for three climates (north, central and south) and one cooling performance independent from the climatic conditions (see Figure 2). The third option presents the heating performance indicator of the coldest climate and a cooling performance indicator independent from the climatic conditions (see Figure 1).

The proposals for label designs are reproduced in Figure 1[11] and 2[12].

Ranking based on the consultants' proposals

Regrettably, the consultants did not provide the product ranking for their proposals. The product ranking presented in this paper is based on extrapolations and calculations based on fragmented information in task 7. This information is essential to make a proper assessment of the proposals and the impact of different factors on the ranking (e.g. climatic conditions, reference building, components and insulation). The products' numbers (first column in Tables 2 and 3) correspond to the products base cases described in the table "façade windows base cases" (Table 1).

The results will be further analysed and discussed in the following points of the present paper.

The absence of accurate ranking in the preparatory study and the resulting difficulties faced to proceed to the assessment of the proposals raise major concerns. Under task 7, the consultants provide scarce and inaccurate information, which make difficult to compare their label proposals to the market reality and consumers' needs. As explained above, the consultants' proposals are based on two rankings: one on the heating performance and the second on the cooling performance. For the first, the ranking does not differentiate window with or without shading devices, making it impossible to evaluate the impact of these components. For the second, the consultants did not provide any ranking at all. This situation is all the more regrettable that the "example windows" provided in the "example classification of cooling performance" do not correspond to the real ranking resulting from the calculations based on the consultants' proposals (see Table 4).

Based on the Lot 32 experience, the following recommendations could be made in order to assess the proposals made in preparatory studies:

- All the relevant information must be made available in the preparatory study and in particular the ranking of products based on the consultants' proposals;
- The ranking resulting from the consultants' proposals should be compared with:
  - The consumers' needs and market reality;
  - Existing comparable labels schemes;
  - The best available technologies (BAT) identified in the preparatory study.

SCOPE OF THE LABEL IN THE LIGHT OF THE VARIETY OF BUILDING TYPES AND PRODUCT MARKETS (B2B VERSUS B2C)

The consultants decided in its draft conclusions to limit the scope of the energy label proposals to "applications where the assumed boundary conditions are representative and only vary within certain limits". However, the residential and non-residential differ greatly from one to the other. The risk was high that, if both categories were to be covered, the study will be based on global averages and over-simplification, which will lead to fundamental inaccuracies and misguiding conclusions. Therefore, the consultants' recommendation to limit the scope

11. Lot 32/Ecodesign of Window Products – Task 7 "Policy Options and Scenarios".
12. Lot 32/Ecodesign of Window Products – Task 7 "Policy Options and Scenarios".

Table 1. Façade windows base cases.

1	Single glazing Frame: even no or bad thermal break
2	Double IGU Standard frame (wood, PVC, Metal)
3	Double IGU Standard frame (wood, PVC, Metal)
4	Double IGU with optimized low e-coating and argon filling Standard frame (wood, PVC, Metal)
5	Triple IGU with low e-coating and argon filling Standard frame (wood, PVC, Metal)
6	Triple IGU with optimized low e-coating and argon filling, thermally improved spacer Improved frame (wood, PVC, Metal)
7	Single and Double IGU with low e-coating and argon filling, thermally improved spacer Coupled window(wood, PVC, Metal)
8	2 Double IGU with low e-coating and argon filling, thermally improved spacer Double window (wood, PVC, Metal)
9	Double IGU with solar control coating Standard frame (wood, PVC, Metal)
10	Double IGU with solar control coating (also low e) and argon filling Standard frame (wood, PVC, Metal)
11	Triple IGU with solar control coating (also low e) and argon filling, thermally improved spacer Improved frame (wood, PVC, Metal)

Table of correspondence provided in Lot 32 Task 4 "Technology", p. 29, and used for the ranking developed in Tables 2 and 3.

Table 2. Ranking heating performance with or without shading by climatic zones for façade windows.

				North		Central		South	
n°	Uw	g	air class	without	WITH	without	WITH	without	WITH
1	5,8	0,85	2	G	G	G	G	G	E
2	2,8	0,78	3	G	G	F	F	D	A
3	1,7	0,65	4	F	E	D	C	B	A
4	1,3	0,6	4	E	D	C	B	B	A
5	1	0,55	4	C	C	B	B	B	B
6	0,8	0,6	4	A	A	A	A	A	A
7	1	0,58	4	C	B	B	A	A	A
8	0,6	0,47	4	A	A	A	A	C	C
9	2,8	0,35	3	G	G	G	G	G	F
10	1,3	0,35	4	F	F	E	E	E	E
11	0,8	0,35	4	D	D	D	C	E	E

Table 3. Ranking cooling performance ("independent from climate conditions") with or without shading for façade windows.

				cooling	FC=0,1
n°	Uw	g	air class	without	average
1	5,8	0,85	2	G	E
2	2,8	0,78	3	G	D
3	1,7	0,65	4	F	D
4	1,3	0,6	4	F	D
5	1	0,55	4	E	D
6	0,8	0,6	4	F	D
7	1	0,58	4	F	D
8	0,6	0,47	4	E	C
9	2,8	0,35	3	D	B
10	1,3	0,35	4	D	B
11	0,8	0,35	4	D	B

Table 4. Lot 32 – Task 7 – Table 19 "Example classification of cooling performance (proposal)".

Class	Class boundaries (-)	class difference	Example windows
A	$g_w \leq 0.10$		Windows with IGU with reduced g-value (e.g.solar control) and/or external solar shading device)
B	$0.10 < g_w \leq 0.13$	0.03	Windows with IGU with reduced g-value (e.g.solar control) and/or external solar shading device)
C	$0.13 < g_w \leq 0.19$	0.06	Windows with IGU with reduced g-value (e.g.solar control) and/or external solar shading device)
D	$0.19 < g_w \leq 0.28$	0.09	Windows with IGU with reduced g-value (e.g.solar control) g > 0.27 or with external shading device
E	$0.28 < g_w \leq 0.40$	0.12	Windows with IGU with reduced g-value (e.g.solar control) g > 0.40 or with internal shading device
F	$0.40 < g_w \leq 0.55$	0.15	Windows with double IGU with high g-value g > 0.58
G	$0.55 < g_w$		Windows with double IGU without low e and single glass g > 0.78

of a label to windows for use in residential buildings was to be expected, as it will be developed below.

Defining the building types

Residential and non-residential buildings (e.g. offices, hospitals, schools, warehouses, etc.) have very different energy consumptions patterns. For instance, non-residential buildings are mainly used during daytime, have higher lighting requirements than residential buildings. Similarly, air-conditioning systems are much more widespread in non-residential buildings than residential ones. As a consequence, the energy consumption pattern of these buildings is completely different than that of residential buildings. Within the commercial sector itself, energy consumption differs a lot between warehouses, office buildings and hospitals.

These realities translate in differences in terms of glazing. The average glazed surface to floor ratio vary significantly. When in residential buildings, the average is estimated to be between 10 and 20 %, this proportion varies between 30 and 100 % in case of office buildings. On the contrary, warehouses will usually have a much smaller glazed surface to floor ratio, i.e. less than 10 %, since access to daylight is not critical. In addition, glass manufacturers produce different ranges of glazing products for the residential and for commercial markets. This separate offer is meant to respond to the different needs of buildings, which require specific solutions that differ from those of residential buildings.

This distinction between residential and commercial buildings is also reflected in market structures. Their economics and sizes also differ. For instance, new constructions or major renovations constitute a larger share of the commercial buildings' market when window/component replacement drives the residential market.

Defining the product markets

Non-residential buildings is essentially a business to business market managed by trained construction professionals, able to digest technical information and thus choose the most adequate glazing and window solution. On the contrary, the residential market is a business to consumers market where final consumers need clear and easily understandable information about the energy performance of windows to make an informed decision. In practice, all existing window energy rating scheme have been developed solely for the residential replacement market. Notwithstanding, at the moment of placing on the market, the manufacturer/seller may not know the exact application. It will be difficult for manufacturers to operate production lines specifically for the residential and non-residential market only.

DEFINING DIFFERENT CLIMATIC ZONES AND REFERENCE BUILDINGS

The definitions of climatic zones and reference building are two crucial elements of the preparatory study since they affect directly the ranking of products in a future label. As highlighted by the minutes of the stakeholders meetings, the contributions sent by stakeholders and the preparatory study[13], these have been two major points of discussion in the preparatory phase and are likely to be revived in the Ecodesign Consultation Forum.

Climatic zones in the three designs for European label

The definition of climatic zones was probably one of the most salient issues in the preparatory study phase. Although the consideration of different climatic conditions was accepted by all stakeholders from the start as a way to ensure the accuracy of a future ranking of products, opinions differ among the stakeholders regarding the number of climatic conditions to be covered (e.g. GfE called for at least three, while Velux considered it could be two) and their representation in a future label (e.g. by way of a map or pictogram).

In the previous draft versions of the preparatory study, the consultants decided to base the performance of the window on three climatic conditions resulting from a previous preparatory study on room air conditioning appliances (Lot 10). The three main climatic conditions considered are: Northern Europe with Helsinki as the reference climate, Central Europe with

13. Documents are available on the dedicated Lot 32 website http://www.ecodesign-windows.eu/documents.htm.

Strasbourg and Southern Europe with Athens. Under Lot 32 task 4, the energy performance of the base cases window products was assessed throughout the year under the three climatic conditions, with one single value merging both the cooling and heating needs.

However, in the last draft version and newly released task 7, the consultants decided not to fully represent the climate conditions in the label proposals and to separate the cooling and heating performance of the windows for the ranking. As a matter of fact, in terms of heating, the first label is only reflecting the central zone condition; the third label, the north zone condition; and the second, all three climate conditions. The cooling rating is climate neutral, since the equation for calculating the cooling performance is not considering the cooling degree and external temperature anymore.

In other words, the consultants decided to close the debate on climatic conditions and zones in Europe with a ranking based on one climate condition (label 1 and 3) or left to the consumers' appreciation of "what they think is the more relevant" (label 2)[14]. As illustrated in Tables 2 and 3, this approach generates discrepancies between the proposed ranking and the best available technologies identified in the same preparatory study (under task 4). For instance, this method leads to recommending triple glazing unit with high solar factor in the South of Europe. This situation is due to four main factors directly related to the consultants' model:

- The differentiation between cooling and heating performances;
- The climate neutral cooling performance (not taking into account the temperature and solar irradiation);
- All climatic conditions are not represented in the label proposals;
- The inclusion of shading devices in both the heating and cooling performances (as it will be developed in the next point).

The main question resulting from the above is "can the consultants propose a different model"? The examples of EU energy labels for other product groups and already existing window label schemes can help to provide an answer.

The existence of different climate across Europe has already been recognised in earlier ecodesign and energy labelling preparatory studies. For instance, three climatic zones have been established for the energy labelling of cooling equipment, water or space heaters, and their respective maps drawn on the labels. In the case of window products, in light of the previous tasks in the same preparatory study, all stakeholders expected the climatic conditions to be represented on an indicative map, based on temperature and levels of solar duration. Unlike other construction material, windows performance is largely dependent on its ability to capture or reflect solar heat and window and glazing solutions proposed across the EU already differ according to climatic differences. In the case of glazing for instance, the share of solar control insulating glass units is already much higher in the South Mediterranean countries than in the UK,

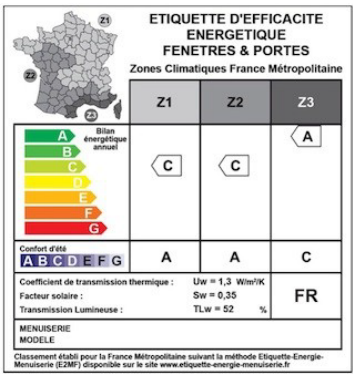

Figure 3. Example of the French window energy label.

where clients rather look at maximising heat gains. In this sense, the consultants' proposals no to take the climatic realities into consideration in the cooling performance is questionable.

Existing national window energy label already take into the climatic conditions (including the level of solar radiation) in the calculations of the ranking that are combining the heating and cooling performances. As illustrated in Figure 3, the "Union des Fabricants de Menuiseries Extérieures" window energy label defines three climatic zones in France only.

In conclusion to this point, the case of window energy labelling underlines the need to proceed to refinement to existing studies on which assumptions and their subsequent calculation and ranking are based. The conclusions of the preparatory study are in this sense quite problematic, since consumers might be misguided by unrealistic ranking resulting from the consultants' choices. It is, at the time of writing these lines, impossible to confirm that the consultants will not reconsider their proposals in the final version of the preparatory study. However, if it was not the case, it is likely that the issue will be raised again by the Ecodesign Consultation Forum which is to take place in June 2015.

Reference buildings

The reference building plays a crucial role in the calculations assessing the level of performance of the products in a future label. The reference building developed in the preparatory study for window products has the potential to generate a precedent for other products and in particular building products. Different models were discussed for the construction of the reference building: Should it be adiabatically isolated (i.e. without transfer of heat)? Should it differ according to the most common building types in the different climatic zones? How to include the exposition of the different window orientations?

We cannot enter into the details of each element of the reference building. However, it can be noted that the consultants decided to base their model on a standard building design as a single reference point. It includes window surfaces on all orientations and the glazed surface to floor ratio is the average of EU residential building stock (i.e. 0.16). All details on the reference building can be found in the boundary conditions in the task 4 "Technology"[15]. This point will focus on two elements which remain under discussion and might be of relevance for

14. Lot 32 task 7 "Policy Options & Scenarios", p. 57.

15. Lot 32 task 4 "*Technology*", p. 31.

the discussions at the Ecodesign Consultative Forum stage: the level of insulation and ventilation.

The level of insulation plays a crucial role while measuring the impact of the window on the energy demand of the building. In case of a reference building with poorly insulated walls and roof, the contribution of windows to the energy demand of the building will be distorted by heat losses through the walls and roof. The level of insulation should not only be realistic, it must also ensure the viability of the label on the medium to long term by reflecting the expected evolution in terms of insulation rate of standard buildings in Europe. The level of insulation defined by the consultants in the preparatory study is U_{wall}=0.8 W/m²K. Although the level of insulation seems to average existing standards, it is however questionable as it limits products' differentiation. The U_{wall} value was questioned during the stakeholders meetings and it is possible that it will be reassessed in the preparatory study final report.

The level of ventilation defined by the consultants in the preparatory study is n=0.5 h^{-1}. Increased ventilation to allow ventilative cooling is set a n=2.0 h^{-1}. It is important to note here that the proposed values are not based on existing standards or studies. In addition, the extra ventilative cooling is based on the assumption that consumers will open the window to increase the cooling (at a non-standard level) if the internal temperature is over 23 °C and superior to the external temperature. This assumption was again questioned by various stakeholders.

From the Lot 32 experience, two main questions related to the definition of the reference building need to be addressed: First, should the reference building be representative of the building stock or should it be an artificial model fostering products differentiation? Second, should the reference building reflect the existing building stock in Europe or should it rather reflect future building stocks projections (at medium or long term) in order to ensure a long term use of the label? In the case of window products, it is clear that a high level of insulation and reduced level of ventilative cooling foster product differentiation and therefore render performance calculations more centred on the impact of windows. However, the consultants preferred to define a building corresponding, as much as possible, to the average building stock.

INCLUDING COMPONENTS (SHADING DEVICES) – PRO ET CONTRA

The inclusion of components and in particular shading has been one of the most salient points of discussion in the framework of the preparatory study. Under task 4 the consultants underline that the product scope shall remain on windows. However, they recommend considering sun shading devices and shutters for the evaluation of the energy demand of buildings (and in particular the standard building). In other words, developing a system approach rather than on the sole window product (glazing plus frame). As it will be developed below, in the case of windows, particular caution is needed when integrating these components (shading devices) in the assessment of the window performance and ranking. Although it is accurate to state that a window "may incorporate (optionally) opaque filling elements or internal, integrated or external shutter/sun shading device", the inclusion of these devices has an important impact on the ranking of products and its accuracy.

This section will question the inclusion of shading devices in the ranking under three sub-points:

- The volumes of sales and trade on the internal market;
- The set point for activation of shading devices and performance to integrate them in the label calculations;
- The impact of the inclusion of shading devices in the consultants three proposals and in particular on the ranking of products.

Volumes of sales and trade on the internal market

The question of volumes of sales and trade on the internal market for shading devices is addressed in the preparatory study under task 2 (market). It appears that roughly 7 million windows were, from factory gate, equipped with solar shading devices. This corresponds to approximately 7 to 10 % of the market. About ⅓ of shading devices sales is motorised. Automation for shading devices are of three types: timer (including twilight), sun control and master control. The relative sizes are respectively 70 % with master control only, 20 % with timer and 10 % with sun control. It is here important to note that the descriptive provided in the preparatory study doesn't reflect the differentiation between residential and tertiary. Nevertheless, it is generally accepted that automated shading devices are mainly installed in the tertiary sector.

The first elements that can be highlighted from these figures is that *a priori* the inclusion of shading device in the implementing measure covers 10 % of the market sales. Based on these numbers, shading devices cannot be considered as niche products. However, as it will be developed below, this conclusion might need to be reviewed in light of the assumptions made in the preparatory study to include their energy performance in the calculations (boundary conditions and set point for activation). In fact, this number could actually be reduced to less than 1% for all sectors if all the conditions set in the study are to be met. Whether or not a high level of sales and trade on the internal market is met is therefore questionable.

Boundary conditions and set point for activation

The introduction of shading devices and shutters in the energy performance calculation is extremely complex, since it requires identifying the products and setting a scenario of use (i.e. when are shading or shutters closed down? When are they open? When are they half open?). So far, no usage scenario at EU level has been defined, so the consultants had to come forward with a proposal. The shading devices parameters and usage scenario are set under task 4 "Technology" of the preparatory study.

Performance level

Under the task 3, Lot 32 consultants address the question of the "real average shutter performance". It illustrates that the Fc-value (or shading coefficient) vary greatly from one type of shading devices to the other (from 0.10 for external roller shutters to 0.75 to internal blinds[16]). There is indeed no single type of shading and shutters. Based on this assessment, the consultant decided to set the level of performance at the highest level in terms of performance (Fc=0.1). This decision

16. Fc=1,0 without shutter.

Table 5. Boundary conditions – Lot 32 – Task 4 "technology", p. 31.

Parameter		Source
Fc-value	Fc = 1 and 0,1	
Set point for activation of the sun shading	Is > 300 W/m² and Te > 15° C	EN ISO 13790, Annex G
Additional ΔR Note: Also applied when the sun shading is in active position during the day	ΔR=0.17 m^2K/W Sunset to complete sunrise	EN 10077-1 Table G.1. Average air permeability Roller shutter made of wood or plastic

implies that the level of performance of the window sold with an integrated shutter will be independent of the actual level of performance of the latter and will always be set at the highest level.

Set point for activation

The boundary conditions include a "set point for activation of shading". This point was questioned on several occasions during the preparatory study stakeholders' consultation process. Windows have a constant and predictable performance which is not influenced by consumer behaviour. On the contrary, performance of shutters, blinds and shading devices is largely dependent on the development of a user behaviour scenario that the consultants consider themselves "as a first indicative analysis with an unknown degree of error"[17]. The quantification of the energy impacts of these devices on heating and cooling is therefore directly relying on assumptions that are at least questionable, since it cannot be assumed that manually-controlled devices are meeting the consultants' scenario. Actually, the probability of this scenario to be met is even more doubtful that the set point for activation presupposes an "optimal" use that requires the end-user to open and close the shutters exactly when needed during the day and night, and depending on the outside and inside temperature and the sun inclination. This situation leads *de facto* to unrealistic information on the product performance if integrated in the calculations for a vast majority of existing shading devices.

In fact, only automatically controlled devices operate when certain temperature levels (inside and outside) and solar radiation levels are detected by sensors. As underlined earlier, these products represent less than 1% of the market share (including both residential and non-residential). It results that the only type of products that could meet in practice the set point for activation is as at best a niche product. Therefore, the consultants decided to include all shading devices assuming that "one uses the shutter optimally (why else would the consumer invest in a shutter if it is not going to be used)" while "ignoring the shutter is considered to be less realistic (…)"[18].

In conclusion to this point on the shading devices performance and set point for activation, the consultants' assumptions will inevitably lead to an overestimation of the impact of shading on the overall performance. As developed in the following point, their inclusion in the ranking calculations raises an additional and maybe even more consequent issue: discrepancies between the consumers need, the market reality, and the products ranking.

Impact on the ranking in the consultants' label proposals

As underlined in the energy labelling section, one of the major problems faced by stakeholders while analysing the proposals is the incomplete information provided on the ranking of products. As a matter of fact, no differentiation between products with or without shading is provided under task 7 to assess their respective performance unlike previous tasks (e.g. task 4). In the framework of this paper, calculations were made in order to assess the impact of shading on the ranking (based on the equations provided in the preparatory study and classes) (see Tables 2 and 3).

The following conclusions can be drawn from the analysis.

1. The same windows with shutters have higher ratings than without;
2. Regarding cooling performance, no window with or without shutter reaches class A. The best performers classify B. All windows with shutter (but a single glazed unit) classify higher than any window without shutter (including window with solar control specially designed for hot climate conditions). The best performing windows on the market in terms of solar control (essential for the cooling performance) classify D, at best, if not equipped with shading;
3. Regarding heating performance, the introduction of shutters leads to paradoxical results, in particular for the south of Europe. For instance, double glazed windows with solar control (with or without shading devices) classify at the same (bad) level than single glazed units with shading devices. The A ranking is only possible with triple glazing units with high solar factor.

In other words, shading devices have an important impact on the information provided to the consumer by the future label, though the reality of the European building stock suggests that the recommended label (as it stands) does not provide accurate information to the consumer.

In practice, the future label will recommend to a consumer living in Málaga, Valetta or Athens to buy a triple glazed window with a high solar factor (Low-E) with incorporated shutter,

17. Lot 32 – Task 3 "User Analysis", p. 13.

18. Lot 32 – Task 7 "Policy Options & Scenarios", p. 43.

since the last will reduce the adverse effects in terms of comfort of a window generating overheating (under the assumption that they will be closed most of the year). Obviously, this conclusion is at odd with the recommendations today formulated by all construction, window and glazing professionals. This window may indeed be suited for some geographical regions of Europe characterized by cold winters and hot summers, like Germany, but would be a terrible choice of window and glazing for other regions such as those enjoying a Mediterranean climate. In the South of Europe, glazed areas in buildings have to be chosen with the objectives to:

- Ensure a good level of insulation in winter to avoid heat losses;
- Ensure a good level of insulation in summer to avoid that outside heat enters buildings;
- Modulate solar factors to avoid heat build-up.

Conclusion on the inclusion of shading devices in the label proposals

One lesson to be learned from the Lot 32 preparatory study is that for this specific product group the system approach was not the most relevant due to the very nature of the window product. Since shading devices have an impact on energy demand, it was logical that the preparatory study covers these components. However, the decision taken by the consultants to include them in the calculations and ranking is questionable in light of the data available in the preparatory study and the ranking outcome. As illustrated by the analysis of the boundary conditions and set point for activation, large room for uncertainties enter the energy performance calculation whereas the same calculation could be very stable and predictable for the sole window (glazing and frame). In practice, as illustrated in the analysis made of the impact of shading devices on ranking, their inclusion within the energy demand calculations distorts the ranking of window products thus leading to inaccurate information. Ultimately, a single scale will have the unintended effect of acting as a disincentive to R&D in best performing glazing, spacers, frames, other window components and external devices themselves, since incremental improvements to single components would be diluted in an overly large and unpredictable rating.

Conclusions

Although building products were included in the Ecodesign Working Plan for 2012–2014 (European Commission, 2012) after the extension of the scope of the Ecodesign Directive to all energy-related products, it seems that the possible development of ecodesign measures is limited for this category. In both the exploratory study on thermal insulation and the preparatory study on window products, the consultants do not recommend developing such measures.

It cannot be concluded that the same conclusions will apply to all building products. Nevertheless, it must be underlined that the existing legislative requirements, and in particular the EPBD and CPR, and the variations in terms of building stock and climatic conditions in Europe leave little room for the development of ecodesign measures.

The recommendation for an energy labelling for window products sheds some light on four barriers that need to be overcome in order to have a meaningful energy label. First, the question of the scope of the label seems to find a solution in the preparatory study. The important variations between residential and non-residential sectors (including within the non-residential alone) do not allow including both categories in the same window label. Therefore, the label should focus its scope and boundary conditions on the residential market only. Second, the variations inside the residential sector require developing a model that should either allow making some differentiation between different zones in Europe or aggregating them without undermining the robustness of the ranking. In the case of the climate conditions, important outlier results appear in the South of Europe demonstrating that aggregations and averages are not always possible. Third, the boundary conditions for the building base case need to be properly modelled in order to allow product differentiation and to reflect future evolutions in the building stock. Under certain circumstances, an artificial reference building might be straighter forward than a more representative one. Fourth, the inclusion of shading devices illustrates that components can have a tremendous impact on the robustness of the model if incorporated in the calculation models and ranking. It illustrates the limits of a system approach compared to a sole product, though it cannot be extrapolated since it is quite specific to the window products.

It is also important to stress that the accuracy and robustness of a label proposal should be assessed in light of the existing market, consumers' needs and best available technologies identified in the preparatory study. A European energy labelling for windows must be a tool for informing all consumers in Europe. The best window solutions should be defined for each climatic condition and should represent the solution offering most energy savings while guaranteeing summer comfort. In so doing, the European Union will be able to tap into the important potential of energy consumption reduction and improve the comfort and wellbeing of its consumers.

References

COWI and VHK for European Commission (2011) "Final report: Methodology for Ecodesign of Energy-related Products – MEErP 2011 Methodology Part 1: Methods". November.

Ecofys 2014 by order of European Commission (2014) "Final technical report: Evaluation of the Energy Labelling Directive and specific aspects of the Ecodesign Directive". ENER/C3/2012-523, 3 June.

Euractiv (2014) "Oettinger lashes out at "anti-European" Ecodesign campaigns". Available at http://www.euractiv.com/sections/energy/oettinger-lashes-out-anti-european-ecodesign-campaigns-302795, 13 June.

European Union (2005) "Directive 2005/32/EC of the European Parliament and of the Council of 6 July 2005 establishing a framework for the setting of ecodesign requirements for energy-using products and amending Council Directive 92/42/EEC and Directives 96/57/EC and 2000/55/EC of the European Parliament and of the Council". L 191/29, 22 July.

European Union (2009) "Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecode-

sign requirements for energy-related products (recast)". L 285/10, 31 October.
European Union (2010) "Directive 2010/30/EU of the European Parliament and of the Council of 19 May 2010 on the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products (recast)". L 153/1, 18 July.
European Union (2015) "Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee, the Committee of the Regions and the European Investment Bank, A Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy". COM (2015) 80 final, 25 February.
European Commission (2012) "Minutes of the Consultation Forum of 20 January 2012". CF-2012-02-EC, 20 January.
European Commission (2012a) "Commission Staff Working Document of 7 December 2012 on the establishment of the Working Plan 2012–2014 under the Ecodesign Directive". *SWD* (2012) 434 final, 7 December.
European Commission (2014) "Working document on Thermal Insulation Products (Lot 36) – Results from exploratory study and suggested way forward". 4 April.
European Commission (2014a) "Final Minutes, Meeting of the Consultation Forum under Article 18 of Directive 2009/125/EC on Energy-related Products on Horizontal Matters". ENER/C3/JMA (2014), 5 May.
European Commission (2014b) "The Juncker Commission: The Right Team to Deliver Change Speech at 10 September 2014 Press Conference". SPEECH/14/585, 10 September.
European Commission (2014c) "Mission Letter: Frans Timmermans – First Vice-President, in charge of Better Regulation, Interinstitutional Relations, the Rule of Law and the Charter of Fundamental Rights". 1 November.
Guardian (2014), "Brussels targets super-sized TVs in drive for energy efficiency". Available at http://www.theguardian.com/environment/2014/nov/18/brussels-targets-super-sized-tvs-in-drive-for-energy-efficiency, 18 November.
International Energy Agency (2014), Capturing the Multiple Benefits of Energy Efficiency". Edition 2014.
Siderius, H.P. (2013) "Speeding up adopting ecodesign and energy labelling measures – analysis, challenges and solutions". *eceee 2013 Summer Study proceeding*, pp. 1637–1649.
VELUX (2013) "The Velux Group Position: EU Energy Labelling for windows". June.
VHK for European Commission (2005) "MEEuP Methodology Report, final", 28 November 2005.
VITO for European Commission (2014) "Final report: Exploratory study with regard to Ecodesign of thermal insulation in buildings (Lot 36): MEErP tasks 0, 1 and 7 (partly)". 2013/TEM/R/38, February.

WEBSITES

http://www.eceee.org
http://www.ecodesign-windows.eu/, Lot 32 "Ecodesign Preparatory Study on Window Products".
http://www.energylabelevaluation.eu/
http://www.glassforeurope.com/en/

Annex 1: Timeline preparatory study on window products[19]

Date	Subject
31 July 2013	Launch of the project website
29 October 2013	Publication of the 1st product screening (Task 0)
December 2013	Opportunity for stakeholders to make written comments
18 February 2014	Publication of Task 1–4 Interim reports
17 March 2014	First Stakeholders meeting
11 April 2014	Publication of three surveys
April 2014	Opportunity for stakeholders to make written comments
6 October 2014	Publication of reports for second stakeholders meeting + stakeholders comments on tasks 1 to 4
31 October 2014	Second Stakeholders meeting
November 2014	Opportunity for stakeholders to make written comments
24 February 2015	Final draft preparatory study
24 March 2015	Deadline for stakeholders to make written comments
May 2015	Final preparatory study
25 June 2015 (tbc)	Ecodesign Consultation Forum

19. Derived from the dedicated website http://www.ecodesign-windows.eu/.