About Swan-labelled

Windows and Exterior Doors

Draft 1

Background to ecolabelling

2008-03-13

Nordic Ecolabelling

Swan-labelled windows and exterior doors - Background to ecolabelling

Draft 1, 13 March 2008

1 Summary

The requirements were evaluated during 2007 and it was decided that they should be revised. Windows and exterior doors have developed during the last years on the Nordic market.

Compared to version 2 the U-value proposed in the draft has been tightened from the version 2 level of 1.3 W/m^{2}K to 1.0 W/m^{2}K. Requirements have been introduced on non-renewable materials in window and exterior door frames, casements and door leaves. The use of recycled material is required. The draft also requires that wood raw material is derived from sustainable forests. The criteria on chemical products have also been updated.

The relevance of the criteria is great since the type of windows and outer doors on a building significantly affect the level of heat loss. The criteria focus on the usage phase since this phase has the most significant environmental impact through energy losses. The largest environmental impact for these products are during the use phase. The energy loss from buildings in which the windows are fitted. Energy production uses a large proportion of non-renewable fuels, producing large quantities of emissions such as carbon dioxide, nitrogen oxides and sulphur dioxide. The majority of windows produced in the Nordic area have a U-value between 0.7-2.7 W/m^{2}K. The potential for ecolabelling is still high.

Nordic Ecolabelling has chosen to set requirements of renewable materials and the use of recycled non-renewable materials. Regards non-renewable plastic materials, requirements are set on the production process and additives.

The main differences in the revised criteria for windows and exterior doors are:

- The products green house effect and climate change effect has been reduced,
- The environmental impacts from chemical products have been reduced due to tightened requirements and
- The health impacts have been reduced due to tightened requirements.

2 Introduction

This background is for the draft for Swan-labelled Windows and Exterior Doors version 3. The requirements were evaluated during 2007 and the requirements needed to be revised. The purpose of this background document is to clarify the revision process and justify the requirements and any changes that have been made since the current version of the criteria.

The requirements for exterior doors are sent out for comments for the first time. The requirements were incorporated without remittance in version 2.3 the 7th December 2006.

3 General facts about the criteria

Products that can be labelled

The windows covered by these criteria can be either fixed or opening. The criteria apply to windows in both heated and cooled buildings. The requirement of a high g-value, i.e. admission of a high level of daylight, must not increase the interior temperature thus requiring cooling during the summer. Subsequently, the consumer must be urged to shade the windows, such as with sunshades, or the customer informed that the window is not suitable for cooled buildings if sunlight falls directly on the window.

Exterior doors that may be Swan labelled are defined as doors forming the boundary between free and heated areas. I.e. doors between an indoor and outdoor environment. There are other types of exterior door that are subject to functional requirements: Doors for halls, access balconies, warm stores, cold stores and street doors are several examples. These doors are not part of the product group since they do not need to provide the same level of insulation.

This requirements have not been changed.

Justification for Swan labelling

The relevance of the criteria is great since the type of windows and outer doors on a building significantly affect the level of heat loss. The criteria focus on the usage phase since this phase has the most significant environmental impact through energy losses. Swan-labelled windows and exterior doors reduces the energy consumption for buildings and then reduces the green house effect and climate change effect. Energy production uses a large proportion of non-renewable fuels, producing large quantities of emissions such as carbon dioxide, nitrogen oxides and sulphur dioxide. The majority of windows produced in the Nordic area have a U-value between 0.7-2.7 W/m^2K. The potential for ecolabelling is still high.

There are currently several national energy labelling systems for windows in the Nordic area. Nordic Ecolabelling can, with maintained steerability, ecolabel windows and thus impose energy and other environmental requirements. The Swan-label is unique compared with energy labelling because Swan-labelling has a life cycle perspective. This means that the Swan-label includes the most important impacts for the products whole life cycle. Swan-label has above energy requirements, requirements for raw materials, chemicals and fitness for use.

Criteria version and validity

The criteria for windows version 1.0 were adopted in October 1997 and valid until 2000-10-22. The current version, version 2.0, was adopted by the Nordic Ecolabelling Board on 12 December 2001 and is valid to 30 June 2009.

The Nordic market

During the evaluation a market analysis were made. The data below is from that market analysis. The requirements refered to below are from the requirements that are valid today.

Denmark has 70-110 window manufacturers. The Danish window industry turns over DEK 5.5 billion (2006). 26% of Danish windows are exported, of which 2/3 go to the UK and Ireland. 1/3 is exported to Sweden and Germany. The Danish windows industry employs 5,500 people. It is estimated that 1-4% of the windows on the Danish market meet the Swan ecolabelling requirements. The majority of windows on the Danish market have a U-value between 1.45 and 1.65 W/m^2K.

There are approximately 60 companies in Sweden that manufacture windows. The window industry in Sweden turns over in excess of SEK 5 billion (2006). The export of Swedish windows is limited. The windows that are exported go primarily to the UK, Japan and Norway. In Sweden, approximately 70% of windows for houses are judged to fulfil Swan requirements. This can be explained by subsidies given for windows with a U-value minimum of 1.2. The proportion of windows for flats and apartments that meet the requirements is somewhat less.

Norway has roughly 120 window manufacturers. In 2005, turnover was NOK 1.2 billion in Norway. 80% were wood-framed windows, 18% aluminium clad and the remainder aluminium or PVC. 295,000 windows were used in new housing projects and 100,000 were exported to the UK and Ireland. The majority of imported windows came from Denmark and Poland. In Norway, almost 5% of windows are judged to fulfil Swan requirements.

The table below is from the report "Building Regulations for Windows in European Countries"[1]. The table provides an outline of praxis in the Nordic countries. The column "Current Standard" describes the standard window in each country.

Country	**Current Standard**	**Practice** **Future Developments**
Denmark	Low E double glazing	From Jan 2006 the requirement for new build will be based on Total Energy Performance. U 1.5 will be required for extensions and major refurbishments.
Finland	Triple (2 + 1), many with Low E and argon.	
Norway	Low E double glazing and argon.	U 1.2 for windows in new buildings in 2007.
Sweden	Volumetric Triple glazing, often with Low E and argon.	Parliamentary review of energy performance of buildings initiated in 2002, to report in 2005. Likely to result in improved regulations in 2006, including provisions for existing buildings.

Windows can be subdivided into several types depending on the frame and casement material used. There are wooden windows with both frame and casement made of wood. Wooden windows are generally treated with wood preserver (biocide) to provide superior protection. Wooden windows can be metal clad (often aluminium) to increase their durability. Aluminium clad wooden windows do not generally require treatment with biocides. In damp environments with harsh climates, such as the west coast of Norway, manufacturers recommend that biocides are used to preserve the wood even if the windows is metal clad. There are also windows with metal frames and casements. Further, there are windows with plastic frames and casements. The

[1] Building Regulations for Windows in European Countries http://www.gepvp.org/

most commonly used plastic material is PVC, but other composite materials such as glass fibre reinforced polyester are also used.

The Nordic window market has changed in recent years. Window manufacturers make and sell more well-insulated windows. Windows have increasingly better U-values. Building regulations have been or will be tightened in the Nordic countries.

The majority of exterior doors on the Nordic market have a similar construction. They comprise a wooden frame filled with insulating material. The frame is then covered with a vapour barrier to prevent moisture wandering through the door. The door often also has a metal plate to ensure that it retains its shape despite the difference between the indoor and outdoor climate that causes movement in the wooden material. The manufacturers use different types of insulation material. These include rock wool, glass wool, cellular plastic and cellulose material. Possible glass elements in an exterior door are manufactured in the same way as traditional windows. The glazed area often negatively affects the insulation provided by the door.

Regulatory requirements

The windows in new buildings in Norway[2] must have a maximum average U-value of 1.2 W/m^{2}K. The new building regulations in Norway has become valid but there is a transition period until 1th august 2009. In the earlier regulations the requirements was a minimum U-value of 1.6 W/m^{2}K for windows. In Denmark[3], as of 2008 windows in new buildings must have a maximum U-value of 2.0 W/m^{2}K. For extensions and renovation, the maximum U-value for windows is 1.5 W/m^{2}K.

In Denmark the solar transmission, i.e. the g-value and proportion of glass, is also considered. A low U-value must be combined with a high g-value. A high g-value gives high sun energy input and “free” heating. In Finland[4], windows used in new buildings must have a maximum U-value of 1.4 W/m2K. A pilot project is currently underway in Finland for the energy classification of windows. In Sweden[5], building regulations primarily set a U-value for the entire building. A U-value for windows is given as an alternative, and this is set to a maximum of 1.3 W/m^{2}K. For buildings heated by electricity, the U-value for the windows must not exceed 1.1 W/m^{2}K. In Sweden, a subsidy is given (30% on materials and labour) to change the windows in existing houses (permanent residences). The maximum subsidy is SEK 10,000. The subsidy is available until 31 December 2008.

In Norway, the average U-value of windows is estimated to be 1.8-1.9 W/m^{2}K, which exceeds the regulatory requirement of a maximum of 1.6 W/m^{2}K. A low U-value for the windows can however be compensated by a better U-value for the walls and roof so that the buildings entire building envelope provides sufficient insulation. The new Norwegian requirements apply to new housing, and exemptions are provided for traditional so-called "laftede" houses (log cabins). 40% of the windows produced goes to new housing while the remainder is put into existing buildings. Small producers custom make windows while large manufacturers produce standard sizes[6].

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[2] http://www.regjeringen.no/upload/kilde/krd/prm/2007/0013/ddd/pdfv/305482-tek.pdf.pdf
[3] http://www.ebst.dk/energibestemmelser
[4] www.ymparisto.fi
[5] http://webtjanst.boverket.se/Boverket/RattsinfoWeb/vault/BBR/PDF/BFS2006-12BBR.pdf
[6] Details from the Norwegian Joinery Manufacturers Association.

Other labels for windows and exterior doors

The Nordic countries have national quality marks for windows and exterior doors. In Sweden, windows and exterior doors can be labelled with the P or SFDK label. These are quality labels that test factors such as the product's insulation, airtightness, fire protection and burglary protection. P-labelling is administered by the Swedish National Testing[7] and Research Institute and SFDK[8] labelling by a trade association. SFDK labelling classes windows and doors according to various standard window and door types.

In Norway, labelling according to NDVK (Norsk Dør- og Vinduskontroll)[9], which is equivalent to the Swedish SFDK, is obligatory for Norwegian manufacturers. NDVK includes factors such as rainproofness, airtightness, quality and warranty. It is also a quality label. The requirements on windows and doors vary slightly between SFDK and NDVK. This can be explained by different building traditions that mean that windows in Norway and Sweden are different. On the west coast of Norway, doors and windows are also subjected to very harsh climatic conditions, which also influences the requirements set by NDVK.

Denmark has a certification body known as Dansk Vindues Certifiering (DVC)[10] that sets requirements equivalent to those of SFDK and NDVK.

Windows in the Nordic countries are energy labelled. The criteria for the energy labelling of windows differ however between the Nordic countries. In Sweden, a window is classified by its U-value. The energy label also provides information about the window's light transmission (LT-value) and solar energy transmission (g-value). In Denmark, windows are classified according to a combination of their U-value and g-value based on an energy supply calculation[11]. The calculation shows how much energy enters the building based on the window's g-value contra how much energy leaves the building due to the window's U-value. Norway does not have an energy label for windows.

Windows and exterior doors can also be CE-labelled. The product standard EN 14351 is ratified and public which means windows and exterior doors can be CE-labelled from February 2007 and must be CE-labelled as of February 2009. With CE-labelling the producer certifies that that the product fulfils the requirements in standard EN 14351:2006.

Wooden products can be ecolabelled with the FSC label in all the Nordic countries. This label is however not commonplace for windows and exterior doors in any of the Nordic countries.

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[7] www.sp.se
[8] www.sfdk.se
[9] www.ndvk.no
[10] www.vinduesindustrien.dk, www.dvc-vinduer.dk
[11] www.energimarkning.dk

4 Criteria development/revision

Purpose of the revision

The requirements on windows shall been revised was the conclusion from the evaluation made 2007. The existing requirements on exterior doors shall be maintained in the review. Investigations have shown that there is no unanimous view in the Nordic region as to what an energy efficient window is. We must fine a solution that gains acceptance in all the Nordic countries or alternatively specify different requirements for the different countries.

The following areas shall be revised (e.g. from section 11 of the present criteria):

- Energy requirements tightened. An investigation of the influence of U-value and g-value in the Nordic countries shall be performed. The possibility to combined the requirements in an "energy contribution" calculation shall be investigated.
- The function of windows shall be developed. Can, for example, requirements be set regarding airtightness. We aim to harmonize the requirement of national systems such as SFDK and NVDK.
- Requirements on wood raw material for windows shall be developed.
- New requirements for wood preservation shall be developed.
- Requirements shall be set for the insulation material in the window frame.
- The requirement on chemical products (filler, adhesives, etc.) shall be revised. Chemical products also refers to the surface treatment of glass and metal.

About this revision

The criteria have been revised by a Nordic project group comprising the product group managers Anders Moberg, SIS Ecolabelling in Sweden, Karen Dahl Jensen, Denmark, and Aina Seland, Norway. The draft has been established through discussions and meetings with manufacturers, test institutions, chemical suppliers and other interested parties.

5 Justification of the requirements

5.1 Energy-related requirements

Life cycle perspective

The heat insulation capacity of a window is one of the most important parameters influencing the energy consumption of a building. Heat losses through windows can constitute up to 35% of the total heat loss from a residential, commercial or public building. In the same way as the windows, exterior doors form part of the building envelope, i.e. the building's exterior that is subject to the outdoor climate and the function of which is to separate the interior environment from the exterior environment. The surface area of the exterior doors on a normal building is normally

less than the total area of the windows. Nonetheless, exterior doors are areas that contribute to the heat loss from the building.

Many life cycle assessments have been done for windows. For example "By og Bygs rapport 046 Miljøvurdering af vinduer[12]" and " Life Cycle Assessment of PVC and of principal competing materials, Commissioned by the European Commission, July 2004[13]". The unanimous conclusion is that the energy efficiency of the window is the most important environmental parameter in a class of its own. Therefore the focus of the requirements for Swan-labelling is on energy efficiency. This reduces the need for energy for buildings and reduces green house effect and the climate change effect.

In addition to the energy efficiency requirements there are requirements for material used in the windows and exterior doors. The requirement that excluded halogenated plastics has been removed. Instead there are requirements for the different material used in windows and exterior doors. The Swan-labelling intention is to reduce the environmental impact from the different materials.

U-value

The U-value of a window or exterior door is the parameter that ensures the greatest energy saving. In this draft, the required U-value for windows is lowered from 1.3 to 1.0 W/m^2K for the entire window. This value has been tightened since it is environmentally justifiable and since we consider that there is scope in the Nordic market for improvement. The development of windows has advanced and the industry is ready for limit value of 1.0 W/m^2K. Observe that the requirements come into force 2010 when the current criteria expire. As 2007, the U-value of windows in new buildings in Norway must not exceed 1.2 W/m^2K, se chapter 2.

Condensation on the outside of windows is a problem that can occur in certain conditions, such as high relative humidity, clear skies and calm winds. There is radiant transmission between the window surface and cold outer space. This is a question of comfort that does not influence the lifespan of the window (unlike condensation on the inside that can cause mould or rot). Version 2 of the criteria set a U-value for the window pane to avoid condensation. This requirement has been omitted from the draft.

The requirement of an exterior door U-value of 1.0 W/m^2K agrees with the Swedish SFDK requirement of exterior doors without window. SFDK have an other requirement of a maximum of 1.3 W/m^2K for doors with glass. We have chosen one U-value that must be fulfilled irrespective of the design of the door. The heat insulation properties are important from an environmental standpoint. The Norwegian NDVK does not specify a U-value for approval.

Solar energy transmittance and light transmittance

Solar energy transmittance, the g-value, is significant to the energy consumption of the building. It has become apparent that many windows have been produced with the

[12] By och Byg Dokumentation 046 Statens Byggeforskningsinstitut 2003
[13] Life Cycle Assessment of PVC and of principal competing materials, Commissioned by the European Commission, July 2004

good intentions of lowering the U-value while the g-value of the glass has not be considered to the same extent.

The energy savings resulting from a window with high g-value depend on its placement (orientation, height, shading from vegetation/building, Venetian blinds or sun blinds). In addition, how much energy can be saved due to solar energy contributions depends largely on how the building's heating system (control system) is able to utilise this energy.

To this revision, the reduction in heat required resulting from the g-value was simulated. The conclusion is that a good g-value can reduce the heating requirement based on all windows installed in the Nordic region. The reduction depends on the location of the window in the building.

The draft criteria set a minimum level for the g-value and consider possible solar energy contributions as a "bonus effect". The proposed g-value is 52% for the glass.

This level is considered possible to achieve through the active choice of window construction regarding the g-value. It is also considered important that the requirement on both U-value and g-value is lucid and easy to interpret.

Light transmittance composes both infrared radiation and visible light. The primary function of a window is to admit light. The draft criteria propose a minimum level of 63% light transmittance. It is vital that user does not consider ecolabelled windows to be dark and unpleasant.

Airtightness

The fitting method used for the exterior door and window is important to its airtightness. Wood is a living material that expands and contracts depending on the temperature and humidity. Sealing strips shall absorb this movement so that the exterior door and window closes tightly. To ensure that the Swan labelled exterior door is well sealed, the exterior door must be tested to EN 12 207 and provide an airtightness of 600 Pa.

This limit value agrees with the Norwegian NDVK requirement. The Swedish SFDK limit is 300 Pa. The Danish VinduesIndustrien and Swedish P-label do not set requirements as to airtightness.
U-value and airtightness requirements are important. Accordingly, we have chosen to set requirements that only the best exterior doors in the Nordic region fulfil. Energy savings resulting from a well insulated exterior door provide environmental gains in all Nordic countries.

This is a new requirement.

5.2 Requirements on materials used in windows and exterior doors

The most important construction materials for the manufacture of windows are glass, wood, aluminium, steel and plastic. In addition to these materials, a large number of other materials and chemicals are used such as wood preservers, coatings, sealants, filler, adhesives, fittings and seals.

Environmental impact of materials

There are significant environmental issues associated with the materials used in windows and exterior doors. The wood raw material comes from forests of varying sustainability. In many cases, wooden windows use wood preservers/biocides to extend their lifespan. The mining industry causes environmental issues with the extraction of ore and refinement of metal. Metal is also a finite resource. The refinement process for metal requires much energy. With regard to plastics used in window frames and casements, PVC production impacts the environment with the emission of persistent organic compounds and since plastic is produced from a finite resource, namely oil. Plastic also contains additives that have a negative environmental impact.

In this draft requirements have been developed for plastics such as PVC in windows. There are requirements for use of recycled material and sharp requirements for additives in plastics. There are also requirements for take-back system for plastic so they are not incinerated as a waste. These requirements motivates Nordic Ecolabel not to exclude halogenated plastics from Swan-labelling.

The environmental issues of PVC are generally associated with the production of the raw material and waste management. PVC is a chlorinated plastic. The primary material, ethene, is chlorinated in two steps to 1,2-dichloroethane which is cracked to monovinyl chloride (MVC). MVC is polymerized to PVC. Chlorine gas is still primarily produced using the amalgam method, i.e. with mercury as the anode metal. Emissions of mercury occur to the air. Chlorine manufacturing also produces waste that contains dioxines, heavy metals and hexachlorobenzene. The presence of chlorine atoms in PVC produce several technical advantages but also cause the production of toxic, persistent and often bioaccumulating compounds, so-called POP substances. POP substances are a high priority in environmental protection contexts since they have been show to disrupt the reproduction, immune and hormone system of animals and humans. Many are carcinogenic.

It is possible to have requirements for the production of chlorine for the production of the PVC-monomer (VCM). Chlorine are produced with electrolyse in three different methods, membrane cathode method, diaphragm cathode method and the mercury cathode method. The membrane cathode method has the least environmental impact.

The European Commission in the Green Paper "Environmental Issues of PVC" commissioned four studies to evaluate the technical aspects of alternative waste management methods for PVC: mechanical recycling, chemical recycling, incineration and landfill. The first priority is to prevent the production of waste. The

commission also asserts that material recycling should take precedence over energy recovery.

The incineration of PVC can occur under both controlled and uncontrolled conditions. The combustion of products that contain chlorine gives rise to hydrogen chloride but also smaller quantities of organic compounds such as benzenes, phenols, furans, PCB and polychlorinated naphthalenes. There are many compounds and knowledge is fairly limited regarding their identity and quantities.

If the technology and security is good, the PVC-Informationsrådet I Danmark[14], thinks that most of the dioxin is caught but not all of it. The environmental authorities in Sweden states that the PVC-industry stands for 1 5 of the dioxin produced in Sweden. PVC is dependent of stabilizers so it can withstand the high temperature during production. The stabilizerscan be based on on lead, barium-zink, calcium-zink, tin or cadmium[15]. 70 % of all tin compounds that are produced are used for PVC-stabilizers. 70 % of the stabilizers for PVC contains lead. The PVC Industry in Europe has undertake to stop use cadmium from 2001[16]. PVC-product produced outside Europe is not without cadmium though.

The majority of lifecycle analyses (e.g. Life Cycle Assessment of PVC and of principal competing materials, commissioned by the European Commission, July 2004) that have been performed for windows show that the energy efficiency of the window is the most important environmental parameter. Nordic Ecolabelling sets requirements based on a lifecycle perspective and emphasizes the importance of the energy efficiency of the window. It is however also important that requirements are set of the material of which the window is made.

Renewable and recycled raw materials

Wood is a renewable resource while aluminium, steel and plastics are finite, which means that such raw materials are not renewed under a foreseeable future but the resources decline at the same rate as they are used. Renewable raw materials are defined as those materials that are derived from biological materials that are continually reproduced in nature.

The size of the global population is expected to increase 50 % in the next 50 years. This increase in population is expected to have a significant effect on the environment. The largest population increase will occur in developing countries, which will constitute 85% of the world's population within several decades. The increased population will demand more raw materials and services to satisfy its needs. This trend will influence the use of raw materials and environmental impact on a global scale17. The European Commission's "Green Paper on Integrated Product Policy" provides product design guidelines to promote a life cycle perspective within companies. The guidelines encourage more environmentally suitable product design and aim to integrate environmental aspects in product development. Design concepts

[14] PVC Informationsrådet i Danmark. www.pvc.dk/t2w_172.asp
[15] Life Cycle Assessment of PVC and of principal competing materials, EU Commission 2004
[16] espa, European Stabiliser Producers Assosiation, http://www.stabilisers.org/breakdown.htm, (30.03.2005)
17 Sustainable use and management of natural resources, European Environment Agency 2005

include "design for use of renewable materials" as a way for products to use resources efficiently and reduce waste, pollutants and the risks associated with the product18. Design for reuse and recycling are also listed as beneficial design concepts.

Nordic Ecolabelling wishes therefore in the criteria for the ecolabelling of windows and exterior doors to promote the use of renewable resources and of recycled non-renewable materials.

The requirements laid down by Nordic Ecolabelling differ for renewable and finite raw materials. For wood, which is renewable, requirements are set regarding forest management. Traceability of the lumber and timber is required, and a requirement is set of the proportion of timber that comes from certified forests.

For non-renewable raw materials, it is required that a certain proportion comes from recycled material. Recycled raw material refers to post-consumer material that is subsequently recycled. Waste from product does not qualify as recycled raw material.

This requirement is new.

Windows of renewable and finite / non-renewable materials

The current criteria, Swan Labelling of Windows and Exterior Doors version 2.4, set requirements of the materials of which the window or exterior door is made. The requirements also cover energy efficiency, chemical products wood preservers and function. The energy requirements are the most significant. This is confirmed by the results of the lifecycle analyses that have been conducted for windows.

In the draft criteria, the project group proposes that the requirements do not prohibit the use of halogenated plastics or non-renewable materials in the frames and casements. It is proposed that window frames and casements must comprise a minimum of 50 % by weight of recycled material if the material is non-renewable. Requirements are also set of the additives in non-renewable materials and the manufacturing process.

Examples of the composition of a window:

1. Wood/aluminium window		2. Plastic window	
Frame/casement		Frame/casement	
Wood*	20 %	PVC	25 %
Aluminium	9.9 %	Aluminium	10 %
Sealing strip	3.8 %	Sealing strip	4 %
Pane, fittings and seal	66 %	Pane, fittings and seal	61 %
Total weight: 45 kg		Total weight: 40 kg	

* The wood preserver forms <1% of the window

18 Green Paper on Integrated Product Policy, European Commission, COM (2001) 68.

Aluminium recycling

Aluminium is the second most commonly used metal in the world following steel. Its use continues to rise due to increased global consumption. Aluminium is light, strong and corrosion resistant, which make it a very good material for windows and exterior doors.

Aluminium is suitable for recycling, and the level of recovery is very high. Aluminium is produced using electrolysis, a process that requires large amounts of energy. The remelting of recycled aluminium requires only five per cent of the energy that was originally used for the production of primary aluminium.

In 2004, the European aluminium production was 5.2 million tons of primary aluminium, 4.7 million tons of recycled aluminium and 2.8 million tons of imported aluminium. In other words, the European aluminium production comprises 37% recycled waste19.

The majority of aluminium waste produced in the Nordic countries is recycled. Aluminium waste has a high value and is thus by and large collected. The increasing raw material prices of metals has increased the demand for recycled aluminium. A large proportion of recycled waste is used in the manufacture of aluminium profiles for windows and exterior doors. Controllability is however limited since a smeltery cannot provide aluminium to a customer's specific desired level of recycled material. Nordic Ecolabelling must thus set requirements of the smeltery's average proportion of recycled material.

Plastic recycling

The plastics used in windows and exterior doors on the European market are PVC and polyester. Windows made of polyester are composite windows and the polyester is reinforced with fibreglass. PVC windows are most common on the European and Nordic markets. There is one manufacturer of composite windows in Denmark and one in Sweden.

The collection and recycling of synthetic, non-renewable plastic for windows and exterior doors is presently very limited and in practice only carried on in small-scale trials. In Europe, many collection centres are being established for the recycling of plastic windows. For example, Germany has more than 100 collection centres20.

The recycling of glass fibre reinforced polyester in composite windows to make products of acceptable quality is not possible today since polyester is a thermosetting plastic. These windows have not been on the market that long. The glass fibre that is used can be made of recycled glass.

It is easier to recycle rigid PVC than soft PVC, which contains plasticizers. The majority of European countries have collection system for PVC waste so that it can be recycled. It is primarily construction waste that is collected.

19 Aluminium Recycling in Europe, European Aluminium Association

20 Details from http://www.plastfonster.com/miljo.htm

Germany has a system for the collection of plastic windows called www.rewindo.de. Denmark follows the system www.wuppi.dk.

According to Swedish PVC-Forum, PVC can be recycled 5-7 times before its strength properties are too poor. Windows can be made of recycled PVC. According to the PVC industry, there are PVC windows in England made with recycled PVC. It is however difficult to acquire recycled PVC and actors in Sweden are doubtful since the collection of windows is not commonplace. Nordic Ecolabelling does not consider production waste that is reused to be recycled material.

Steerability for ecolabelling

Despite the widespread recycling of aluminium in Europe, it is not easy for window and door manufactures to purchase recycled aluminium. The smelteries that produce aluminium mix primary and recycled aluminium.

The recycling of PVC windows and doors to make other objects is uncommon in the Nordic area, but systems are being established in Europe were plastic windows are more common. Therefore, Nordic Ecolabelling considers that requirements should be set for the recycling of plastic. This indicates in which direction the plastic industry should strive in order that the raw materials can be considered sustainable. Setting requirements on recycling reduces the consumption of fossil oil. The requirement of the use of a proportion of recycled plastic is supplemented with requirements regarding additives and the production of plastic that is not recycled.

There are requirements for additives in virgin plastics and recycled plastics. Environmentally hazardous additives like lead, cadmium, halogenated paraffines, tin compounds, phtalates and halogenated flame retardants must not be added plastics. Test must be done for content of halogenated paraffines, tin compounds, phtalates and halogenated flame retardants in the recycled plastic.

This requirement is new.

5.3 Wood raw material

A catch requirement has been added to the criteria for windows and exterior doors for the version 2.3. The licensee must ensure that wood raw materials do not originate from forest environments meriting protection due to their high biological and/or social value. Nordic Ecolabelling may revoke a licence if it is found that wood raw materials are derived from forest environments in which the forests meriting protection are damaged or threatened by the forestry practices. This means that the licensee must from which geographic location the wood raw material in the ecolabelled doors comes. If conditions in the region are controversial (e.g. illegal forestry), a licence will not be granted for that wood raw material. The licence can also be revoked if controversies arise regarding the forestry in the region or if the traceability cannot assure that the forestry practices do not endanger forests meriting protection.

It is also required that 70% of the solid wood in windows and exterior doors must come from certified sustainable forests. The requirement applies to solid wood, for

example in the frame and casement, and veneers on doors. Fibreboards are not subject to this requirement. The requirement applies to the annual purchase of solid wood.

This requirement is justified since there are windows and exterior doors that contain wood raw materials from tropical forests. For example, teak and mahogany are sold in the Nordic countries. The requirement applies to all wood raw materials irrespective of the geographic location from which they come. However, the tropics have the greatest problems with the illegal felling of forest meriting protection.

The requirement for wood from certified forests is new.

5.4 Insulation material

The criteria stipulate that thermal insulation materials must not contain brominated flame retardants or flame retardants containing borax or boric acid. Expanding insulation material must not be produced using chlorinated propellants such as hydrofluorocarbons (HFC). Mineral insulation material must not be classified as carcinogenic according to Directive 97/69/EC. Different brominated flame retardants have varying effects on health and the environment. Some substances are long lived and suspected to cause heritable genetic damage. The Danish Environmental Protection Agency lists PBB and PBDE as the most problematic substances. The European Union prohibited the use of penta-BDE and octo-BDE as of 1 July 2004. Fluorinated propellants have s significant effect on the greenhouse effect.

Borates can be toxic and corrosive. It is on the Norwegian “OBS-list” because it reduces fertility and can be harmful to fetus[21].

The requirements on the insulation materials used in windows and exterior doors are harmonised with the criteria regarding the ecolabelling of houses.

5.5 Requirements for filler gas

The window often contains filler gas to increase the insulation effect. Sometimes green house gases are used and therefore there is a requirement that the filler gas should have low “Global Warming Potential”. This requirement is not changed.

5.6 Requirements on chemical products

Classification of chemical products

During the production of windows and exterior doors, various chemical products are used such as adhesives, sealants, wood preservers, primers and top coats. These products contain varying amounts of substances that are classified as environmentally

21 OBS-listen, Norske miljøvernmyndighetenes liste over helse- og miljøfarlige stoffer man skal være spesielt oppmerksom på, TA-1910/2002, ISBN82-7655-466-0

dangerous and/or harmful.
The most serious health aspects are associated with substances that are acutely toxic and substances with long-term effects such as substances that are carcinogenic, mutagenic and toxic to reproduction. Another serious aspect, which is primarily associated with the use of chemical products, is sensitisation. Regarding the environmental aspects, consideration must be taken to both substances that have acute toxicity and those that are bioaccumulable or not readily biodegradable.
The requirement regarding the classification of chemical products is based on information about the content of health and/or environmentally classified substances in 40-50 products that are used during the production of windows. The requirement specifies the danger classes and risk phrases that are prohibited during the production of Swan-labelled windows and exterior doors. An exception is made for wood preservers and products for surface treatment since almost all are classified with the risk phrase R52/53. This requirement is new.

CMR substances

This requirement is set to prevent the product from containing substances that are classified as carcinogenic, mutagenic or reproduction toxic at levels lower than those of the dangerous substance classification. The requirement covers for example arsenic compounds, boron, solvents, chlorinated solvents, some glycols and heavy metals. This requirement is new.

Substances not permitted in chemical products for windows and exterior doors

The substances that are listed under this requirement are substances included on the environmental protection agencies' lists of substances with serious health and/or environmental effects. The substances specified are primarily of relevance to coatings, varnishes and adhesives. Many of the substances have properties that mean they are also regulated by R2. Nonetheless, they are included here to avoid ambiguity in cases where a substance has not been officially classified. This requirement is new.

Nano materials

Using nanotechnology, materials can be constructed from an atomic level. This can give materials totally new, customised properties. Nano-particles are defined as microscopic particles that in at least one dimension are smaller than 100 nm. Nanometals, for example, include nanosilver, nanogold and nanocopper. Nanometals such as nanosilver and nanocopper are particularly in focus since they can be found in many products from socks to refrigerators due to their antibacterial properties. Nanosilver is categorised as a biocide by the American Environmental Protection Agency.
Nanotechnology utilises unique properties that occur at atomic and molecular level. For example, many substances become far more reactive at nano-level. One example is gold, which is normally extremely stable but at nano-level is chemically reactive. Particles at nano-level have particular properties that may be harmful to the environment or health. Simply put, products may emit nano-particles which in turn may be able to penetrate deep into the lungs or penetrate the skin or other barriers in the body or nature. They may also react with other substances and thereby cause damage to body tissue. In general, knowledge about the health and environmental effects of nano-particles is very limited. Based on the cautionary principle, Nordic

Ecolabelling therefore requires that if nano-materials are used during the production of the window or door that there is documented evidence that these particles do not constitute a danger to health or the environment. This requirement is new.

Emission of solvents during the impregnation and coating

The traditional method of impregnating windows is vacuum impregnation with solvent-based preserver according to Class AB of the Nordic Wood Preservation Council.

Volatile organic compounds (VOC) are damaging to health and can cause work environment issues. The compounds react with other gases in the atmosphere and can therefore cause ozone depletion. Within the EU there are requirements in force in a number of industries with the aim of reducing the emission of VOC. Regarding the impregnation of wood, new and more extensive requirements came into force in October 2007. The VOC-directive. These requirements prohibit the use of a range of solvent-based products. As a result, new products have been developed with lower solvent contents so that the emission of VOC in use is lower than the limit value of 11 kg/m^3. Alternative methods for wood preservation have also been developed and employed using water-based "flowcoating" in conjunction with a high level of heartwood. This method is widespread in Denmark, while in Norway and Sweden, many producers continue to use vacuum impregnation and solvent-based products.

One reason for the slow move from solvent-based to water-based/flowcoat with a high level of heartwood products is that this requires large investments in new equipment. There is also a scepticism in Norway and Sweden as to whether the durability of the wood will be sufficient. The experience in Denmark is though that flowcoating with a minimum level of 90 % heartwood gives the most durable windows. Many window producers in Sweden and Norway claims that best durability is obtained through vacuum impregnation. It also stated that wood rich of heartwood is difficult to buy and also expensive. The Danish producers means that this is not correct.

Since durability is an important parameter, solvent-based impregnation methods are not prohibited in this version of the criteria. The ecolabelling requirements nonetheless go further than the regulatory requirements. Ecolabelling required that all plants fulfil the VOC directive and not only those over a certain size.

The requirement on VOC emissions can be fulfilled in the following ways:

- limited quantity of VOC in the product that is used
- higher proportion of heartwood lowers the absorption of preserver
- purification of waste air/emissions

This requirement is new.

Durability

To ensure the durability of Swan-labelled windows and exterior doors, impregnated wood must be tested according to EN 351. This standard is intended for solvent-based preservers, but according to producers of preservers/coatings, it also works well for water-based flowcoats.

It is also required that the producer of the coating system shall document durability in accordance with EN 927 "Coating materials and coating systems for exterior wood surfaces".
Parts of this standard are relatively new (2007). It is divided into the following sections:

EN 927-1 (1996)	Classification and selection
EN 927-2 (2006)	Performance specification
EN 927-3 (2007)	Natural weathering test
EN 927-4 (2000)	Assessment of the water-vapour permeability
EN 927-5 (2007)	Assessment of the liquid water permeability

Parts 4 and 5 are voluntary and therefore not included in the ecolabelling criteria. For products to be Swan labelled, it must be documented that the coating system fulfil the limit values for "stable end use category" in Table 1 in EN 927-2 The "Exposure condition" defined in Table 2 of EN 927-1 shall be "Severe".

These requirements are new.

5.7 Waste management during manufacture

Production waste

The manufacturing of windows and exterior doors produces waste in the form of processing waste, chemical waste, packaging and faulty products. Processing waste includes for example waste from cutting glass, and machining wood, metal and plastic frames. The possibilities to recover this material are good, except for impregnated wood and plastics. Chemical waste is also produced in the form of sealants, adhesives, coatings and the packaging for these products.

It is required that the manufacturer carefully sorts waste during production of the window/door and that the material is wherever possible recycled through material recycling or energy recovery.

Take-back system for plastic

It must be possible to collect non-renewable materials in a window or exterior door for recycling in the countries in which the product is sold with the Swan label. The criteria require that recycling systems exist, such as for plastics, and that the licence applicant is affiliated to a system that enables the collection of windows and exterior doors at the end of their life.

As part of the European PVC industry's environmental initiative, Vinyl 2010, systems for the collection of rigid PVC, such as for windows, will be established in December 2007. The makers of PVC window profiles will be able to affiliate to a collection system and finance the collection of PVC materials, which can then be recycled[22].

PVC windows are not presently collected for recycling in Sweden, Norway and Finland. The industry explains this by the fact that the windows have a long lifespan

22 Details from Swedish PVC-Forum

and have not been used that long. In Germany, post-consumer PVC windows are collected and the plastic recycled and used in new PVC windows, doors and pipes. During 2006, roughly 12,000 tons of PVC were collected in Germany[23]. This requirement is new.

5.8 Requirements on performance

Technical requirements

The requirements on the fulfilment of product and functional standards for windows and exterior doors are not specified ti specific standards that should be fulfilled. The reason for this is the large number of standards that exist. The development of EN standards is underway and this requirement will be adjusted in future revisions once this work is completed and the standards are more applicable. In Denmark you have windowcertification DVC, in Norway NDVK and in Sweden SFDK and P. The window and exterior door producer must certify their Swan-labelled product according to one of these certification systems. This requirement is not changed.

Guarantee

The manufacturer shall provide a 10-year warranty for the window or exterior door, provided that the consumer maintains the product in accordance with the manufacturer's recommendations. For exterior doors the manufacturer shall provide a 5-year warranty for the function and features. Installation is a large economic and environmental investment and must be possible within a reasonable timeframe. The guarantee period must be realistic for both the consumer and producer.

Customer information

The criteria require detailed consumer information regarding how the window or exterior door is to be handled from the point of purchase to completed installation. To ensure that the low U-value of the window is fully utilised, information on best practice regarding fitting must be supplied.

The committee has concluded that it is difficult to set requirements regarding maintenance procedures for a number of reasons. It is difficult for the manufacturer to guarantee and check that a maintenance procedure is performed. Further, the environmental impact of maintenance is judged to be of limited significance during the lifespan of the product. To ensure the long service life of the product and fulfilment of guarantee terms, the criteria do however require that instructions regarding transport, storage, fitting, maintenance and risk of condense are supplied with the product.

23 www.rewindo.de

6 Changes from the previous version

- The requirements for U-value has been sharpened
- Requirements for airtightness has been added
- Requirements for wood from certified forests are new for windows
- The requirements for plastics are new
- Requirements for recycled non-renewable materials are new
- The requirements for chemical products have been developed and sharpened
- Requirements for VOC are new
- Requirement for insulation is new

7 References

- Building Regulations for Windows in European Countries http://www.gepvp.org/
- http://www.regjeringen.no/upload/kilde/krd/prm/2007/0013/ddd/pdfv/305482-tek.pdf.pdf
- http://www.ebst.dk/energibestemmelser
- www.ymparisto.fi
- http://webtjanst.boverket.se/Boverket/RattsinfoWeb/vault/BBR/PDF/BFS2006-12BBR.pdf
- Uppgifter från Norske Trevarefabrikkers Landsforbund
- www.sp.se
- www.sfdk.se
- www.ndvk.no
- www.vinduesindustrien.dk, www.dvc-vinduer.dk
- www.energimarkning.dk
- By och Byg Dokumentation 046 Statens Byggeforskningsinstitut 2003
- Life Cycle Assessment of PVC and of principal competing materials, Commissioned by the European Commission, July 2004
- Building Regulations for Windows in European Countries http://www.gepvp.org/
- Sustainable use and management of natural resources, European Environment Agency 2005
- Grönbok om Integrerad produktpolicy, Europeiska Kommissionen, KOM (2001) 68
- PVC Informationsrådet i Danmark. http://www.pvc.dk/t2w_172.asp(22.03.2005).
- Life Cycle Assessment of PVC and of principal competing materials, EU Commission 2004.
- espa, European Stabiliser Producers Assosiation, http://www.stabilisers.org/breakdown.htm, (30.03.2005)
- Green Paper – Environmental issues of PVC, European Commission 2000.
- Aluminium Recycling in Europe, European Aluminum Association

- Uppgifter från Plastfönster AB Hemsida, http://www.plastfonster.com/miljo.htm
- OBS-listen, Norske miljøvernmyndighetenes liste over helse- og miljøfarlige stoffer man skal være spesielt oppmerksom på, TA-1910/2002, ISBN82-7655-466-0
- Uppgifter från svenska PVC-forum
- Nanoteknik – stora risker med små partiklar. KEMI rapport nr 6/07
- Uppgifter från www.rewindo.de