Windows
- Windows, Glazed doors, and Skylights

Green Public Procurement Product Sheet

Green Public Procurement (GPP) is a voluntary instrument. This Product Sheet provides a summary of the GPP criteria developed for the Window product group, including glazed doors and skylights as well as windows. The Background Report provides full details on the reasons for selecting these criteria and references for further information.

The format for the purchasing recommendations comes in the form of two sets of criteria:

- The **core criteria** are those suitable for use by any contracting authority across the Member States and address the key environmental impacts for the product in question. They are designed to be used with minimum additional verification effort or cost increases.
- The **comprehensive criteria** are for those procurers wishing to purchase the best products available on the market. These may require additional verification effort or a slight increase in cost compared to other products with the same functionality.

Within the core and comprehensive criteria, the guidance follows the various stages of a public procurement procedure and explains how best to integrate environmental criteria at each stage:

- Subject matter. It means the title of the tender, i.e. a short description of the product, works or service to be procured.
- Technical Specifications. Provide a clear, accurate and full description of the requirement and standard to which goods, works or services should conform. Description of the minimal technical specifications which all bids need to comply with. Set specific environmental criteria, including hurdles and levels that need to be met for specific products.
- Selection Criteria. It is based in the capacity / ability of the bidders to perform the contract. Assist in the identification of appropriate suppliers, for example to ensure adequately trained personnel or relevant environmental policies and procedures are in place.
- Award Criteria. The award criteria on the basis of which the contracting authority will compare the offers and base its award. Award criteria are not pass/fail criteria, meaning that offers of products that don't comply with the criteria may still be considered for the final decision, depending on their score on the other award criteria.
- Contract Performance Clause - Specify the conditions that must be met in the execution of the contract, for example as to how the goods or services are to be supplied, including information or instructions on the products to be provided by the supplier.

It should be noted that the contractor is bound by the existing legal framework.

Where the verification for the criteria states that other appropriate means of proof can be used, this could include a technical dossier from the manufacturer, a test report from a recognised body, or other relevant evidence. The contracting authority will have to satisfy itself on a case by case basis, from a technical/legal perspective, whether the submitted proof can be considered appropriate.

1. Definition and Scope

For the purpose of these Green Public Procurement criteria Windows are defined as an opening in a wall or roof with glass mounted in a fixed frame to admit day-light. Often it is possible to open the window through a sliding or hinged component of the frame to allow air to enter into the building. This definition deliberately encompasses external glazed doors and skylights: where 'window' is written it refers to all three products.

The criteria apply to windows, external glazed doors and skylights that will be used in the building envelope, encompassing residential and commercial properties, and social properties such as schools and hospitals.

Technologies considered during the preparation of this document include the glazing (single and multi-pane), spacing distance between the panes, low-E coatings, air or inert gas fill between the panes of glass, and frame design.

Currently none of the existing standards and eco-labels covers all climatic regions of Europe, so a pre-existing single eco-label should not be applied as a basis to identify GPP criteria which can be applied across the whole of the EU.

2. Key Environmental Impacts

The key environmental impacts of windows are linked to thermal efficiency in terms of energy exchanges between the temperature-controlled interior of a building and the outside world, estimated to be an order of magnitude (ten times) greater than the energy required to manufacture a window.[1] This ultimately translates into increased fuel consumption, increased carbon dioxide emissions and the emission of other pollutants such as carbon monoxide from the burning of fossil fuels.

In addition there are material impacts from the materials used to construct the windows, the processing such materials require, the chemical treatments necessary to preserve materials both at the beginning of the lifetime and during use, the waste generated during manufacture and installation and the waste created at end of life when windows are replaced.

- The core criteria focus on achieving an improvement in thermal efficiency, over and above that required by national regulations, together with some basic material impact requirements.
- The comprehensive criteria require further energy efficiency savings to be made, and cover a greater range of material impacts that are associated with the production, installation and disposal of windows.

[1] EMPA, Materials Research and Technology, http://www.empa.ch/plugin/template/empa/*/32776/---/l=2

Key Environmental Impacts	GPP Approach
• Impact of the energy used to heat/cool the building LOST through the window during its use lifetime. • Environmental impact of the materials used to construct the window. • Impact of waste, including packaging and end of life waste.	• Promote the purchase of thermally efficient glazing. • Promote use of frames with higher thermal efficiency and lower impacts (using LCA). • Promote the use of appropriate glazing - consideration of climatic conditions in inform the decision making process. • Promote effective maintenance of windows to extend useful life. • Promote end of life management e.g. take back schemes / re-use / recycling. • Promote products designed to be easily dismantled and recycled. • Promote use of recycled materials. • Promote environmentally sound materials

Please note that the order of impacts does not necessarily translate to the order of their importance.

3. GPP Criteria for Windows

3.1. Core GPP Criteria for Windows

SUBJECT MATTER
Purchase of high thermal efficiency and environmentally sound windows.

TECHNICAL SPECIFICATIONS
1. To ensure that all windows fitted into new buildings and as replacement windows in pre-existing buildings achieve greater thermal efficiency than required by National Regulations. To achieve this, the following indicators shall demonstrate [X]% improvement on the value defined in [insert relevant national legislation]: a. U-value b. G-value c. L50 value d. Daylight transmittance. The indicators are to be applied to the whole window, glazing and frame combined. The percentage level (ambition level) to insert highly depends on the ambition level defined in national legislation. It is recommended to aim for at least a 20% improvement on existing thermal efficiency national standard demands, while improvements for the other three factors must be defined according to local requirements and present a good level of improvement on national requirements. Where relevant national regulations are absent, the procurement professional should look to national regulations from other, appropriate, countries in Europe. **Verification:** Where the listed criteria for a product are included in a relevant harmonised European standard, under the Construction Products Directive (89/10/EEC), for CE marking, the supplier must provide the information accompanying the required CE marking to demonstrate compliance with the listed criteria. Where the listed criteria for a product are not included in the accompanying information to CE marking under the Construction Products Directive (89/10/EEC), products holding a relevant Type 1 Ecolabel fulfilling the listed criteria will be deemed to comply. Other appropriate means of proof or a signed declaration will also be accepted.
2. Timber used shall come from legal sources. **Verification:** The legal origin of timber can be demonstrated with a chain-of-custody tracing system being in place. These voluntary systems may be 3rd-party certified, often as part of ISO 9000 and/or ISO 14000 or EMAS management system. Certificates of chain of custody for timber certified as FSC[2], PEFC[3] or any other equivalent means of proof will also be accepted as proof of compliance. If timber

[2] FSC (Forest Stewardship Council): http://www.fsc.org/en
[3] PEFC (Programme for the Endorsement of Forest Certification): http://www.pefc.org/internet/html

stems from a country that has signed a Voluntary Partnership Agreement (VPA) with the EU, the FLEGT license may serve as proof of legality[4]. Other means of proof that will be accepted includes a relevant and valid CITES certificate or other equivalent and verifiable means such as the application of a "due diligence" system. For the non-certified virgin material bidders shall indicate the types (species), quantities and origins of the timber, together with a declaration of their legality. As such the timber shall be able to be traced throughout the whole production chain from the forest to the product.
3. Plastic components weighing more than 50g should be marked according to ISO 11469 or equivalent. **Verification:** Products holding a relevant Type 1 Ecolabel fulfilling the listed criteria will be deemed to comply. Other appropriate means of proof will also be accepted.
4. Filler gases that contribute to the greenhouse effect, with a Global Warming Potential (GWP) > 5 *over a period of 100 years*, may not be used in the insulating units. Inert gases (e.g. argon, krypton) have a GWP <5. **Verification:** Products holding a relevant Type 1 Ecolabel fulfilling the listed criteria will be deemed to comply. Other appropriate means of proof will also be accepted.
5. The bidder shall demonstrate that the production of PVC complies with best practice in accordance with Vinyl 2010 or equivalent. **Verification:** Participation with Vinyl2010 will be acceptable, otherwise the bidder must provide written evidence that Vinyl2010's recommendations, or equivalent, are complied with.[2]

AWARD CRITERIA **Additional points will be awarded for:**
1. The final product made of wood, wood fibres or wood particles stemming from forests that are verified as being sustainably managed so as to implement the principles and measures aimed at ensuring sustainable forest management, on condition that these criteria characterize and are relevant for the product. In Europe, these principles and measures shall at least correspond to those of the Pan-European Operational Level Guidelines for Sustainable Forest Management, as endorsed by the Lisbon Ministerial Conference on the Protection of Forests in Europe (2 to 4 June 1998). Outside Europe they shall at least correspond to the UNCED Forest Principles (Rio de Janeiro, June 1992) and, where applicable, to the criteria or guidelines for sustainable forest management as adopted under the respective international and regional initiatives (ITTO, Montreal Process, Tarapoto Process, UNEP/FAO Dry-Zone Africa Initiative). **Verification:** Acceptable proof of sustainable harvest for timber may be provided for by means of a tracing system being in place. These voluntary systems may be 3rd party certified, often as part of ISO 9000 and/or ISO 14000 or EMAS management system. Certificates of chain of custody for the wood fibres certified as FSC, PEFC or

[4] The FLEGT (Forest Law Enforcement Governance and Trade) action plan was adopted by the EU in 2003. The Action Plan outlines a series of measures to address illegal logging in developing countries. The Plan defines a timber licensing system to guarantee the legality of imported wood products. In order to obtain the license, Voluntary Partnership Agreements (VPAs) have to be signed between timber-producing countries and the EU. Timber products, which have been legally produced in VPA partner countries, will be licensed for the legality of production; more information at: http://ec.europa.eu/environment/forests/flegt.htm

[2] http://www.vinyl2010.org/

any other equivalent means of proof, will also be accepted as proof of compliance.

2. Lead (R23, R25 and H301, H331) and its compounds must not intentionally be added to the plastics and coatings used in windows.

   The final window product will not release or leach out any substances or preparations that are classified according to Directive 1999/45/EC and 67/548/CEEany substances with the listed R-phrases specified below, under normal usage conditions:

   - carcinogenic (R40, R45, R49)
   - harmful to the reproductive system (R60, R61, R62, R63)
   - mutagenic, cause heritable genetic damage and possible risks of irreversible effects (R46, R68)
   - toxic (R23, R24, R25, R26, R27, R28, R51)
   - allergenic when inhaled (R42)
   - harmful to the environment (R50, R50/53, R51/53, R52, R52/53, R53)
   - danger of serious damage to health by prolonged exposure (R48),

   Regulation (EC) No 1272/2008, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006, gives the following H-phrases which relate to the above R-phrases. The final window product will not release or leach out any substances or preparations that are classified with the listed H-phrases, below under normal usage conditions:

   - carcinogenic (Carcinogenic 1A, 1B and 2: H350, H350i, H351)
   - harmful to the reproductive system (Reproductive 1A, 1B and 2: H360F, H360D, H361f, H361d, H360FD, H361fd, H360Fd, and H360Df)
   - mutagenic and cause heritable genetic damage (Mutagenic 1B and 2: H340 and H341)
   - toxic (Acute Toxicity 1, 2 and 3: H330, H331, H311, H301, H310, H300, Aquatic Chronic 2: H412)
   - allergenic when inhaled (Repertory Sensitivity 1: H334)
   - harmful to the environment (Aquatic Acute 1 and Aquatic Chronic 1, 2, 3 and 4: H400, H410, H411, H412, H413
   - danger of serious damage to health by prolonged exposure (Health Hazard: H372 and H373)

   Verification: Products holding a relevant Type 1 Ecolabel fulfilling the listed criteria will be deemed to comply. Other appropriate means of proof will also be accepted.

3. Additional points will be awarded in proportion to the recycled content of materials used. This excludes process waste.

   Verification: Products holding a relevant Type 1 Ecolabel fulfilling the listed criteria will be deemed to comply. Other appropriate means of proof will also be accepted, for example a manufacturer's appropriate certification.

CONTRACT PERFORMANCE CLAUSE

1. The bidder must ensure maintenance recommendations are provided with the product. It also has to provide documented procedures and instructions for quality and environmental assurance

   Verification: Products holding a relevant Type 1 Ecolabel fulfilling the listed criteria will be deemed to comply. Other appropriate means of proof will also be accepted.

3.2. Comprehensive GPP Criteria for Windows

SUBJECT MATTER
Purchase of high thermal efficiency and environmentally sound windows.

TECHNICAL SPECIFICATIONS
1. To ensure that all windows fitted into new buildings and as replacement windows in pre-existing buildings achieve greater thermal efficiency than required by National Regulations. To achieve this, the following indicators shall demonstrate [X]% improvement on the value defined in [insert relevant national legislation]: a. U-value b. G-value c. L50 value d. Daylight transmittance. The indicators are to be applied to the whole window, glazing and frame combined. The percentage level (ambition level) to insert highly depends on the ambition level defined in national legislation. It is recommended to aim for at least a 30% improvement on existing thermal efficiency national standard demands, while improvements for the other three factors must be defined according to local requirements and present an excellent level of improvement on national requirements. Where relevant national regulations are absent, the procurement professional should look to national regulations from other, appropriate, countries in Europe. **Verification:** Where the listed criteria for a product are included in a relevant harmonised European standard, under the Construction Products Directive (89/10/EEC), for CE marking, the supplier must provide the information accompanying the required CE marking to demonstrate compliance with the listed criteria. Where the listed criteria for a product are not included in the accompanying information to CE marking under the Construction Products Directive (89/10/EEC), products holding a relevant Type 1 Ecolabel fulfilling the listed criteria will be deemed to comply. Other appropriate means of proof or a signed declaration will also be accepted.
2. Timber used shall come from legal sources. **Verification:** The legal origin of timber can be demonstrated with a chain-of-custody tracing system being in place. These voluntary systems may be 3rd-party certified, often as part of ISO 9000 and/or ISO 14000 or EMAS management system. Certificates of chain of custody for timber certified as FSC[2], PEFC[3] or any other equivalent means of proof will also be accepted as proof of compliance. If timber stems from a country that has signed a Voluntary Partnership Agreement (VPA) with the EU, the FLEGT license may serve as proof of legality[4]. Other means of proof that

[2] FSC (Forest Stewardship Council): http://www.fsc.org/en
[3] PEFC (Programme for the Endorsement of Forest Certification): http://www.pefc.org/internet/html
[4] The FLEGT (Forest Law Enforcement Governance and Trade) action plan was adopted by the EU in 2003. The Action Plan outlines a series of measures to address illegal logging in developing countries. The Plan defines a timber licensing system to guarantee the legality of imported wood products. In order to obtain the license, Voluntary Partnership Agreements (VPAs) have to be

will be accepted includes a relevant and valid CITES certificate or other equivalent and verifiable means such as the application of a "due diligence" system. For the non-certified virgin material bidders shall indicate the types (species), quantities and origins of the timber, together with a declaration of their legality. As such the timber shall be able to be traced throughout the whole production chain from the forest to the product.

3. Plastic components weighing more than 50g should be marked according to ISO 11469 or equivalent.

   Verification: Products holding a relevant Type 1 Ecolabel fulfilling the listed criteria will be deemed to comply. Other appropriate means of proof will also be accepted.

4. Filler gases that contribute to the greenhouse effect, with a Global Warming Potential (GWP) > 5 *over a period of 100 years*, may not be used in the insulating units.

   Inert gases (e.g. argon, krypton) have a GWP <5.

   Verification: Products holding a relevant Type 1 Ecolabel fulfilling the listed criteria will be deemed to comply. Other appropriate means of proof will also be accepted.

5. The bidder shall demonstrate that the production of PVC complies with best practice in accordance with Vinyl 2010 or equivalent.

   Verification: Participation with Vinyl2010 will be acceptable, otherwise the bidder must provide written evidence that Vinyl2010's recommendations, or equivalent, are complied with.[3]

AWARD CRITERIA
Additional points will be awarded for:

1. The final product made of wood, wood fibres or wood particles stemming from forests that are verified as being sustainably managed so as to implement the principles and measures aimed at ensuring sustainable forest management, on condition that these criteria characterize and are relevant for the product.

   In Europe, these principles and measures shall at least correspond to those of the Pan-European Operational Level Guidelines for Sustainable Forest Management, as endorsed by the Lisbon Ministerial Conference on the Protection of Forests in Europe (2 to 4 June 1998). Outside Europe they shall at least correspond to the UNCED Forest Principles (Rio de Janeiro, June 1992) and, where applicable, to the criteria or guidelines for sustainable forest management as adopted under the respective international and regional initiatives (ITTO, Montreal Process, Tarapoto Process, UNEP/FAO Dry-Zone Africa Initiative).

   Verification: Acceptable proof of sustainable harvest for timber may be provided for by means of a tracing system being in place. These voluntary systems may be 3rd party certified, often as part of ISO 9000 and/or ISO 14000 or EMAS management system. Certificates of chain of custody for the wood fibres certified as FSC, PEFC or any other equivalent means of proof, will also be accepted as proof of compliance.

2. Lead (R23, R25 and H301, H331) and its compounds must not intentionally be added to the plastics and coatings used in windows.

signed between timber-producing countries and the EU. Timber products, which have been legally produced in VPA partner countries, will be licensed for the legality of production; more information at: http://ec.europa.eu/environment/forests/flegt.htm

[3] http://www.vinyl2010.org/

The final window product will not release or leach out any substances or preparations that are classified according to Directive 1999/45/EC and 67/548/CEEany substances with the listed R-phrases specified below, under normal usage conditions:

- carcinogenic (R40, R45, R49)
- harmful to the reproductive system (R60, R61, R62, R63)
- mutagenic, cause heritable genetic damage and possible risks of irreversible effects (R46, R68)
- toxic (R23, R24, R25, R26, R27, R28, R51)
- allergenic when inhaled (R42)
- harmful to the environment (R50, R50/53, R51/53, R52, R52/53, R53)
- danger of serious damage to health by prolonged exposure (R48),

Regulation (EC) No 1272/2008, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006, gives the following H-phrases which relate to the above R-phrases. The final window product will not release or leach out any substances or preparations that are classified with the listed H-phrases, below under normal usage conditions:

- carcinogenic (Carcinogenic 1A, 1B and 2: H350, H350i, H351)
- harmful to the reproductive system (Reproductive 1A, 1B and 2: H360F, H360D, H361f, H361d, H360FD, H361fd, H360Fd, and H360Df)
- mutagenic and cause heritable genetic damage (Mutagenic 1B and 2: H340 and H341)
- toxic (Acute Toxicity 1, 2 and 3: H330, H331, H311, H301, H310, H300, Aquatic Chronic 2: H412)
- allergenic when inhaled (Repertory Sensitivity 1: H334)
- harmful to the environment (Aquatic Acute 1 and Aquatic Chronic 1, 2, 3 and 4: H400, H410, H411, H412, H413
- danger of serious damage to health by prolonged exposure (Health Hazard: H372 and H373)

Verification: Products holding a relevant Type 1 Ecolabel fulfilling the listed criteria will be deemed to comply. Other appropriate means of proof will also be accepted.

3. Additional points will be awarded in proportion to the recycled content of materials used. This excludes process waste.

   Verification: Products holding a relevant Type 1 Ecolabel fulfilling the listed criteria will be deemed to comply. Other appropriate means of proof will also be accepted, for example a manufacturer's appropriate certification.

4. Chemical products (paint, adhesive, sealants, putty, etc.) in the finished window must satisfy one of the following two requirements:
   a. The product may not be classified as environmentally hazardous according to the EU Directive 1999/45/EC

   OR

   b. The product may contain a maximum of 2% by weight of substances classified as environmentally hazardous according to EC Directive 67/548/EEC.

   For wood preservative this rises to 3% as defined by 67/548/EEC.

   Verification: Products holding a relevant Type 1 Ecolabel fulfilling the listed criteria will be deemed to comply. Other appropriate means of proof will also be accepted. In addition confirmation that either requirement (a) or (b) has been fulfilled, material safety data sheets specifying how the products are classified must be provided. The material safety data sheets must not be more than 3 years old. Written confirmation that the chemical products are approved for their intended purpose by an authority in

the window's country of manufacture, and conformation that CCA (chromate copper arsenate), CC (copper citrate), organic tin compounds or creosote oil are not present in the final window product.

CONTRACT PERFORMANCE CLAUSE
1. The bidder must demonstrate that the contractor for retro-fitting or refurbishing window installations has in place effective policies and procedures to ensure that post-consumer waste (i.e. the removed windows) is properly dealt with in a sustainable manner, such as recycling or diverting from landfill where possible. **Verification:** Possible means of proof include EMAS and ISO 14001 certificates or equivalent certificates issued by bodies conforming to Community law or the relevant European or international standards concerning certification based on environmental management standards. Other appropriate means of proof will also be accepted.
2. The bidder must ensure maintenance recommendations are provided with the product. It also has to provide documented procedures and instructions for quality and environmental assurance **Verification:** Products holding a relevant Type 1 Ecolabel fulfilling the listed criteria will be deemed to comply. Other appropriate means of proof will also be accepted.

3.3. Explanatory notes:

The purchasing authority shall have regard to local circumstances:

- local climate – which way a window may face, shading of an area, etc.
- regional climate – the prevailing weather conditions and whether the predominant climate control inside the building will be heating or cooling.
- level of sophistication of the window - whether the environmental payback will be achieved in the lifetime of the window.

Local Climate: Passive solar building design involves the orientation of windows, walls, place awnings, porches, and trees such that the windows and roofs are shaded in the summer while allowing maximum solar gain in the winter. Effective window placement provides more natural light and lessens the need for electric lighting during the day – thus window placement should be considered by the purchasing authority where practical and effective.

Regional climate: Whether heating or cooling is predominantly used in the building will affect the use of tints in the glass, as these can be used to reduce the glare and solar gain in hot climates. It will also affect the choice of coatings, especially Low-E ones, as different arrangements and coatings are used to reduce heat loss from inside to outside a building, or to prevent heat from outside transferring to the interior of a building.

Level of sophistication of the window: Triple glazing requires more materials and may not deliver environmental benefits over and above those consumed during its production, when installed in a temperate climate such as southern England or France for example. However installation of triple glazing in Scandinavia would be appropriate, and is mandatory in some cases, as the environmental benefits it would deliver would make the extra material

investment worthwhile. The potential CO_2 savings of using different types of glass optimally have been quantified by a TNO study.[4]

To ensure the durability and longevity of wood or wood/aluminium windows is maximised the purchasing authority should consider whether the exposed wood has been suitably treated. Depending on the type of wood this could include, but not be limited to, treatment with preservatives that fulfil penetration class P5 according to EN 351 1 or 351 2 or coating with wood preservative through dipping or flowcoating.

Award criteria
Contracting authorities will have to indicate in the contract notice and tender documents how many additional points will be awarded for each award criterion. Environmental award criteria should, altogether, account for at least 10 to 15 % of the total points available.

Packaging:

Article 3 of the Directive 94/62/EC of 20 December 1994 on packaging and packaging waste, defines packaging as being:

- all products made of any materials of any nature to be used for the containment, protection, handling, delivery and presentation of goods, from raw materials to processed goods, from the producer to the user or the consumer. 'Non-returnable` items used for the same purposes shall also be considered to constitute packaging.

The extent to which packaging is an important environmental consideration for a product depends on a number of variables including product lifetime and packaging material. For example, for a short lived product, packaging is more likely to be important than it is for a long lived product. Similarly, packaging is less likely to be significant in life cycle terms for an energy using product.

Where the contracting authority views packaging as a significant issue they may wish to seek information from potential suppliers to confirm they have taken into account the environmental impact of their packaging option and that the supplier is consistent with the contracting authority's policies.

4. Cost Considerations

Windows are a major component of most buildings, certainly of those used as homes or work places. The use of windows, especially in commercial properties is increasing due to a combination of improved strength and thermal properties, and due to changing fashions. The cost of windows is a considerable part of any build budget, so as a product they must be durable and economical.

Once a building is completed and moves into the use phase, the energy efficiency of the windows becomes a primary concern, as discussed in Section 4.2.1 of the Technical Background Report. If refurbishment is being undertaken it is likely that the energy efficiency of the windows will be improved, while the majority, if not all, of the remaining building envelope remains the same.

The payback period for windows will depend on whether their installation is into a new build or a refurbishment. As many older properties do not satisfy the same high level building standards as new builds today, greater energy savings will be afforded through installing highly thermally efficient windows. This will reduce the payback period as energy bills will be reduced by a greater degree. This demonstrates that all stages, initial cost, running costs and

[4] Solar Control Glass for Greater Energy Efficiency: How policy-makers could save energy and significantly reduce CO2 emissions to meet EU targets for 2020, http://www.glassforeurope.com/issues/building/EnergyAndEnvironment/Pages/solarprotectiveglazing.aspx

the anticipated life expectancy will have an impact on the cost effectiveness of a window product.

In most buildings windows will have a shorter service life than that expected for the life of the building as a whole. It is therefore likely the windows will need replacing several times over the life of the building. On a day-to-day basis windows experience environmental conditions that cause gradual degradation – the weather. The rate of degradation will depend on factors such as geometric position, construction details, composition, porosity, and adherence of corrosion products, environmental pollution, humidity, sun exposure and temperature variations. It must also be considered that the service life of windows not only concerns technical performance, but aesthetic concerns and fashions.

Estimating the average expected lifetime of windows is challenging and depends on many factors including local climatic conditions, use and maintenance. Consequently there are a number of conflicting estimations for window lifetimes. A report by BRE for the British Plastics Federation predicted the service life of PVC, and also assessed timber, steel and aluminium in the context of LCA calculations: [5,6]

- At least 35 years for PVC-U windows,
- 40 years for steel, kiln dried timber and aluminium.

Guidelines issued by the German Ministry of Buildings in 2001 for sustainable buildings, gave the following expected lifetimes for window materials:[7]

1. Soft Wood-Windows – 30-50 years
2. Plastic Windows – 40-60 years
3. Hard Wood-Aluminium Windows 40-60 years
4. Galvanised Steel 40-60 years
5. Glazing – 20-30 years.

A report by the UK's Waste and Resources Action Plan (WRAP)[8] also provides an overview of typical life expectancies and replacement rates for common glazing types and frame materials (see Table 1). This shows that windows are typically replaced before the end of their actual service life, possibly due to technical progress, financial incentives to replace old windows or changing tastes.

Table 1 Common domestic window frame and glazing life expectancy and replacement periods

Frame type	Average life expectancy (years)	Typical replacement period (years)
Softwood timber frames	8 – 10	7 – 8
Hardwood timber frames	20 – 35	10 – 15
Steel frames	40 – 60	30 – 40
Aluminium frames	20 – 35	Glazing (10 – 15)
Polyester powder coated aluminium frames	20 – 40	Glazing (10 – 15)
PVC-U	20 – 25	10 – 20

It should be noted that the replacement periods for the glazing section of aluminium windows is included in the table above as this was the format of the original reference – not to single out aluminium windows. Some standards, such as BS 7543: 2003 require a design life of 30 years, and figures provided by European sector associations state that the expected service life for an IGU (Insulating Glass Unit) could be 20 years or more, while the window itself could have a service life at least double that of the IGU.

5 Report by BRE for British Plastic Federation, http://www.pauljervis.net/filemgmt_data/files/BRE%20Service%20Life%20PVC-U%20Windows%20Executive%20Summary.pdf

6 Information provided by the Council for Aluminium in Buildings during the consultation phase.

7 Leitfaden Nachhaltiges Bauen, Bundesamt für Bauwesen und Raumordnung, Januar 2001, Guidelines for Sustainable Construction, Federal Office for Building and Regional Planning, January 2001.

8 Sjogren Leong, M. (2004). Increasing the Collection and Recycling of Post Consumer Domestic Window Waste. WRAP Research Report. Tabulated data from BNWS01: Domestic window systems – industry, product and market overview.

The more technically advanced a window is the greater the cost at the point of purchase. Technical advances that will increase the cost of a window include using double or triple glazing, using a noble gas (e.g. argon) to fill the cavity between panes rather than dry air, using low-E coatings or noise reducing laminated glass and using frames with minimised thermal bridges. In terms of cost savings achieved through using more thermally efficient windows in a building, there is a balance to be achieved between technologically advanced windows and cost at point of purchase.

The current general advice is that the installation of double glazed units is cost effective and will provide significant environmental benefits compared to single pane glazing in temperate climates – it can be expected to halve the heat lost through a window.[9] Installing triple glazed windows will generate cost and environmental savings, with the additional cost of the glazing sections of the windows usually between 20-40% more than double glazing.[10] The installation of such windows may not be economically beneficial overall, unless extreme cold or hot weather is the norm for significant periods each year, or there is considerable noise pollution in which case the interior environment can be further improved by its use. However, the benefits delivered by triple glazing, even in temperate climates, are not insignificant and a number of European countries are proposing their widespread introduction, Sweden for example already stipulates them, Germany and Austria are soon to introduce standards that will encourage the adoption of them, and such windows are already standard in many demonstration low carbon homes. The ultra-low energy PassivHaus standard requires triple glazed windows with a U-value of no more than 0.8 W/m²K. To achieve a window with such a low U-value it is necessary to use triple glazing and to insulate the frame itself, as well as using more expensive manufacturing techniques, for example the gas krypton tends to be used, instead of argon.

New technologies, such as vacuum sealed units which have not been covered here due to their current very limited availability, may in the future offer increased benefits. However, the primary considerations will continue to be the local climate and use patterns, which need to be taken into account when deciding which level, and type, of glazing is most appropriate for a building.

[9] Energy Saving Trust Advice, www.energysavingtrust.org.uk

[10] Information taken from http://www.glaziersregister.com/About_Double_Glazing.php and comments from Eurowindow

5. Relevant EU legislation and information sources

5.1. EU Legislation

- Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of the Member States relating to construction products.
  http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31989L0106:EN:HTML

- Directive on the indication by labelling and standard product information of the consumption of energy and other resources by energy related products 2010/30/EU
  http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:153:0001:0012:EN:PDF

- Energy Performance of Buildings Directive (EPBD) 2010/31/EU
  http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:153:0013:0035:EN:PDF

- Council Directive 94/62/EC to reduce packaging and packaging waste.
  http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31994L0062:EN:HTML

- Commission Decision (97/129/EC) of 28 January 1997 establishing the identification system for packaging materials pursuant to European Parliament and Council Directive 94/62/EC on packging and waste packaging
  http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31997D0129:EN:HTML

- Directive amending Directive 94/62/EC on packaging and packaging waste 2004/12/EC
  http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:047:0026:0031:EN:PDF

- Waste Framework Directive 2008/98/EC
  http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:312:0003:0030:EN:PDF

- Landfill Directive 1999/31/EC
  http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31999L0031:EN:HTML

- Council Directive 2006/32/EC which focuses on end users of energy.
  http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:114:0064:01:EN:HTML

- REACH Regulation 1907/2006 ensuring the Registration, Evaluation, Authorisation and Restriction of Chemical substances.
  http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:396:0001:0849:EN:PDF

- The CLP Regulation (EC) No 1272/2008. The Regulation of 16 December 2008 on classification, labelling and packaging of substances and mixtures
  http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:353:0001:1355:en:PDF

- Council Directive 93/68/EEC amending many Directives including 89/106/EEC (construction products).
  http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31993L0068:EN:HTML

- Directive establishing a framework for the setting of Ecodesign Requirements for Energy-related Products 2009/125/EC:

http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:285:0010:0035:en:PDF

5.2 Ecolabels and other criteria sources

- Window Efficiency Rating System (WERS), Window Association of New Zealand
  www.wanz.org.nz

- Window Energy Rating System (WERS), Australia
  www.wers.net

- Energy Star, Canada, Office of Energy Efficiency
  http://www.oee.nrcan.gc.ca/energystar/english/consumers/window.cfm?attr=4

- Korean Ecolabel
  EL250 2003/1/2003-200
  http://www.koeco.or.kr/eng/business/business01_01.asp?search=1_1

- Chinese Ecolabel, China Eco-labelling Centre
  Technical Requirement for Environmental Products, The Certifiable Technical Requirement for Environmental Labeling Products, Energy Saving Doors and Windows HBC 14-2002.

- Hong Kong Green Label Scheme
  Product Environmental Criteria for Windows GL-008-004
  http://www.greencouncil.org/eng/greenlabel/cert.asp

- Energy Star, Programme Requirements for Residential Windows, Doors and Skylights – Version 4, 14th May 2007.
  http://www.energystar.gov/index.cfm?c=manuf_res.pt_windows

- BFRC energy performance label and ratings calculations
  http://www.bfrc.org/

- Nordic Swan
  Ecolabelling of Windows and Exterior Doors, Criteria Document, covering the period 12 December 2004 – 30 June 2009.
  http://www.svanen.nu/

- International Organisation for Standardisation
  Ref 1131
  http://www.iso.org/iso/pressrelease.htm?refid=Ref1131
  http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=40360
  http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=30300

- European Committee for Standardisation
  www.cen.en/cenorm/homepage.htm

- VMRG Keurmerk
  Dutch Association of Metal Windows and Facades (VMRG)
  http://www.vmrg.nl/paginas/english/

- VKG Keurmerk
  Dutch Association of PVC façade elements industry
  http://www.vkgkozijn.nl/page.php?id=54