ENVIRONMENTAL PRODUCT DECLARATION

as per ISO 14025 and EN 15804

Owner of the Declaration	QKE Qualitätsverband Kunststofferzeugnisse e.V. EPPA European PVC Window Profiles and related Building Products Association ivzw
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-QKE-20130248-IBG2-EN
Issue date	23/05/2014
Valid to	22/05/2019

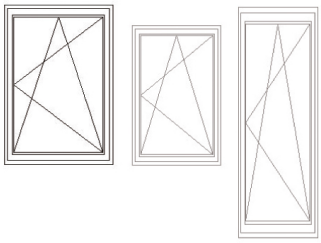
PVC-U plastic windows

Tilt & turn window with dimensions 1.23 x 1.48 m
Insulated triple-glazing; depth > 80 mm

QKE e.V.
EPPA ivzw

www.bau-umwelt.com / https://epd-online.com

Institut Bauen und Umwelt e.V.



Presented by

EPPA

GÜTEZEICHEN KUNSTSTOFF ERZEUGNISSE

1. General Information

QKE / EPPA

Programme holder
IBU - Institut Bauen und Umwelt e.V.
Panoramastr. 1
10178 Berlin
Germany

Declaration number
EPD-QKE-20130248-IBG2-EN

This Declaration is based on the Product Category Rules:
Windows and doors, 10-2012
(PCR tested and approved by the independent expert committee)

Issue date
23/05/2014

Valid to
22/05/2019

Prof. Dr.-Ing. Horst J. Bossenmayer
(President of Institut Bauen und Umwelt e.V.)

Dr. Burkhart Lehmann
(Managing Director IBU)

PVC-U window (1.23 x 1.48 m) with insulated triple-glazing

Owner of the Declaration
QKE - Qualitätsverband Kunststofferzeugnisse e.V.
Am Hofgarten 1-2; 53113 Bonn
Germany

EPPA - European PVC Window Profiles and related Building Products Association ivzw
Avenue de Cortenbergh 71; 1000 Brussels
Belgium

Declared product / Declared unit
PVC-U single-sash tilt & turn window, with the dimensions 1.23 m x 1.48 m, insulated triple-glazing and variable surface (white, painted, laminated with PVC film or coated with PMMA).

Scope:
This EPD is an association EPD. The arithmetical average from the manufacturer's specifications submitted by nine member companies was used as the data basis for the steel reinforced plastic window profiles. The companies supplying data represent a share of approximately 90% of the production of all systems traders affiliated with the QKE and EPPA associations and therefore nearly 90% of European production.
As a worst case approximation, the scope also contains profile types with a lower proportion of steel (glass fibre-reinforced PVC frame material / aluminium reinforcement).
As the various profile coatings and sealing materials are taken into account according to their market share, this EPD covers all designs for PVC windows that conform to the stated requirements.

The following companies were involved in the collection of data:

aluplast GmbH, D - Karlsruhe
Deceuninck nv, B - Hooglede-Gits
GEALAN Fenster-Systeme GmbH, D - Oberkotzau
Internorm Bauelemente GmbH, A - Traun
profine GmbH, D - Pirmasens
REHAU AG + Co., D - Erlangen
Salamander Industrie-Produkte GmbH, D - Türkheim
Schüco International KG, D - Weißenfels
VEKA AG, D - Sendenhorst

The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

Verification

The CEN Norm EN 15804 serves as the core PCR
Independent verification of the declaration according to ISO 14025
☐ internally ☒ externally

Dr. Eva Schmincke
(Independent tester appointed by SVA)

2. Product

2.1 Product description

The declared product is a single-sash tilt & turn window with the dimensions 1.23 x 1.48 m and insulated triple-glazing. It consists of a PVC frame profile (depth > 80 mm) with a transparent glass filling. The surface of the frame can vary in design: laminated with PVC film, coated with PMMA (polymethyl-methacrylate) or painted. This produces white or coated, structured or smooth surfaces. The seals are made from soft PVC, EPDM (ethylene propylene diene monomers) or TPE (thermoplastic elastomers), the fittings from steel.

The EPD does not relate to a specific product from a manufacturer, but confirms the average environmental quality for all PVC windows from member companies of the EPPA and QKE associations. The specifications for these products represent approximately 90% of the European market. Detailed data can be found in the respective manufacturer's product description.

A reference service life of 50 years was assumed. The respective useful lives of the individual components - glazing, seals and fittings - is shorter, however, which means that these will need replacing during the reference service life of the window unit. These planned replacements of individual components are also included in the declared unit.

2.2 Application

Windows are used in the outer shell of buildings for lighting, ventilation and protection from the elements.

2.3 Technical Data

Technical construction data

Name	Value	Unit
Heat transfer coefficient glass according to /EN 674/, /EN 675/	0.7	W/(m²K)
Heat transfer coefficient frame according to /EN 674/, /EN 675/	1.1	W/(m²K)
Heat transfer coefficient window according to /EN 674/, /EN 675/	0.9	W/(m²K)
Total enegry transmittance	50	%
Driving rain impermeability according to /EN 1027/, /EN 12208/	4A - 9A	Class
Airborne sound reduction Rw according to /EN ISO 717-1/	32	dB
Installation depth	> 80	mm
Possible opening types	Tilt & turn	-

For further technical construction data, only the minimum requirements that apply to quality-assured windows according to /RAL-GZ 695/ are cited below.

Depending on the design of frame, seals and fittings, considerably higher performance classes can be achieved by the windows produced.

- Min. air permeability according to /EN 1026/, /EN 12207/: Class 2
- Min. resistance to wind load according to /EN 12211/, /EN 12210/: Class B1

Further specific data can be found in the relevant manufacturer's product description.

2.4 Placing on the market / Application rules

Placing on the market within EU/EFTA is subject to the /Construction Products Regulation/. The products must have a declaration of performance compliant with the harmonized product standard /EN 14351-1/ and the CE marking.

Usage is governed by the relevant national rules.

2.5 Delivery status

The EPD relates to plastic windows with the dimensions 1.23 x 1.48 m. The face area is 1.82 m².

2.6 Base materials / Ancillary materials

The base materials of the declared unit are:

Name	Value	Unit
Frame material PVC	22.7	Mass %
Reinforcement steel	15.6	Mass %
Seals	1.0	Mass %
Fittings steel	3.8	Mass %
Glazing	56.9	Mass %

The additives used to manufacture the PVC frame material can be found in the following overview:

PVC formulation

- 82.0 mass % PVC
- 6.5 mass % Filler (chalk)
- 4.9 mass % Impact-resistance modifiers
- 3.3 mass % Calcium/zinc stabilisers
- 3.3 mass % Titanium oxide (TiO_2) pigment

Recycled material obtained from used windows is used to manufacture proprietary profiles. These profiles can contain more than 0.1% lead compounds. These are treated as SVHC (Substances of Very High Concern) in accordance with /REACH/.

2.7 Manufacture

Plastic windows are made from a variety of individual components: each window consists of a PVC frame with seals, the glazing, the fittings and, where required, the steel reinforcement. The manufacture of the base materials glass, PVC and steel is described in the /WECOBIS/ database.

PVC profiles for window frames are manufactured in an extrusion process from a mixture of PVC powder and additives. These protect the PVC from damage during processing and give the profile the necessary properties (impact resistance, colour, weathering stability etc.). The PVC powder used to manufacture

the frames is a widely used bulk plastic and is obtained through polymerisation. Due to its chemical structure, PVC contains a high proportion of the halogen chlorine.

The majority of window frames are made from white hard PVC profiles. Some frames are manufactured from profiles that are also laminated with PVC film, coated with PMMA or painted.

Seals are generally attached to the window profiles in a coextrusion process and consist of soft PVC, EPDM or TPE.

The window profiles are then delivered in standard lengths to the window manufacturers, where they are sawn to the length actually required for the particular window. Where necessary, steel reinforcement is inserted and screwed in. The profiles are then welded, the fittings attached and the glass pane and glass retaining strips fitted. The window can now be supplied and fitted.

The steel for manufacturing the fittings is largely obtained from iron ores in a blast furnace process by means of reduction with coke.

The basic raw material for manufacturing the glazing is quartz sand to which various fluxing agents and oxidants (soda ash, sodium sulphate, potash etc.) have been added. In a further processing step, the molten raw glass is added to molten tin, from which a flat strip of glass can be continuously extracted (float glass process). /European IPPC Bureau/

The member companies of QKE e.V. are subject to external quality monitoring within the framework of voluntary self-regulation. Plastic window systems that bear the RAL quality mark according to /RAL-GZ 716/ are listed on the website at gkfp.de.

2.8 Environment and health during manufacturing

Of all the constituents of PVC formulations, only the calcium/zinc stabilisers have to be classified and marked as follows in accordance with /GHS/:

H302: Harmful if swallowed
H318: Causes serious eye damage
H317: May cause an allergic skin reaction
Pictogram: corrosive and irritating

2.9 Product processing/Installation

The finished windows are transported to the construction site and installed. Screws made from zinc-plated steel and polyurethane foam are required for each window unit for assembly.

2.10 Packaging

Polyethylene foam pads, a cardboard edge protector, polypropylene load retaining straps, aluminium or steel clamps and PE stretch film are used as packaging materials for plastic windows.

2.11 Condition of use

No requirement for any specific declarations.

2.12 Environment and health during use

No requirement for any specific declarations.

2.13 Reference service life

The reference service life of the declared PVC-U plastic windows is 50 years.

The technical life of certain individual components is thus exceeded; as a result, there will be two replacements of seals and one replacement of fittings and glazing during this service life.

2.14 Extraordinary effects

Fire

Plastic windows are classified in classes B – E for fire behaviour (depending on the surface characteristics), s3 for smoke gas development and d0 for burning droplets in accordance with /EN 13501-1/. Individual proof shall be obtained project-oriented from the manufacturer.

Fire protection

Name	Value
Building material class	B - E
Burning droplets	d0
Smoke gas development	s3

Plastic windows therefore meet the requirements of B2 "normal combustibility" according /DIN 4102-1/ as a minimum.

Water

No requirement for any specific declarations.

Mechanical destruction

No requirement for any specific declarations.

2.15 Re-use phase

The most important processes in the reuse phase of PVC are the recycling of materials and dumping. In addition, PVC can also be thermally utilised.

A large amount of the steel used in the fittings and reinforcement is also recycled for materials.

Glazing is mostly dumped in landfill sites, but a small amount is recycled for materials or sent to waste incineration plants.

2.16 Disposal

The waste codes according to the European Waste Catalouge /EWC/ are as follows:

- 17 02 02 Glass
- 17 02 03 Plastic
- 17 04 05 Iron and steel

2.17 Further information

Possible sources of further information are available from the associations' websites

http://www.qke-bonn.de
http://www.eppa-profiles.org

and the websites of the manufacturers.

3. LCA: Calculation rules

3.1 Declared Unit

The declared unit is a window 1.23 x 1.48 m (reference window in accordance with /EN 14351-1/) with a depth of > 80 mm, a frame proportion of 22.7% and a mass of 70.1 kg and has a service life of 50 years including the incidental replacement of the glazing, fittings and seals.

3.2 System boundary

Type of EPD: "Cradle to grave"; the entire life cycle of the product is assessed.

Manufacture

The aggregate view in modules A1-A3 is used for manufacturing. This includes the supply of raw materials, the manufacture of the steel reinforcement, flat glass, fittings and PVC profile, all transportation to the window manufacturer, the energy requirements for constructing the windows, and any production waste generated.

The proportions of coated profiles and sealing materials are taken into account according to their market share.

Capital goods (machinery, buildings etc.) and the illumination and heating of buildings are not considered.

Transportation from the plant gate to the construction site is taken into account in module A4. All processes relating to the installation of the window in the building are considered in module A5.

Usage

The transmission heat losses occurring during the usage phase are taken into account in module B1. The measures described in 2.13 for replacing window components are taken into account in module B4.

Disposal

All processes relating to the removal, dismantling or demolition of the window from the building, including an initial sorting on the construction site, are factored into module C1.

Redistribution transportation from the construction site for recovering heat and recycling materials and for dumping fall under module C2. Module C3 covers the material/thermal recycling of the PVC, the steel from the fittings and reinforcement as well as the glazing.

Dumping of the relevant parts of the PVC, the steel from the fittings and reinforcement, and the glazing are assigned to module C4.

Credit

Finally, module D shows the potential for reuse, recovery and recycling derived from modules C3 and C4.

3.3 Estimates and assumptions

Apart from the assumptions and estimates described in section 4, no further assumptions or estimates are made that will impact on the outcome.

3.4 Cut-off criteria

The quantities of packaging used are below the cut-off criteria and are not factored into the life cycle assessment.

The disregarded input flows are all under 1% of both the total mass and the total flow of primary energy. Taken together they form less than 5% of the total mass or 5% of the total energy.

3.5 Background data

The primary data for window manufacturing was provided by the members of the declaring associations (see scope). In addition, life cycle assessments from the /GaBi/ database were used for modelling the manufacture of the PVC, glazing and fittings. The background data for steel and all other data originate from the /ecoinvent 2.2/ database. Life cycle assessment modelling was performed with the /SimaPro 7/ software.

3.6 Data quality

The data for the products examined was collected through analyses of internal production and environmental data, by collating LCA-related data within the supplier chain, and on the basis of average data submitted by the associations. The data collated was checked for plausibility and consistency.

Apart from one exception (disposal of glazing at the landfill site, 1995), the background data records used for the assessment do not go back more than 12 years.

3.7 Period under review

All primary data was collected in 2010/2011.

3.8 Allocation

No allocations are modelled.

3.9 Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to /EN 15804/ and the building context, respectively the product-specific characteristics of performance, are taken into account.

4. LCA: Scenarios and additional technical information

The following technical information forms the basis for the declared modules, or can be used to develop specific scenarios in the context of a building assessment if modules are not declared (MND).

Transportation to construction site (A4)

Name	Value	Unit
Litres of fuel 40 t truck	31	l/100km
7.5 t truck	19	l/100km
Transport distance 40 t truck	150	km
7.5 t truck	50	km
Capacity utilisation (including empty runs) 40 t truck	47	%
7.5 t truck	73	%
Gross density of products transported	3276	kg/m³

Installation in building (A5)

Name	Value	Unit
Water consumption	0	m³
Electricity consumption , current mix for Germany	0.12	kWh
Screws	0.24	kg
Polyurethane	0.20	kg

Usage (B1), see Chapter 2.12 Usage

The net heat losses caused by the window are taken into account here. These consist of the transmission heat losses and the solar heat gains from the window. A degree-day factor of 66 kKh/a and solar irradiation of 155 kWh/(m²*a) are assumed.

Name	Value	Unit
Net heat loss (usage phase 50 years)	1521	kWh

The impacts in the usage phase depend to a very great extent on the actual climatic and technical circumstances of a specific building. The calculations for the heat losses and gains and the results of the impact assessment are based on parameters for average Central European conditions.

The energy demand during the usage phase at the reference location is calculated from the transmission heat losses Qtr and the solar heat gains Qirr in winter according to /DIN V 18599-2/:

Qges = Qtr - Qirr

Both the degree-day factor as a climatic KPI and measure of the general building insulation and the alignment of the window have a major effect on the net heat losses and gains. In this life cycle assessment, it is assumed that the windows are installed in a new building that meets the requirements of /EnEV 2013/. The transmission heat losses calculated with a degree-day factor of 66 kKh/a are therefore used.

The data for German heating requirements was used to model the provision of heating energy: 49% gas, 30% heating oil and 13% district heating. The remaining 8% is divided aliquot across the cited energy sources.

Replacement (B4), conversion/renovation (B5)

Name	Value	Unit
Replacement cycle Glazing	1	Number/RSL
Seals	2	Number/RSL
Fittings	1	Number/RSL
Replacement of worn parts Glazing	40.4	kg
Seals	1.6	kg
Fittings	2.7	kg

Reference service life

Name	Value	Unit
Reference service life	50	a

End of life (C1-C4)

Name	Value	Unit
Collected separately Glass	34.6	kg
PVC	14.5	kg
Steel	11.8	kg
Recycling Glass	5.2	kg
PVC	7.2	kg
Steel	9.5	kg
Landfilling Glass	27.7	kg
PVC	3.0	kg
Steel	1.0	kg

Reuse, recovery and recycling potential (D), relevant scenario specifications

The energy (thermal energy and current) resulting from heat recovery and recycling of waste and the recycled material thus created is credited here.

5. LCA: Results

In Table 1 "Description of the system boundary", all declared modules shall be indicated with an "X"; all modules that are not declared shall be indicated with "MND". In the following tables 2, 3 and 4, columns may be deleted for modules that are not declared. Indicator values should be declared with three valid digits (eventually exponential form (e.g. 1,23E-5 = 0,0000123). A uniform format should be used for all values of one indicator. If several modules are not declared and therefore have been deleted from the table, the abbreviations for the indicators can be replaced by the complete names, while the readability and clear arrangement should be preserved; the legends can then be deleted.

If no reference service life is declared (see chapter 2.13 "Reference Service Life"), the LCA results of the modules B1-B2 and B6-B7 must refer to a period of one year. This must be indicated as an explanatory text in Chapter 5, "LCA: Results". Also in this case, the calculation formula for the total life cycle results is to be specified.

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARYS
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement[1)]	Refurbishment[1)]	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
X	X	X	X	X	X	MND	MND	X	MND	MND	MND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: one piece / window (1.23 x 1.48 m)

Parameter	Unit	A1-A3	A4	A5	B1	B4	C1	C2	C3	C4	D
GWP	[kg CO_2-Eq.]	1.46E+2	1.07E+0	1.34E+0	4.37E+2	8.07E+1	0.00E+0	3.13E+0	7.02E+0	2.47E-1	-4.74E+1
ODP	[kg CFC11-Eq.]	6.33E-6	1.75E-7	3.18E-8	5.84E-5	3.90E-6	0.00E+0	4.94E-7	1.88E-7	7.40E-8	-1.57E-6
AP	[kg SO_2-Eq.]	7.16E-1	3.34E-3	5.81E-3	6.14E-1	3.51E-1	0.00E+0	9.43E-3	1.50E-2	1.47E-3	-1.98E-1
EP	[kg $(PO_4)^{3-}$- Eq.]	1.42E-1	8.97E-4	2.05E-3	1.01E-1	5.13E-2	0.00E+0	2.49E-3	9.97E-4	3.59E-4	-7.99E-2
POCP	[kg Ethen Eq.]	4.33E-2	1.38E-4	6.40E-4	4.77E-2	2.47E-2	0.00E+0	3.80E-4	3.16E-4	5.41E-5	-1.40E-2
ADPE	[kg Sb Eq.]	4.27E-3	1.35E-5	5.22E-5	7.18E-4	2.19E-3	0.00E+0	3.61E-5	2.47E-6	1.73E-6	-1.70E-3
ADPF	[MJ]	5.78E+3	8.09E+2	2.72E+1	7.17E+3	2.76E+3	0.00E+0	2.27E+3	5.48E+2	3.76E+2	-2.44E+3

Caption	GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non fossil resources; ADPF = Abiotic depletion potential for fossil resources

RESULTS OF THE LCA - RESOURCE USE: one piece / window (1.23 x 1.48 m)

Parameter	Unit	A1-A3	A4	A5	B1	B4	C1	C2	C3	C4	D
PERE	[MJ]	9.53E+1	2.30E-1	8.41E-1	2.67E+1	4.03E+1	0.00E+0	6.61E-1	4.68E-1	5.10E-2	-2.73E+1
PERM	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
PERT	[MJ]	9.53E+1	2.30E-1	8.41E-1	2.67E+1	4.03E+1	0.00E+0	6.61E-1	4.68E-1	5.10E-2	-2.73E+1
PENRE	[MJ]	2.35E+3	1.82E+1	2.78E+1	7.02E+3	1.09E+3	0.00E+0	5.16E+1	2.83E+1	6.86E+0	-8.39E+2
PENRM	[MJ]	3.04E+2	0.00E+0	0.00E+0	0.00E+0	2.81E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-4.80E+1
PENRT	[MJ]	2.66E+3	1.82E+1	2.78E+1	7.02E+3	1.12E+3	0.00E+0	5.16E+1	2.83E+1	6.86E+0	-8.87E+2
SM	[kg]	3.06E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	IND
RSF	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	IND
NRSF	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	IND
FW	[m^3]	3.75E+1	4.60E-3	2.12E-2	3.16E-1	3.72E+1	0.00E+0	1.17E-2	3.28E-2	5.96E-3	-3.01E-1

Caption	PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non renewable primary energy excluding non renewable primary energy resources used as raw materials; PENRM = Use of non renewable primary energy resources used as raw materials; PENRT = Total use of non renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non renewable secondary fuels; FW = Use of net fresh water

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: one piece / window (1.23 x 1.48 m)

Parameter	Unit	A1-A3	A4	A5	B1	B4	C1	C2	C3	C4	D
HWD	[kg]	1.94E-1	1.83E-5	3.53E-5	5.71E-3	2.05E-1	0.00E+0	4.82E-5	3.13E-6	2.53E-6	-6.85E-2
NHWD	[kg]	2.13E+2	1.36E-1	9.27E-2	3.29E+0	1.34E+3	0.00E+0	3.02E-1	1.27E+1	3.48E+1	-3.94E+0
RWD	[kg]	4.66E-2	1.38E-5	2.33E-5	1.57E-3	4.66E-2	0.00E+0	4.06E-5	2.05E-5	3.13E-6	-1.16E-3
CRU	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
MFR	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	8.10E+0	0.00E+0	0.00E+0	2.30E+1	0.00E+0	-2.57E+1
MER	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	9.94E+0	0.00E+0	0.00E+0
EEE	[MJ]	3.13E-1	0.00E+0	0.00E+0	0.00E+0	1.53E+0	0.00E+0	0.00E+0	2.90E+0	0.00E+0	-4.43E+0
EET	[MJ]	5.14E-1	0.00E+0	0.00E+0	0.00E+0	4.44E+0	0.00E+0	0.00E+0	8.41E+0	0.00E+0	-1.28E+1

Caption	HWD = Hazardous waste disposed; NHWD = Non hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EEE = Exported thermal energy

6. LCA: Interpretation

The environmental impacts are dominated by the provision of energy to compensate the transmission heat losses caused by installing the window (module B1), the manufacturing phase (module A1-A3) and the replacement of the glazing in module B4 (see figure).

In the categories of global warming potential (GWP), ozone depletion potential (ODP) and non-renewable primary energy (PENRE), the compensation of transmission heat losses accounts for more than 65-84% of the impacts or energy requirements.

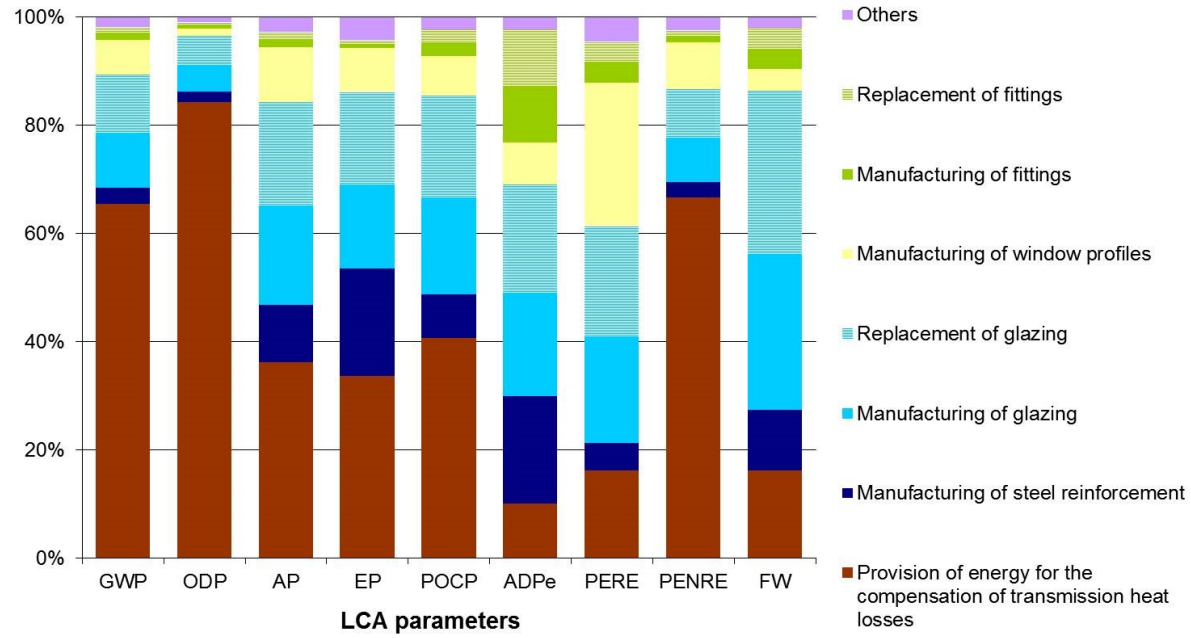
The categories of acidification potential (AP), eutrophication potential (EP), photochemical ozone creation potential (POCP), abiotic resource depletion potential for elements (ADPe), renewable primary energy (PERE) and fresh water consumption (FW) are each dominated by the environmental impacts of manufacturing the main window components in A1-A3 (glazing, steel reinforcement, plastic window profile) and the replacement of the glazing in module B4 with a proportion of 52-74%.

The manufacture of the fittings in modules A1-A3 and the replacement of fittings in module B4 contribute approx. 21% to the abiotic resource depletion potential for elements (ADPe).

It should be pointed out that the consideration of module B1 is optional. It shows that reducing transmission heat losses or unintentional heat gains is the key factor in optimising environmental quality in the building. If module B1 were taken out of the equation, virtually all environmental impacts would be caused by modules A1-A3 and B4.

The environmental impacts of the end-of-life phase are of less importance when considered over the entire service life.

Relative Shares of Selected Processes in the Manufacturing and Use of the Declared Product for Selected LCA parameters



7. Requisite evidence

Fire

Fire tests on several test elements from different manufacturers using the SBI test method according to

/EN 13823/ by Efectis Nederland BV, project number 2012-Efectis-R0205
Result: In accordance with the average parameters identified, plastic windows meet the following classification criteria according to /EN 13501-1/:
Building material class: B - D
Smoke gas development: s3
Burning droplets: d0

Research project into VOC emissions from building products; German Federal Office for Building and Regional Planning as part of the Building the Future research initiative, file reference Z6-10.08.18.7-08.20/II2-F20-08-005; December 2010
Result: In terms of the indoor exposure, the VOC emissions fall largely below the requirements of the assessment by the German Committee for Health-related Evaluation of Building Products.

VOC (volatile organic compounds)

8. References

Construction Products Regulation: Regulation (EU) No 305/2011 of the European Parliament and of the council of March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC

DIN 4102-1: Fire behaviour of building materials and building components - Part 1: Building materials; concepts, requirements and tests;
DIN 4102-1:1998

DIN V 18599-2: Energy efficiency of buildings - Calculation of the net, final and primary energy demand for heating, cooling, ventilation, domestic hot water and lighting - Part 2: Net energy demand for heating and cooling of building zones;
DIN V 18599-2:2011

EN 674: Glass in building. Determination of thermal transmittance (U value). Guarded hot plate method;
EN 674:2011

EN 675: Glass in building. Determination of thermal transmittance (U value). Heat flow meter method;
EN 675:2011

EN 1026: Windows and doors - Air permeability - Test method; EN 1026:2000

EN 1027: Windows and doors - Watertightness - Test method; EN 1027:2000

EN 12207: Windows and doors - Air permeability - Classification; EN 12207:1999

EN 12208: Windows and doors - Watertightness - Classification; EN 12208:1999

EN 12210: Windows and doors - Resistance to wind load - Classification; EN 12210:1999+AC:2002

EN 12211: Windows and doors - Resistance to wind load - Test method; EN 12211:2000

EN 13501-1: Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests;
EN 13501-1:2007+A1:2009

EN 13823: Reaction to fire tests for building products - Building products excluding floorings exposed to the thermal attack by a single burning item;
EN 13823:2010

EN 14351-1: Windows and doors - Product standard, performance characteristics - Part 1: Windows and external pedestrian doorsets without resistance to fire and/or smoke leakage characteristics;
EN 14351-1:2006+A1:2010

EN ISO 717-1: Acoustics - Rating of sound insulation in buildings and of building elements - Part 1: Airborne sound insulation; ISO 717-1:2013

ecoinvent 2.2: Ecoinvent database, v. 2.2, Swiss Centre for Life Cycle Inventories (pub.), Duebendorf, Switzerland, 2010

EnEV 2013: Regulations on the energy-saving thermal insulation and energy-saving installations in buildings (Energieeinsparverordnung – EnEV), latest version: November 18th, 2013

European IPPC Bureau: Draft Reference Document on Best Available Techniques in the Glass Manufacturing Industry, 2001

EWC: European Waste Catalogue, established by Decision 2000/532/EC of European Commission

Fachverband Schloss- und Beschlagindustrie e.V.: EPD on window fittings according to ISO 14025, declaration number EPD-FVS-2011311-D. Institut Bauen und Umwelt e.V. (pub.), Königswinter, 2011

GaBi: GaBi version 6.3: Software and Databases for Life Cycle Engineering, pub.: PE International, Leinfelden-Echterdingen, 2013

GHS: Globally Harmonized System of Classification and Labelling of Chemicals

RAL-GZ 695: Quality assurance of windows, doors, facades and winter gardens

RAL-GZ 716: General Quality and Test Requirements, System Description and Suitability Testing of Plastic Window and Door Profile Systems

REACH: Regulation (EC) No 1907/2006 of the European Parliment and of the Council of 18

December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals

SimaPro 7: Software version 7.3.2, 2011; pub.: Pré Consultants bv, Amersford (NL)

WECOBIS: Information system on ecological aspects of building materials, Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (pub.) http://www.wecobis.de

Institut Bauen und Umwelt
Institut Bauen und Umwelt e.V., Berlin (pub.): Generation of Environmental Product Declarations (EPDs);

General principles
for the EPD range of Institut Bauen und Umwelt e.V. (IBU), 2013-04
www.bau-umwelt.de

PCR Part A
Institut Bauen und Umwelt e.V., Königswinter (pub.): Product Category Rules for Construction Products from the range of Environmental Product Declarations of Institut Bauen und Umwelt (IBU), Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Background Report. April 2013
www.bau-umwelt.de

ISO 14025
DIN EN ISO 14025:2011-10: Environmental labels and declarations — Type III environmental declarations — Principles and procedures

EN 15804
EN 15804:2012-04+A1 2013: Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

Publisher
Institut Bauen und Umwelt e.V.
Panoramastr. 1
10178 Berlin
Germany

Tel +49 (0)30 3087748- 0
Fax +49 (0)30 3087748- 29
Mail info@bau-umwelt.com
Web **www.bau-umwelt.com**

Programme holder
Institut Bauen und Umwelt e.V.
Panoramastr 1
10178 Berlin
Germany

Tel +49 (0)30 - 3087748- 0
Fax +49 (0)30 – 3087748 - 29
Mail info@bau-umwelt.com
Web **www.bau-umwelt.com**

Author of the Life Cycle Assessment
SKZ - Das Kunststoffzentrum
Friedrich-Bergius-Ring 22
97076 Würzburg
Germany

Tel +49 931 4104132
Fax +49 931 4104717
Mail kfe@skz.de
Web **skz.de**

Owner of the Declaration
EPPA European PVC Window Profiles and related Building Products Association
Avenue de Cortenbergh 71
1000 Brussels
Belgium

Tel +32 2 7324124
Fax +32 2 7324218
Mail info@eppa-profiles.org
Web **eppa-profiles.org**

QKE Qualitätsverband Kunststofferzeugnisse e.V.
Am Hofgarten 1-2
53113 Bonn
Germany

Tel +49 228 7667654
Fax +49 228 7667650
Mail info@qke-bonn.de
Web **qke-bonn.de**