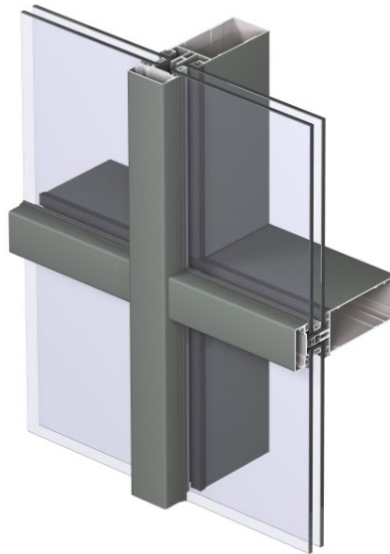


## ENVIRONMENTAL PRODUCT DECLARATION in accordance with ISO 14025 and EN 15804

Product

Concept Wall® 50



Declaration holder



Publisher and  
programme holder

European Aluminium



EUROPEAN ALUMINIUM

Declaration number

EPD EUROPEAN ALUMINIUM 2016 – REYNAERS 7

Issue date

1 Nov 2016

Valid until



30 Apr 2023\*

\*An update of this EPD is under development and will be published soon. this EPD has been prolonged by the program operator until publication of the new EPD.

Weblink

[www.reynaers.com](http://www.reynaers.com)

## 1. General information

Owner of the declaration	Reynaers Aluminium Oude Liersebaan 266 B- 2570 Duffel, Belgium						
Programme holder	European Aluminium AISBL (previously European Aluminium Association) Avenue de Broqueville, 12 B - 1150 Brussels Belgium   Dr Gerd Götz, Director General						
PCR used for the verification	EAA Product Category Rules (PCR) for Aluminium Building Products – version of 30 January 2013						
Verification	<table border="1"> <tr> <td colspan="2">EN15804 serves as core PCR completed by EAA PCR</td> </tr> <tr> <td colspan="2">Verification of the EPD by an independent third party in accordance with ISO 14025</td> </tr> <tr> <td><input type="checkbox"/> Internally</td> <td><input checked="" type="checkbox"/> Externally</td> </tr> </table>	EN15804 serves as core PCR completed by EAA PCR		Verification of the EPD by an independent third party in accordance with ISO 14025		<input type="checkbox"/> Internally	<input checked="" type="checkbox"/> Externally
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<input type="checkbox"/> Internally	<input checked="" type="checkbox"/> Externally						
Verifier	Carl-Otto Nevén NEVÉN Miljökonsult/Environmental Cons.   Carl-Otto Neven						
Declaration number	EPD EUROPEAN ALUMINIUM 2016 – REYNAERS 7						
Declared Unit	1 m <sup>2</sup> of curtain wall type Concept Wall® 50						
Product group covered and applicability	This EPD covers 1 m <sup>2</sup> of curtain wall type Concept Wall® 50. The EPD results have been calculated from a modelling tool developed by thinkstep via an i-report in GaBi 6. Among the Concept Wall® 50 curtain walls, two representative products have been selected and corresponding EPD results have been calculated based on specific bill of materials. These two products refer to a standard product and a highly insulated product. The results generated by this EPD-data software can be considered as a good proxy to model the curtain wall designed by Reynaers and fabricated by their European distributors..						
Liability	The owner of the declaration is liable for the underlying manufacturing information and evidence; European Aluminium, i.e. the programme holder, is not be liable in this respect.						

## 2. Product

### 2.1. Product description and application

This Environmental Product Declaration (EPD) is for business to business communication. This EPD refers to the Concept Wall® 50 (CW 50) which is a façade and roof system that offers unlimited design freedom and allows maximum transparency. CW 50 is available in several design and glazing variants, but also includes different technical variants to comply with specified levels of fire-resistance and thermal insulation. The design variants offer solutions for both the exterior and the interior of the building.

The representative product is a double-glazed curtain wall of 7.2 m high by 3.6 m wide as sketched in Figure 1.

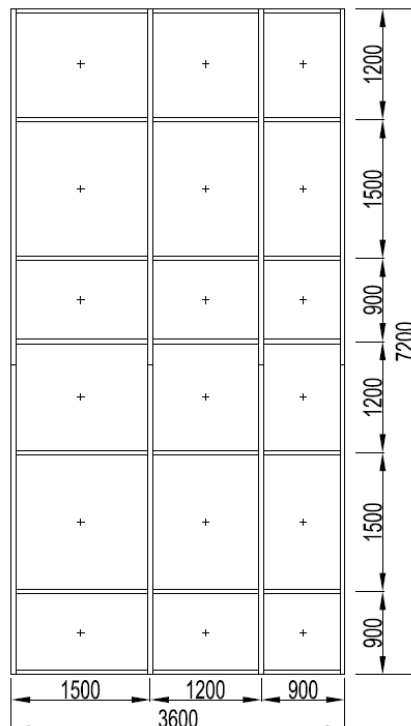


Figure 1. Sketch of the representative product for the curtain wall.

The representative products are composed of 2 vertical mullions (profiles) and 2 horizontal transoms forming the border of the section. 2 additional vertical mullions and 5 transoms divide the curtain wall area in 18 sections, ranging in size from 0.9m x 0.9m to 1.5m x 1.5m. All these sections are filled with double glazing units. As a conservative estimate, the calculated BoM considers 100% of the mass of the profiles located at the boarder of the representative product. In practice, these profiles can be shared with subsequent curtain wall sections.

EPD results have been calculated for 2 types of curtain walls, i.e. one standard product and one highly insulated. Both products are doubled-glazed. There is no integration of operable windows in the representative product.

Table 1. List of representative products for the CW 50 curtain walls

Size (W x H)	Type of Product	Glazing unit	No of rep products	Surface area
7.2 m x 3.6 m	Standard (S) or Highly Insulated (HI)	Double	2	25.92 m <sup>2</sup>

## 2.2. Technical data

The most relevant technical data are reported in Table 2.

Table 2. Most relevant technical data

Category	Description & value	Standards
Thermal Insulation	Uf-value down to 0.56 W/m <sup>2</sup> K depending on the profile combination and the glass thickness.	EN 12631
Acoustic performance	Sound reduction Index (Rw) from 33 up to 60 depending on glazing	EN ISO 10140-2; EN ISO 717-1
Air tightness	Class A4; AE 1200 or AE 1950	EN 12153, EN 12152
Water tightness	Class R7; RE 1200 or RE 1950	EN 12155, EN 12154
Wind load resistance	2000 Pa or 2400 Pa	EN 12179, EN 13116
Resistance against impact	I3/E5 or I5/E5	EN 12600, EN 14019
Burglar resistance	WK2/RC2 or WK3/RC3	EN 1630; EN1627
Fire resistance	EI 15; EW 30; EI 30; E60; EW 60 or EI 60	EN 1364-3, EN 13501-2

For the most up-to-date values of the technical data, please refer to the product specifications available on the Reynaers website (see the specifications of CW 50 products in the section [www.reynaers.com/consumers/our-products](http://www.reynaers.com/consumers/our-products) ).

## 2.3. Relevant Standards for market Applications

Most relevant standards for applications of aluminium curtain walls in buildings are EN 13830 & EN 13119.

## 2.4. Delivery status and packaging

Curtain walls are supplied in customised dimensions with appropriate protection and transport equipment e.g. racks. Occasionally, the aluminium profiles can be protected with a thin adhesive plastic film. This packing is not considered in this EPD study.

## 2.5. Curtain wall fabrication (foreground processes)

The curtain wall considered in the EPD project is a stick-type curtain wall.

This curtain wall is based on installed long vertical aluminium profiles (called mullions) covering several floors, i.e. between 2 to 3 floors, and shorter aluminium profiles positioned horizontally (called transoms) to fix the various glazing units or opaque panels. Framing members may be fabricated in a shop, but all installation and glazing is typically performed at the jobsite.

The contribution of the fabrication process to the overall production impact of the curtain wall is below the cut-off rule of 5%. Hence, no specific LCA modelling has been done on that process step, except a scrap rate of 3% for the aluminium profile which has been considered.

## 2.6. Main background processes

The main production processes are reported in Figure 2.

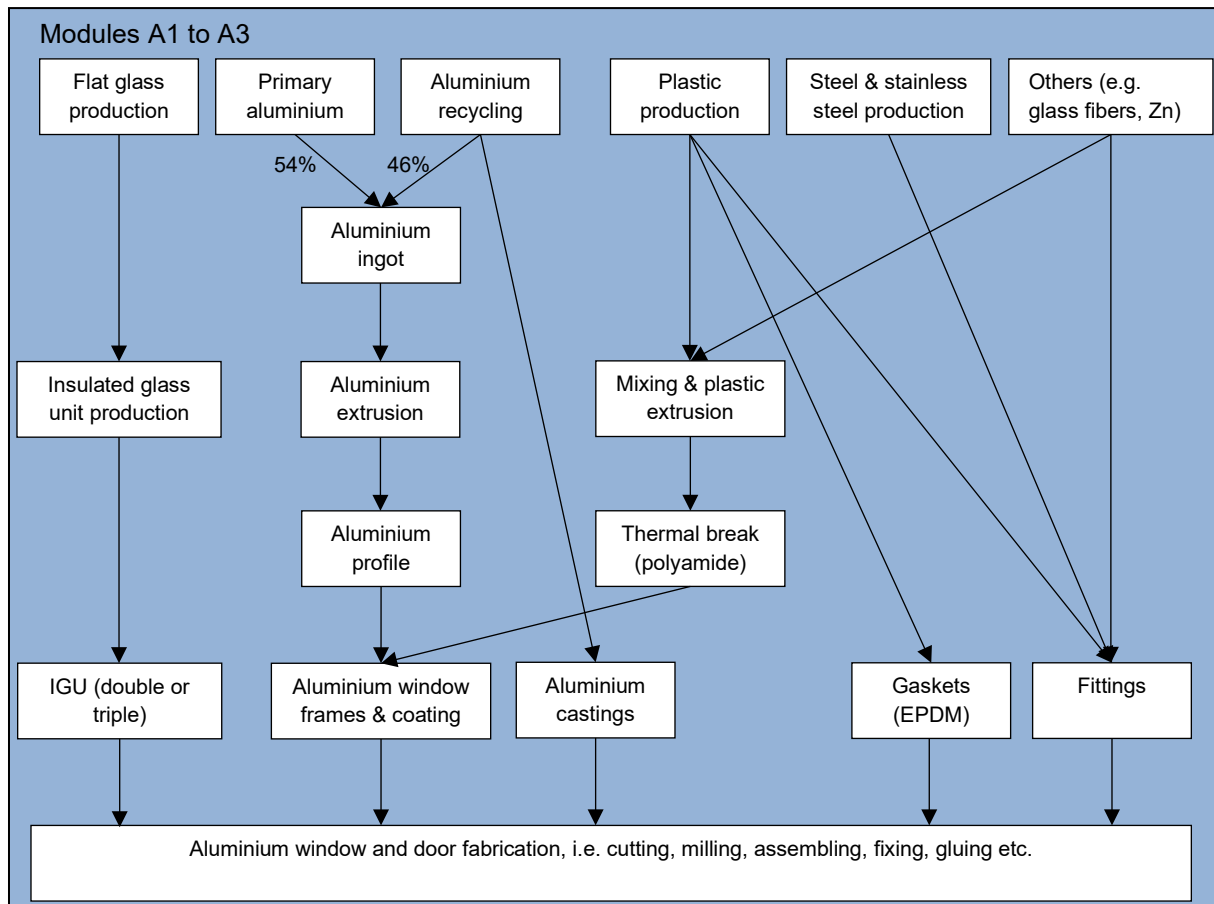


Figure 2. Main production processes and components of aluminium curtain walls

The aluminium profile production has been modelled using European Aluminium LCI datasets (year 2010) for the primary aluminium production, recycling and remelting as described in the Environmental profile report developed by European Aluminium. The aluminium ingot (i.e. the billet) production has assumed that aluminium originated for 54% from primary aluminium and 46% from recycling which corresponds to the average recycling input rate of aluminium produced in Europe.

For the other components and materials production, e.g. thermal break, gaskets or glass unit, datasets from the GaBi database have been used (version GaBi 6, SP27, 2015). The powder coating of aluminium profile has been modelled using GaBi datasets as well.

## 2.7. Health and safety aspects during production and installation

There are no critical health and safety aspects during the production of aluminium curtain walls. Cr-free pre-treatments are used for the pre-treatment of aluminium profile prior the VOC-free powder coating process.

There are no relevant aspects of occupational health and safety during the further processing and installation of Reynaers curtain walls. Under normal installation, no measurable environmental impacts can be associated with the use of Reynaers aluminium curtain walls. The appropriate safety measures need to be taken at the building site, especially if installation takes place on a high-rise building.

## 2.8. Further processing, use and reference service life

CW 50 curtain walls are customised building products which are assembled on the building site. This EPD does not cover the downstream process to install the product at the building site.

During use, the indoor air quality, i.e. VOC emission, is not affected by aluminium curtain walls / VOC from aluminium windows/.

Since the use phase is not modelled, no specific information can be given about the Reference Service Life. In normal use, aluminium building products are not altered or corroded over time. A regular cleaning (e.g. once a year) of the product suffices to secure a long service life. However, the use of highly alkaline (pH >10) or highly acidic (pH < 4) cleaning solutions should be avoided.

In practice, a service life of 50 years can be assumed in normal use for such application /DURABILITY/ with the exception of the IGU (Insulated Glass Unit) which needs to be replaced usually after 30 years due to a slow degradation of its performance.

In case of fire, aluminium is a non-combustible construction material (European Fire Class A1) in accordance with Directive 96/603/EC, and does therefore not make any contribution to fire.

## 2.9. End of life stage

At the end-of-life stage, aluminium curtain walls should be specifically dismantled and collected in order to be treated since they include several materials which can be efficiently recycled or can be used for energy recovery.

In particular the aluminium profiles are systematically dismantled and sent for recycling. This high collection rate has been confirmed by a study done by Delft University showing that large aluminium pieces like aluminium profiles are systematically collected thanks to their intrinsic economic value /EAA DELFT/. Hence, a collection rate of 99% was used for the profiles.

Gaskets and thermal breaks are collected together with the aluminium profiles and are then treated through shredding and sorting with the aluminium profile.

The glazing unit, however, is not systematically collected at the building renovation or demolition site. Indeed, the glazing unit is still often broken on site and is then sent to landfilling. In some European countries, the glazing unit is specifically collected and sent to recycling, e.g. in the Netherlands. Hence, two extreme end of life scenarios have been used for flat glass: 99% recycling or 100% landfilling. Table 3 reports the main parameters of the End of life scenario for the various materials and components of the curtain wall.

Table 3. Parameters of the end of life scenarios for the main materials and components

Component/material	Collection rate	Typical treatment	Overall recycling rate
Aluminium frame	99%	Shredding, sorting & recycling	92%
Thermal break (e.g. PA)	99%	Shredding, sorting & incineration	/
Gaskets (e.g. EPDM)	99%	Shredding, sorting & incineration	/
Glass – scenario 1	99%	Shredding, sorting & recycling	90%
Glass – Scenario 2	0%	100% landfilling	

In the case of scenario 1, only a small fraction of the product (1%) is then considered as landfilled in the LCA model. From collected aluminium scrap (99%) up to the recycled aluminium ingot (92%), it is assumed as a conservative estimate that 7% of the aluminium metal is lost. Hence, the overall recycling rate of aluminium has been fixed to 92%.

The waste code for aluminium in accordance with the European Waste Catalogue (EWC) is 17 04 02. Figure 3 reports the main processes and parameters used for the end of life stage modelling.

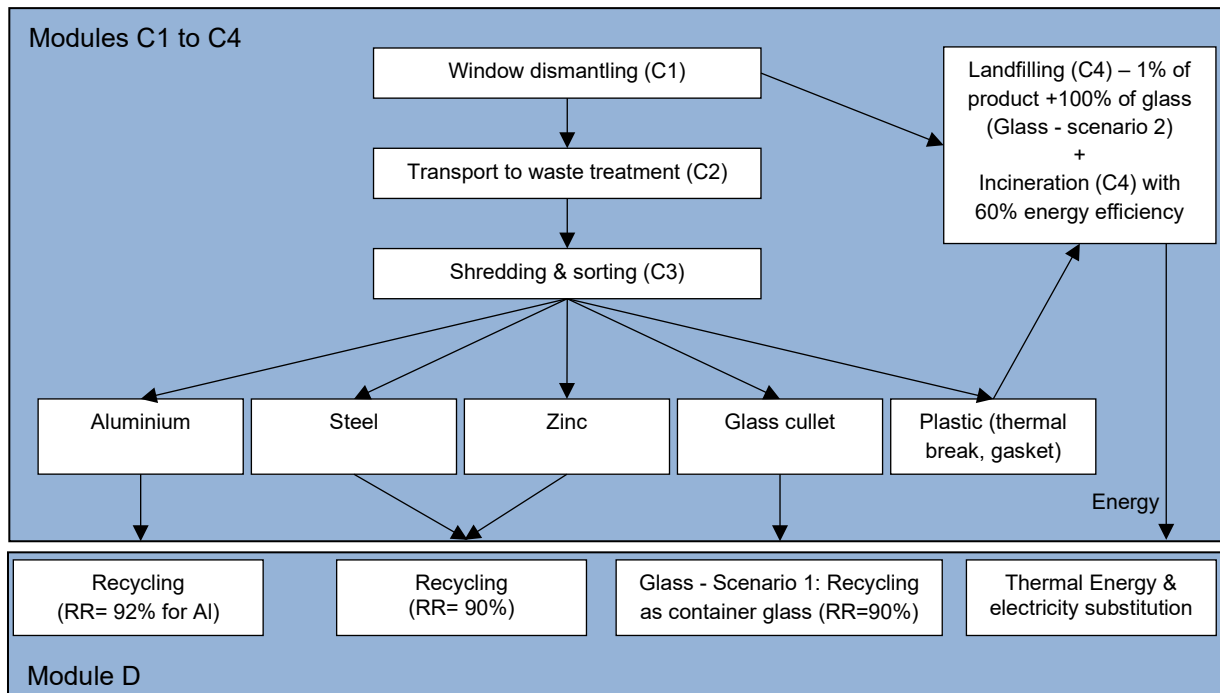


Figure 3. Main processes and parameters for the end of life stage modelling

### 3. LCA: Calculation rules

#### 3.1. Product size, Bill of Materials and declared unit

EPD calculations have been done for the two curtain walls as described under point 2.1. The Bill of Materials of the two representative products are reported in Table 4. The declared unit corresponds to 1 m<sup>2</sup> of curtain wall.

The EPD results are reported for the two representative products in the 2 annexes of this EPD.

Table 4. Bill of Materials (kg) of the declared unit for the 2 representative products

Reference	1	2
Type	Standard	Highly insulated
Aluminium frame	6,47	6,47
Thermal break	0,01	0,01
Gaskets	0,73	0,60
Glass	18,00	18,00
Fittings and others	0,32	0,14
<b>Total</b>	<b>25,53</b>	<b>25,22</b>

### 3.2. System boundaries

Type of EPD: Cradle to gate – with options

The production stage (modules A1-A3) includes processes that provide materials and energy input for the system, manufacturing and transport processes up to the factory gate, as well as waste processing.

For the end of life, a collection rate of 99% is assumed and directed to recycling (module D). The 1% lost product is modelled through landfilling (module C4). Considering the few losses along the recycling chain, it is assumed that 92% of the Al material is effectively recycled as new ingot. Hence, an end of life recycling rate of 92% is used within module D to reflect the benefits of recycling through the substitution principle.

According to the PCR document, modules C1, C2 and C3 shall be addressed in the EPD. Since aluminium products covered in these EPDs are intermediate building products for which it is difficult to define deconstruction and transport scenarios, it has been decided not to cover these three modules. For building products made of aluminium, the contribution of these modules is below the 5% cut-off rule and their omission can be considered as reasonable.

### 3.3. Estimates and assumptions

It has been assumed that the aluminium profiles were composed of a mix of 54% primary aluminium and 46% recycled aluminium. Such mix represents the typical sourcing of aluminium in Europe, all markets included. Alloying elements were not considered and a pure aluminium profile has been assumed as a proxy. Alloy used by Reynaers is composed of at least 98% of Aluminium. Hence, such assumption appears adequate.

### 3.4. Cut-off criteria

No specific data were collected and used to model the fabrication stage, which has a limited impact on the full life cycle profile of windows, doors or curtain walls. The impacts of fabrication operations are below the cut-off rules of 5%. Nevertheless, a scrap rate of 3% at the fabrication stage has been used into the LCA model.

All other known operating data was taken into consideration in the analysis, except for modules C1, C2 and C3 which were not calculated. Based on the long experience of data collection within the European Aluminium Industry, it can be estimated that the ignored processes or flows contribute to much less than 5% to the impact categories under review.

### 3.5. Background data

GaBi 6 2014- the software system for comprehensive analysis developed by thinkstep (previously PE International) – was used for modelling the life cycle for the production of the aluminium curtain walls. Generic GaBi 6 data sets have been used for energy, transport and consumables. For the aluminium primary production, recycling and sheet production, the datasets described in the environmental profile report of European Aluminium have been used /EAA EPR/.



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### 3.6. Foreground data and EPD-data tool

The modelling efforts were focussed on the identification of representative products and the proper calculation and consideration of the BoM of the representative products within the LCA model.

No specific process data have been collected considering that their impact on the whole product life cycle is limited. In most cases, the curtain wall fabrication is not performed by Reynaers but by their distributors disseminated in Europe who sell and install Reynaers curtain wall systems on the European market. Hence, collecting data on this process step is also very challenging. In any case, energy and consumables used at the fabrication stage are below the cut-off rule of 5% and were not considered. A scrap rate of 3% at fabrication stage was anyway considered in the model.

### 3.7. Data quality

The data quality can be considered as good. The LCA models have been checked and most relevant flows are considered. Technological, geographical and temporal representativeness is appropriate. The use of collective data can be considered as a reasonable proxy for the Reynaers aluminium windows, doors and curtains walls.

### 3.8. Allocation

Any aluminium scrap produced along the fabrication chain is sent back to recycling. This recycling loop has been modelled in the GaBi model so that the aluminium curtain wall is the only product exiting the gate. Hence, the production process does not deliver any co-products.

For the end-of-life stage, curtain wall scrap is sent to an EoL treatment and environmental burdens and benefit credits are calculated on basis of scenarios and are modelled in module D.

### 3.9. Comparability

As a general rule, a comparison or evaluation of EPD data is only possible when all of the data to be compared has been drawn up in accordance with EN 15804 and the building context or product-specific characteristics are taken into consideration.

#### 4. LCA scenarios and additional technical information

Modules A4, A5, B1-B7 and C1-C3 are not taken into consideration in this Declaration. In module A1, a recycled metal content of 46% is assumed. Hence, end of life credits are calculated in Module D based on a net aluminium recycling of 92% at end of life minus 46% at production stage, i.e. a quantity representing 46% of the aluminium content of the curtain wall. It is assumed that the inherent properties are conserved through recycling, i.e. quality factor is kept to one.

Module C1 to C3 shall be calculated in “Cradle to Grave” EPD or for integration in Building assessment.

Table 5. Modules addressed in the EPD study (X: module declared, Y: module required by PCR but not calculated, MND: module not declared)

Production			Installation		Use stage							End-of-Life				Next product system
Raw material supply (extraction, processing, recycled material)	Transport to manufacturer	Manufacturing	Transport to building site	Installation into building	Use / application	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction / demolition	Transport to EoL	Waste processing for reuse, recovery or recycling	Disposal	Reuse, recovery or recycling potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	Y	Y	Y	X	X

#### 5. LCA results

The LCA results are reported in the 2 annexes.

List of abbreviations: GWP: Global warming potential; ODP: Ozone layer depletion potential; AP: Acidification potential of land and water; EP: Eutrophication potential; POCP: Photochemical oxidation potential; ADPE: Abiotic depletion potential (elements); ADPF: Abiotic depletion potential (fossil fuels); 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 materials; RSF: Use of renewable secondary fuels; NRSF: Use of non-renewable secondary fuels; FW: Use of net fresh water; 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; EET: Exported thermal energy.

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## 6. LCA interpretation

- Aluminium curtain wall production – Modules A1 to A3

The majority of the environmental impacts come from the aluminium profile and to a lesser extent from the glazing unit. Hence, most indicators are influenced by the mass of aluminium in the declared unit. Within the aluminium production processes, the primary aluminium production is dominant, especially the alumina production and the electrolysis. The recycled ingot production, which presents a much lower impact than the primary ingot production, is used in Module A1-A3 for the fraction of aluminium coming from recycling (46%). The extrusion process which converts ingot, i.e. billets, into profile is much less significant. The LCA modelling and the impact of the primary aluminium production is detailed in the environmental profile report /EAA EPR/.

The impact of the other components, e.g. gaskets & fittings, is less significant due to their low contribution to the BoM.

- End of life stage: modules C4 and module D

Parameters reported in Table 3 were used to model the end of life stage.

Module C4: In the case of the glass recycling scenario, the contribution of module C4 (disposal) is very limited compared to modules A1-A3 and module D. However, in case of the glass landfilling scenario, the mass of non-hazardous waste disposed becomes significant, i.e. corresponding at least to the mass of the glazing unit.

Module D: The environmental benefits come not only from the recycling of aluminium and metal fittings but also from glass recycling in case of scenario 1. About 30% to 40% of GWP savings are obtained in Module D compared to the value calculated for module A1-A3. The energy indicators follow the same trends. Additional benefits are also resulting from the energy recovery from the incineration of the gaskets and the thermal break.

These calculations show the relevance to consider Module D in the full assessment of windows in the building context.

## 7. References

CEN/TR 15941	Sustainability of construction works - Environmental product declarations - Methodology for selection and use of generic data; CEN/TR 15941:2010
DIRECTIVE 96/603/EC	COMMISSION DECISION of 4 October 1996 establishing the list of products belonging to Classes A ' No contribution to fire '
DURABILITY	<a href="#">Aluminium and Durability - Towards Sustainable Cities</a> , edited by Michael Stacey, Published by Cwningen Press, November 2014 ISBN 978-0-9930162-0-2 (available at <a href="http://www.world-aluminium.org/publications/">http://www.world-aluminium.org/publications/</a> )
EAA DELFT	COLLECTION OF ALUMINIUM FROM BUILDINGS IN EUROPE - A Study by Delft University of Technology – 2004, available at <a href="http://european-aluminium.eu/media/1628/collection-of-aluminium-from-buildings-in-europe.pdf">http://european-aluminium.eu/media/1628/collection-of-aluminium-from-buildings-in-europe.pdf</a>
EAA EPR	Environmental Profile Report for the European Aluminium Industry - April 2013- Data for the year 2010, available at <a href="http://european-aluminium.eu/media/1329/environmental-profile-report-for-the-european-aluminium-industry.pdf">http://european-aluminium.eu/media/1329/environmental-profile-report-for-the-european-aluminium-industry.pdf</a>
EAA PCR	Product Category Rules (PCR) for Aluminium Building Products – version of 30 Jan 2013, available at <a href="http://european-aluminium.eu/resource-hub/epd-programme-according-to-en15804/">http://european-aluminium.eu/resource-hub/epd-programme-according-to-en15804/</a>
EN 12152	Curtain walling. Air permeability. Performance requirements and classification
EN 12153	Curtain walling. Air permeability. Test method
EN 12154	Curtain walling. Watertightness. Performance requirements and classification
EN 12155	Curtain walling. Watertightness. Laboratory test under static pressure
EN 12179	Curtain walling. Resistance to wind load. Test method
EN 12600	Glass in building. Pendulum test. Impact test method and classification for flat glass
EN 13116	Curtain walling. Resistance to wind load. Performance requirements
EN 13501-	Fire classification of construction products and building elements. Classification using data from fire resistance tests, excluding ventilation services
EN 1364-3	Fire resistance tests for non-loadbearing elements. Curtain walling. Full configuration (complete assembly)
EN 13947	Thermal performance of curtain walling. Calculation of thermal transmittance
EN 14019	Curtain walling. Impact resistance. Performance requirements
EN 15804	Sustainability of construction works –Environmental Product Declarations – Core rules for the product category of construction products
EN 1627	Pedestrian doorsets, windows, curtain walling, grilles and shutters. Burglar resistance. Requirements and classification
EN 1630	Pedestrian doorsets, windows, curtain walling, grilles and shutters - Burglar resistance - Test method for the determination of resistance to manual burglary attempts
EN 573-3	Aluminium and aluminium alloys – Chemical composition and form of wrought products – Part 3: Chemical composition and form of products
EN ISO 14025	Environmental labels and declarations - Type III environmental declarations - Principles and procedures
EN ISO 140-3	Acoustics -- Measurement of sound insulation in buildings and of building elements -- Part 3: Laboratory measurements of airborne sound insulation of building elements
EN ISO 14040	Environmental management - Life cycle assessment - Principles and framework
EN ISO 14044	Environmental management - Life cycle assessment - Requirements and guidelines
EN ISO 717-1	Acoustics -- Rating of sound insulation in buildings and of building elements -- Part 1: Airborne sound insulation
GABI 6	GaBi 6.3 dataset documentation for the software-system and databases, LBP, University of Stuttgart and PE INTERNATIONAL AG, Leinfelden-Echterdingen, 2013 ( <a href="http://documentation.gabi-software.com/">http://documentation.gabi-software.com/</a> )
ISO 10140-2	Acoustics -- Laboratory measurement of sound insulation of building elements -- Part 2: Measurement of airborne sound insulation
RECYCLING IN EN15804	TACKLING RECYCLING ASPECTS IN EN15804 – paper presented at the « LCA & Construction » conference in Nantes 10-12 July 2012
VOC from Al windows	Evaluation of Volatile Organic Compounds and aldehydes emitted by a “thermolacquered aluminium window posed (White QUALICOAT)” according to ISO 16000, Bureau Veritas Laboratoires, Report N°1200410-1 (E12-002890)

## Annex 1: CW 50 curtain wall – standard product

Reference	1
Width of the curtain wall [m]	3,60
Height of the curtain wall [m]	7,20
Transparent of area fraction (%)	90%
Glazing Unit	Double glazing (2 X 4 mm of glass)

Bill of Materials of the declared unit in kg	
Aluminium frame	6,47
Thermal break	0,01
Gaskets	0,73
Glass	18,00
Fittings and others	0,32
<b>Total</b>	<b>25,53</b>

## EPD results

Per m2 of curtain wall									
ENVIRONMENTAL IMPACTS				Glass recycling			Glass landfilling		
Parameter	Unit	A1-3	C4	D	C4	D	C4	D	
GWP	Global warming potential	[kg CO2-eq.]	72,99	2,538	-36,18	2,754	-24,3		
ODP	Ozone layer depletion potential	[kg CFC11-eq.]	1,701E-06	1,026E-11	-1,27E-06	1,386E-11	-1,27E-06		
AP	Acidification potential of land and water	[kg SO2-eq.]	0,2853	0,000999	-0,162	0,002358	-0,0972		
EP	Eutrophication potential	[kg PO43--eq.]	0,03384	5,994E-05	-0,0144	0,0002556	-0,00558		
POCP	Photochemical oxidation potential	[kg ethene-eq.]	0,01989	3,618E-05	-0,004167	0,0001674	-0,005994		
ADPE	Abiotic depletion potential (elements)	[kg Sb-eq.]	0,0002376	2,772E-07	-0,000776	3,555E-07	-1,73E-05		
ADPF	Abiotic depletion potential (fossil fuels)	[MJ]	888,3	1,368	-377,1	4,23	-257,4		
RESOURCE USE				Glass recycling			Glass landfilling		
Parameter	Unit	A1-3	C4	D	C4	D	C4	D	
PERE	Use of renewable primary energy excluding renewable primary energy resources used as raw materials	[MJ]	165,6	0	0	0	0	0	
PERM	Use of renewable primary energy resources used as raw materials	[MJ]	0	0	0	0	0	0	
PERT	Total use of renewable primary energy resources	[MJ]	165,6	0,1737	-109,8	0,4608	-107,1		
PENRE	Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	[MJ]	1035	0	0	0	0	0	
PENRM	Use of non-renewable primary energy resources used as raw materials	[MJ]	0	0	0	0	0	0	
PENRT	Total use of non-renewable primary energy resources	[MJ]	1035	1,548	-464,4	4,527	-341,1		
SM	Use of secondary materials	[kg]	2,907	0	0	0	0	0	
RSF	Use of renewable secondary fuels	[MJ]	0	0	0	0	0	0	
NRSF	Use of non-renewable secondary fuels	[MJ]	0	0	0	0	0	0	
FW	Use of net fresh water	[m3]	0,3888	0,005157	-0,2466	0,005706	-0,2169		
END OF LIFE STAGE (output materials from Module C1)				Glass recycling			Glass landfilling		
Material collected separately		kg		25,45			6,75		
for recycling (e.g. metals & glass)		kg		24,49			6,49		
for energy recovery (e.g. gaskets & thermal break)		kg		0,96			0,26		
Material for landfilling		kg		0,08			18,78		
OUTPUT FLOWS AND WASTE				Glass recycling			Glass landfilling		
Parameter	Unit	A1-3	C4	D	C4	D	C4	D	
HWD	Hazardous waste disposed	[kg]	0,0004446	6,291E-07	-0,002205	1,575E-06	-3,06E-05		
NHWD	Non-hazardous waste disposed	[kg]	9,99	0,3915	-5,895	18,5	-5,454		
RWD	Radioactive waste disposed	[kg]	0,05922	7,146E-05	-0,03582	0,000117	-0,03438		
CRU	Components for re-use	[kg]	0	0	0	0	0	0	
MFR	Materials for recycling	[kg]	0	0	23,99	0	5,931		
MER	Materials for energy recovery	[kg]	0	0	0	0	0	0	
EEE	Exported electrical energy	[MJ]	0	3,186	0	3,186	0		
EET	Exported thermal energy	[MJ]	0	7,353	0	7,353	0		

## Annex 2: CW 50 curtain wall – highly insulated product

Reference	2
Width of the curtain wall [m]	3,60
Height of the curtain wall [m]	7,20
Transparent of area fraction (%)	90%
Glazing Unit	Double glazing (2 X 4 mm of glass)

Bill of Materials of the declared unit in kg	
Aluminium frame	6,47
Thermal break	0,01
Gaskets	0,60
Glass	18,00
Fittings and others	0,14
<b>Total</b>	<b>25,22</b>

## EPD results

Per m2 of curtain wall							
ENVIRONMENTAL IMPACTS							
		Glass recycling			Glass landfilling		
Parameter	Unit	A1-3	C4	D	C4	D	
GWP	Global warming potential	[kg CO2-eq.]	72	1,782	-36	2,007	-24,03
ODP	Ozone layer depletion potential	[kg CFC11-eq.]	1,701E-06	4,887E-12	-1,27E-06	8,505E-12	-1,27E-06
AP	Acidification potential of land and water	[kg SO2-eq.]	0,2799	0,0001998	-0,1611	0,001557	-0,0963
EP	Eutrophication potential	[kg PO43--eq.]	0,03348	3,024E-05	-0,0144	0,0002259	-0,005544
POCP	Photochemical oxidation potential	[kg ethene-eq.]	0,01944	1,728E-05	-0,004113	0,0001485	-0,005949
ADPE	Abiotic depletion potential (elements)	[kg Sb-eq.]	0,0002286	2,718E-08	-0,000775	1,053E-07	-1,67E-05
ADPF	Abiotic depletion potential (fossil fuels)	[MJ]	864,9	0,3168	-374,4	3,186	-254,7
RESOURCE USE							
		Glass recycling			Glass landfilling		
Parameter	Unit	A1-3	C4	D	C4	D	
PERE	Use of renewable primary energy excluding renewable primary energy resources used as raw materials	[MJ]	164,7	0	0	0	0
PERM	Use of renewable primary energy resources used as raw materials	[MJ]	0	0	0	0	0
PERT	Total use of renewable primary energy resources	[MJ]	164,7	0,03753	-109,8	0,3249	-107,1
PENRE	Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	[MJ]	1008	0	0	0	0
PENRM	Use of non-renewable primary energy resources used as raw materials	[MJ]	0	0	0	0	0
PENRT	Total use of non-renewable primary energy resources	[MJ]	1008	0,369	-460,8	3,357	-337,5
SM	Use of secondary materials	[kg]	2,898	0	0	0	0
RSF	Use of renewable secondary fuels	[MJ]	0	0	0	0	0
NRSF	Use of non-renewable secondary fuels	[MJ]	0	0	0	0	0
FW	Use of net fresh water	[m3]	0,3789	0,003645	-0,2457	0,004194	-0,2169
END OF LIFE STAGE (output materials from Module C1)							
		Glass recycling			Glass landfilling		
Material collected separately		kg	<b>25,15</b>			<b>6,58</b>	
for recycling (e.g. metals & glass)		kg	24,48			6,48	
for energy recovery (e.g. gaskets & thermal break)		kg	0,66			0,09	
Material for landfilling		kg	<b>0,07</b>			<b>18,64</b>	
OUTPUT FLOWS AND WASTE							
		Glass recycling			Glass landfilling		
Parameter	Unit	A1-3	C4	D	C4	D	
HWD	Hazardous waste disposed	[kg]	0,0004185	1,197E-07	-0,002205	1,062E-06	-2,75E-05
NHWD	Non-hazardous waste disposed	[kg]	9,99	0,02862	-5,886	18,1	-5,436
RWD	Radioactive waste disposed	[kg]	0,05913	2,061E-05	-0,03564	6,624E-05	-0,0342
CRU	Components for re-use	[kg]	0	0	0	0	0
MFR	Materials for recycling	[kg]	0	0	23,95	0	5,922
MER	Materials for energy recovery	[kg]	0	0	0	0	0
EEE	Exported electrical energy	[MJ]	0	2,538	0	2,538	0
EET	Exported thermal energy	[MJ]	0	5,814	0	5,814	0