

ENVIRONMENTAL PRODUCT DECLARATION in accordance with ISO 14025 and EN 15804

Product

SMARTIA S440 sliding door



Declaration holder



Publisher and
programme holder

European Aluminium



EUROPEAN ALUMINIUM

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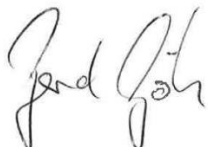
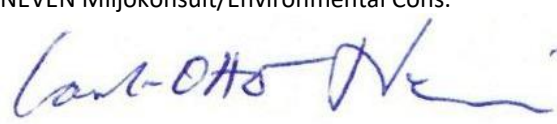
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1. General information

Owner of the declaration	Alumil 44 Chrysostomou Smyrnis 56429 Efkarpia Thessaloniki Greece						
Programme holder	European Aluminium AISBL 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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Verifier	Carl-Otto Nevén NEVÉN Miljökonsult/Environmental Cons.  Carl-Otto Neven						
Declaration number	EPD EUROPEAN ALUMINIUM 2017 – ALUMIL 6						
Declared Unit	1 m ² of sliding door type SMARTIA S440						
Product group covered and applicability	This EPD covers 1 m ² of sliding door type S440. The EPD results have been calculated from a modelling tool developed by thinkstep via an i-report in GaBi 6 using the specific bill of materials of the S440 window for calculating the EPD results. The results generated by this EPD-data software can be considered as a good proxy to model the S440 windows designed by Alumil and fabricated and/or installed 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 SMARTIA S440 sliding door which is the new system for thermal insulated sliding frames that offers high level of quality and performances.

The representative product, as represented in Figure 1, is made of made of two operable vents corresponding to an overall size of the sliding door of 2,18 m high by 3 m wide.

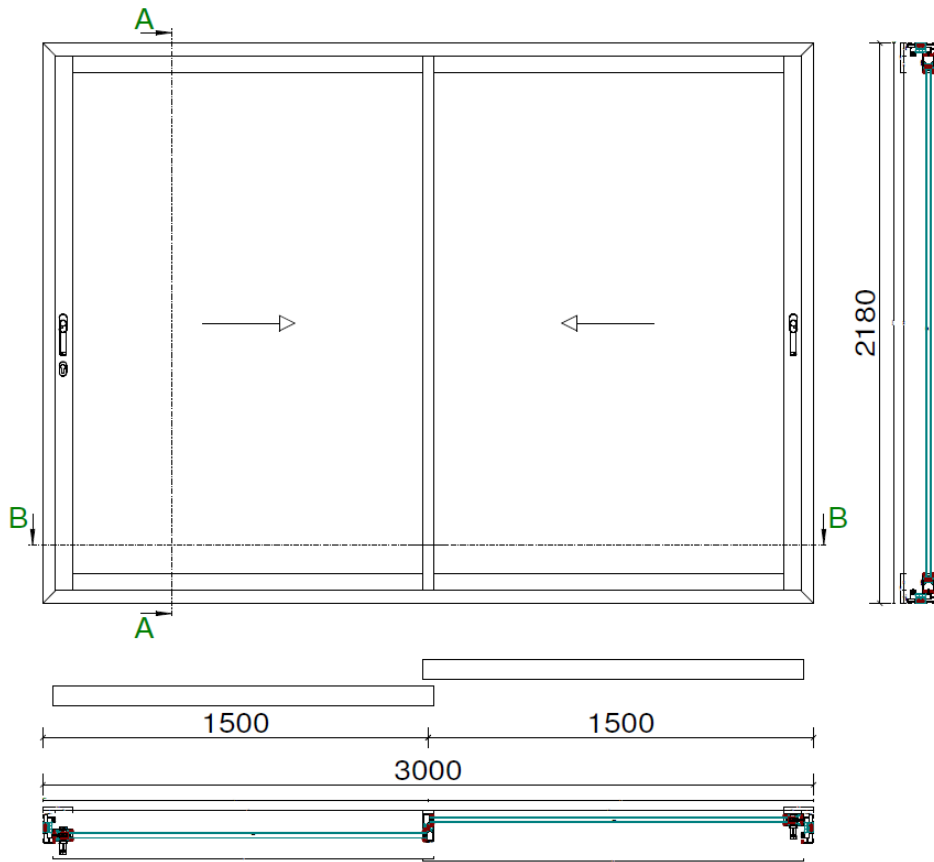


Figure 1. Sketch of the representative product for the S440 sliding door (size in mm)

2.2. Technical data

The most relevant technical data are reported in Table 1.

Table 1. Most relevant technical data for S440 sliding door

Category	Description & value	Standards
Thermal Insulation	Uf-value down to 3.1 W/m ² K depending on the profile combination and the glass thickness.	EN 10077-2
Air tightness	Class 4	EN 12207
Water tightness	Class E750	EN 12208
Wind load resistance	Class C3/B3	EN 12210

For the most up-to-date values of the technical data, please refer to the product specifications available on the Alumil website (see the specifications of S440 sliding door)

2.3. Relevant Standards for market Applications

Most relevant standards for applications of aluminium window or door products in buildings are EN 14351-1 (performances) & EN 12519 (terminology).

2.4. Delivery status and packaging

The sliding doors are supplied 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. Window and door fabrication (foreground processes)

The window and door fabrication consists mainly in the following operations:

1. Aluminium profile preparation mainly via sawing, milling and gluing. Those aluminium profiles are powder coated and thermally broken profiles.
2. Frame production by assembling the various profiles via corner connections and fixing via gluing and/or crimping. Connectors are composed of aluminium die cast.
3. Positioning and fixing the various gaskets.
4. The fittings integration (if relevant)
5. The fixing of the glazing unit via the glazing bead.

The contribution of the fabrication process to the overall production impact of the window or door 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.

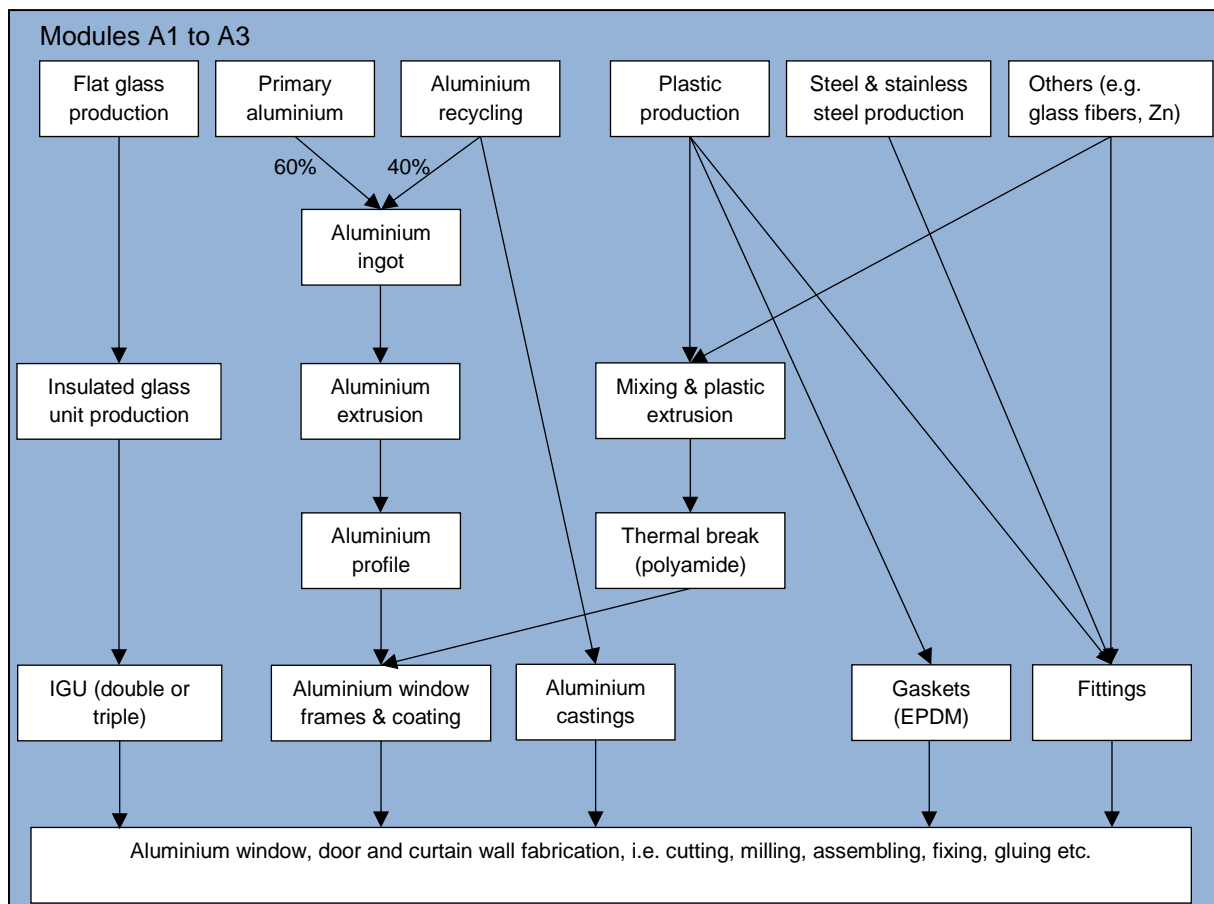


Figure 2. Main production processes and components of aluminium windows and doors

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 60% from primary aluminium and 40% 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 windows and doors. 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 Alumil windows or doors. Under normal installation, no measurable environmental impacts can be associated with the use of Alumil aluminium windows and doors. 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

S440 sliding doors 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 windows and doors / 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 not therefore make any contribution to fire.

2.9. End of life stage

At the end-of-life stage, aluminium windows and doors 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 2 reports the main parameters of the End of life scenario for the various materials and components of the door.

Table 2: 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

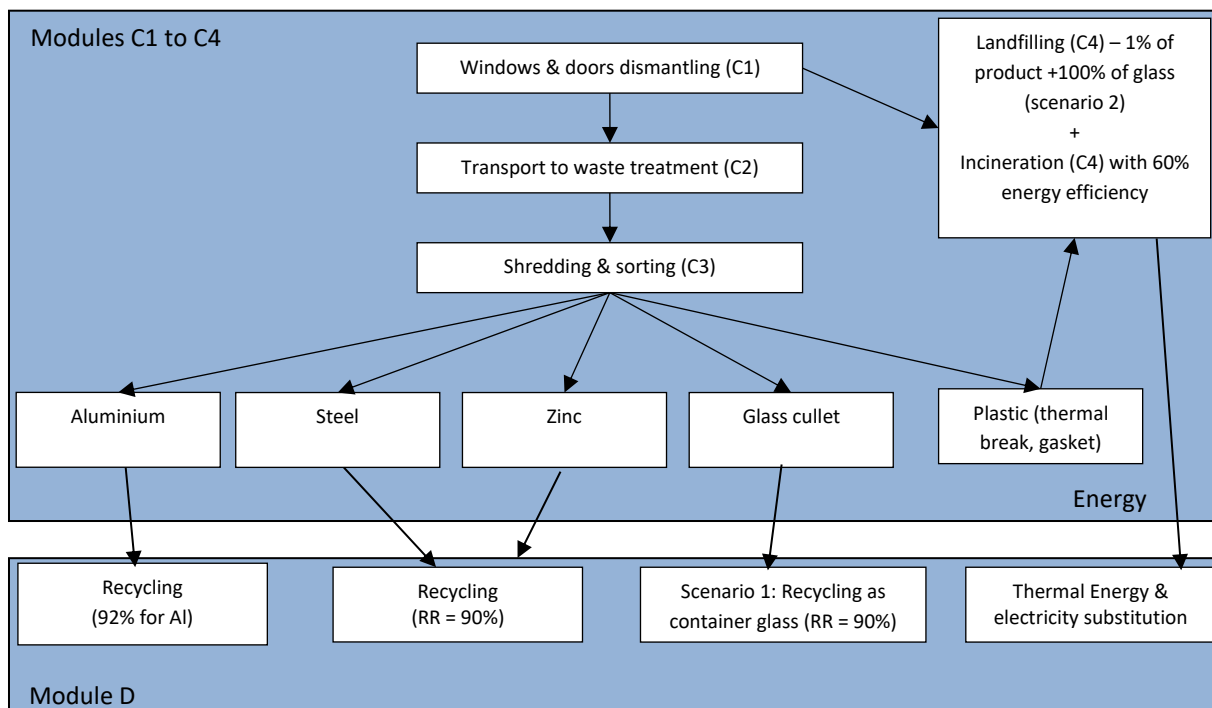


Figure 3: Main processes and parameters for the end of life stage modelling

3. LCA: Calculation rules

3.1. Product size, Bill of Materials and declared unit

EPD calculations have been done for the representative product as described under point 2.1. The Bill of Materials of this representative product is reported in Table 3. The declared unit corresponds to 1 m² of sliding door.

The EPD results are reported for the representative product in the annex of this EPD.

Table 3 Bill of Materials (kg) of the declared unit for the S440 representative product

Bill of Materials (BOM)		
Per declared Unit (per m2)	Kg	%
Aluminium profile	5,98	23,8%
Aluminium die cast	0,10	0,4%
Thermal break - PA	1,19	4,7%
Gaskets - EPDM	0,18	0,7%
Glass	16,77	66,8%
Fittings -stainless steel	0,10	0,4%
PVC	0,74	3,0%
PE foam	0,05	0,2%
Total	25,10	100,0%

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 are usually moderate 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 60% primary aluminium and 40% 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 Alumil 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 windows and doors. 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/.

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 window or door fabrication is not performed by Alumil but by their distributors disseminated in Europe who sell and install Alumil window 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 Alumil 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 window or door is the only product exiting the gate. Hence, the production process does not deliver any co-products.

At the end-of-life stage, the aluminium window or door is sent to an EoL treatment which is modelled according to the scenario reported in section 2.9. The environmental burdens and benefits of recycling and energy recovery are calculated in module D accordingly.

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 40% 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 40% at production stage, i.e. a quantity representing 52% of the aluminium content of the window or door. 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 4: 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.

6. LCA interpretation

- Aluminium window and door 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 (40%). 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 lower 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 or doors 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	Aluminium and Durability - Towards Sustainable Cities , edited by Michael Stacey, Published by Cwningen Press, November 2014 ISBN 978-0-9930162-0-2 (available at http://www.world-aluminium.org/publications/), see case studies from page 78.
EAA DELFT	COLLECTION OF ALUMINIUM FROM BUILDINGS IN EUROPE - A Study by Delft University of Technology – 2004, available at http://european-aluminium.eu/media/1628/collection-of-aluminium-from-buildings-in-europe.pdf
EAA EPR	Environmental Profile Report for the European Aluminium Industry - April 2013- Data for the year 2010, available at http://european-aluminium.eu/media/1329/environmental-profile-report-for-the-european-aluminium-industry.pdf
EAA PCR	Product Category Rules (PCR) for Aluminium Building Products – version of 30 Jan 2013, available at http://european-aluminium.eu/resource-hub/epd-programme-according-to-en15804/
EN 1026	Windows and doors. Air permeability. Test method
EN 1027	Windows and doors. Watertightness. Test method
EN 12207	Windows and doors. Air permeability. Classification
EN 12208	Windows and doors. Watertightness. Classification
EN 12210	Windows and doors. Resistance to wind load. Classification
EN 12211	Windows and doors. Resistance to wind load. Test method
EN 12519	Windows and pedestrian doors — Terminology
EN 12519	Windows and pedestrian doors — Terminology
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 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 10077-1	Thermal performance of windows, doors and shutters -- Calculation of thermal transmittance -- Part 1: General
EN ISO 10077-2	Thermal performance of windows, doors and shutters -- Calculation of thermal transmittance -- Part 2: Numerical method for frames
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 (http://documentation.gabi-software.com/)
NEN 6069	Beproeving en klassering van de brandwerendheid van bouwdeelen en bouwproducten (fire resistance testing and classification of building elements and products)
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: EPD results for the S440 representative product
Doubled-glazing, standard size: 2,18 m * 3 m

Reference	1
Width of the window [m]	3
Height of window [m]	2,18
Transparent of area (%)	84%
Glazing Unit	Double glazing (2 X 4 mm of glass)

BoM for 1 m2 in kg	
Glass	16,77
Aluminium frame	6,08
Thermal break (PA)	1,19
Gasket	0,18
Fitting and others	0,89
total	25,10

EPD results

Per m ² of window										
ENVIRONMENTAL IMPACTS				Glass recycling		Glass landfilling				
Parameter	Unit	A1-3	C4	D	C4	D				
GWP	Global warming potential	[kg CO ₂ -eq.]	80,052	4,5276	-36,708	4,7124	-26,376			
ODP	Ozone layer depletion potential	[kg CFC11-eq.]	1,75E-06	2,63E-11	-1,3E-06	2,94E-11	-1,3E-06			
AP	Acidification potential of land and water	[kg SO ₂ -eq.]	0,30156	0,005124	-0,16044	0,006308	-0,10416			
EP	Eutrophication potential	[kg PO ₄ -eq.]	0,035448	0,000736	-0,01369	0,000907	-0,00603			
POCP	Photochemical oxidation potential	[kg ethene-eq.]	0,02352	0,000218	-0,0049	0,000332	-0,00649			
ADPE	Abiotic depletion potential (elements)	[kg Sb-eq.]	0,000292	8,65E-07	-0,00068	9,32E-07	-2E-05			
ADPF	Abiotic depletion potential (fossil fuels)	[MJ]	991,2	4,5528	-386,4	7,0476	-282,24			
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]	173,88	-	-	-	-			
PERM	Use of renewable primary energy resources used as raw materials	[MJ]	0	-	-	-	-			
PERT	Total use of renewable primary energy resources	[MJ]	173,88	0,52332	-116,76	0,77364	-114,24			
PENRE	Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	[MJ]	1150,8	-	-	-	-			
PENRM	Use of non-renewable primary energy resources used as raw materials	[MJ]	0	-	-	-	-			
PENRT	Total use of non-renewable primary energy resources	[MJ]	1150,8	5,0736	-479,64	7,6692	-372,96			
SM	Use of secondary materials	[kg]	2,4108	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	[m ³]	0,56028	0,01092	-0,25704	0,011424	-0,23184			
END OF LIFE STAGE (output materials from Module C1)				Glass recycling		Glass landfilling				
Material collected separately		kg		25,02		8,25				
for recycling (e.g. metals & glass)		kg		22,89		6,12				
for energy recovery (e.g. gaskets & thermal break)		kg		2,13		2,13				
Material for landfilling		kg		0,08		16,85				
OUTPUT FLOWS AND WASTE				Glass recycling		Glass landfilling				
Parameter	Unit	A1-3	C4	D	C4	D				
HWD	Hazardous waste disposed	[kg]	0,005149	1,96E-06	-0,00193	2,78E-06	-4,1E-05			
NHWD	Non-hazardous waste disposed	[kg]	10,164	1,344	-6,1908	15,456	-5,796			
RWD	Radioactive waste disposed	[kg]	0,060648	0,000207	-0,03839	0,000247	-0,03713			
CRU	Components for re-use	[kg]	0	0	-	0	-			
MFR	Materials for recycling	[kg]	0	0	19,74	0	5,5944			
MER	Materials for energy recovery	[kg]	0	0	-	0	-			
EEE	Exported electrical energy	[MJ]	0	5,922	-	5,922	-			
EET	Exported thermal energy	[MJ]	0	13,776	-	13,776	-			