

Owner: Eiler Thomsen Alufacader A/S  
No.: MD-20036-EN  
Issued: 18-12-2020  
Valid to: 18-12-2025

3<sup>rd</sup> PARTY VERIFIED

**EPD**

VERIFIED ENVIRONMENTAL PRODUCT DECLARATION | ISO 14025 & EN 15804+A1



**Owner of declaration**

Eiler Thomsen Alufacader A/S  
Ivar Lundgaards vej 25,  
DK-7500 Holstebro  
CVR: 12843747



**Issued:**  
18-12-2020

**Valid to:**  
18-12-2025

**Programme**

EPD Danmark  
www.epddanmark.dk



- Industry EPD
- Product EPD

**Basis of calculation**

This EPD is developed in accordance with the European standard EN 15804+A1.

**Comparability**

EPDs of construction products may not be comparable if they do not comply with the requirements in EN 15804. EPD data may not be comparable if the datasets used are not developed in accordance with EN 15804 and if the background systems are not based on the same database.

**Validity**

This EPD has been verified in accordance with ISO 14025 and is valid for 5 years from the date of issue.

**Use**

The intended use of an EPD is to communicate scientifically based environmental information for construction products, for the purpose of assessing the environmental performance of buildings.

**Declared product(s)**

Aluminium façades, within the ETA50 system.

Number of declared datasets/product variations: 3  
With 18 scaling factors, resulting in 54+3 datasets.

**Production site**

Ivar Lundgaards vej 25,  
DK-7500 Holstebro

**Product(s) use**

The products are used as façade, containing a large field of solid glass panels, or other panel filling. The aluminum profiles vary, to accommodate various needs regarding panel sizing, loads and design from customers.

**EPD type**

- Cradle-to-gate
- Cradle-to-gate with options
- Cradle-to-grave

**Declared or functional unit**

1m<sup>2</sup> of façade element with various filling, being either:

- Triple layer glazing
- Enamelled double layer glazing
- Panel filling

**Year of data**

2019

CEN standard EN 15804+A1 serves as the core PCR
Independent verification of the declaration and data, according to EN ISO 14025
<input type="checkbox"/> internal <input checked="" type="checkbox"/> external
Third party verifier:
 <hr/> Ninkie Bendtsen

Henrik Fred Larsen  
EPD Danmark

Life cycle stages and modules (MND = module not declared)																
Product			Construction process		Use							End of life			Beyond the system boundary	
Raw material supply	Transport	Manufacturing	Transport	Installation process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Re-use, recovery and 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	X	MND	X	X	MND	MND	X	X	X

# Product information

## Product description

The EPD contains three representative aluminium façade variations, within the ETA50 system from Eiler Thomsen Alufacader A/S. Additionally this EPD assesses scaling factors for the product variations of profiles within the ETA50 system.

Aluminium profiles are based on "Hydro 4.0 Aluminium Extrusion Ingot" (REDUXA) covered by the EPD: NEPD-1840-468-EN.

The declared unit includes the following three declared product variations, for which results are given separately. The results and scaling references are based on ETA50 profile variation 3264, which has a depth of 170mm.

- ETA50 with triple layer glass (170 mm REDUXA Aluminium profiles, glass: triple layer (6-15-4-15-8))
- ETA50 with enamelled glass (170 mm REDUXA Aluminium profiles, enamelled glass, double glazing (6-15-8))
- ETA50 with panel (170 mm REDUXA Aluminium profiles, aluminium sheeting and PUR insulation boards)

The main product components are shown in Table 1 below. Values are given as intervals divided into the three declared product variations, and the applicable scaling factors which considers the varying profile dimensions. Specific recipes are not shown in this table due to reasons of confidentiality.

**Table 1. Material composition of façade elements declared explicitly with reference profile 3264**

Material	Triple Glazing	Enamelled Double Glazing	Panel
Aluminium	6-20%	8-24%	19-48%
Glazing	76-89%	71-87%	-
Insulation	-	-	5-7%
Alu sheets	-	-	39-60%
Fibre skirting	<1%	<1%	1-2%
EPDM rubber	<1%	<1%	<1-1%
Butyl tape	<1%	<1%	<1%
PVC	~3%	3-4%	7-10%
Steel (screws)	<1%	<1%	<1%
<b>SUM</b>	<b>&gt;99%</b>	<b>&gt;99%</b>	<b>&gt;99%</b>

The main packaging material for the outgoing façade product is shown in Table 2.

**Table 2. Main packaging material for outgoing product in kg per declared unit of 1 m<sup>2</sup> of façade**

Material		Unit
Wooden frame	1,679	kg
Screws	1,74E-03	kg

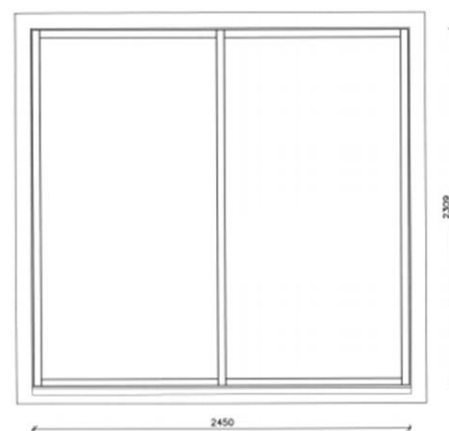
The ETA facades variations with enamelled double glazing and panel filing are installed with, additional, insulation at the construction site. This is a (technical) design requirement, in order for the facades to obtain the required insulation performance. However, the insulation used is not pre-determined by ETA, and is thus decided upon by the designers of a project and the contractor at building site. The additional insulation is thus omitted from this study but must be applied upon using the EPD for building level LCA

## Representativity

This declaration, including data collection and the modelled foreground system including results, represents the production of 1 m<sup>2</sup> of Eiler Thomsen Alufacader A/S' ETA50 curtain wall system at the production site located in Holstebro, Denmark.

Product specific data are based on average values collected in 2020, covering the production period from 01.01.2019 to 31.12.2019.

The declared unit (1 m<sup>2</sup>) is calculated based on a 2,45mx2,3m facade element module, as shown in Figure 1, measured from centreline to centreline.



**Figure 1. Representative façade section used as reference for the declared unit, dimension 2,45m\*2,3m**

Background data are almost exclusively based on GaBi and are less than 10 years old. Only in one case, GaBi data was supplemented with data fromecoinvent and the consistency of the data used is therefore considered as high. Generally, the used background datasets are of high quality, and the majority of the datasets are only a couple of years old and therefore the requirements in EN15804 are met.

The scaling factors are representing variations caused by profile size/dimension variations. A linear coherency is applied

The scaling factor is represented by a set of impact values for the façade, excluding the aluminium profiles. The impact profile for aluminium profiles and fittings, are shown in separate tables, and upon their scaling they need to be added to the 'basic impact values.

### Hazardous substances

The products declared within the ETA50 system do not contain any substances listed in the "Candidate List of Substances of Very High Concern for Authorisation".

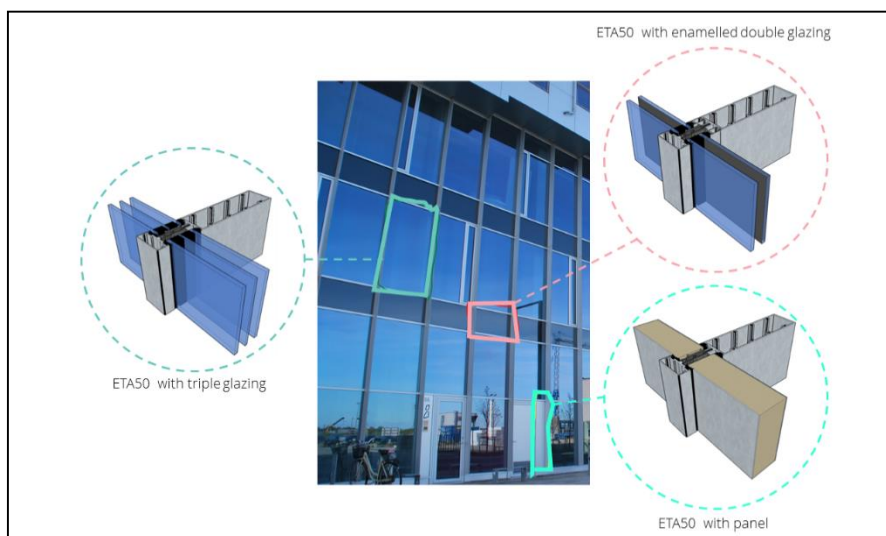
(<http://echa.europa.eu/candidate-list-table>)

Absence of these substances are declared by Eiler Thomsen Alufacader A/S

### Essential characteristics (CE)

The façade elements, from Eiler Thomsen Alufacader, are intended for use as exterior facades/curtainwalling. The products are CE-marked, according to DS/EN 13830. DoP for the façade

### Picture of product(s)



elements can be obtained upon request, from Eiler Thomsen Alufacader A/S, as these are design/project specific.

While the declared characteristics developed in accordance with the relevant harmonised product standard are important, e.g. DoP specifications, U-values etc., they need to be considered in the contexts of the building in/on which the façade elements are installed, cf. DS/EN 17213.

### Reference Service Life (RSL)

The reference service life (RSL) is 50 years for curtain walling, according to the predicted service life given in the product standard, DS/EN 13830. However, components (divided in primary and secondary components) in the curtain walls are expected to have a shorter service life and need replacement. See Table 3 for included replacement/life spans.

**Table 3. RSL and component replacement cycles, based on DS/EN13830, DS/EN 17213 and 'Levetider af bygningsdele ved vurdering af bæredygtighed og totaløkonomi'**

	Curtain walling kit	Framing and fixings	Glazing (IGU)	Infill panels	Gaskets & sealants
Service life (years)	50	50	25	Not applicable	As glazing
Replacements	0	0	1	0	1

Maintenance descriptions are available at the website of Eiler Thomsen Alufacader A/S:

<https://et-alu.dk/drift-og-vedligehold/>.



# LCA background

## Declared unit

The LCI and LCIA results in this EPD relates to 1 m<sup>2</sup> of ETA50 curtain wall of the types: ETA50 with triple layer glass, ETA50 with enamelled double layer glass and ETA50 with panel. All types are manufactured with REDUXA aluminium profiles. The declared unit (1 m<sup>2</sup>) is calculated based on a 2,45mx2,3m facade element module. See specifications in Table 4.

## PCR

This EPD is developed according to the core rules for the product category of construction products in EN15804:2012+A1:2013 Guidance has been obtained in product specific PCRs, for decision/modelling support:

- "IBU PCR for Building-Related Products and Services – Part B: Requirements on the EPD for Curtain walling"
- "IBU PCR for Building-Related Products and Services – Part B: Requirements on the EPD for Double skin metal faced sandwich panels"
- "Product Category Rules (PCR) for Aluminium Building Products PCR developed within the EAA EPD program"
- DS/EN 17213:2020 – "Windows and doors – Environmental Product Declarations – Product category rules for windows and pedestrian doorsets"

## Flowdiagram

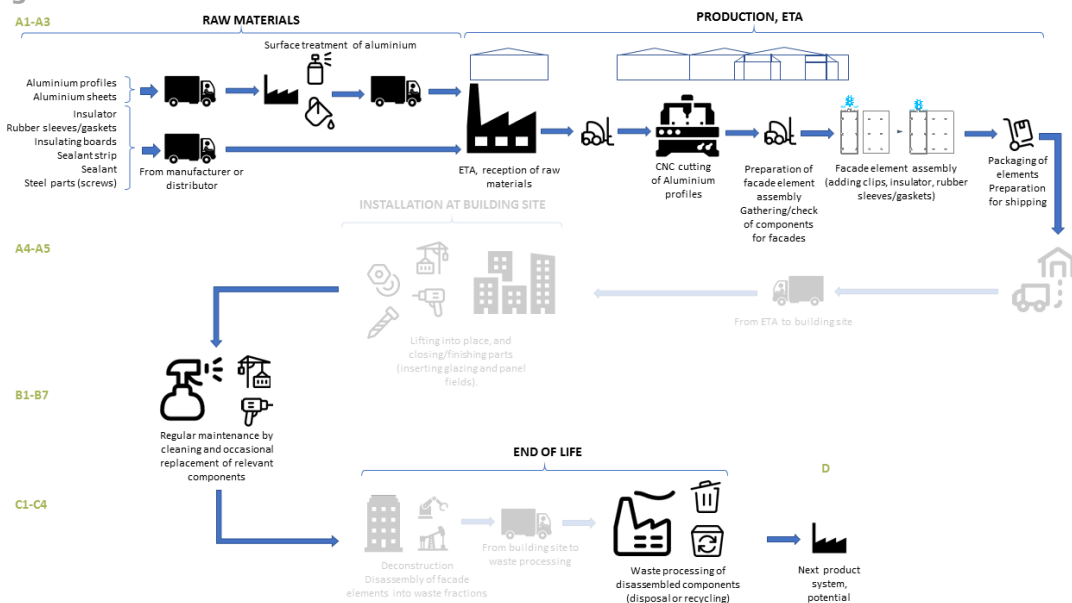


Table 4. Declared unit, all profile variations. Weight/mass [kg/m<sup>2</sup>] and conversion factor to 1 kg

Profile no.	Triple glazing		Enamelled double glazing		Panel	
	Mass per m <sup>2</sup>	Conv. factor to 1 kg	Mass per m <sup>2</sup>	Conv. factor to 1 kg	Mass per m <sup>2</sup>	Conv. factor to 1 kg
	kg/m <sup>2</sup>	-	kg/m <sup>2</sup>	-	kg/m <sup>2</sup>	-
40910	53,61	0,01865	44,23	0,02261	21,69	0,04611
3148	54,52	0,01834	45,14	0,02215	22,60	0,04425
3239	52,29	0,01912	42,91	0,02331	20,37	0,04910
3208	51,59	0,01938	42,21	0,02369	19,67	0,05085
3264	50,55	0,01978	41,17	0,02429	18,63	0,05369
3210	50,55	0,01978	41,17	0,02429	18,63	0,05368
3242	49,55	0,02018	40,17	0,02490	17,63	0,05673
3105	49,34	0,02027	39,96	0,02503	17,42	0,05742
3243	48,79	0,02050	39,41	0,02538	16,87	0,05928
3244	48,43	0,02065	39,04	0,02561	16,50	0,06060
3114	47,71	0,02096	38,32	0,02610	15,78	0,06337
3147	47,25	0,02116	37,87	0,02641	15,33	0,06523
3241	52,40	0,01908	43,02	0,02325	20,48	0,04883
3220	50,75	0,01970	41,37	0,02417	18,83	0,05311
3207	49,65	0,02014	40,26	0,02484	17,72	0,05642
3171	49,27	0,02030	39,89	0,02507	17,35	0,05765
3245	48,98	0,02042	39,60	0,02526	17,06	0,05863
3246	48,61	0,02057	39,23	0,02549	16,69	0,05992
3236 + 3237	55,63	0,01797	46,25	0,02162	23,71	0,04217

### System boundary

This EPD is based on a cradle-to-gate with options LCA, in which >99 weight-% has been accounted for.

The general rules for the exclusion of inputs and outputs follows the requirements in EN 15804+A1, 6.3.5, where the total of neglected input flows per module shall be a maximum of 5 % of energy usage and mass and 1 % of energy usage and mass for unit processes.

ETA has obliged themselves to only using REDUXA aluminium ingot for the extruded profiles from Hydro. This EPD thus only account for ETA50 facades using REDUXA aluminium profiles from Hydro.

As the glass used in the facades varies, the assessment has been based on a conservative approach, using the solution of ETA facades wherein the heaviest composition/most glass is used. The study is thus representing a 'worst-case' according to regarding this issue.

The ETA facades variations with enamelled double glazing and panel filing are installed with, additional, insulation at the construction site. This is a (technical) design requirement, in order for the facades to obtain the required insulation performance. However, the insulation used is not pre-determined by ETA, and is thus decided upon by the designers of a project and the contractor at building site. The additional insulation is thus omitted from this study but must be applied upon using the EPD for building level LCA.

#### Product stage (A1-A3) includes:

- A1 – Extraction and processing of raw materials
- A2 – Transport to the production site
- A3 – Manufacturing processes

The product stage comprises the acquisition of all raw materials, products and energy, transport to the production site, packaging and waste processing up to the "end-of-waste" state or final disposal. The LCA results are declared in aggregated form for the product stage, which means, that the sub-modules A1, A2 and A3 are declared as one module A1-A3.

The raw materials are distributed to the relevant project on racks, once checked for errors, which are then distributed to the CNC cutters.

The surface treated (coating or anodization) aluminium profiles are run through CNC machines, where the profiles, delivered by meters, are cut according to project requests. After CNC machining, the fitted profiles are placed in new/different racks.

The components to the façade elements are prepared for assembly; adding clips, insulator, rubber and gathering/checking that all components are there.

From the assembly rack, the façade elements are assembled horizontally, in fitting/selected sizes. The assembled façade elements are then moved to the wooden racks for transportation by crane or pallet lift.

#### Construction process stage (A4-A5)

##### includes:

Not included in the declaration. However, see 'Additional information' for qualitative descriptions.

##### Use stage (B1-B7) includes:

B4, B6 and B7 are included in the declaration. However, see 'Additional information' for qualitative descriptions.

B4 represents the replacement of components during the curtain wall lifetime. Whereas the curtain wall has a n RSL of 50 years, the glazing unit, is estimated with a lifespan of 25 years.

Thus, the glazing in the ETA facades has to be replaced once in the life/use span of the declared product. Gaskets and sealant, applied with/in coherency with the glazing, are replaced as well.

The façade is assembled in a way, where all parts can be disassembled. To replace the glazing unit, a new unit need to be acquired.

The replacement stage comprises the acquisition of all raw materials (for replacement components), products and energy, transport to the construction/building site and waste processing up to the "end-of-waste" state or final disposal of the replaced materials.

Life cycle modules B6 and B7, are assessed as not relevant for the façade elements, as they do not directly provide to the operational water or energy use of the building.

**End of Life (C1-C4) includes:**

Only C3 and C4 included in the declaration. However, see 'Additional information' for qualitative descriptions.

The ETA façade elements are designed and assembled in a way, which enables them to be disassembled upon end of use. The disassembly should occur on the 'construction' site (life cycle module C1, not included in this study), and the single components are transported to a relevant waste processing site (life cycle module C2, not included in this study).

The components of the ETA50 façade element are either recycled, incinerated, or landfilled. In order to assess the materials for recycling, the end-of-waste is defined at the processing of the secondary material.

The aluminium used for profiles, Hydro REDUXA, have an EPD covering life cycle modules A1-A4 & C2-C4 and D. As the EPD represents/covers, the European market, the life cycle modules C3 and C4 are assessed applicable.

**Re-use, recovery and recycling potential (D) includes:**

Several of the materials in the ETA façade system have potential for benefits and loads beyond the system boundary.

The aluminium used for profiles, Hydro REDUXA, is covered by an EPD covering life cycle modules A1-A4 & C2-C4 and D. As the EPD represents/-

covers, the European market, the life cycle module D is assessed applicable

Part of the glass is recycled in C3. According to DS/EN 17074, the cPCR for flat glass, a EoL (C3/C4) and benefit potential (D) modelling division can be estimated as 25% glass for recycling, and 5% for direct (closed-loop) recycling. The other 70% of glass are landfilled, in C4.

95% of aluminium sheets are recycled in C3, replacing average European aluminium ingots/-billet mix.

95% steel scrap from C3 replaces steel (made from virgin ores). However, as the waste stream for steel is only from screws, which are presumably made of 100% alloyed scrap, no benefits are accounted for the steel waste. This is a conservative approach to avoid double counting of benefits.

Additionally, benefits credited from waste incinerator is credited as electricity (replaces Danish electricity grid mix) and thermal energy (replaces thermal energy from natural gas)

Benefits beyond the system boundary are summed up from all life cycle modules beyond the production gate. Thus, the potential benefits from the replacement of glazing (B4), and from the waste processing in C3 are included.

# LCA results

The results for the three main product variations, with representative profile 3264, are shown on page 8 - 10. Scaling factors for profile variations are listed/presented on page 11 - 14.

## ETA50 with triple glazing

Table 5. LCIA for the ETA50 system with representative profile 3264, Triple Glazing

ENVIRONMENTAL IMPACTS PER 1m <sup>2</sup> ETA50 FAÇADE ELEMENT								
Parameter	Unit	A1-A3	B4	B6	B7	C3	C4	D
GWP	[kg CO <sub>2</sub> -eq.]	1,09E+02	7,47E+01	0,00E+00	0,00E+00	2,22E+00	4,44E-01	-3,41E+01
ODP	[kg CFC11-eq.]	2,99E-06	6,29E-07	0,00E+00	0,00E+00	5,73E-08	2,45E-15	-1,78E-06
AP	[kg SO <sub>2</sub> -eq.]	4,32E-01	2,87E-01	0,00E+00	0,00E+00	4,99E-03	2,83E-03	-2,20E-01
EP	[kg PO <sub>4</sub> <sup>3-</sup> -eq.]	6,74E-02	5,49E-02	0,00E+00	0,00E+00	1,12E-03	3,18E-04	-1,34E-02
POCP	[kg ethene-eq.]	2,68E-02	1,81E-02	0,00E+00	0,00E+00	1,95E-04	2,14E-04	-1,13E-02
ADPE	[kg Sb-eq.]	5,03E-05	2,53E-05	0,00E+00	0,00E+00	9,89E-06	4,49E-08	-7,29E-05
ADPF	[MJ]	1,29E+03	9,40E+02	0,00E+00	0,00E+00	1,81E+01	6,29E+00	-3,40E+02
Caption	GWP = Global warming potential; ODP = Ozone depletion potential; AP = Acidification potential of soil and water; EP = Eutrophication potential; POCP = Photochemical ozone creation potential; ADPE = Abiotic depletion potential for non fossil resources; ADPF = Abiotic depletion potential for fossil resources							

Table 6. Resource use (LCI) for the ETA50 system with representative profile 3264, Triple Glazing

RESOURCE USE PER 1m <sup>2</sup> ETA50 FAÇADE ELEMENT								
Parameter	Unit	A1-A3	B4	B6	B7	C3	C4	D
PERE	[MJ]	5,00E+02	6,30E+01	0,00E+00	0,00E+00	1,62E+00	8,50E-01	-1,41E+02
PERM*	[MJ]	3,01E+01	2,71E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	[MJ]	5,30E+02	6,33E+01	0,00E+00	0,00E+00	1,62E+00	8,50E-01	-1,41E+02
PENRE	[MJ]	1,33E+03	9,50E+02	0,00E+00	0,00E+00	1,94E+01	6,49E+00	-4,06E+02
PENRM**	[MJ]	3,91E+01	3,39E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	[MJ]	1,37E+03	9,84E+02	0,00E+00	0,00E+00	1,94E+01	6,49E+00	-4,06E+02
SM	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RSF	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	[m <sup>3</sup> ]	1,70E+00	1,81E-01	0,00E+00	0,00E+00	5,22E-03	1,64E-03	-2,69E-01
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							

\* Equals contribution from packaging material of raw material (Module A1: 4,70E-01 MJ, Module B4: 2,71E-01MJ), and packaging material of façade elements (module A3: 2,96E+01 MJ)

\*\* Contribution from packaging material of raw material (Module A1: 5,08E-03MJ) and raw material/components of the façade element (Module A1: 3,91E+01MJ, Module B4: 3,39E+01)

Table 7. End of Life (LCI) for the ETA50 system with representative profile 3264, Triple Glazing

WASTE CATEGORIES AND OUTPUT FLOWS PER 1m <sup>2</sup> ETA50 FAÇADE ELEMENT								
Parameter	Unit	A1-A3	B4	B6	B7	C3	C4	D
HWD	[kg]	1,97E-01	6,28E-06	0,00E+00	0,00E+00	3,64E-02	9,89E-08	2,93E-02
NHWD	[kg]	1,46E+01	3,65E+01	0,00E+00	0,00E+00	6,90E+00	3,29E+01	-1,56E+01
RWD	[kg]	2,77E-02	1,63E-02	0,00E+00	0,00E+00	5,48E-05	7,36E-05	-2,54E-03
CRU	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	[kg]	1,48E+00	1,20E+01	0,00E+00	0,00E+00	1,76E+01	0,00E+00	-5,50E+00
MER	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,59E-01	0,00E+00	0,00E+00
EEE	[MJ]	0,00E+00	2,29E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EET	[MJ]	0,00E+00	4,29E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
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; EET = Exported thermal energy							



## ETA50 with enamelled double glazing

**Table 8. LCIA for the ETA50 system with representative profile 3264, Enamelled Double Glazing**

ENVIRONMENTAL IMPACTS PER 1m <sup>2</sup> ETA50 FAÇADE ELEMENT								
Parameter	Unit	A1-A3	B4	B6	B7	C3	C4	D
GWP	[kg CO <sub>2</sub> -eq.]	1,01E+02	6,61E+01	0,00E+00	0,00E+00	2,06E+00	3,52E-01	-3,30E+01
ODP	[kg CFC11-eq.]	3,73E-06	1,37E-06	0,00E+00	0,00E+00	5,73E-08	1,94E-15	-1,78E-06
AP	[kg SO <sub>2</sub> -eq.]	4,06E-01	2,60E-01	0,00E+00	0,00E+00	4,81E-03	2,24E-03	-2,12E-01
EP	[kg PO <sub>4</sub> <sup>3-</sup> -eq.]	7,87E-02	6,62E-02	0,00E+00	0,00E+00	1,08E-03	2,52E-04	-1,25E-02
POCP	[kg ethene-eq.]	2,55E-02	1,68E-02	0,00E+00	0,00E+00	1,92E-04	1,70E-04	-1,23E-02
ADPE	[kg Sb-eq.]	1,35E-04	1,10E-04	0,00E+00	0,00E+00	9,87E-06	3,56E-08	-7,28E-05
ADPF	[MJ]	1,20E+03	8,47E+02	0,00E+00	0,00E+00	1,58E+01	4,99E+00	-3,26E+02
Caption	GWP = Global warming potential; ODP = Ozone depletion potential; AP = Acidification potential of soil and water; EP = Eutrophication potential; POCP = Photochemical ozone creation potential; ADPE = Abiotic depletion potential for non fossil resources; ADPF = Abiotic depletion potential for fossil resources							

**Table 9. Resource use (LCI) for the ETA50 system with representative profile 3264, Enamelled Double Glazing**

RESOURCE USE PER 1m <sup>2</sup> ETA50 FAÇADE ELEMENT								
Parameter	Unit	A1-A3	B4	B6	B7	C3	C4	D
PERE	[MJ]	5,11E+02	7,29E+01	0,00E+00	0,00E+00	1,49E+00	6,73E-01	-1,40E+02
PERM*	[MJ]	3,01E+01	2,71E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	[MJ]	5,40E+02	7,31E+01	0,00E+00	0,00E+00	1,49E+00	6,73E-01	-1,40E+02
PENRE	[MJ]	1,29E+03	9,07E+02	0,00E+00	0,00E+00	1,71E+01	5,14E+00	-3,92E+02
PENRM**	[MJ]	3,91E+01	3,39E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	[MJ]	1,33E+03	9,40E+02	0,00E+00	0,00E+00	1,71E+01	5,14E+00	-3,92E+02
SM	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RSF	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	[m <sup>3</sup> ]	1,79E+00	2,63E-01	0,00E+00	0,00E+00	5,03E-03	1,30E-03	-2,67E-01
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							

\* Equals contribution from packaging material of raw material (Module A1: 4,70E-01 MJ, Module B4: 2,71E-01MJ), and packaging material of façade elements (module A3: 2,96E+01 MJ)

\*\* Contribution from packaging material of raw material (Module A1: 5,08E-03MJ) and raw material/components of the façade element (Module A1: 3,91E+01MJ, Module B4: 3,39E+01)

**Table 10. End of Life (LCI) for the ETA50 system with representative profile 3264, Enamelled Double Glazing**

WASTE CATEGORIES AND OUTPUT FLOWS PER 1m <sup>2</sup> ETA50 FAÇADE ELEMENT								
Parameter	Unit	A1-A3	B4	B6	B7	C3	C4	D
HWD	[kg]	1,97E-01	5,12E-06	0,00E+00	0,00E+00	3,64E-02	7,84E-08	2,93E-02
NHWD	[kg]	1,36E+01	2,87E+01	0,00E+00	0,00E+00	6,90E+00	2,61E+01	-1,54E+01
RWD	[kg]	2,45E-02	1,30E-02	0,00E+00	0,00E+00	4,89E-05	5,83E-05	-2,28E-03
CRU	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	[kg]	1,48E+00	9,36E+00	0,00E+00	0,00E+00	1,49E+01	0,00E+00	-5,50E+00
MER	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,59E-01	0,00E+00	0,00E+00
EEE	[MJ]	0,00E+00	2,29E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EET	[MJ]	0,00E+00	4,29E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
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; EET = Exported thermal energy							

ETA50 with panel filling

Table 11. LCIA for the ETA50 system with representative profile 3264, Panel

ENVIRONMENTAL IMPACTS PER 1m <sup>2</sup> ETA50 FAÇADE ELEMENT								
Parameter	Unit	A1-A3	B4	B6	B7	C3	C4	D
GWP	[kg CO <sub>2</sub> -eq.]	1,36E+02	0,00E+00	0,00E+00	0,00E+00	4,64E+00	3,96E-02	-1,03E+02
ODP	[kg CFC11-eq.]	2,99E-06	0,00E+00	0,00E+00	0,00E+00	5,73E-08	2,20E-16	-1,78E-06
AP	[kg SO <sub>2</sub> -eq.]	5,26E-01	0,00E+00	0,00E+00	0,00E+00	6,55E-03	2,51E-04	-5,01E-01
EP	[kg PO <sub>4</sub> <sup>3-</sup> -eq.]	3,69E-02	0,00E+00	0,00E+00	0,00E+00	1,53E-03	2,83E-05	-2,67E-02
POCP	[kg ethene-eq.]	3,24E-02	0,00E+00	0,00E+00	0,00E+00	2,98E-04	1,91E-05	-3,33E-02
ADPE	[kg Sb-eq.]	4,06E-05	0,00E+00	0,00E+00	0,00E+00	9,87E-06	4,01E-09	-8,15E-05
ADPF	[MJ]	1,59E+03	0,00E+00	0,00E+00	0,00E+00	1,63E+01	5,60E-01	-1,08E+03
Caption	GWP = Global warming potential; ODP = Ozone depletion potential; AP = Acidification potential of soil and water; EP = Eutrophication potential; POCP = Photochemical ozone creation potential; ADPE = Abiotic depletion potential for non fossil resources; ADPF = Abiotic depletion potential for fossil resources							

Table 12. Resource use (LCI) for the ETA50 system with representative profile 3264, Panel

RESOURCE USE PER 1m <sup>2</sup> ETA50 FAÇADE ELEMENT								
Parameter	Unit	A1-A3	B4	B6	B7	C3	C4	D
PERE	[MJ]	9,51E+02	0,00E+00	0,00E+00	0,00E+00	1,68E+00	7,58E-02	-5,53E+02
PERM*	[MJ]	3,78E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	[MJ]	9,89E+02	0,00E+00	0,00E+00	0,00E+00	1,68E+00	7,58E-02	-5,53E+02
PENRE	[MJ]	1,74E+03	0,00E+00	0,00E+00	0,00E+00	1,76E+01	5,77E-01	-1,28E+03
PENRM**	[MJ]	7,14E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	[MJ]	1,81E+03	0,00E+00	0,00E+00	0,00E+00	1,76E+01	5,77E-01	-1,28E+03
SM	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RSF	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	[m <sup>3</sup> ]	2,77E+00	0,00E+00	0,00E+00	0,00E+00	1,09E-02	1,45E-04	-1,31E+00
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							

\* Equals contribution from packaging material of raw material (Module A1: 8,23E+00 MJ), and packaging material of façade elements (module A3: 2,96E+01 MJ)

\*\* Contribution from packaging material of raw material (Module A1-A3: 3,98E-03MJ) and raw material/components of the façade element (Module A1: 7,14E+01MJ)

Table 13. End of Life (LCI) for the ETA50 system with representative profile 3264, Panel

WASTE CATEGORIES AND OUTPUT FLOWS PER 1m <sup>2</sup> ETA50 FAÇADE ELEMENT								
Parameter	Unit	A1-A3	B4	B6	B7	C3	C4	D
HWD	[kg]	1,97E-01	0,00E+00	0,00E+00	0,00E+00	3,64E-02	8,80E-09	2,93E-02
NHWD	[kg]	3,44E+01	0,00E+00	0,00E+00	0,00E+00	7,00E+00	3,14E+00	-3,61E+01
RWD	[kg]	8,19E-02	0,00E+00	0,00E+00	0,00E+00	6,70E-05	6,47E-06	-5,57E-02
CRU	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	[kg]	1,48E+00	0,00E+00	0,00E+00	0,00E+00	1,42E+01	0,00E+00	-5,50E+00
MER	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,59E-01	0,00E+00	0,00E+00
EEE	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	5,01E+00	0,00E+00	0,00E+00
EET	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	2,06E+01	0,00E+00	0,00E+00
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; EET = Exported thermal energy							

## SCALING FACTORS

The scaling factors are representing variations caused by profile size/dimension variations. A linear coherency is applied. The scaling factor is represented by a set of impact values for the façade, excluding the aluminium profiles (and fittings) – see Table 18 to Table 20. The scaling factors are shown in Table 14 and the impact profile for aluminium profiles and fittings, are shown in Table 15 - Table 17.

A further explanation of the scaling factor use, with coherent application example, is shown in page 15.

## ALUMINIUM PROFILE/FITTING IMPACTS, REP. 3264, AND SCALING FACTORS

**Table 14. Aluminium scaling factors, with reference to profile 3264 (setting profile 3264 as '1,000')**

Profile no.	Profile depth [mm]	Scaling factor [-]	Profile no.	Profile depth [mm]	Scaling factor [-]	Profile no.	Profile depth [mm]	Scaling factor [-]
40910	320	1,485	3105	125	0,808	3220	170	1,033
3148	230	1,640	3243	105	0,720	3207	145	0,857
3239	230	1,281	3244	80	0,662	3171	125	0,797
3208	185	1,167	3114	60	0,547	3245	105	0,751
3210	170	1,001	3147	30	0,475	3246	80	0,692
3242	145	0,841	3241	230	1,299	3236 + 3237	230	1,819

**Table 15. LCIA for aluminium profile/fitting impacts**

ENVIRONMENTAL IMPACTS PER 1m <sup>2</sup> ETA50 FAÇADE ELEMENT								
Parameter	Unit	A1-A3	B4	B6	B7	C3	C4	D
GWP	[kg CO <sub>2</sub> -eq.]	3,34E+01	0,00E+00	0,00E+00	0,00E+00	1,48E+00	4,24E-03	-2,92E+01
ODP	[kg CFC11-eq.]	2,36E-06	0,00E+00	0,00E+00	0,00E+00	5,74E-08	2,36E-17	-1,78E-06
AP	[kg SO <sub>2</sub> -eq.]	1,42E-01	0,00E+00	0,00E+00	0,00E+00	4,16E-03	2,69E-05	-1,85E-01
EP	[kg PO <sub>4</sub> <sup>3-</sup> -eq.]	1,18E-02	0,00E+00	0,00E+00	0,00E+00	9,51E-04	3,03E-06	-9,62E-03
POCP	[kg ethene-eq.]	8,14E-03	0,00E+00	0,00E+00	0,00E+00	1,81E-04	2,04E-06	-1,56E-02
ADPE	[kg Sb-eq.]	1,88E-05	0,00E+00	0,00E+00	0,00E+00	9,82E-06	4,29E-10	-7,26E-05
ADPF	[MJ]	3,10E+02	0,00E+00	0,00E+00	0,00E+00	7,89E+00	6,00E-02	-2,78E+02

**Table 16. Resource use (LCI) for aluminium profile/fitting impacts**

RESOURCE USE PER 1m <sup>2</sup> ETA50 FAÇADE ELEMENT								
Parameter	Unit	A1-A3	B4	B6	B7	C3	C4	D
PERE	[MJ]	4,06E+02	0,00E+00	0,00E+00	0,00E+00	1,02E+00	8,14E-03	-1,37E+02
PERM	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	[MJ]	4,06E+02	0,00E+00	0,00E+00	0,00E+00	1,02E+00	8,12E-03	-1,37E+02
PENRE	[MJ]	3,40E+02	0,00E+00	0,00E+00	0,00E+00	9,09E+00	6,19E-02	-3,41E+02
PENRM	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	[MJ]	3,40E+02	0,00E+00	0,00E+00	0,00E+00	9,09E+00	6,19E-02	-3,41E+02
SM	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RSF	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	[m <sup>3</sup> ]	1,50E+00	0,00E+00	0,00E+00	0,00E+00	4,39E-03	1,56E-05	-2,60E-01

**Table 17. End of Life (LCI) for aluminium profile/fitting impacts**

WASTE CATEGORIES AND OUTPUT FLOWS PER 1m <sup>2</sup> ETA50 FAÇADE ELEMENT								
Parameter	Unit	A1-A3	B4	B6	B7	C3	C4	D
HWD	[kg]	1,97E-01	0,00E+00	0,00E+00	0,00E+00	3,64E-02	9,43E-10	2,93E-02
NHWD	[kg]	9,91E+00	0,00E+00	0,00E+00	0,00E+00	6,91E+00	5,47E-01	-1,48E+01
RWD	[kg]	9,50E-03	0,00E+00	0,00E+00	0,00E+00	2,86E-05	6,94E-07	-1,35E-03
CRU	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	5,51E+00	0,00E+00	-5,51E+00
MER	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,59E-01	0,00E+00	0,00E+00
EEE	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EET	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

BASIC FAÇADE IMPACT PROFILE

Triple glazing filling

Table 18. LCIA for the basic façade components/unit, Triple glazing

ENVIRONMENTAL IMPACTS PER 1m <sup>2</sup> ETA50 FAÇADE ELEMENT								
Parameter	Unit	A1-A3	B4	B6	B7	C3	C4	D
GWP	[kg CO <sub>2</sub> -eq.]	7,57E+01	7,47E+01	0,00E+00	0,00E+00	7,41E-01	4,44E-01	-4,99E+00
ODP	[kg CFC11-eq.]	6,29E-07	6,29E-07	0,00E+00	0,00E+00	2,81E-16	2,45E-15	-1,40E-14
AP	[kg SO <sub>2</sub> -eq.]	2,90E-01	2,87E-01	0,00E+00	0,00E+00	8,41E-04	2,83E-03	-3,52E-02
EP	[kg PO <sub>4</sub> <sup>3-</sup> -eq.]	5,55E-02	5,49E-02	0,00E+00	0,00E+00	1,69E-04	3,18E-04	-3,75E-03
POCP	[kg ethene-eq.]	1,86E-02	1,81E-02	0,00E+00	0,00E+00	1,43E-05	2,14E-04	4,23E-03
ADPE	[kg Sb-eq.]	3,14E-05	2,53E-05	0,00E+00	0,00E+00	9,39E-08	4,49E-08	-3,04E-07
ADPF	[MJ]	9,77E+02	9,40E+02	0,00E+00	0,00E+00	1,02E+01	6,29E+00	-6,22E+01
Caption	GWP = Global warming potential; ODP = Ozone depletion potential; AP = Acidification potential of soil and water; EP = Eutrophication potential; POCP = Photochemical ozone creation potential; ADPE = Abiotic depletion potential for non fossil resources; ADPF = Abiotic depletion potential for fossil resources							

Table 19. Resource use (LCI) for the basic façade components/unit, Triple glazing

RESOURCE USE PER 1m <sup>2</sup> ETA50 FAÇADE ELEMENT								
Parameter	Unit	A1-A3	B4	B6	B7	C3	C4	D
PERE	[MJ]	9,48E+01	6,30E+01	0,00E+00	0,00E+00	6,02E-01	8,50E-01	-3,78E+00
PERM*	[MJ]	3,01E+01	2,71E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	[MJ]	1,25E+02	6,33E+01	0,00E+00	0,00E+00	6,02E-01	8,50E-01	-3,78E+00
PENRE	[MJ]	9,87E+02	9,50E+02	0,00E+00	0,00E+00	1,03E+01	6,49E+00	-6,53E+01
PENRM**	[MJ]	3,91E+01	3,39E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	[MJ]	1,03E+03	9,84E+02	0,00E+00	0,00E+00	1,03E+01	6,49E+00	-6,53E+01
SM	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RSF	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	[m <sup>3</sup> ]	2,06E-01	1,81E-01	0,00E+00	0,00E+00	8,27E-04	1,64E-03	-8,97E-03
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							

\* Equals contribution from packaging material of raw material (Module A1: 4,70E-01 MJ, Module B4: 2,71E-01MJ), and packaging material of façade elements (module A3: 2,96E+01 MJ)

\*\* Contribution from packaging material of raw material (Module A1: 5,08E-03MJ) and raw material/components of the façade element (Module A1: 3,91E+01MJ, Module B4: 3,39E+01)

Table 20. End of Life (LCI) for the basic façade components/unit, Triple glazing

WASTE CATEGORIES AND OUTPUT FLOWS PER 1m <sup>2</sup> ETA50 FAÇADE ELEMENT								
Parameter	Unit	A1-A3	B4	B6	B7	C3	C4	D
HWD	[kg]	6,19E-06	6,28E-06	0,00E+00	0,00E+00	4,63E-07	9,89E-08	-9,16E-08
NHWD	[kg]	4,69E+00	3,65E+01	0,00E+00	0,00E+00	1,70E-03	3,26E+01	-7,73E-01
RWD	[kg]	1,83E-02	1,63E-02	0,00E+00	0,00E+00	2,62E-05	7,36E-05	-1,19E-03
CRU	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	[kg]	1,48E+00	1,20E+01	0,00E+00	0,00E+00	1,21E+01	0,00E+00	0,00E+00
MER	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EEE	[MJ]	0,00E+00	2,29E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EET	[MJ]	0,00E+00	4,29E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
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; EET = Exported thermal energy							

## Enamelled Double glazing filling

**Table 21. LCIA for the basic façade components/unit, Enamelled double glazing**

ENVIRONMENTAL IMPACTS PER 1m <sup>2</sup> ETA50 FAÇADE ELEMENT								
Parameter	Unit	A1-A3	B4	B6	B7	C3	C4	D
GWP	[kg CO <sub>2</sub> -eq.]	6,74E+01	6,61E+01	0,00E+00	0,00E+00	5,75E-01	3,52E-01	-3,89E+00
ODP	[kg CFC11-eq.]	1,37E-06	1,37E-06	0,00E+00	0,00E+00	2,18E-16	1,94E-15	-1,10E-14
AP	[kg SO <sub>2</sub> -eq.]	2,64E-01	2,60E-01	0,00E+00	0,00E+00	6,52E-04	2,24E-03	-2,74E-02
EP	[kg PO <sub>4</sub> <sup>3-</sup> -eq.]	6,69E-02	6,62E-02	0,00E+00	0,00E+00	1,31E-04	2,52E-04	-2,92E-03
POCP	[kg ethene-eq.]	1,73E-02	1,68E-02	0,00E+00	0,00E+00	1,11E-05	1,70E-04	3,30E-03
ADPE	[kg Sb-eq.]	1,16E-04	1,10E-04	0,00E+00	0,00E+00	7,29E-08	3,56E-08	-2,37E-07
ADPF	[MJ]	8,88E+02	8,47E+02	0,00E+00	0,00E+00	7,89E+00	4,99E+00	-4,85E+01
Caption	GWP = Global warming potential; ODP = Ozone depletion potential; AP = Acidification potential of soil and water; EP = Eutrophication potential; POCP = Photochemical ozone creation potential; ADPE = Abiotic depletion potential for non fossil resources; ADPF = Abiotic depletion potential for fossil resources							

**Table 22. Resource use (LCI) for the basic façade components/unit, Enamelled double glazing**

RESOURCE USE PER 1m <sup>2</sup> ETA50 FAÇADE ELEMENT								
Parameter	Unit	A1-A3	B4	B6	B7	C3	C4	D
PERE	[MJ]	1,05E+02	7,29E+01	0,00E+00	0,00E+00	4,67E-01	6,73E-01	-2,96E+00
PERM*	[MJ]	3,01E+01	2,71E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	[MJ]	1,35E+02	7,31E+01	0,00E+00	0,00E+00	4,67E-01	6,73E-01	-2,96E+00
PENRE	[MJ]	9,47E+02	9,07E+02	0,00E+00	0,00E+00	7,99E+00	5,14E+00	-5,09E+01
PENRM**	[MJ]	3,91E+01	3,39E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	[MJ]	9,87E+02	9,40E+02	0,00E+00	0,00E+00	7,99E+00	5,14E+00	-5,09E+01
SM	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RSF	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	[m <sup>3</sup> ]	2,88E-01	2,63E-01	0,00E+00	0,00E+00	6,41E-04	1,30E-03	-7,00E-03
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							

\* Equals contribution from packaging material of raw material (Module A1: 4,70E-01 MJ, Module B4: 2,71E-01MJ), and packaging material of façade elements (module A3: 2,96E+01 MJ)

\*\* Contribution from packaging material of raw material (Module A1: 3,79E-03MJ) and raw material/components of the façade element (Module A1: 3,91E+01MJ, Module B4: 3,39E+01)

**Table 23. End of Life (LCI) for the basic façade components/unit, Enamelled double glazing**

WASTE CATEGORIES AND OUTPUT FLOWS PER 1m <sup>2</sup> ETA50 FAÇADE ELEMENT								
Parameter	Unit	A1-A3	B4	B6	B7	C3	C4	D
HWD	[kg]	5,18E-06	5,12E-06	0,00E+00	0,00E+00	3,59E-07	7,84E-08	-7,15E-08
NHWD	[kg]	3,71E+00	2,87E+01	0,00E+00	0,00E+00	1,32E-03	2,59E+01	-6,03E-01
RWD	[kg]	1,50E-02	1,30E-02	0,00E+00	0,00E+00	2,03E-05	5,83E-05	-9,30E-04
CRU	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	[kg]	1,48E+00	9,36E+00	0,00E+00	0,00E+00	9,39E+00	0,00E+00	0,00E+00
MER	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EEE	[MJ]	0,00E+00	2,29E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EET	[MJ]	0,00E+00	4,29E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
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; EET = Exported thermal energy							



Panel filling

Table 24. LCIA for the basic façade components/unit, Panel

ENVIRONMENTAL IMPACTS PER 1m <sup>2</sup> ETA50 FAÇADE ELEMENT								
Parameter	Unit	A1-A3	B4	B6	B7	C3	C4	D
GWP	[kg CO <sub>2</sub> -eq.]	1,02E+02	0,00E+00	0,00E+00	0,00E+00	3,16E+00	3,96E-02	-7,35E+01
ODP	[kg CFC11-eq.]	6,31E-07	0,00E+00	0,00E+00	0,00E+00	1,03E-15	2,20E-16	-1,12E-13
AP	[kg SO <sub>2</sub> -eq.]	3,84E-01	0,00E+00	0,00E+00	0,00E+00	2,39E-03	2,51E-04	-3,16E-01
EP	[kg PO <sub>4</sub> <sup>3-</sup> -eq.]	2,51E-02	0,00E+00	0,00E+00	0,00E+00	5,80E-04	2,83E-05	-1,71E-02
POCP	[kg ethene-eq.]	2,42E-02	0,00E+00	0,00E+00	0,00E+00	1,17E-04	1,91E-05	-1,77E-02
ADPE	[kg Sb-eq.]	2,17E-05	0,00E+00	0,00E+00	0,00E+00	7,82E-08	4,01E-09	-8,88E-06
ADPF	[MJ]	1,28E+03	0,00E+00	0,00E+00	0,00E+00	8,37E+00	5,60E-01	-8,00E+02
Caption	GWP = Global warming potential; ODP = Ozone depletion potential; AP = Acidification potential of soil and water; EP = Eutrophication potential; POCP = Photochemical ozone creation potential; ADPE = Abiotic depletion potential for non fossil resources; ADPF = Abiotic depletion potential for fossil resources							

Table 25. Resource use (LCI) for the basic façade components/unit, Panel

RESOURCE USE PER 1m <sup>2</sup> ETA50 FAÇADE ELEMENT								
Parameter	Unit	A1-A3	B4	B6	B7	C3	C4	D
PERE	[MJ]	5,46E+02	0,00E+00	0,00E+00	0,00E+00	6,56E-01	7,58E-02	-4,17E+02
PERM*	[MJ]	3,78E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	[MJ]	5,83E+02	0,00E+00	0,00E+00	0,00E+00	6,56E-01	7,58E-02	-4,17E+02
PENRE	[MJ]	1,40E+03	0,00E+00	0,00E+00	0,00E+00	8,51E+00	5,77E-01	-9,42E+02
PENRM**	[MJ]	7,14E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	[MJ]	1,47E+03	0,00E+00	0,00E+00	0,00E+00	8,51E+00	5,77E-01	-9,42E+02
SM	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RSF	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	[m <sup>3</sup> ]	1,27E+00	0,00E+00	0,00E+00	0,00E+00	6,53E-03	1,45E-04	-1,05E+00
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							

\* Equals contribution from packaging material of raw material (Module A1: 8,23E+00 MJ), and packaging material of façade elements (module A3: 2,96E+01 MJ)

\*\* Contribution from packaging material of raw material (Module A1: 3,98E-03MJ) and raw material/components of the façade element (Module A1: 7,14E+01MJ)

Table 26. End of Life (LCI) for the basic façade components/unit, Panel

WASTE CATEGORIES AND OUTPUT FLOWS PER 1m <sup>2</sup> ETA50 FAÇADE ELEMENT								
Parameter	Unit	A1-A3	B4	B6	B7	C3	C4	D
HWD	[kg]	3,91E-06	0,00E+00	0,00E+00	0,00E+00	3,36E-07	8,80E-09	-5,17E-07
NHWD	[kg]	2,45E+01	0,00E+00	0,00E+00	0,00E+00	9,86E-02	2,90E+00	-2,13E+01
RWD	[kg]	7,24E-02	0,00E+00	0,00E+00	0,00E+00	3,84E-05	6,47E-06	-5,44E-02
CRU	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	[kg]	1,48E+00	0,00E+00	0,00E+00	0,00E+00	8,74E+00	0,00E+00	0,00E+00
MER	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EEE	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	5,01E+00	0,00E+00	0,00E+00
EET	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	2,06E+01	0,00E+00	0,00E+00
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; EET = Exported thermal energy							

## SCALING FACTOR APPLICATION EXAMPLE

The scaling factors are representing variations caused by profile size/dimension variations. A linear coherency is applied.

The scaling factor is represented by a set of impact values for the façade, excluding the aluminium profiles (and fittings) – see Table 18 to Table 20. Aluminium scaling factors are shown in Table 14 and must be multiplied with the impact results for aluminium profiles and fittings, which are shown in Table 15 - Table 17. The scaling is calculated by a linear equation:

$$y = a * x + b$$

Where

$y$  = the impact results for a given profile variation. Profile variations are dependent on the profile depth and the specification and variations are shown in Table 4, page 5

$a$  = the impact results for aluminium profiles and fittings, which are shown in Table 15 - Table 17

$x$  = the profile variation scaling factor, as given in Table 14

$b$  = impact values for the basic façade, excluding the aluminium profiles (and fittings) with fillings, as given in Table 18 to Table 20

### EXAMPLE #1

Showcasing the application of scaling factor tables on GWP for the reference profile, 3264, triple glazing filling, life cycle modules A1-A3.

The reference value is given in Table 5, page 8 and read as: 1,09E+02 kg CO<sub>2</sub>-eq. per m<sup>2</sup> ETA50 façade element, using profile variation 3264 with triple layer glazing filling.

When calculating the impact by using the linear coherency equation

$$y = a * x + b$$

Where

$y$  = impact profile calculated by the scaling equation

$a$  = 3,34E+01 kg CO<sub>2</sub>-eq. per m<sup>2</sup> ETA50 façade element, using profile variation 3264 (found in Table 15, page 11)

$x$  = is found as 1,000 (Table 14)

$b$  = 7,57E+01 kg CO<sub>2</sub>-eq. per m<sup>2</sup> ETA50 façade element with triple layer glazing filling (found in Table 18, page 12)

Thus, by calculating these values, GWP is found as

$$y = 3,34E + 01 * 1,000 + 7,57E + 01$$

The GWP derived by applying the scaling factor is thus found as: 1,09E+02 kg CO<sub>2</sub>-eq. per m<sup>2</sup> ETA50 façade element, using profile variation 3264 with triple layer glazing filling.

### EXAMPLE #2

Another application example is applied for GWP for profile variation 3148, with enamelled double glazing filling, life cycle module B4.

When calculating the impact by using the linear coherency equation the values are found as:

$y$  = impact profile calculated by the scaling equation

$a$  = 0,00E+00 kg CO<sub>2</sub>-eq. per m<sup>2</sup> ETA50 façade element, using profile variation 3148 (found in Table 15, page 11)

$x$  = is found as 1,640 (Table 14)

$b$  = 6,61E+01 kg CO<sub>2</sub>-eq. per m<sup>2</sup> ETA50 façade element with enamelled double layer glazing filling (found in Table 21, page 13)

Thus, by calculating these values, GWP is found as

$$y = 0,00E + 00 * 1,640 + 6,61E + 01$$

The GWP of B4 derived by applying the scaling factor is thus found as: 6,61E + 01kg CO<sub>2</sub>-eq. per m<sup>2</sup> ETA50 façade element, using profile variation 3148 with enamelled double layer glazing filling.

### EXAMPLE #3

Another application example is applied for GWP for profile variation 3244, with panel filling, life cycle module C3.

When calculating the impact by using the linear coherency equation the values are found as:

$y$  = impact profile calculated by the scaling equation

$a$  = 1,48E+00 kg CO<sub>2</sub>-eq. per m<sup>2</sup> ETA50 façade element, using profile variation 3244 (found in Table 15, page 11)

$x$  = is found as 0,662 (Table 14)

$b$  = 3,16E+00 kg CO<sub>2</sub>-eq. per m<sup>2</sup> ETA50 façade element with panel filling (found in Table 24, page 14)

Thus, by calculating these values, GWP is found as

$$y = 1,48E + 00 * 0,662 + 3,16E + 00$$

The GWP of C3 derived by applying the scaling factor is thus found as: 4,14E + 00 CO<sub>2</sub>-eq. per m<sup>2</sup> ETA50 façade element, using profile variation 3244 with panel filling.

# Additional information

## Technical information on scenarios

### Reference service life

RSL information		Unit
Reference service Life	50	years

### Use (B4, B6 & B7)

Scenario information	Value	Unit
<b>B4 – Replacement</b>		
Replacement cycle	1	per RSL
Energy input during replacement	None	kWh
Exchange of worn parts during products life cycle (glazing units, insulator, rubber, butyltape)	Triple glazing	46,18
	Enamelled double glazing	36,32
	Panel	0
<b>B6 + B7 – Use of energy and water</b>		
Ancillary materials specified by material	0	kg
Net fresh water consumption	0	m <sup>3</sup>
Type of energy carrier	0	kWh
Power output of equipment	0	kW

### End of life (C3-C4)

Scenario information	Value	Unit
For reuse	None	kg
For recycling	Triple glazing	12,04-12,10
	Enamelled double glazing	9,37-9,42
	Panel	8,71-8,77
For recycling, REDUXA	2,81-10,74	kg
For energy recovery	Triple glazing	0
	Enamelled double glazing	0
	Panel	1,08
For final disposal	Triple glazing	32,41-32,84
	Enamelled double glazing	25,70-26,13
	Panel	2,73-3,16
Assumptions for scenario development	Transportation of recycled good to reach 'end-of-waste- state	900
		km

### Re-use, recovery and recycling potential (D)

Scenario information/Materiel	Value	Unit
From B4	Float glass production	0-2,01
	Sand	0-10,03
	Electricity	0-0,02
	Thermal energy	0-0,04
From C3	Glass	0-2,01
	Sand	0-10,03
	REDUXA aluminium	2,81-10,74
	Primary aluminium ingot	8,71
	Electricity	0-5,01
	Thermal energy	0-20,62

### Indoor air

*The EPD does not give information on release of dangerous substances to indoor air because the horizontal standards on measurement of release of regulated dangerous substances from construction products using harmonised test methods according to the provisions of the respective technical committees for European product standards are not available.*

### Soil and water

*The EPD does not give information on release of dangerous substances to soil and water because the horizontal standards on measurement of release of regulated dangerous substances from construction products using harmonised test methods according to the provisions of the respective technical committees for European product standards are not available.*

### Qualitative descriptions of life cycle modules not included in system boundary, A4-D

Below are some qualitative descriptions of the life cycle modules which are not included in the assessments.

#### Transport to the building site (A4)

The ETA façade elements are transported from the production site, in Holstebro, to the building site. ETA estimates that sales distribution is 70% delivered to Copenhagen projects, 15% to Aarhus project and the rest is distributed across the country (Denmark).

#### Installation into the building (A5)

Upon arrival and installation at the construction site, the façade elements are lifted to vertical facades, and fitted to the building. Glazing is installed in the relevant fields of the façade, and the façade is closed by finishing the insulation and panel fields/boxes.

When installing the façade elements at the building site, the needed equipment is cranes and lifting platforms – depending on the construction size where the façade elements are installed. ETA estimates that approx. 1-2 m<sup>2</sup>

façade elements can be/is installed per hour, as the assembly is done manually. ETA are, besides manufacturers, also contractors, for which reason in-house craftsmen are installing the façade elements in most cases.

ETA façade elements are delivered with a packaging of timber and screws. This packaging becomes waste at the building site.

#### Use stage (B1-B7)

The product standard, DS/EN 13830, prescribes primary and secondary components.

The impact on the environment of the in-use phase is primarily related to maintenance in the form of cleaning with water. The façade elements require regular cleaning, which is partially described in the maintenance guidance papers on the website of ETA.

Anodised or powder coated aluminium is recommended cleaned at least every 6 months, unless they're exposed to heavy polluting sources e.g. industrial production. If they're installed at ground level, they're to be cleaned more often. The cleansing of anodised and powder coated aluminium is done with regular tap water, and weak cleansing products.

Powder coated surfaces are further recommended to be treated with wax once or twice every year.

Thus, for maintenance, the main auxiliary product/material used, is tap water.

If installed correctly, there should be no need for refurbishment of the façade elements during the design lifetime of 50 years.

#### De-construction, demolition (C1)

ETA are working on establishing a take-back scheme, this is however not up and running by the time of this assessment (summer 2020).

## References

<b>Publisher</b>	 epddanmark <a href="http://www.epddanmark.dk">www.epddanmark.dk</a>
<b>Programme operator</b>	Danish Technological Institute Gregersensvej DK-2630 Taastrup
<b>LCA-practitioner</b>	Danish Technological Institute Buildings & Environment Gregersensvej DK-2630 Taastrup <a href="http://www.teknologisk.dk">www.teknologisk.dk</a>
<b>LCA software / background data</b>	GaBi 2020 incl. databases (8.7) + ecoinvent 3.5 2019 <a href="http://www.gabi-software.com">http://www.gabi-software.com</a> <a href="http://www.ecoinvent.org">http://www.ecoinvent.org</a>
<b>3<sup>rd</sup> party verifier</b>	Ninkie Bendtsen NIRAS A/S Sortemosevej 19, DK-3450 Allerød <a href="http://www.niras.dk">www.niras.dk</a>

### General programme instructions

Version 2.0

[www.epddanmark.dk](http://www.epddanmark.dk)

#### EN 15804

DS/EN 15804 + A1:2013 – "Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products"

#### EN 15942

DS/EN 15942:2011 – "Sustainability of construction works – Environmental product declarations – Communication format business-to-business"

#### ISO 14025

DS/EN ISO 14025:2010 – "Environmental labels and declarations – Type III environmental declarations – Principles and procedures"

#### ISO 14040

DS/EN ISO 14040:2008 – "Environmental management – Life cycle assessment – Principles and framework"

#### ISO 14044

DS/EN ISO 14044:2008 – "Environmental management – Life cycle assessment – Requirements and guidelines"

#### EN ISO 12631

DS/EN ISO 12631:2017 – "Thermal performance of curtain walling – Calculation of thermal transmittance"

#### EN 13830

DS/EN 13830:2015 – "Curtain walling – product standard"

#### EN 17074

DS/EN 17074:2019 – "Glass in building – Environmental product declaration – Product category rules for flat glass product"

#### EN 17213

DS/EN 17213:2020 – "Windows and doors – Environmental Product Declarations – Product category rules for windows and pedestrian doorsets"

SBI 2013:30; "Levetider af bygningsdele ved vurdering af bæredygtighed og totaløkonomi", BUILD AAU, [publication](#)

"**IBU PCR** for Building-Related Products and Services – Part B: Requirements on the EPD for Curtain walling", version 1.6, revised 2017

"**IBU PCR** for Building-Related Products and Services – Part B: Requirements on the EPD for Double skin metal faced sandwich panels", version 1.7, revised 2019

"**Product Category Rules (PCR)** for Aluminium Building Products PCR developed within the EAA EPD program", 2013, [PCR document](#)