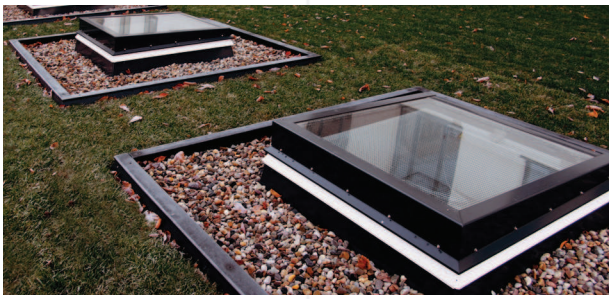
EPD Glass Element

Environmental **P**roduct **D**eclaration
Acc. to ISO 14025 and EN 15804

CI System Glass Element F | F100 | $FE_{enerysave}$ | Smoke lift ME (company EPD)

LAMILUX Heinrich Strunz GmbH





Declaration code
EPD-EG-GB-11.1

Total Life Cycle

ift ROSENHEIM

Environmental Product Declaration in accordance with ISO 14025 and EN 15804

Glass element F, F100, $FE_{energysave}$ and smoke lift ME

Detailed version

Programme operator	**ift Rosenheim GmbH** Theodor-Gietl-Strasse 7-9 83026 Rosenheim
LCA analyst	brands & values GmbH Karl-Ferdinand-Braun Straße 2 28359 Bremen
Holder of the declaration	LAMILUX Heinrich Strunz GmbH Zehstraße 2 D-95111 Rehau
Declaration code	EPD-EG-11.1
Designation of declared product	Glass element F, glass element F100, glass element $FE_{energysave}$ and smoke lift ME
Scope	Daylight systems for increased daylight incidence and natural ventilation and extraction
Basis	This EPD was compiled in accordance with EN ISO 14025:2011 and EN 15804:2012. In addition the Guidance on preparing Type III Environmental Product Declarations is valid. The Declaration is based on the PCR document „Fenster, Flachdachfenster, Lichtkuppeln und Lichtbänder“ :(windows, flat roof windows, light domes and continuous rooflights) PCR-FE-2.0 : 2013
Validity	This verified Environmental Product Declaration applies solely to the specified products and is valid for a period of 5 years from the date created
	Date of publication: 30 September 2013 / Next revision: 30 September 2018
LCA basis	The LCA was prepared in accordance with EN ISO 14040 and EN ISO 14044. The base data includes both the data collected at the production site of Lamilux and generic data from the "GaBi 6“ database. LCA calculations were based on the "cradle to grave“ life cycle including all upstream processes (e.g. raw material extraction, etc.).
Notes on publication	The "Conditions and Guidance on the Use of **ift** Test Documents" apply. The declaration holder assumes full liability for the underlying data, certificates and verifications.

Prof. Ulrich Sieberath Director of Institute	Florian Stich Verifier

Environmental Product Declaration in accordance with ISO 14025 and EN 15804

Glass element F, F100, $FE_{energysave}$ and smoke lift ME

Detailed version

1 Product definition

Product definition

This EPD applies to:

LAMILUX CI system glass element F, glass element F100, glass element $FE_{energysave}$ and smoke lift ME

The LCA was prepared using the declared unit:

1 m² area

The functional unit is specified as follows:

1.20 m x 1.20 m

Product description:
Different individual elements made of real glass for flat roofs. There are flat glass, pitched, pyramid-shaped or hipped roof daylight systems.

- Glass element type F
  - Up to triple glazing
  - As standard thermal break aluminium profile with optimized insulating core
  - Thermally insulated upstand made of fibre-reinforced plastics

- Glass element F100
  - Insulating glazing
  - PVC frame profile
  - Thermally insulated upstand made of fibre-reinforced plastics

- Glass element $FE_{energysave}$:
  The LAMILUX CI system glass element FE $_{energysave}$ is a rooflight suitable for passive house applications. The daylight element for the flat roof has been rated phA advanced component representing the highest energy efficiency class.
  - Triple glazing in series production
  - Thermal break aluminium profile with optimized insulating core manufactured in series production
  - Thermally insulated upstand made of fibre-reinforced plastics with triple multistage sealing system

- Smoke lift ME:
  The LAMILUX CI system smoke lift ME combines smoke and heat exhaust ventilation functions as per EN 12101-2, high daylight incidence and natural ventilation and extraction in a solid system.
  - Tested to DIN EN 12101-2
  - Ventilation function possible
  - Fair weather ventilation: opening up to 60° openin g width (depends on size)
  - Pneumatic or electric (24 V) SHEV function
  - Thermal release with CO_2 cylinders is not damaged during tests or due to false alarms
  - Optional: RAL coating of your choice
  - Optional: insect protection grating
  - Optional: wind and/or rain sensors for automated opening and closing of rooflight domes in the event of wind and rain (group or individual operation)
  - Resistance against wind load (Class C4/B5 EN 12210)
  - Watertight against driving rain (Class E, 1200 EN 12208)
  - High air impermeability (Class 4, EN 12207)
  - Permanent fall-through protection (GS-BAU-18)

For detailed product descriptions and performance specifications of LAMILUX real glass variants refer to the manufacturer specifications at www.lamilux.de or product descriptions of the respective product.

Application Daylight systems for increased daylight incidence and natural ventilation and extraction

Verifications (optional) The following verifications are held:

- Product quality as per DIN EN 14351-1
- $FE_{energysave}$ certified for passive house applications

Management systems (optional) The following management systems are in place:

- Quality management system as per DIN EN ISO 9001:2008

Additional information For detailed structural characteristics refer to the CE marking and to the documents accompanying the product.
All performance characteristics have been tested and certified.

2 Materials used

2.1 Primary products

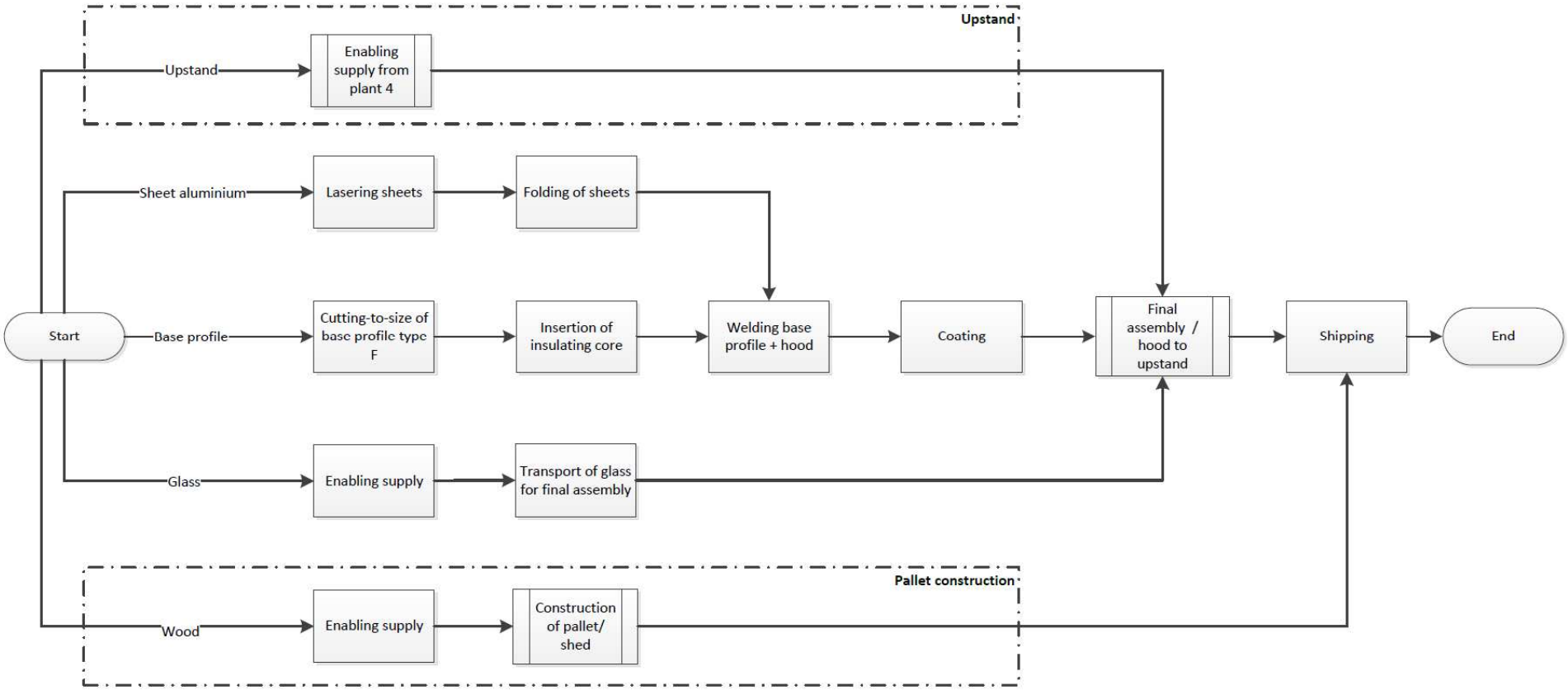
Primary products The primary products used are listed in the LCA (see Section 7).

2.2 Declarable substances

Declarable substances In accordance with the REACH candidate list, no substances of very high concern are contained.
All safety data sheets are available on request from Lamilux.

3 Production stage

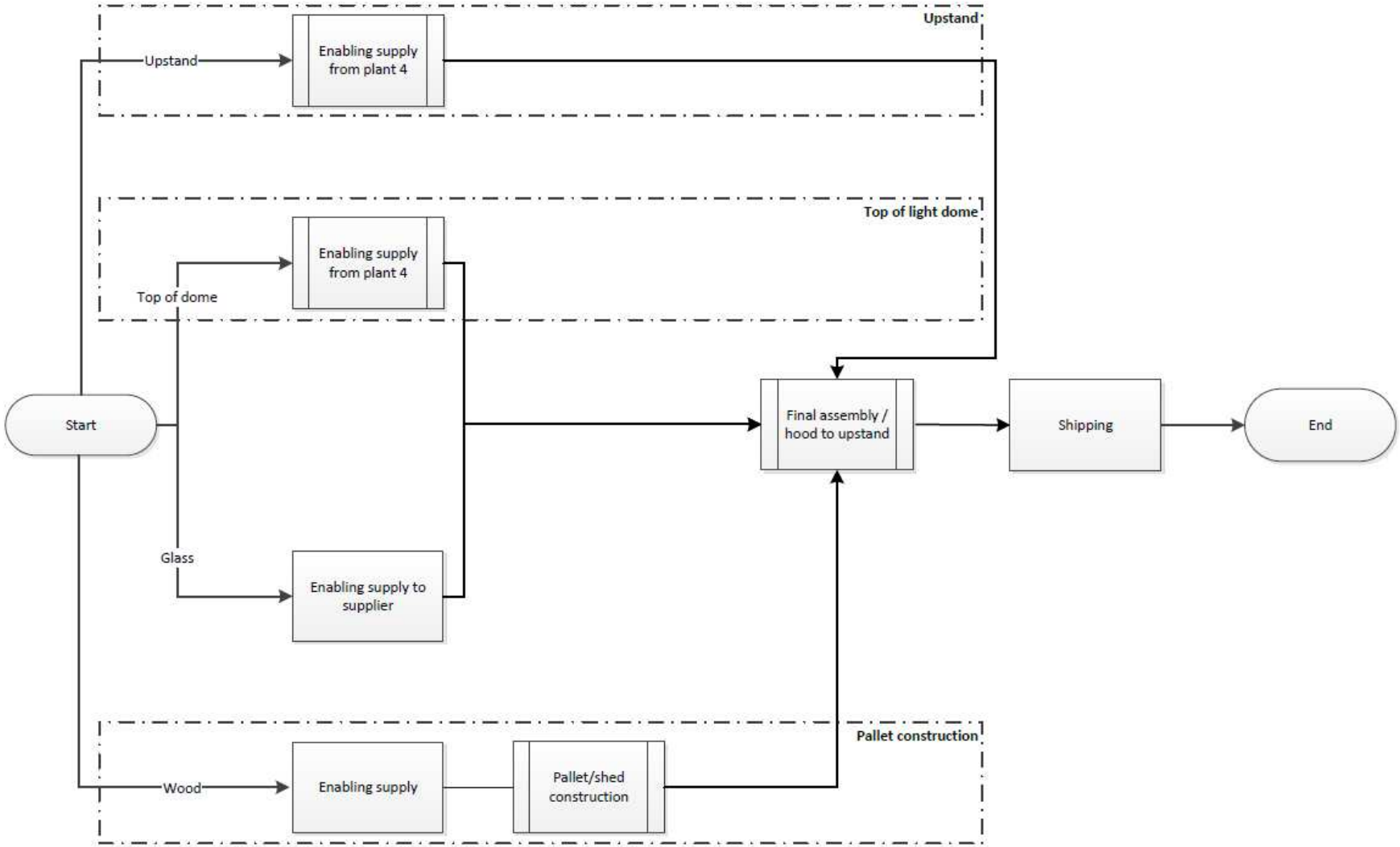
Glass element F and $FE_{energysave}$



Glass element F100

Product group: Daylight systems
Declaration code: EPD-EG-11.1

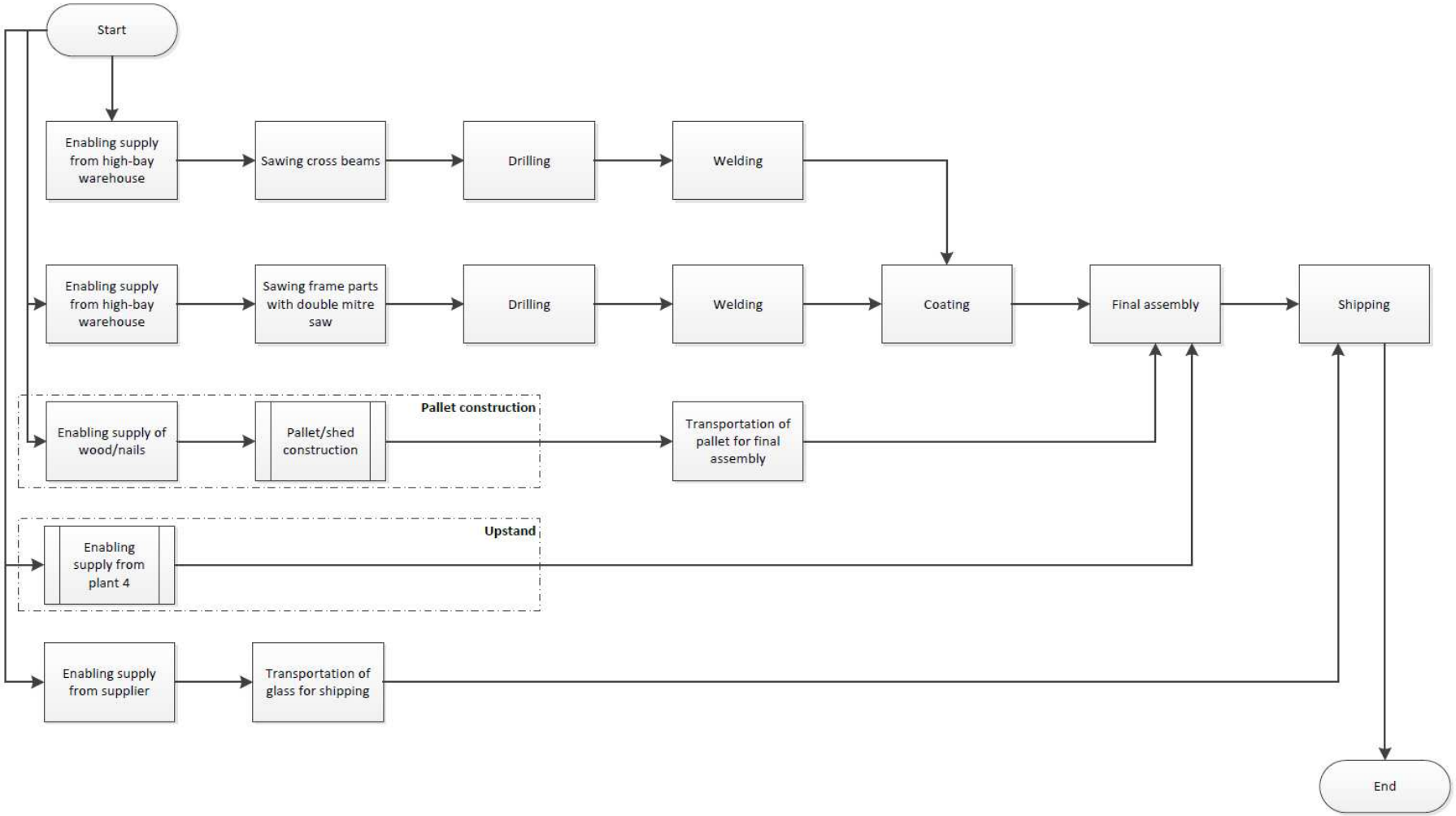
Date created: 30 September 2013
Next revision: 30 September 2018



Smoke lift ME:

Product group: Daylight systems
Declaration code: EPD-EG-11.1

Date created: 30 September 2013
Next revision: 30 September 2018



4 Construction stage

Processing recommendations - installation

For product-specific installation manuals, instructions for use, assembly instructions and cleaning and maintenance instructions refer to www.lamilux.de.

5 Use stage

Emissions to the environment

No emissions to indoor air, water and soil known.

Reference service life (RSL)

A reference service life of 50 years as per table "Nutzungsdauer von Bauteilen" (service life of building components) from the information platform Nachhaltiges Bauen – Baustoff- und Gebäudedaten (sustainable construction - building materials and building data) (mean value) has been specified for roof windows of aluminium, which are very similar to real glass systems. Here the following applies:
„Die Datensätze der nun vorliegenden Tabelle können nicht alle zu differenzierenden Einflussfaktoren für die Austauschzyklen von Bauteilen abbilden (Einbauzustände, klimatische Einflüsse, Nutzerbeanspruchung, Instandhaltungskonzept etc.). Auch können nicht alle Bauteilvarianten und –qualitäten differenziert dargestellt werden wie z. B. Schichtdicken von Verzinkungen etc. Zum Teil liegen noch keine ausreichenden Daten vor, zum Teil würde ein zu großer Differenzierungsgrad auch dem vielfach geäußerten Wunsch nach einer noch mit vertretbarem Aufwand zu berücksichtigenden Tabelle entgegenstehen.“ (The data sets of the given table cannot include all the different influential factors relevant to the replacement cycles of building components (built conditions, climatic influences, wear, maintenance concepts, etc). Neither can all the different building component variants and grades/properties, e.g. anodised film thicknesses, etc. be shown in detail. No sufficient data are available yet in some instances, and extreme differentiation would counteract the goal of an applicable table to be used without too much effort.)

For the reference service life the following characteristics apply:

- Declared product characteristics: refer to product definition
- Application parameters for the construction: refer to processing recommendations, additional information
- Expected quality of workmanship: refer to processing recommendations, application
- External conditions: heavy weather conditions e.g. hail or heavy snow loads can have a negative effect on the RSL.
- Internal conditions: no impacts are known that could have a negative effect on the reference service life-
- Conditions of use: refer to Annex scenarios The reference service life solely applies to the specified conditions of use
- Maintenance: refer to scenario B2

The service life solely applies to the characteristics specified in this EPD or corresponding references, respectively.

6 End-of-life stage

Possible end-of-life stages

The glass elements are disposed of at central collection points. Normally they are shredded and sorted into their original pure components. Metal and glass are recycled. Residual fractions are thermally recycled.

Disposal routes

The LCA includes the average disposal routes.

All life cycle scenarios are detailed in the Annex.

7 Life Cycle Assessment (LCA)

Environmental product declarations are based on life cycle analyses (LCAs) which use material and energy flows for the calculation and subsequent representation of environmental impacts.

As the basis for this, an LCA was prepared for glass elements. The LCA was developed in accordance with EN 15804 and the requirements set out by the international standards EN ISO 14040, EN ISO 14044, ISO 21930 and EN ISO 14025.

The LCA is representative of the products presented in the Declaration and the specified reference period.

The LCA was prepared by brands & values GmbH.

7.1 Definition of goal and scope

Goal

The goal of the LCA is to demonstrate the environmental impacts of glass elements. As set out by EN 15804 the environmental impacts for the whole service life covered by the Environmental Product Declaration are presented in the form of basic information. Apart from these no other environmental impacts have been specified/presented.

Data quality and data availability as well as geographical and time-related system boundaries

The specific data used originate exclusively from the fiscal year 2012. The data were collected on-site at the production plant of Lamilux and originate in parts from company records and partly from direct measurements. Validity of the data was checked by the ift.

The generic data originate from the professional data base and building materials database of the GaBi 6 software and the ecoinvent database version 2.2. The last update of the GaBi 6 software was in 2013 and the update of ecoinvent in 2010.

Data from before this date originate also from the database and are not more than 4 years old.
No other generic data were used for the calculation.
Data gaps were filled either by comparable data, or the data were cut off by restricting the system boundaries.

The life cycle was modelled using the sustainability software tool "GaBi 6" for the development of Life Cycle Assessments.

Scope and system boundaries

The system boundaries refer to the supply of raw materials and purchased parts, manufacture/production, use and end-of-life stage of glass elements (cradle to grave).
No additional data from pre-suppliers/subcontractors or other sites were taken into consideration.

Cut-off criteria

All data from the company data collected, i.e. all commodities/input and raw materials used, the thermal energy used as well as electricity consumption, were taken into consideration.

The boundaries cover only the product-relevant data. Building sections/parts of facilities that are not relevant to the manufacture of the product were excluded.

The transport distances of primary products are included as generic values.

It can be assumed that the total of negligible processes per life cycle stage does not exceed 5 percent. The life cycle calculation also includes material and energy flows that account for less than 1 percent.

7.2 Inventory analysis

Goal

All material and energy flows are described below. The processes covered are presented as input and output parameters and refer to the declared/functional units.

The models of the unit processes used for the LCA have been documented in a transparent manner.

Life cycle stages

The Annex depicts the entire life cycle of glass elements as follows:
product stage A1-A3, construction process stage A4-A5, use stage B1 - B7, end-of-life stage C1 - C4 and benefits and loads beyond the system boundaries D.

Benefits

The following benefits have been defined as per EN 15804:

- Benefits from recycling
- Benefits (thermal and electrical) from incineration

Allocation procedures Allocation of co-products

Resulting production wastes (steel, aluminium, as well as plastic waste) are treated as co-products since there is a market for secondary raw materials. The expenses attributable to these co-products are allocated economically (energy consumption) or physically (material consumption).

Allocations for reuse and recycling

If glass elements are reused/recycled in the manufacturing process (rejects), they are shredded and then sorted into their original pure components as necessary. This is realised by different process plants e.g. magnetic separators

Allocations based on life cycle boundaries

Use of recycled materials in the manufacturing process was based on the current market-specific situation. In parallel to this, a recycling potential was taken into consideration that reflects the economic value of the product after recycling (recyclate). The system boundary set for the recycled material refers to collection.

Inputs

The LCA includes the below production-relevant inputs:

Energy:

The electricity mix is based on "Strommix Deutschland" (German electricity mix). Gas is based on "Erdgas Germany" (German natural gas). In addition, electricity generated from the photovoltaic system of Lamilux was considered as follows:

Facility	Share of electricity from photovoltaic cells
Manufacturing glass elements	4,3 %
Manufacturing glass architecture/continuous rooflights	2,4 %

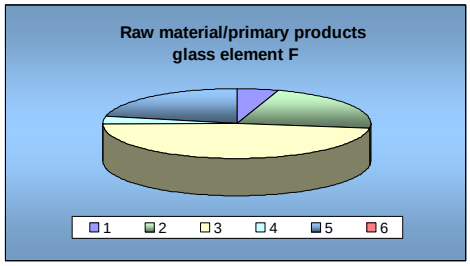
Process heat is partially used for facility heating.

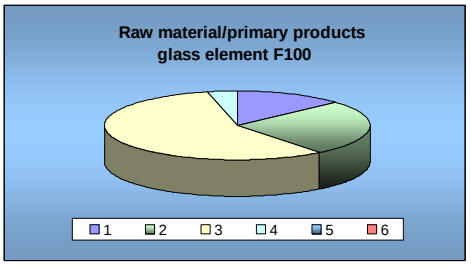
Water:

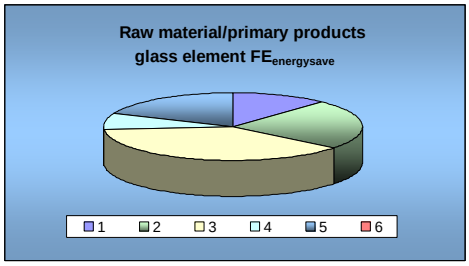
No fresh water is needed for the production of glass elements at Lamilux. The fresh water consumption designated in Section 7.3 is caused by the process chain of primary products.

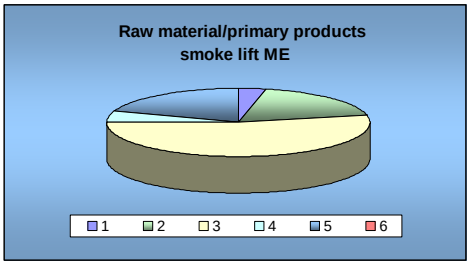
Raw material/primary products:

The following graph shows the use of raw materials/primary products in percent.









No.	Material	Glass element F Mass in %	Glass element F100 Mass in %	Glass element $FE_{energysave}$ Mass in %	Smoke lift ME Masse in %
1	Plastic	5,1	13,2	11,8	3,2
2	GRP	22,0	26,3	24,0	18,3
3	Glass	47,3	56,7	37,6	53,4
4	(Stainless) steel	3,7	3,6	7,8	5,3
5	Aluminium	21,6	-	18,7	19,7
6	Other metals	< 1	< 1	< 1	< 1

Ancillary materials as per EN 15804 (ancillary materials as per ISO 14040):

Gas used for the forklifts is the only relevant ancillary material for real glass variants.

Outputs

The LCA includes the production-relevant outputs per m² glass element given below:

Waste

Refer to 7.3 -Impact assessment

Secondary materials were included in the benefits.

- Open loop (waste recycled into new products)

Waste water

The manufacturing process of glass elements does not produce any waste water.

7.3 Impact assessment

Goal

Impact assessment covers inputs and outputs. The impact categories applied are set out below:

Impact assessment categories

The impact assessment is conducted for the following impact categories. The characterization factors of ELCD (European Reference Life Cycle Database) are used. The characterization factors for the consumption of abiotic resources are adopted from CML (Institute of Environmental Sciences Faculty of Science Universität Leiden, Niederlande).

- Global warming potential (GWP 100)
- Ozone depletion potential (ODP)
- Acidification potential of soil and waterl(AP)
- Eutrophication potential (EP)
- Photochemical ozone creation potential (POCP)
- Abiotic depletion potential - non-fossil resources (ADP - elements)
- Abiotic depletion potential – fossil resources (ADP – fossil fuels)

Waste

The waste generated for the production of 1 m² glass element is evaluated and shown separately for each of the three main fractions, namely trade wastes, special wastes and radioactive wastes. Since waste handling is modelled within system boundaries, the quantities shown are deposited wastes.
Waste is partly generated from the production of primary products. In module A3 no waste was modelled. The designated waste is produced throughout the entire life cycle.

Results per m² glass element F	Unit	A1 – A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Environmental impacts																
Global warming potential (GWP 100)	kg CO_2equiv.	257,00	3,25	47,30	-	0,11	6,36	-	-	-	-	-	0,22	30,10	0,20	-181,00
Ozone depletion potential (ODP)	kg R11 equiv.	2,57E-06	6,77E-11	3,17E-10	-	2,42E-11	7,05E-08	-	-	-	-	-	4,61E-12	1,77E-07	9,88E-11	-2,77E-07
Acidification potential of soil and waterl(AP)	kg SO_2 equiv.	1,62	0,02	-0,01	-	1,59E-04	0,02	-	-	-	-	-	1,00E-03	0,02	6,54E-04	-1,12
Eutrophication potential (EP)	kg PO_4^{3-}-- equiv.	0,12	3,72E-03	-3,90E-04	-	1,38E-04	1,14E-03	-	-	-	-	-	2,43E-04	9,02E-03	4,69E-04	-0,07
Photochemical ozone creation potential (POCP)	kg C_2H_4equiv.	0,12	-5,32E-03	-2,04E-04	-	2,12E-05	2,47E-03	-	-	-	-	-	-3,45E-04	1,30E-03	9,41E-05	-0,06
Abiotic depletion potential - non-fossil resources (ADP - elements)	kg Sb equiv.	2,97E-03	1,50E-07	-3,32E-07	-	3,53E-08	2,26E-04	-	-	-	-	-	1,02E-08	7,44E-06	4,00E-08	-1,31E-03
Abiotic depletion potential – fossil resources (ADP – fossil fuels)	MJ	4.600,00	44,50	-304,00	-	0,64	109,00	-	-	-	-	-	3,03	54,20	2,49	-2.250,00
Use of resources	**Unit**	**A1 – A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Use of renewable primary energy – excluding renewable primary energy resources used as raw materials	MJ	1.310,00	2,63	0,72	-	0,03	4,89	-	-	-	-	-	0,18	3,86	0,13	-601,00
Use of renewable primary energy resources used as raw material (material use)	[MJ]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total use of renewable primary energy resources (primary energy and renewable primary energy resources used as raw materials) (energy + material use)	[MJ]	1.310,00	2,63	0,72	-	0,03	4,89	-	-	-	-	-	0,18	3,86	0,13	-601,00
Use of non renewable primary energy excluding non-renewable primary energy resources used as raw materials	[MJ]	4.600,00	44,50	-304	-	0,64	110,00	-	-	-	-	-	3,03	54,30	2,49	-2.250,00
Use of non renewable primary energy resources used as raw materials (material use))	[MJ]	0,37	7,63E-11	5,09E-10	-	4,52E-11	1,16E-05	-	-	-	-	-	5,20E-12	1,36E-04	1,82E-10	-1,74E-07
Total use of non-renewable primary energy resources (primary energy and non-renewable primary energy resources used as raw materials) (energy +material use)	[MJ]	4.610,37	44,50	-304	-	0,64	110,00	-	-	-	-	-	3,03	54,30	2,49	-2.250,00
Use of secondary material	kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Use of renewable secondary fuels	MJ	0,06	3,31E-04	-	-	7,96E-04	-7,74E-05	-	-	-	-	-	2,25E-05	6,57E-05	2,48E-03	-0,02
Use of non-renewable secondary fuels	MJ	0,59	3,46E-03	-2,74E-03	-	8,31E-03	-2,08E-03	-	-	-	-	-	2,36E-04	6,87E-04	5,92E-03	-0,15
Use of net fresh water	m³	763,00	0,20	7,29E-01	-	0,05	3,63	-	-	-	-	-	0,01	18,80	0,10	-613,00

All values marked with [-] are either marginal, not available or can not be stated. Irrelevant modules are described in the annex.

Results per m² glass element F	Unit	A1 – A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Waste categories																
Hazardous waste disposed	kg	0,20	-	-	-	-	0,07	-	-	-	-	-	-	-	-	-2,77E-04
Non hazardous waste disposed	kg	681,00	0,28	2,20	-	0,10	11,50	-	-	-	-	-	0,02	2,54	5,59	-352,00
Radioactive waste disposed	kg	0,20	6,38E-05	4,44E-04	-	2,11E-05	2,67E-03	-	-	-	-	-	4,35E-06	3,59E-04	4,44E-05	-0,11
Output material flows	**Unit**	**A1 – A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Components for reuse	kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Materials for recycling	kg	-	-	0,09	-	-	0,51	-	-	-	-	-	-	39,90	-	-
Materials for energy recovery	kg	3,57	-	29,00	-	-	1,14	-	-	-	-	-	-	14,40	-	-
Exported energy	MJ	27,33	-	227,60	-	-	17,42	-	-	-	-	-	-	125,90	-	-

All values marked with [-] are either marginal, not available or can not be stated. Irrelevant modules are described in the annex.

Results per m² glass element F100	Unit	A1 – A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Environmental impacts																
Global warming potential (GWP 100)	kg CO_2equiv.	82,70	2,90	47,30	-	0,11	6,36	-	-	-	-	-	0,20	38,10	0,23	-42,30
Ozone depletion potential (ODP)	kg R11 equiv.	6,39E-07	6,06E-11	3,17E-10	-	2,42E-11	7,05E-08	-	-	-	-	-	4,13E-12	1,50E-07	1,10E-10	-2,43E-07
Acidification potential of soil and water (AP)	kg SO_2 equiv.	0,44	0,01	-0,01	-	1,59E-04	0,02	-	-	-	-	-	8,98E-04	0,03	7,12E-04	-0,26
Eutrophication potential (EP)	kg PO_4^{3-}-- equiv.	0,07	3,33E-03	-3,90E-04	-	1,38E-04	1,14E-03	-	-	-	-	-	2,17E-04	8,13E-03	5,60E-04	-0,03
Photochemical ozone creation potential (POCP)	kg C_2H_4equiv.	0,07	-4,76E-03	-2,04E-04	-	2,12E-05	2,47E-03	-	-	-	-	-	-3,09E-04	1,64E-03	1,05E-04	-0,02
Abiotic depletion potential - non-fossil resources (ADP - elements)	kg Sb equiv.	1,38E-03	1,34E-07	-3,32E-07	-	3,53E-08	2,26E-04	-	-	-	-	-	9,12E-09	1,65E-05	4,41E-08	-6,91E-04
Abiotic depletion potential – fossil resources (ADP – fossil fuels)	MJ	2.420,00	39,80	-304,00	-	0,64	109,00	-	-	-	-	-	2,71	77,50	2,82	-641,00
Use of resources	**Unit**	**A1 – A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Use of renewable primary energy – excluding renewable primary energy resources used as raw materials	MJ	689,00	2,36	0,72	-	0,03	4,89	-	-	-	-	-	0,16	5,74	0,15	-12,20
Use of renewable primary energy resources used as raw material (material use)	MJ	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total use of renewable primary energy resources (primary energy and renewable primary energy resources used as raw materials) (energy + material use)	MJ	690,00	2,36	0,72	-	0,03	4,89	-	-	-	-	-	0,16	5,74	0,15	-12,20
Use of non renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	2.420,00	39,80	-304,00	-	0,64	110,00	-	-	-	-	-	2,71	77,60	2,82	-642,00
Use of non renewable primary energy resources used as raw materials (material use))	MJ	7,86E-04	6,83E-11	5,09E-10	-	4,52E-11	1,16E-05	-	-	-	-	-	4,66E-12	1,14E-04	2,02E-10	-2,05E-08
Total use of non-renewable primary energy resources (primary energy and non-renewable primary energy resources used as raw materials) (energy +material use)	MJ	2.420,00	39,80	-304,00	-	0,64	110,00	-	-	-	-	-	2,71	77,60	2,82	-642,00
Use of secondary material	kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Use of renewable secondary fuels	MJ	-	2,96E-04	-	-	7,96E-04	-7,74E-05	-	-	-	-	-	2,02E-05	4,07E-04	2,71E-03	-
Use of non-renewable secondary fuels	MJ	-	3,10E-03	-2,74E-03	-	8,31E-03	-2,08E-03	-	-	-	-	-	2,11E-04	4,25E-03	6,48E-03	-
Use of net fresh water	m³	107,00	0,18	0,73	-	0,05	3,63	-	-	-	-	-	0,01	17,90	0,11	-13,90

All values marked with [-] are either marginal, not available or can not be stated. Irrelevant modules are described in the annex.

Results per m² glass element F100	Unit	A1 – A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Waste categories																
Hazardous waste disposed	kg	0,09	-	-	-	-	0,07	-	-	-	-	-	-	-	-	-2,79E-04
Non hazardous waste disposed	kg	283,00	0,25	2,20	-	0,10	11,50	-	-	-	-	-	0,02	19,40	5,61	-57,40
Radioactive waste disposed	kg	0,07	5,71E-05	4,44E-04	-	2,11E-05	2,67E-03	-	-	-	-	-	3,89E-06	1,73E-03	5,05E-05	-9,57E-03
Output material flows	**Unit**	**A1 – A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Components for reuse	kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Materials for recycling	kg	-	-	0,09	-	-	0,51	-	-	-	-	-	-	27,10	-	-
Materials for energy recovery	kg	3,57	-	0,09	-	-	1,14	-	-	-	-	-	-	17,60	-	-
Exported energy	MJ	27,33	-	227,60	-	-	17,41	-	-	-	-	-	-	138,70	-	-

All values marked with [-] are either marginal, not available or can not be stated. Irrelevant modules are described in the annex.

Results per m² glass element $FE_{energysave}$	Unit	A1 – A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Environmental impacts																
Global warming potential(GWP 100)	kg CO_2equiv.	421,00	4,58	48,60	-	0,11	6,36	-	-	-	-	-	0,31	64,20	0,37	-269,00
Ozone depletion potential (ODP)	kg R11 equiv.	3,92E-06	9,55E-11	3,26E-10	-	2,42E-11	7,05E-08	-	-	-	-	-	6,50E-12	3,09E-07	1,81E-10	-3,45E-07
Acidification potential of soil and water (AP)	kg SO_2 equiv.	2,36	0,02	-0,01	-	1,59E-04	0,02	-	-	-	-	-	1,41E-03	0,03	1,16E-03	-1,58
Eutrophication potential (EP)	kg PO_4^{3-}-- equiv.	0,18	5,25E-03	-3,98E-04	-	1,38E-04	1,14E-03	-	-	-	-	-	3,42E-04	0,02	9,69E-04	-0,09
Photochemical ozone creation potential (POCP)	kg C_2H_4equiv.	0,19	-7,51E-03	-2,07E-04	-	2,12E-05	2,47E-03	-	-	-	-	-	-4,86E-04	2,33E-03	1,72E-04	-0,09
Abiotic depletion potential - non-fossil resources (ADP - elements)	kg Sb equiv.	4,15E-03	2,11E-07	-3,40E-07	-	3,53E-08	2,26E-04	-	-	-	-	-	1,44E-08	5,96E-06	7,18E-08	-2,08E-03
Abiotic depletion potential – fossil resources (ADP – fossil fuels)	MJ	7.330,00	62,70	-312,00	-	0,64	109,00	-	-	-	-	-	4,27	98,00	4,78	-3.350,00
Use of resources	**Unit**	**A1 – A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Use of renewable primary energy – excluding renewable primary energy resources used as raw materials	MJ	1.700,00	3,71	0,74	-	0,03	4,89	-	-	-	-	-	0,25	6,53	0,24	-846,00
Use of renewable primary energy resources used as raw material (material use)	MJ	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total use of renewable primary energy resources (primary energy and renewable primary energy resources used as raw materials) (energy + material use)	MJ	1.700,00	3,71	0,74	-	0,03	4,89	-	-	-	-	-	0,25	6,53	0,24	-846,00
Use of non renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	7.330,00	62,70	-312,00	-	0,64	110,00	-	-	-	-	-	4,27	98,30	4,78	-3.350,00
Use of non renewable primary energy resources used as raw materials (material use))	MJ	0,47	1,08E-10	5,22E-10	-	4,52E-11	1,16E-05	-	-	-	-	-	7,33E-12	2,21E-04	3,33E-10	-2,45E-07
Total use of non-renewable primary energy resources (primary energy and non-renewable primary energy resources used as raw materials) (energy +material use)	MJ	7.330,47	62,70	-312,00	-	0,64	110,00	-	-	-	-	-	4,27	98,30	4,78	-3.380,00
Use of secondary material	kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Use of renewable secondary fuels	MJ	0,07	4,67E-04	-	-	7,96E-04	-7,74E-05	-	-	-	-	-	3,18E-05	1,67E-04	4,37E-03	-
Use of non-renewable secondary fuels	MJ	0,59	4,88E-03	-3,42E-03	-	8,31E-03	-2,08E-03	-	-	-	-	-	3,32E-04	1,74E-03	0,01	-
Use of net fresh water	m³	1.140,00	0,28	0,75	-	0,05	3,63	-	-	-	-	-	0,02	30,90	0,18	-862,00

All values marked with [-] are either marginal, not available or can not be stated. Irrelevant modules are described in the annex.

Results per m² glass element $FE_{energysave}$	Unit	A1 – A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Waste categories																
Hazardous waste disposed	kg	0,40	-	-	-	-	0,07	-	-	-	-	-	-	-	-	-2,65E-04
Non hazardous waste disposed	kg	1.110,00	0,39	2,28	-	0,10	11,50	-	-	-	-	-	0,03	8,50	9,12	-538,00
Radioactive waste disposed	kg	0,32	9,00E-05	4,56E-04	-	2,11E-05	2,67E-03	-	-	-	-	-	6,12E-06	1,10E-03	8,52E-05	-0,16
Output material flows	**Unit**	**A1 – A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Components for reuse	kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Materials for recycling	kg	-	-	0,09	-	-	0,51	-	-	-	-	-	-	57,10	-	-
Materials for energy recovery	kg	4,61	-	29,80	-	-	1,14	-	-	-	-	-	-	30,80	-	-
Exported energy	MJ	39,90	-	233,40	-	-	17,42	-	-	-	-	-	-	297,80	-	-

All values marked with [-] are either marginal, not available or can not be stated. Irrelevant modules are described in the annex.

Results per m² smoke lift ME	Unit	A1 – A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Environmental impacts																
Global warming potential(GWP 100)	kg CO_2equiv.	298,00	3,66	47,10	-	0,63	6,36	-	-	-	-	-	0,25	28,30	0,21	-205,00
Ozone depletion potential (ODP)	kg R11 equiv.	2,58E-06	7,64E-11	3,16E-10	-	6,34E-11	7,05E-08	-	-	-	-	-	5,20E-12	2,11E-07	1,09E-10	-3,02E-07
Acidification potential of soil and water (AP)	kg SO_2 equiv.	1,61	0,02	-0,01	-	2,07E-03	0,02	-	-	-	-	-	1,13E-03	0,02	7,38E-04	-1,29
Eutrophication potential (EP)	kg PO_4^{3-}-- equiv.	0,14	4,20E-03	-3,88E-04	-	2,40E-04	1,14E-03	-	-	-	-	-	2,74E-04	0,01	4,64E-04	-0,08
Photochemical ozone creation potential (POCP)	kg C_2H_4equiv.	0,13	-6,01E-03	-2,03E-04	-	2,45E-04	2,47E-03	-	-	-	-	-	-3,89E-04	1,49E-03	1,04E-04	-0,07
Abiotic depletion potential - non-fossil resources (ADP - elements)	kg Sb equiv.	2,12E-03	1,69E-07	-3,31E-07	-	1,03E-07	2,26E-04	-	-	-	-	-	1,15E-08	8,96E-06	4,47E-08	-1,06E-03
Abiotic depletion potential – fossil resources (ADP – fossil fuels)	MJ	4.880,00	50,20	-302,00	-	26,44	109,00	-	-	-	-	-	3,42	63,60	2,64	-2.550,00
Use of resources	**Unit**	**A1 – A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Use of renewable primary energy – excluding renewable primary energy resources used as raw materials	MJ	1.340,00	2,97	0,71	-	0,21	4,89	-	-	-	-	-	0,20	4,54	0,15	-661,00
Use of renewable primary energy resources used as raw material (material use)	MJ	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total use of renewable primary energy resources (primary energy and renewable primary energy resources used as raw materials) (energy + material use)	MJ	1.340,00	2,97	0,71	-	0,21	4,89	-	-	-	-	-	0,20	4,54	0,15	-661,00
Use of non renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	4.880,00	50,20	-302,00	-	26,44	110,00	-	-	-	-	-	3,42	63,60	2,64	-2.550,00
Use of non renewable primary energy resources used as raw materials (material use))	MJ	7,72E-04	8,62E-11	5,07E-10	-	6,31E-11	1,16E-05	-	-	-	-	-	5,87E-12	1,64E-04	2,00E-10	-1,94E-07
Total use of non-renewable primary energy resources (primary energy and non-renewable primary energy resources used as raw materials) (energy +material use)	MJ	4.880,00	50,20	-302,00	-	26,44	110,00	-	-	-	-	-	3,42	63,60	2,64	-2.550,00
Use of secondary material	kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Use of renewable secondary fuels	MJ	0,02	3,74E-04	-	-	9,79E-04	-7,74E-05	-	-	-	-	-	2,54E-05	6,04E-05	2,81E-03	-
Use of non-renewable secondary fuels	MJ	0,15	3,91E-03	-2,72E-03	-	0,01	-2,08E-03	-	-	-	-	-	2,66E-04	6,32E-04	6,71E-03	-
Use of net fresh water	m³	790,00	0,22	0,73	-	0,23	3,63	-	-	-	-	-	0,02	22,50	0,11	-675,00

All values marked with [-] are either marginal, not available or can not be stated. Irrelevant modules are described in the annex.

Results per m² smoke lift ME	Unit	A1 – A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Waste categories																
Hazardous waste disposed	kg	1,14E-03	-	-	-	-	0,07	-	-	-	-	-	-	-	-	-5,70E-05
Non hazardous waste disposed	kg	720,00	0,31	2,19	-	0,47	11,50	-	-	-	-	-	0,02	2,49	6,76	-407,00
Radioactive waste disposed	kg	0,20	7,21E-05	4,42E-04	-	1,26E-04	2,67E-03	-	-	-	-	-	4,91E-06	3,48E-04	4,70E-05	-0,12
Output material flows	**Unit**	**A1 – A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Components for reuse	kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Materials for recycling	kg	-	-	0,09	-	-	0,51	-	-	-	-	-	-	51,40	-	-
Materials for energy recovery	kg	3,57	-	29,00	-	-	1,14	-	-	-	-	-	-	13,80	-	-
Exported energy	MJ	27,33	-	227,30	-	-	17,42	-	-	-	-	-	-	112,30	-	-

All values marked with [-] are either marginal, not available or can not be stated. Irrelevant modules are described in the annex.

7.4 Interpretation, LCA presentation and critical verification

Interpretation

All modules with values were considered in the interpretation.

Regarding the indicator global warming potential there is a significant contribution from module A5, as the disposal of wood used for transport packaging was taken into account. This applies to all product variants. The resulting greenhouse gas emissions are climate-neutral, since they are absorbed through the cultivation of timber. Moreover there is a substantial contribution in modul C3, which is caused by the thermal conversion of plastic components from daylight systems. The heavy GRP-upstand of type $FE_{energysave}$ results in a higher greenhouse gas amount. The recirculation of recyclable components and the greenhouse gases saved thereby were credited in module D. Furthermore benefits resulted from the thermal conversion of product components as outlined above were added, since the generated heat and electricity were credited with the same amount of natural gas burned.

The depicted environmental impacts can be used for the certification of buildings.

Report

The LCA report was prepared in accordance with the requirements of EN ISO 14040, EN ISO 14044, EN 15804 and ISO 14025. The report is not addressed to third parties due to confidential information contained in the report.

The results of the study are not designed to be used for comparative statements intended for publication.

The results and conclusions reported to the target group are complete, correct, without bias and transparent.

Critical verification

The LCA was critically verified by Florian Stich**,** an independent verifier.

8 General information regarding the EPD

Comparability

This EPD was prepared in accordance with EN 15804 and is therefore only comparable to those EPDs that that also comply with EN 15804.
For a comparison of EPDs for construction products the rules set out by EN 15804 (Clause 5.3) apply.

Communication

The communications format of this EPD meets the requirements of EN 15942:2011 and is therefore the basis for B2B communication. Only the nomenclature has been changed according to EN 15804.

Verification/Validation

Verification of the Environmental Product Declaration is documented in accordance with the **ift** "Richtlinie zur Erstellung von Typ III Umweltproduktdeklarationen" (Guidance on preparing Type III Environmental Product Declarations) in accordance with the requirements set out by EN ISO 14025.

This Declaration is based on the **ift** PCR document „Fenster, Flachdachfenster, Lichtkuppeln und Lichtbänder“ :(windows, flat roof windows, light domes and continuous rooflights). PCR-FE-2.0 : 2013

The European standard EN 15804 serves as the core PCR.
Independent verification of the declaration, according to ISO 14025:2010 ☒ internal ☐ external
Independent third party verifier Florian Stich
a Product category rules

Revision of this document:

Ser. No.	Date	Comment	LCA analyst	Verifier
1	27/09/2013	first internal verfication and release	Y.Bernard	F.Stich
2				
3				
4				
5				

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[39] Zulassung Z-10.1-404 (Authorization)
Selbsttragendes lichtdurchlässiges Dachbausystem `CI-System Lichtband B` nach ETA-09/0347 (self supporting translucent roof kits `CI-System continuous rooflight B` according to ETA-09/0347)
DIBT Berlin, 2010

[40] Zulassung ETA-09/0347 (Authorization)
CI-System Lichtband B. Selbsttragendes lichtdurchlässiges Dachbausystem (CI-System continuous roof light B. self supporting translucent roof kits)
DIBT Berlin, 2013

[41] EN 1873:2006-03
Prefabricated accessories for roofing - Individual roof lights of plastics - Product specification and test methods
Beuth Verlag GmbH, Berlin

Annex: Description of life cycle scenarios for glass elements

Product stage			Construction process stage		Use stage							End-of-life stage				Benefits and loads beyond the system boundaries
A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Raw material supply	Transport	Manufacturing	Transport	Construction / Installation	Use	Maintenance:	Repair	Replacement	Modification/refurbishment	Operational energy use	Operational water use	De-construction	Transport	Waste management	Disposal	Re-use Recovery Recycling potential

Calculation of the scenarios was based on a service life of 50 years (in accordance with the table "Nutzungsdauern von Bauteilen" [service life of building components] of the information portal "Nachhaltiges Bauen – Baustoff- und Gebäudedaten – 'mittlerer Wert'") (Sustainable construction - data of building materials and buildings - "average value").
Furthermore, the scenarios of the research project "EPDs for transparent building components" were used.

The scenarios selected are presented in bold type.

A4 Transport

No.	Scenario	Description
A4.1	**Direct shipment to construction site/branch Domestic**	**40 t truck EURO 4, 30 percent capacity used, approx. 350 km to domestic construction site and return trip with 0 percent load Weight: 132 kg Volume: 1.125m³**
A4.2	Direct shipment to construction site/branch Abroad	40 t truck EURO 4, 40 percent capacity used, approx. 900 km to construction site abroad and return trip with 0 percent load Weight: 132 kg Volume: 1.125 m³

A4 Transport	Unit	A4.1	A4.2	A4.1	A4.2
Environmental impacts		F100	F100	$FE_{energysave}$	$FE_{energysave}$
Global warming potential(GWP 100)	kg CO_2equiv.	**2,90**	5,91	**4,58**	9,32
Ozone depletion potential (ODP)	kg R11 equiv.	**6,06E-11**	1,23E-10	**9,55E-11**	1,94E-10
Acidification potential of soil and water (AP)	kg SO_2 equiv.	**0,01**	0,03	**0,02**	0,04
Eutrophication potential (EP)	kg PO_4^{3-}-- equiv.	**3,33E-03**	6,71E-03	**5,25E-03**	0,01
Photochemical ozone creation potential (POCP)	kg C_2H_4equiv.	**-4,76E-03**	-9,59E-03	**-7,51E-03**	-0,02
Abiotic depletion potential - non-fossil resources (ADP - elements)	kg Sb equiv.	**1,34E-07**	2,73E-07	**2,11E-07**	4,30E-07
Abiotic depletion potential - fossil resources (ADP - fossil fuels)	MJ	**39,80**	81,10	**62,70**	128,00
Use of resources					
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	**2,36**	4,80	**3,71**	7,56
Use of renewable primary energy resources used as raw material (material use)	MJ	**-**	-	**-**	-
Total use of renewable primary energy resources (primary energy and renewable primary energy resources used as raw materials) (energy + material use)	MJ	**2,36**	4,80	**3,71**	7,56
Use of non renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	**39,80**	81,10	**62,70**	128,00
Use of non renewable primary energy resources used as raw materials (material use))	MJ	**6,83E-11**	1,39E-10	**1,08E-10**	2,19E-10
Total use of non-renewable primary energy resources (primary energy and non-renewable primary energy resources used as raw materials) (energy +material use)	MJ	**39,80**	81,10	**62,70**	128,00
Use of secondary material	kg	**-**	-	**-**	-
Use of renewable secondary fuels	MJ	**2,96E-04**	6,03E-04	**4,67E-04**	9,50E-04
Use of non-renewable secondary fuels	MJ	**3,10E-03**	6,31E-03	**4,88E-03**	9,94E-03
Use of net fresh water	m³	**0,18**	0,36	**0,28**	0,57

All values marked with [-] are either marginal, not available or can not be stated. Irrelevant modules are described in the annex.

A4 Transport	Unit	A4.1	A4.2	A4.1	A4.2
Waste categories		F100	F100	$FE_{energysave}$	$FE_{energysave}$
Hazardous waste disposed	kg	**-**	-	**-**	-
Non hazardous waste disposed	kg	**0,25**	0,50	**0,39**	0,79
Radioactive waste disposed	kg	**5,71E-05**	1,16E-04	**9,00E-05**	1,83E-04
Output material flows					
Components for reuse	kg	**-**	-	**-**	-
Materials for recycling	kg	**-**	-	**-**	-
Materials for energy recovery	kg	**-**	-	**-**	-
Exported energy	MJ	**-**	-	**-**	-

All values marked with [-] are either marginal, not available or can not be stated. Irrelevant modules are described in the annex.

A4 Transport	Unit	A4.1	A4.2	A4.1	A4.2
Environmental impacts		**F**	**F**	**Smoke lift ME**	**Smoke lift ME**
Global warming potential(GWP 100)	kg CO_2-Äqv.	**3,25**	6,61	**3,66**	7,46
Ozone depletion potential (ODP)	kg R11-Äqv.	**6,77E-11**	1,38E-10	**7,64E-11**	1,56E-10
Acidification potential of soil and water (AP)	kg SO_2-Äqv.	**0,02**	0,03	**0,02**	0,03
Eutrophication potential (EP)	kg PO_4^{3-}-Äqv.	**3,72E-03**	7,50E-03	**4,20E-03**	8,47E-03
Photochemical ozone creation potential (POCP)	kg C_2H_4-Äqv.	**-5,32E-03**	-0,01	**-6,01E-03**	-0,01
Abiotic depletion potential - non-fossil resources (ADP - elements)	kg Sb-Äqv.	**1,50E-07**	3,05E-07	**1,69E-07**	3,44E-07
Abiotic depletion potential - fossil resources (ADP - fossil fuels)	MJ	**44,50**	90,60	**50,20**	102,00
Use of resources					
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	**2,63**	5,36	**2,97**	6,05
Use of renewable primary energy resources used as raw material (material use)	MJ	**-**	-	**-**	-
Total use of renewable primary energy resources (primary energy and renewable primary energy resources used as raw materials) (energy + material use)	MJ	**2,63**	5,36	**2,97**	6,05
Use of non renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	**44,50**	90,60	**50,20**	102,00
Use of non renewable primary energy resources used as raw materials (material use))	MJ	**7,63E-11**	1,55E-10	**8,62E-11**	1,76E-10
Total use of non-renewable primary energy resources (primary energy and non-renewable primary energy resources used as raw materials) (energy +material use)	MJ	**44,50**	90,60	**50,20**	102,00
Use of secondary material	kg	**-**	-	**-**	
Use of renewable secondary fuels	MJ	**3,31E-04**	6,74E-04	**3,74E-04**	7,61E-04
Use of non-renewable secondary fuels	MJ	**3,46E-03**	7,04E-03	**3,91E-03**	7,95E-03
Use of net fresh water	m^3	**0,20**	0,40	**0,22**	0,46

All values marked with [-] are either marginal, not available or can not be stated. Irrelevant modules are described in the annex.

A4 Transport	Unit	A4.1	A4.2	A4.1	A4.2
Waste categories		**F**	**F**	**Smoke lift ME**	**Smoke lift ME**
Hazardous waste disposed	kg	**-**	-	**-**	-
Non hazardous waste disposed	kg	**0,28**	0,56	**0,31**	0,63
Radioactive waste disposed	kg	**6,38E-05**	1,30E-04	**7,21E-05**	1,47E-04
Output material flows					
Components for reuse	kg	**-**	-	**-**	-
Materials for recycling	kg	**-**	-	**-**	-
Materials for energy recovery	kg	**-**	-	**-**	-
Exported energy	MJ	**-**	-	**-**	-

All values marked with [-] are either marginal, not available or can not be stated. Irrelevant modules are described in the annex.

A5 Construction / Installation

No.	Scenario	Description
A5.1	**Crane/inclined lift**	**A crane/inclined lift is required for the installation of the elements.**

Installation of glass elements forms part of the site management and is covered at the building level.

B1 Use

Refer to Section 5 Emissions to the environment. Emissions can not be quatified.

B2 Maintenance

B2.1 Cleaning

No.	Scenario	Description
B2.1.1	**Rarely manual**	**Manually using suitable cleaning agents, annually**

Ancillary materials, energy use and waste as well as transport distances during cleaning are negligible.

The data in the following table is valid for glass element F100, $FE_{energysave}$, F and smoke lift ME.

B2.1 Cleaning	Unit	B2.1.1
Environmental impacts		
Global warming potential(GWP 100)	kg CO_2equiv.	**0,11**
Ozone depletion potential (ODP)	kg R11 equiv.	**2,42E-11**
Acidification potential of soil and water (AP)	kg SO_2 equiv.	**1,59E-04**
Eutrophication potential (EP)	kg PO_4^{3-}--equiv.	**1,38E-04**
Photochemical ozone creation potential (POCP)	kg C_2H_4equiv.	**2,12E-05**
Abiotic depletion potential - non-fossil resources (ADP - elements)	kg Sb equiv.	**3,53E-08**
Abiotic depletion potential - fossil resources (ADP - fossil fuels)	MJ	**0,64**
Use of resources		
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	**0,03**
Use of renewable primary energy resources used as raw material (material use)	MJ	**-**
Total use of renewable primary energy resources (primary energy and renewable primary energy resources used as raw materials) (energy + material use)	MJ	**0,03**
Use of non renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	**0,64**
Use of non renewable primary energy resources used as raw materials (material use))	MJ	**4,52E-11**
Total use of non-renewable primary energy resources (primary energy and non-renewable primary energy resources used as raw materials) (energy +material use)	MJ	**0,64**
Use of secondary material	kg	**-**
Use of renewable secondary fuels	MJ	**7,96E-04**
Use of non-renewable secondary fuels	MJ	**8,31E-03**
Use of net fresh water	m^3	**0,05**

All values marked with [-] are either marginal, not available or can not be stated. Irrelevant modules are described in the annex.

B2.1 Cleaning	Unit	B2.1.1
Waste categories		
Hazardous waste disposed	kg	**-**
Non hazardous waste disposed	kg	**0,10**
Radioactive waste disposed	kg	**2,11E-05**
Output material flows		
Components for reuse	kg	**-**
Materials for recycling	kg	**-**
Materials for energy recovery	kg	**-**
Exported energy	MJ	**-**

All values marked with [-] are either marginal, not available or can not be stated. Irrelevant modules are described in the annex.

B2.2 Maintenance

No.	Scenario	Description
B2.2.1	**Normal use smoke lift**	**Annual functional test, visual inspection, lubrication, maintenance if necessary**

Ancillary materials and waste as well as transport distances during maintenance are negligible. Fresh water and energy are not needed for maintenance.

The data in the following table is valid for smoke lift ME.

B2 Maintenance	Unit	B2.2.1
Environmental impacts		
Global warming potential(GWP 100)	kg CO_2equiv.	**0,52**
Ozone depletion potential (ODP)	kg R11 equiv.	**3,92E-11**
Acidification potential of soil and water (AP)	kg SO_2 equiv.	**1,91E-03**
Eutrophication potential (EP)	kg PO_4^{3-}--equiv.	**1,02E-04**
Photochemical ozone creation potential (POCP)	kg C_2H_4equiv.	**2,24E-04**
Abiotic depletion potential - non-fossil resources (ADP - elements)	kg Sb equiv.	**6,76E-08**
Abiotic depletion potential - fossil resources (ADP - fossil fuels)	MJ	**25,80**
Use of resources		
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	**0,18**
Use of renewable primary energy resources used as raw material (material use)	MJ	**-**
Total use of renewable primary energy resources (primary energy and renewable primary energy resources used as raw materials) (energy + material use)	MJ	**0,18**
Use of non renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	**25,80**
Use of non renewable primary energy resources used as raw materials (material use))	MJ	**1,79E-11**
Total use of non-renewable primary energy resources (primary energy and non-renewable primary energy resources used as raw materials) (energy +material use)	MJ	**25,80**
Use of secondary material	kg	**-**
Use of renewable secondary fuels	MJ	**1,83E-04**
Use of non-renewable secondary fuels	MJ	**1,93E-03**
Use of net fresh water	m^3	**0,18**

All values marked with [-] are either marginal, not available or can not be stated. Irrelevant modules are described in the annex.

B2 Maintenance	Unit	B2.1
Waste categories		
Hazardous waste disposed	kg	**-**
Non hazardous waste disposed	kg	**0,36**
Radioactive waste disposed	kg	**1,05E-04**
Output material flows		
Components for reuse	kg	**-**
Materials for recycling	kg	**-**
Materials for energy recovery	kg	**-**
Exported energy	MJ	**-**

All values marked with [-] are either marginal, not available or can not be stated. Irrelevant modules are described in the annex.

B3 Repair

No.	Scenario	Description
B3.1	**Normal use**	**One replacement* of hardware 0.589 kg/m², seals/gaskets 1.278 kg/m²**

* Assumptions for evaluation of possible environmental impacts; statements made do not constitute any guarantee or warranty of performance

Ancillary materials, waste, fresh water resources, material losses, transport distances and energy use during repair are negligible. In scenario B3 there will be balanced just building parts, where the expected useful life is lesser then the RSL.

The data in the following table is valid for glass element F100, $FE_{energysave}$, F and smoke lift ME.

B3 Repair	Unit	B3.1
Environmental impacts		
Global warming potential(GWP 100)	kg CO_2equiv.	**6,36**
Ozone depletion potential (ODP)	kg R11 equiv.	**7,05E-08**
Acidification potential of soil and water (AP)	kg SO_2 equiv.	**0,02**
Eutrophication potential (EP)	kg PO_4^{3-}--equiv.	**1,14E-03**
Photochemical ozone creation potential (POCP)	kg C_2H_4equiv.	**2,47E-03**
Abiotic depletion potential - non-fossil resources (ADP - elements)	kg Sb equiv.	**2,26E-04**
Abiotic depletion potential - fossil resources (ADP - fossil fuels)	MJ	**109,00**
Use of resources		
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	**4,89**
Use of renewable primary energy resources used as raw material (material use)	MJ	**-**
Total use of renewable primary energy resources (primary energy and renewable primary energy resources used as raw materials) (energy + material use)	MJ	**4,89**
Use of non renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	**110,00**
Use of non renewable primary energy resources used as raw materials (material use))	MJ	**1,16E-05**
Total use of non-renewable primary energy resources (primary energy and non-renewable primary energy resources used as raw materials) (energy +material use)	MJ	**110,00**
Use of secondary material	kg	**-**
Use of renewable secondary fuels	MJ	**-7,74E-05**
Use of non-renewable secondary fuels	MJ	**-2,08E-03**
Use of net fresh water	m^3	**3,63**

All values marked with [-] are either marginal, not available or can not be stated. Irrelevant modules are described in the annex.

B3 Repair	Unit	B3.1
Waste categories		
Hazardous waste disposed	kg	**0,07**
Non hazardous waste disposed	kg	**11,50**
Radioactive waste disposed	kg	**2,67E-03**
Output material flows		
Components for reuse	kg	**-**
Materials for recycling	kg	**0,51**
Materials for energy recovery	kg	**1,14**
Exported energy	MJ	**17,42**

All values marked with [-] are either marginal, not available or can not be stated. Irrelevant modules are described in the annex.

B4 Replacement (not relevant)

The service life of 50 years assumed here does not include replacement.

B5 Upgrade/Refurbishment (not relevant)

Upgrade/refurbishment of glass elements is not assumed.

B6 Operational energy use (not relevant)

No energy consumption when used as intended.

B7 Operational water use (not relevant)

No water consumption when used as intended. Water consumption for cleaning is specified in module B2.1.

C1 De-construction

No.	Scenario	Description
C1.1	Dismantling	99 % de-construction The energy consumed for de-construction is negligible. Resulting expenditures are marginal.

Due to a simple dismountability, a correspondingly high de-construction rate is assumed.

C2 Transport

No.	Scenario	Description
C2.1	Transport	Transport to collection point using 40 t truck, 80 % capacity used, 50 km distance

C2 Transport	Unit	C2.1	C2.1	C2.1	C2.1
Environmental impacts		**F100**	**$FE_{energysave}$**	**F**	**Smoke lift ME**
Global warming potential(GWP 100)	kg CO_2equiv.	**0,20**	**0,31**	**0,22**	**0,25**
Ozone depletion potential (ODP)	kg R11 equiv.	**4,13E-12**	**6,50E-12**	**4,61E-12**	**5,20E-12**
Acidification potential of soil and water (AP)	kg SO_2 equiv.	**8,98E-04**	**1,41E-03**	**1,00E-03**	**1,13E-03**
Eutrophication potential (EP)	kg PO_4^{3-}-- equiv.	**2,17E-04**	**3,42E-04**	**2,43E-04**	**2,74E-04**
Photochemical ozone creation potential (POCP)	kg C_2H_4equiv.	**-3,09E-04**	**-4,86E-04**	**-3,45E-04**	**-3,89E-04**
Abiotic depletion potential - non-fossil resources (ADP - elements)	kg Sb equiv.	**9,12E-09**	**1,44E-08**	**1,02E-08**	**1,15E-08**
Abiotic depletion potential - fossil resources (ADP - fossil fuels)	MJ	**2,71**	**4,27**	**3,03**	**3,42**
Use of resources					
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	**0,16**	**0,25**	**0,18**	**0,20**
Use of renewable primary energy resources used as raw material (material use)	MJ	**-**	**-**	**-**	**-**
Total use of renewable primary energy resources (primary energy and renewable primary energy resources used as raw materials) (energy + material use)	MJ	**0,16**	**0,25**	**0,18**	**0,20**
Use of non renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	**2,71**	**4,27**	**3,03**	**3,42**
Use of non renewable primary energy resources used as raw materials (material use))	MJ	**4,66E-12**	**7,33E-12**	**5,20E-12**	**5,87E-12**
Total use of non-renewable primary energy resources (primary energy and non-renewable primary energy resources used as raw materials) (energy +material use)	MJ	**2,71**	**4,27**	**3,03**	**3,42**
Use of secondary material	kg	**-**	**-**	**-**	**-**
Use of renewable secondary fuels	MJ	**2,02E-05**	**3,18E-05**	**2,25E-05**	**2,54E-05**
Use of non-renewable secondary fuels	MJ	**2,11E-04**	**3,32E-04**	**2,36E-04**	**2,66E-04**
Use of net fresh water	m^3	**0,01**	**0,02**	**0,01**	**0,02**

All values marked with [-] are either marginal, not available or can not be stated. Irrelevant modules are described in the annex.

C2 Transport	Unit	C2.1	C2.1	C2.1	C2.1
Waste categories		**F100**	**$FE_{energysave}$**	**F**	**Smoke lift ME**
Hazardous waste disposed	kg	**-**	**-**	**-**	**-**
Non hazardous waste disposed	kg	**0,02**	**0,03**	**0,02**	**0,02**
Radioactive waste disposed	kg	**3,89E-06**	**6,12E-06**	**4,35E-06**	**4,91E-06**
Output material flows					
Components for reuse	kg	**-**	**-**	**-**	**-**
Materials for recycling	kg	**-**	**-**	**-**	**-**
Materials for energy recovery	kg	**-**	**-**	**-**	**-**
Exported energy	MJ	**-**	**-**	**-**	**-**

All values marked with [-] are either marginal, not available or can not be stated. Irrelevant modules are described in the annex.

C3 Waste management

No.	Scenario	Description
C3.1	Disposal	De-construction of glazing 90 %, recirculation of aluminium 98 %, recirculation of other metals 95 %, residual fractions in waste incinerator 90 %

Disposal processes are described in the following table and shown in per cent by weight. The calculation of the percentage is expressed per declared unit.

C3 Disposal	Unit	F100	$FE_{energysave}$	F	Smoke lift ME
Collection process , collect separately	kg	-	-	-	-
Collection process, collect with mixed construction waste	kg	**49,54**	**95,67**	**59,09**	**71,00**
Recovery system, for re-use	kg	-	-	-	-
Recovery system, for recycling	kg	**27,06**	**57,11**	**39,88**	**51,42**
Recovery system, for energy recovery	kg	**17,58**	**30,80**	**14,44**	**13,79**
Disposal	kg	**4,90**	**7,76**	**4,77**	**5,79**

All values marked with [-] are either marginal, not available or can not be stated. Irrelevant modules are described in the annex.

C4 Disposal

No.	Scenario	Description
C4.1	Disposal	Non-recordable amounts and losses within the re-use/recycling chain (C1 and C3) are modelled as "disposed". The expenditures can not be quantified.

D Benefits and loads beyond the system boundaries

No.	Scenario	Description
D	Recycling potential	Metals from C3.1 excluding the scrap used in A3 replaces metal at 100 % Glass recyclate from C3.1 excluding glass shards used in A3 replace glass at 100 % Aluminium recyclate from C3.1 excluding the aluminium used in A3 replaces aluminium at 100 % Benefits from waste incinerator: electricity replaces German electricity mix, thermal energy replaces thermal energy from natural gas.

Impressum

Programme operator
ift Rosenheim GmbH
Theodor-Gietl-Str. 7-9
D - 83026 Rosenheim
Phone: +49 (0) 80 31/261-0
Fax: +49 (0) 80 31/261 290
email: info@ift-rosenheim.de
www.ift-rosenheim.de

LCA analyst
brands & values GmbH
Karl-Ferdinand-Braun Straße 2
28359 Bremen
Phone: +49 (0) 421/960 96 40
www.brandsandvalues.com

Declaration holder
Lamilux Heinrich Strunz GmbH
Zehstraße 2
D - 95111 Rehau

Notes
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Layout
ift Rosenheim GmbH

ift Rosenheim GmbH
Theodor Gietl Straße 7-9
D-83026 Rosenheim
Phone: +49 (0) 80 31 / 261-0
Fax: +49 (0) 80 31 / 261-290
email: info@ift-rosenheim.de
www.ift-rosenheim.de